Oregon Coastal Coho Assessment

Part 3B: Policy for the Evaluation of Conservation Efforts: The Certainty That the Conservation Effort Will Be Effective

Final Report

State of Oregon[1]

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Introduction

The Oregon Coastal Coho Project is a multi-faceted approach to assessing the status of the Oregon Coast coho ESU and conservation efforts implemented to restore the species. The State's analyses demonstrate that the ESU currently exceeds viability criteria necessary to avoid becoming threatened with extinction in the foreseeable future (Part 2, Viability Analysis). Part 1 (Synthesis Report) integrates viability analysis (Part 2), an evaluation of past and present conservation efforts implemented to stabilize and/or reverse factors for decline, and Part 3 (PECE A and B) analyses into a summary of the status of the fish and an evaluation of ongoing conservation efforts. Part 3 (PECE A and B) focuses on current or future conservation efforts that have yet to be implemented or that have been implemented but where the effects of the efforts will occur over an extended period of time and are not yet fully known. PECE Section A focuses on the certainty of implementation while this section (B) focuses on the certainty that the conservation effort will be effective.

This report (Part 3 (B) PECE) is a mixture of quantitative and qualitative analyses of the ***certainty of effectiveness*** of current regulatory and non-regulatory programs that address threats to the viability of the Oregon Coast coho ESU. Where empirical data, research or modeling is available to support assumptions or conclusions they are provided. Where data is lacking or programs are in early stages of implementation, the State describes the goals and objectives of the programs and our expectations with regards to these actions in the future.

In order to analyze the certainty that the conservation effort will continue to be effective, Oregon identified the state and federal programs that make up the conservation effort in the Oregon Coastal Coho ESU and analyzed each under the PECE criteria. Details about individual programs are found in Parts 4(A – J) and include the following programs:

- Forest management programs, including state forest management, private forest management and federal forest management under the Northwest Forest Plan;
- Water quality programs, including monitoring, updating water quality standards, NPDES permitting, water quality certification for instream work and removal and fill activities, nonpoint source pollution prevention programs, developing Total Maximum Daily Loads (TMDLs) and implementation plans, and providing technical and financial assistance;
- Agricultural management programs, including Agricultural Water Quality Management program, Confined Animal Feeding Operation program, Pesticides program, Weed Control and Invasive Species programs, and Soil and Water Conservation District programs;
- Water use programs, including monitoring and distributing water for instream water rights, and regulation of water rights;
- Fisheries harvest management programs;
- Hatchery management programs, including the state's Hatchery Management Policy and Native Fish Conservation Policy;

- Dredge, fill, and in-water construction programs, including the Removal-Fill Program, Wetland Management and Planning Program;
- Urban Growth Management, including the Statewide Planning Program and Statewide Planning Goals for Agricultural Lands, Forest Lands, Urbanization, Natural Resources and Estuarine Resources; and
- Watershed restoration programs.

In this document, we address the questions put forth in Part B of the PECE document (68FR15100). The focus of this document is those Factors for Decline that remain as *threats* to the present or future viability of the Oregon Coast coho ESU. We describe the conservation efforts in place and their likelihood to halt or reverse the threats the actions may impose. The PECE describes six criteria by which the federal agencies will evaluate the likelihood that a conservation effort will be effective. Below are the six criteria with a summary analysis of the state's conservation programs and overall conservation effort.

PECE Analysis Part B: The Certainty That The Conservation Effort Will Be Effective:

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

Our assessment of the current threats to the Oregon Coast coho ESU was developed based on the findings in Part 2 (Viability Analysis). Viability criteria for abundance, productivity, distribution/diversity, persistence, and genetic variability were developed and applied to the 21 functionally and potentially independent populations, designated by the NOAA Fisheries Oregon Coast coho Technical Recovery Team (TRT; Lawson et al., 2004). The results of these population-based analyses were then integrated into intermediate scale (strata) and ESU-based assessments of viability to determine the status of the ESU. Fourteen of the twenty-one populations passed all five of the population viability criteria and seven failed one or more criteria.

Oregon determined population bottlenecks for the 21 coho populations that comprise the ESU. This analysis is an important new element of Oregon's effort to create future conditions that will strengthen ESU viability. Whereas conservation and restoration efforts from 1997 to 2004 were conducted in an attempt to address all factors for decline, the results of a risk factor analysis has the potential of providing more effective focus to conservation and restoration work. The methodology used to determine the rankings for risk factors is described in Part 1 (Synthesis Report) of the Oregon Coastal Coho Assessment.

Oregon's intent was to identify the *primary* risk factor that limits production for each population in the ESU, regardless of whether or not the population passed the viability criteria. This risk factor is referred to as a population *bottleneck:* the risk factor that most limits the population. In theory, then, efforts to improve viability or production of the population would address the population bottleneck first.

Oregon believes that it is most useful to identify bottlenecks at the scale where restoration or management action could affect a positive response to improve ESU viability. In most instances, this means the population. However, some management actions are implemented so broadly that they affect the ESU. The following two examples illustrate these contrasting situations.

1. Management action to reduce impacts of fishery mortality in the ocean would affect many populations across the ESU.
2. A restoration project designed to improve fish passage at a culvert would affect only an individual population.

Regardless of whether a specific population currently *does or does not* meet biological criteria, restoration work designed to address a population bottleneck should serve to strengthen the population and, thus, strengthen the existing viability of the ESU. In addition, Oregon used these determinations to focus their analysis on specific programs when evaluating the "certainty the conservation effort will be effective" under PECE.

Population bottlenecks identified via Oregon's risk assessment are displayed in Table 1. A scarcity of stream complexity (crucial to over-winter survival of juvenile coho) was the most common primary risk factor bottleneck and water quality was the most common secondary bottleneck in these populations. Stream complexity was the primary bottleneck for 13 of 21 populations and a secondary bottleneck for 8 of 21 populations. Water quality was not a primary bottleneck for any populations; however, it is a secondary bottleneck for 15 of 21 populations. Other risk factors that were identified as primary population bottlenecks include: hatchery impacts (2 populations), exotic fish species (3 populations), water quantity (2 populations), and spawning gravel (1 population). Identification of these population bottlenecks provides a useful context for work to both conserve present conditions and to create improved future conditions for the ESU that should strengthen viability beyond its present condition.

Conservation Efforts Directed at Threats to Habitat

The certainty of effectiveness (reducing the threat) is based upon four basic principles:

1. Addressing factors for decline by changing historic management practices;
2. Conserving existing conditions that support viability of the ESU by addressing current and future threats to ESU viability;
3. Creating future conditions that further strengthen ESU viability and support achievement of broad Oregon Plan objectives; and
4. Monitoring to detect future trends and support adaptive management.

This section focuses on regulatory and non-regulatory programs that address the threats to coho habitat as identified in our analysis of risk factors for the Oregon Coast coho ESU. Our emphasis is on programs that influence stream complexity, water quantity and water quality, along with restoration programs enacted to restore watershed health, water quantity and water quality.

Table 1. Primary and secondary life cycle bottlenecks for functionally and potentially independent populations in the Oregon Coast coho ESU.

Population	Primary Bottleneck	Secondary Bottleneck	Viability Status
Necanicum	Stream Complexity	--	Pass
Nehalem	Stream Complexity	Water Quality	**Fail**
Tillamook	Stream Complexity	Water Quality	**Fail**
Nestucca	Stream Complexity	--	Pass
Salmon	Hatchery Impacts	Stream Complexity	**Fail**
Siletz	Stream Complexity	--	**Fail**
Yaquina	Stream Complexity	Water Quality	Pass+
Beaver	Spawning Gravel	Stream Complexity	Pass+
Alsea	Stream Complexity	Water Quality	**Fail**
Siuslaw	Stream Complexity	Water Quality	Pass+
Lower Umpqua	Stream Complexity	Water Quality	Pass+
Middle Umpqua	Water Quantity	Stream Complexity Water Quality	Pass+
North Umpqua	Hatchery Impacts	Stream Complexity	**Fail**
South Umpqua	Water Quantity	Stream Complexity Water Quality	Pass+
Siltcoos	Exotic Fish Species	Stream Complexity Water Quality	Pass+
Tahkenitch	Exotic Fish Species	Stream Complexity Water Quality	Pass+
Tenmile	Exotic Fish Species	Stream Complexity Water Quality	Pass+
Coos	Stream Complexity	Water Quality	Pass+
Coquille	Stream Complexity	Water Quality	Pass
Floras	Stream Complexity	Water Quality	Pass
Sixes	Stream Complexity	Water Quality	**Fail**

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In the past, evaluations of habitat-related threats to this ESU have focused on known and potential impacts of historical patterns of land management on watershed function, most directly manifested by impacts to riparian areas which can translate into degraded water quality and reductions in habitat quality and quantity. The legacy of past management practices, such as splash damming, stream cleaning, stream channelization, agricultural practices, urbanization, and the diking and filling of wetlands and estuaries have left significant imprints on the landscape. Regulatory programs enacted in the last 35 years have continued to evolve in response to new information and needs of present and future generations. More recently, through efforts like the Oregon Plan, non-regulatory

programs have been put in place to address additional needs to protect and restore watersheds.

Biological Status of Coho and the Relationship to Habitat Conditions in the ESU

Oregon concludes that the Oregon Coast Coho ESU is biologically viable, an assessment based on the performance of populations as evaluated by specific, scientifically based, criteria (Part 2, Viability Analysis). To pass the viability criteria, both individual populations and the ESU as a whole must demonstrate sufficient productivity to maintain populations through periods of poor marine survival. Productivity, measured in this way, is a product of coho adaptation, resilience, and behavior as expressed over a mosaic of habitats. The quality of freshwater habitats is the most critical factor that supports this productivity, and a key focus of Oregon Plan restoration efforts. Our analysis, based on the empirical record, demonstrates that most populations retain sufficient productivity in freshwater habitats to maintain meet viability criteria through environmental conditions similar to or slightly worse than those experienced over the last forty-plus years.

Sensitivity of ESU Viability to Changes in Habitat Quality

In the status assessment, we conducted a sensitivity analysis to determine the effect of varying levels of life cycle survival on the persistence of populations. Our sensitivity analysis of changes in life cycle survival are premised on the assumption that changes on survival are carried throughout the life cycle, regardless of which stage it occurs. During periods of poor marine survival, coho salmon freshwater productivity above replacement levels is limited to areas of the highest habitat quality (Nickelson and Lawson, 1998). Our sensitivity analysis of life stage survival rates concludes that these rates (egg to smolt survival in particular) are key indicators of habitat quality. Decreases in the quality of these habitats directly affect life stage specific survival that carries through the remainder of the life cycle reducing the overall productivity of a population. This process operates over the full range of environmental conditions, but the critical impact of habitat capacity on coho productivity is most clearly expressed during periods of poor marine survival.

Our analysis of life cycle survival and habitat capacity concludes that the ESU could sustain moderate reductions (<15%) in productivity yet remain viable (see Table 10, Coho Assessment Part 2: Viability Analysis). Holding marine survival constant, the amount of high quality habitat is likely the primary driver of population productivity. These findings are consistent with past research (Nickelson and Lawson, 1998) and new analyses by the Coastal Coho Technical Recovery Team (TRT, unpublished data). Nickelson and Lawson (1998) found that those populations with the poorest habitat quality (Tillamook and Nestucca) would see substantial increases in the risk of extinction ($p = 0.05$) when habitat quality decreased by 20% or more. Preliminary analyses from the TRT, based on ODFW's current habitat data, shows that those populations with the lowest levels of high quality habitat have lower probabilities of persisting over the next 100 years using the Nickelson-Lawson model (P. Lawson, personal communication). The availability of high quality habitat remains the critical bottleneck to increased productivity in freshwater for most populations.

Current Status of Habitat in the ESU

ODFW's analysis of stream channel and riparian data collected from 1998 to 2003 indicates no consistent trend in stream habitat conditions within the Oregon Coast Coho ESU (Part 4(C) ODFW (3) Habitat). These results are consistent with a study by Thom and Jones (1999) who assessed change in habitat from 1993-99 for all Oregon coastal streams. Although our ability to detect significant trends is affected by the low statistical power of our analyses, we believe that short of catastrophic habitat changes (which have not occurred) we would not expect to see significant changes in habitat variables over the short time span we have been monitoring habitat with our random surveys. Improvements in habitat conditions will occur on a longer time scale as large trees are recruited into riparian areas and upland areas continue to stabilize.

ODEQ's analysis of 31 long-term water quality monitoring locations within this ESU demonstrates overall improvement in the water quality of larger rivers and streams (Part 4(B) Water Quality Report). Thirty-nine percent of sites showed improving water quality and no sites had decreasing water quality from 1993 to 2002. The water quality index was excellent to good at 42% of the sites while only 19% had poor to very poor water quality. While sites used by this program are typically located on larger rivers and streams, they reflect the integrated water quality impacts from point and nonpoint sources as well as the natural geological, hydrological, and biological impacts on water quality for the watersheds they represent. Additional ODEQ sampling from randomly selected sites in smaller streams found that 54% exceed water temperature standards and 41% exceed fine sediment standards, suggesting the high summer stream temperatures are a concern. However, an analysis by ODFW concluded that winter habitat, and not summer habitat, is the likely freshwater bottleneck to coho productivity in all populations. Further discussion of these findings is found in Part 4 (C) ODFW (3) Habitat Report of the assessment. This is not to diminish the importance of water quality issues at the local scale. Our current understanding of what limits coho productivity places water quality as a secondary consideration. We also recognize the synergistic relationship between water quality, riparian conditions, and habitat complexity. Efforts to protect and restore these processes and functions will all benefit coho salmon.

Coho streams in this ESU currently are characterized by a general scarcity of large wood in the channel, lack of large conifers in riparian areas, reduced interactions with off-channel alcoves and flood plains, and presence of fine sediment in gravels. Complex, low-gradient habitats that include large wood instream, large riparian conifers, off-channel connectivity and clean gravels are key components of over-wintering habitat for juvenile coho in coastal watersheds. During periods of poor marine survival (3% marine survival), freshwater productivity is reduced to the areas of highest quality overwinter rearing habitats. By quantifying and mapping high quality habitat in the ESU by populations, we determined there are about 900 miles of high quality overwinter rearing habitat in the ESU (Figure 1, see Part 4 (C) ODFW (3) Habitat Report for additional details). This represents about 14% of the overwinter rearing habitat available to coho salmon, but may underestimate the availability of high quality winter habitat as it is based

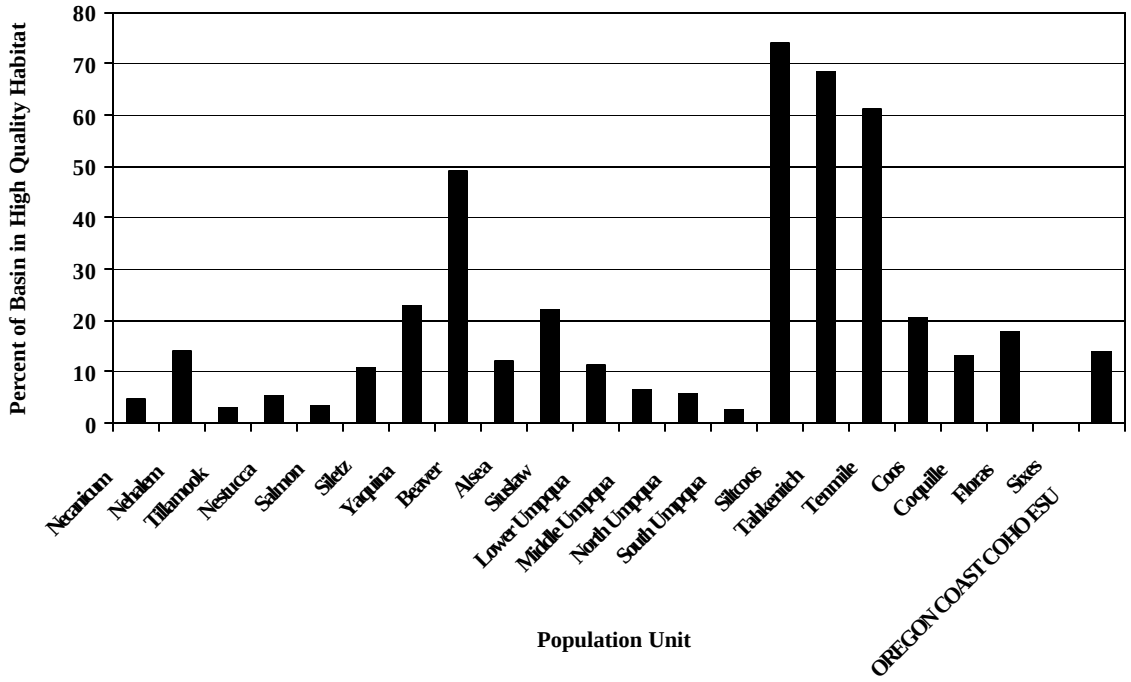

Figure 1. Percentage of habitat determined to be high quality for winter rearing for each of the functionally and potentially independent populations in the Oregon Coast coho ESU, based on current habitat conditions.

on surveys of wadeable streams. Areas downstream of wadeable streams may provide additional high quality habitat in the form of off-channel habitats, beaver ponds and wetlands. On-going mapping of wetlands and estuaries in the ESU by DSL will be a critical next step in identifying important areas of additional habitat or opportunities for restoration. Even though Oregon has determined that the ESU is currently viable, the relative scarcity of high quality overwinter rearing habitat is of concern. Our analysis of the quantity and distribution of high-quality habitat is a basis for protecting existing habitats and focusing restoration to create additional habitat. It is also a baseline to monitor future changes as conservation efforts are enacted.

Future Trends in Habitat Conditions

The Coastal Landscape Analysis and Modeling Study (CLAMS), a joint venture between Oregon State University and the USDA Pacific Northwest Research Station, has developed the most comprehensive analysis of future trends in forest conditions in coastal watersheds (Spies et al., in press). CLAMS analyses were based on current forest management in the ESU as guided by the federal Northwest Forest Plan and the state's Forest Practices Act. The analyses did not consider the potential influence of restoration programs in the ESU or riparian management on urban or agricultural lands.
From the CLAMS analysis of future trends in riparian forest cover adjacent to reaches with high intrinsic potential for coho salmon and steelhead in the Oregon Coast coho

ESU, we arrive at the following conclusions. Under current forest management rules, the frequency of the larger (>50-cm dbh) forest-cover classes is expected to increase on fish-bearing streams over the next 100 years. Public lands currently contribute most of the larger diameter classes and this is expected to continue into the future. In 100 years, larger diameter classes will make up approximately 75% of riparian areas on federal lands, 60% on state forest lands, but no more than 25% on private lands. While larger diameter trees increase adjacent to all fish-bearing streams, the increase is only half as much along high intrinsic potential reaches for coho salmon as for steelhead. This reflects that high intrinsic potential reaches for coho salmon are concentrated on private lands whereas those for steelhead are more evenly distributed across public and private ownerships (Burnett et al., in press). Based on these findings, the amount of large wood delivered from sources adjacent to fish-bearing streams is anticipated to increase.

The amount of large wood expected to be delivered to perennial channels from intermittent channels will depend on the amount of large wood stored in intermittent channels and the likelihood that this wood is transported downstream. The amount of large wood stored in an intermittent channel will vary based on the landscape processes that deliver wood to that channel and on the policies governing riparian management. Whether or not any stored wood is delivered to perennial channels downstream is primarily determined by the likelihood of debris-flow initiation and transport. Where debris flows are prevalent and the channel network is conducive to transport (high gradients, low tributary junction angles), as much of 50% of the large wood may be delivered from intermittent to perennial streams in unmanaged watersheds (Reeves et al. 2003). In such areas, large wood is expected to decrease for perennial streams on private lands because most intermittent streams are unlikely to store much large wood in the future if current riparian management policies remain in place.

These conclusions suggest that the availability of larger trees for recruitment into streams from adjacent riparian areas will increase over time on fish-bearing streams while the ability to recruit wood from intermittent streams will vary across the landscape. The potential for wood recruitment is likely to vary across the forest ownerships, with the highest potentials on public lands and lower potentials on private lands. Whether these projections are adequate to improve coho habitat is uncertain, but the likelihood that habitat will be worse in 100 years under current policies than it is today seems low.

The CLAMS analyses did not consider what is likely to happen to riparian vegetation on agricultural or urban portions of the landscape. CLAMS did look at land use change adjacent to HIP reaches. Developed uses (non-forest uses) are expected to remain relatively low across the ESU but in certain areas (North Coast and Mid-South Coast) are expected to increase particularly adjacent to high intrinsic potential reaches for coho salmon. Based on our assessment of current regulatory and non-regulatory programs, the State concludes that we are likely to see slow improvements in riparian vegetation on agricultural lands under current rules with uncertainty about how much and where the changes will occur. Further consideration of this issue will be taken up in the development of the joint federal and state conservation plan for coastal coho.

Despite poor habitat conditions relative to reference conditions or water quality standards, we find little evidence that habitat conditions continue to decline in the ESU. There was no consistent trend in physical habitat (acknowledging low power to detect one) and the water quality index at large river monitoring sites was stable or improving. Regulatory programs designed to maintain or restore ecological functions associated with riparian and aquatic areas as well as the upland areas that directly influence stream ecosystems are in various stages of implementation. Non-regulatory programs are focused on the principal threats to viability (habitat complexity, water quality, riparian conditions) and will continue to evolve in response to this assessment. Even if the State is wrong and habitat conditions are declining, the regulatory and non-regulatory programs are directed at the predominant threats to viability. Through monitoring and adaptive management processes, we have the ability to evaluate the activities being conducted in the Oregon Coast coho ESU and to continue to direct activities at critical needs and critical uncertainties.

Current Habitat Management Programs

Numerous programs regulate land management in the Oregon Coast Coho ESU. On forested lands, federal lands are managed under the Northwest Forest Plan (NFP) and the myriad of federal laws that direct forest management. The Northwest Oregon Forest Management Plan and the Elliot State Forest Management Plan guide management of State forestlands in the ESU. On private timberlands, land management is regulated under Oregon's Forest Practices Act. Management of agricultural lands is guided by a variety of programs, including Agricultural Water Quality Management (SB 1010), Confined Animal Feeding Operation (CAFO), Pesticides, Weed Control and Invasive Species programs, removal-fill regulation, and land use controls. The state's management of urban lands is carried out through the statewide comprehensive land use planning program. State and federal agencies administer a number of Clean Water Act authorities that regulate activities affecting water quality and wetlands. In addition, there are a variety of restoration efforts conducted by a range of entities, including watershed councils, Soil and Water Conservation Districts (SWCD), and a range of federal and private programs. Funding for restoration is administered by OWEB (Ballot Measure 66 funds, Pacific Coastal Salmon Recovery Fund) and ODFW (Restoration and Enhancement program) at the state level. A number of restoration grant programs are administered by federal agencies (e.g., EPA, NOAA Fisheries, USFWS, and NRCS). Finally, several programs developed non-regulatory measures under the Oregon Plan to bolster the collective efforts to protect and restore aquatic habitats.

Oregon Plan programs reduce the threats to habitat conditions necessary for ESU viability and restoration with a three-pronged approach: regulatory, non-regulatory, and monitoring. As an example, all riparian areas adjacent to coho streams in the ESU receive some kind of protection. These protections include water quality management plans and rules on agricultural lands, riparian reserves on federal forestlands, restricted riparian management areas on state and private forestlands, setbacks from development, and riparian improvement projects. What follows is a description of the regulatory and

non-regulatory restoration programs and how they reduce the threats associated with aquatic and riparian conditions in the Oregon Coast coho ESU.

Conservation Efforts Directed at Forest Management

This discussion of forest management programs in the Oregon Coast coho ESU is based on supporting documentation found in Parts 4(D) Forestry, (E) Federal Forest Management, and (J) Technical Reports of the Oregon Coastal Coho Assessment. Current forest management programs have the potential to impact coho salmon through changes to instream habitats, riparian conditions, water quality and fish passage. Oregon's risk analysis identified stream complexity and water quality as primary or secondary risk factors that currently limit the viability or recovery potential of the ESU's constituent populations. We evaluated current forest management programs in relationship to these risk factors and assessed their effectiveness at addressing current and future risks to ESU viability.

Oregon's forests are held by a rich variety of owners - federal, tribal, state, and local governments, as well as private industrial owners and family forest landowners. The owners manage for a variety of objectives and values and provide for an array of benefits resulting from different actions in different places at different times. Across these ownerships, forest management strategies can be grouped into four broad categories: Wood production, Multiple-resource, Reserve, and Residential value emphasis. Currently, federal lands (37% of the ESU) are dominantly in the reserve strategy, state-owned lands (9%) dominantly in the multiple-resource, and private lands (37%) are dominantly in either the wood production or residential value strategies. Based upon these four strategies, different approaches are used to provide for protection of habitat and water quality, with approaches being very "precautionary" on federal and state-owned lands. An adaptive Oregon Forest Practices Act (FPA) and a strong but flexible Land Use Planning Program are the cornerstones of forest resource protection on private lands in Oregon. While some may perceive protections provided under the FPA as less precautionary than protections on state or federal lands, by ensuring that private forest uses remain viable in the long-term, Oregon avoids the conversion of these private forestlands to other land uses that are likely to pose more significant threats to habitat and water quality. Comparable data from California and Washington clearly demonstrate the success of Oregon's integrated strategy of forest practices and land use protection. For example, the Natural Resources Conservation Service (NRCS) has reported that "Washington's forestland is being converted to other uses at a rate that exceeds the rate of conversion in the Pacific Northwest region and the nation as a whole" (Clinton and Lassiter 2002).

Oregon Plan actions describe a set of activities along riparian areas to increase leave tree retention along fish-bearing streams as well as to leave trees along small non-fish bearing streams where tree retention is not other-wise required. These types of activities are being implemented on state and private forest land. Other Oregon Plan riparian activities include livestock exclusion fences and tree planting. These types of activities typically occur along agricultural land. The incentives for landowners to participate in these

programs were to support the Oregon Plan and associated goals for improved watershed conditions. Parts 4(D) ODF Chapter B1 Riparian Areas and 4(D) ODF Chapter A1 Forest Practices Act describe in detail implementation of these non-regulatory activities.

In general, these activities increase the numbers of trees left on non-fish bearing and fish bearing streams above that required by the Forest Practices Act. The desired effect is to reduce risks to coho associated with otherwise low levels of large wood recruitment from near-stream and upland sources. Increased tree retention along non fish-bearing streams increases upland sources while increased retention along fish-bearing streams increases near-stream sources of large wood. Increased retention along fish-bearing streams may also benefit coho if shade levels are increased and stream temperature reduced. Effectiveness of these measures has not been demonstrated with a field study. Future monitoring will focus on the effectiveness of these practices to increase large wood recruitment from near-stream and upland sources, the effects on shade and stream temperature.

Current forestland protections have virtually eliminated (since the mid-1980s) the removal of large downed wood from stream channels and riparian areas. Riparian protection strategies vary based upon ownership, but all strategies now require retention of trees in a manner that will result in increased inputs of large wood over time as compared to the very limited buffers protected prior to the mid-1980s. Significant investments in road and drainage systems have been made over the last decade, resulting in improved fish passage, reduced risk from road-induced sedimentation and other drainage-related risks from transportation systems. Overall, timber growth in the ESU exceeds harvests and the amount of large diameter trees is increasing both in riparian and upland areas (Johnson and Spies, 2001).

Reducing the Threat on Federally Managed Forestlands

This discussion of federal forest management in the Oregon Coast coho ESU is based on supporting documentation found in Part 4(E) Federal Forest Management of the Oregon Coastal Coho Assessment.

For federal lands, a goal of the Northwest Forest Plan (NWFP), as enacted through the Aquatic Conservation Strategy (ACS), is to protect and restore salmon and steelhead habitat on federal lands. The nine objectives under the ACS are implemented primarily through the designation of riparian reserves and key watersheds along with watershed analysis to guide management actions and watershed restoration to address watershed function. Through these actions, federal land management activities directly or indirectly address factors for decline associated with physical habitat, water quality, water quantity, and biological condition. On the basis of this approach and the implementation record since 1994, NOAA Fisheries concluded in the June 14, 2004 proposed listing determinations for 27 ESUs of west coast salmonids, that "where the standards are implemented, the resulting conditions will be consistent with the recovery of salmon and *O. mykiss* ESUs" (50 CFR Parts 223 and 224).

Following 3 years of NWFP implementation, NOAA Fisheries subsequently reviewed the adequacy of 14 individual Long Range Management Plans (LRMP), as modified by the NWFP and its ACS, for conserving Oregon Coast and Southern Oregon/ Northern California Coast coho salmon. The results of these reviews are described in two conference opinions (NMFS, 1997 and 1998) that document NMFS' determinations that the programmatic direction for Federal land management actions embodied in the 14 LRMPs would not be likely to jeopardize the continued existence of OC coho salmon. Moreover, the opinions concluded that implementation of management direction in the LRMPs and Riparian Management Plans will result in substantially improved habitat conditions for these ESUs over the next few decades and into the future. Improved habitat conditions will result in increased survival of the freshwater life stages of these fish. Implementation of actions consistent with the ACS objectives and components—including watershed analysis, watershed restoration, reserve and refugia land allocations, and associated standards and guidelines—will provide high levels of aquatic ecosystem understanding, protection, and restoration for aquatic habitat dependent species.

Reducing the Threat on State Managed Forestlands

State managed forestlands are administered under Board of Forestry Forest Management Plans (FMPs). The biological and ecological objectives of the FMPs are to maintain and/or restore the ecological functions of aquatic and riparian areas as well as upland areas that directly influence aquatic and riparian areas. The intent is to manage for proper functioning aquatic systems by providing diverse aquatic and riparian conditions over time and space. This approach is intended to more closely emulate the historical conditions maintained by the natural disturbance regimes under which native species evolved. Desired future conditions for non-fish bearing streams are differentiated for those that are perennial streams, seasonally high-energy streams, and potential debris flow track reaches. Aquatic and riparian conditions are linked with landscape processes such as mass soil movements and hydrologic regimes. The FMP uses a blended approach to manage riparian and aquatic habitat at the landscape and site-specific levels. Through this approach, the FMP addresses physical habitat, water quality, water quantity, and biological condition factors for decline. The Independent Multidisciplinary Science Team (IMST) cited this approach as having a high likelihood of restoring and maintaining properly functioning aquatic systems (IMST 1999).

The water protection rules require the establishment of riparian management areas (RMAs) on most streams that are within or adjacent to a harvest unit. The RMA width requirements vary depending on the stream classification (OAR 629-635-300). Oregon Department of Forestry (ODF) classifies streams by "Type" and by stream size. The "Type" designations include Type F for fish-bearing streams, Type N for non-fish-bearing streams and Type D for domestic water sources without fish presence. Stream sizes are based on average annual stream flow in cubic feet per second (cfs). The stream size classifications are small (< 2 cfs), medium ($\geq$2cfs and <10 cfs), or large ($\geq$10cfs). Desired conditions are explicitly described for (a) fish-bearing and large and medium non-fish bearing streams and (b) small-non-fish bearing streams. The desired future conditions described in the Forest Management Plan have been designed around a

scientifically based understanding of habitat requirements for anadromous and native fish. Therefore, if the desired conditions are met, the program is likely to reduce the threat to coho sustainability on state-managed lands, and potentially speed up the time within which restoration is achieved. While the FMPs are in the early stages of implementation, Oregon submits that the blended approach is likely to be effective at reducing the threat from forest operations on state lands to coho viability for the following reasons:

- The goal to attain mature forest condition in riparian areas is likely to meet coho needs by creating and maintaining large diameter trees in riparian areas that will be available for recruitment to streams.
- The FMP has explicitly described basal area targets for achieving mature forest condition (80 – 100 years) and relates that to a typical number of large trees per acre (40-45 32-inch conifer trees).
- The FMP makes a commitment to leave riparian areas untouched that meet the mature forest condition.
- Riparian areas are 170 feet wide with varying management options to meet the mature forest condition within the 170 feet. The mature riparian forest goal, commitment to maintain these once achieved, and the wide buffers widths are likely to capture 70-99% of the large wood recruitment (Murphy and Koski 1989, Van Sickle and Gregory 1990, McDade et al. 1990, Bilby and Bisson 1998).
- The wide buffers and standard management targets designed to mimic mature forest conditions are highly likely to maintain shade and thus stream temperature.
- The FMP describes alternative approaches for managing riparian areas that don't meet mature forest condition in ways that will achieve that condition in a timelier manner.
- The FMP describes goals and options for aquatic habitat restoration.
- Upland strategies designed to minimize impacts of roads on aquatic and riparian ecosystems recognize the connectivity between aquatic habitat and upslope management practices.
- The FMP incorporates upland strategies that attempt to manage the risk of landslides so as to maintain and restore these areas to mimic historic process of upland large wood recruitment and routing to streams.

In addition to the reduced threats associated with the blended approach, the state forests program has devised a plan to further reduce the threat to anadromous fish in 17 watersheds identified as Salmon Anchor Habitat. Within these watersheds additional precautions have been outlined, in part with prescriptive elements. These elements include:

- No harvest on all fish-bearing streams and medium type F streams.
- Limitations on harvest along perennial, seasonal, and debris-flow prone non-fish bearing streams.
- No harvest within 50 feet of perennial and debris-flow prone, small, type N streams,
- No harvest within 25 feet of seasonal small type N streams.

- Additional leave-tree requirements (15-25 conifer trees and snags per acre) within 100 feet.
- No ground based equipment operation is allowed within 50 feet of the aquatic zone on all small type N streams.
- There are specific limitations on timber harvest activities associated with specific basins. Examples include caps on the percent of watersheds that can be clearcut harvested (ranging from 10 – 25%)

These strategies accomplish the following with regard to reducing the threat to coho habitat:

- They virtually eliminate the possibility that that there will be reductions in shade on fish-bearing streams associated with timber harvest.
- They lower the risk that harvesting will reduce shade on non-fish bearing streams.
- No harvest within 100 feet of the stream is highly likely to capture 70 to 99% of the large wood recruitment potential (Murphy and Koski 1989, Van Sickle and Gregory 1990, McDade et al. 1990, Bilby and Bisson 1998).
- Increased retention of trees along non-fish bearing streams provides large wood recruitment to fish bearing streams that is associated with debris torrents.

Reducing the Threat on Private Forestlands

Private land management is likely to restore substantial coho habitat over time because:

- The goal for large and medium fish-bearing streams to attain mature forest condition in riparian areas is likely to meet coho habitat needs in the long-term by creating and maintaining large diameter trees in riparian areas that will be available for recruitment to streams.
- The rules have explicit basal area targets for achieving mature forest condition (80 – 100 years) and relates that to a typical number of large trees per acre (40-45 32-inch conifer trees).
- The goal to attain mature forest condition in riparian areas is likely to meet coho needs by creating and maintaining large diameter trees in riparian areas that will be available for recruitment to streams.
- The rules provide alternative prescriptions for managing riparian areas that do not meet mature forest condition in ways that are intended to achieve that condition in a timelier manner.
- The rules provide options and incentives for aquatic habitat restoration.
- Upland strategies designed to minimize impacts of roads on aquatic and riparian ecosystems recognize the connectivity between aquatic habitat and upslope management practices.
- Economically efficient practices and adaptive management promote retention of private forestland in continued forest use.

- Social acceptance by the regulated community provides for very high levels of compliance.

A detailed discussion of the benefits and impacts of riparian protection measures are provided in Part 4(D) ODF B1 Riparian Areas, providing estimates on the likelihood that the FPA strategies will be effective at providing large wood recruitment and shade in both the short term and longer term. To summarize, available research and monitoring suggests that over time, and depending on how riparian areas are managed, the FPA Rules are estimated to maintain 46-92% of large wood potential recruitment on large streams, 30-80% on medium streams, and 12-26% on small streams. Changes in large wood recruitment were not statistically significant for medium or large streams. Likewise, Dent (2001) observed reductions in shade averaging 1% on large streams, 7% on medium streams, and 12% on small streams. Again, the findings were only statistically significant on small streams. The study concluded that the 1994 rules were not likely to meet the goals as described in the FPA on small and medium streams.

ODF and ODEQ combined this information with other results regarding shade, to evaluate the sufficiency of the FPA in meeting water quality standards (ODF and ODEQ 2002). They made a series of recommendations for increasing tree retention to be consistent with achieving mature forest conditions in a timely manner. The Board of Forestry is currently considering a rule package to increase leave tree requirements on small and medium streams. This package also addresses portions of IMST (1999) recommendations for increased leave tree requirements on small and medium streams. See Part 4(D) Chapter A1, for more information on this topic.

The private and state forests programs at ODF have an ongoing study in the coast range that continues to evaluate the effectiveness of the forest practice rules and FMP strategies (described above). Preliminary results from this study describing baseline conditions will be available in 2005.

Large Woody Debris

The Oregon Department of Forestry has demonstrated the use of adaptive management to revise rules when scientific analyses suggest a change is needed to meet desired conditions. As new rules are adopted it will be necessary to continue monitoring and research to determine if there is increased effectiveness associated with changes in rules for large wood recruitment and shade. In the absence of empirical data or model projections on how the new rules might perform, the following discussion represents our professional judgment of how current rules are likely to effect the recruitment of large woody debris from riparian and upslope sources.

Large Wood Recruitment

For the sake of clarity, the following terminology will be used to define large wood sources for this discussion.

Near-stream riparian: Areas directly adjacent to the stream. Large wood is delivered simply by the tree falling directly into the stream from the adjacent streambank or hillslope.

Upstream riparian: Near-stream riparian sources that are upstream of the reach of concern. High water and/or a debris flow transport the large wood to its current location after initially falling into the stream from the riparian area.

Upslope: Zero-order channels (zero-order channels are small, unbranched draws), hollows, or hillslopes. Areas outside of the riparian area. Large wood is delivered by a landslide or landslide-debris flow combination that moves the wood into the stream channel from these areas.

Near-stream Sources

A review of the literature shows that 70 to 99 percent of potential large wood input *from adjacent riparian stands* originates from within the first 30 meters, or about 100 feet, of the stream (see Part 4 (D) ODF Chapter B1 Riparian Areas for further discussion). It is also possible, however, for 70-99 percent of the potential large wood input from riparian stands to originate from within the first 50 feet of the riparian forest. The majority of larger pieces of large wood, such as key pieces, originate from within a distance less than 100 feet. The bulk of the potential *riparian area* inputs of large wood come from vegetation in close proximity to the channel, with diminishing amounts coming from distances farther from the stream. It should be emphasized that these studies did not intend to examine upslope source areas. They analyze potential large wood inputs in terms of the total large wood potential from riparian areas only.

Under the current forest practice rules, riparian management areas for small, medium and large streams are 50, 70, and 100 feet wide, respectively. Given the summary of literature discussed above it is likely that increases in tree retention within 50 – 70 feet of the stream will contribute to increases in large wood recruitment from small and medium streams. The summary also supports ODF's conclusions that 100-foot wide riparian management areas (as required on large fish-bearing streams) can adequately protect large wood recruitment functions if managed appropriately.

Critics have expressed concern that the riparian rules do not adequately address large wood recruitment because landowners will disproportionately harvest large trees from riparian areas, preventing smaller diameter trees from ever maturing into trees that are important for large wood recruitment. Recent data from ODF demonstrate that in general, landowners do not disproportionately harvest large diameter trees from riparian areas. The average diameter within RMAs (within 50, 70 and 100 feet) of small, medium, and large streams did not change significantly with harvesting (p-value = 0.74, 0.48, and 0.18 respectively).

Upstream and Upslope Sources

Source areas for potential inputs of large wood are not limited to near-stream sources. Upstream or upslope areas can also be a source of large wood for fish-bearing streams. In steep landscapes, where the occurrence of debris flows is a normal part of the disturbance regime, relatively large pieces of wood in small streams can play an important role in maintaining salmonid habitat. High stream flows and debris flows are both mechanisms by which large wood can be transported from relatively small stream channels downstream to larger channels. Debris flows can periodically move very large pieces of wood from a hillslope or hollow downslope to fish-bearing streams where the large wood can interact with the channel and form fish habitat. In these cases, small stream channels can play a significant role in contributing key pieces of large wood to downstream riparian functions. These sources of large wood have been referred to as both "upslope" and "upstream" sources.

Available scientific information suggests the relative inputs from upslope sources ranges from 10-50%. In terms of upslope sources, the relative importance of potential large wood from zero-order channels and hillslopes to a given stream reach becomes less and less the larger the channel network is above that reach. The larger the channel is along a given reach, the greater the percentage of potential large wood originates from near-stream and upstream riparian sources. This will vary, however, depending on the topographic characteristics and landslide/debris flow potential. An area where debris flows rarely occur and where the slopes are relatively mild will have virtually all of the large wood originating from near-stream and upstream riparian sources. An area that has frequent landslide/debris flow activity and relatively steep slopes, on the other hand, may have a significant portion of the large wood potential in upslope sources originating from the zero-order channels and hillslopes.

Where shallow rapid landslides are rare or do not occur, the dominant mechanism for transporting large wood downstream is stream flow. For this population of streams, the hydrologic regime will determine what sizes of large wood will be stable and hydrologically functional in the channel.

The current forest practice rules establish a systematic process for identifying locations where landslides might occur. This is the first step in managing to reduce the landslide-associated management risks. The science and technology for identifying debris flow-prone terrain and channels is available and key drivers from that science have been incorporated into ODF's approach. Recent analysis documented that at least 78% of the landslides that occurred in the 1996 storm event were identified as "high risk sites" for landslides - confirming the value of that identification process.

While research has established that the rates of erosion are higher in younger stands than in older stands, it has also established that landslides occur with or without forest management and supply both sediment and structure such as large wood and boulders to streams. Therefore, ODF's focus is on creating an environment where when landslides do occur, they are beneficial to aquatic habitat. The science and technology for

identifying debris flow-prone terrain and channels is available, however, the marriage between science and management strategies to reduce threats is not as well developed and requires more research and monitoring. Currently, the FPA requires leave trees in debris flow paths that have the potential to impact public safety. While these rules are geared towards public safety, it stands to reason that the practice would be beneficial to aquatic habitat as well. Research has also established that such areas provide high quality and complex aquatic habitat. Modeling exercises to evaluate leave tree management practices, while not available at this time, could inform management and monitoring strategies.

There is no scientific or monitoring data on whether the High Landslide Hazard requirements to leave trees on headwalls are reducing the threats to coho associated with debris flows. Acknowledging that these rules are geared towards public safety, it stands to reason that in the event of a debris torrent, a landslide that contributes wood as well as sediment and boulders could better mimic historic processes. Future analyses from CLAMS will be available that attempt to model likely large wood recruitment under various management scenarios, with a focus on landslide and debris flow sources of wood.

Stream Shade

While it is well accepted that shade is critically important to controlling stream temperature, it is important to recognize that a focus on maximizing shade may reduce goals for large wood recruitment. Stand structure (i.e. basal area, stand density, and live crown ratio) plays an important role in determining the range of shade over streams and how this range will be affected by adjacent forest harvest activities. Stream shade levels reflect expected stand development characteristics. Open-grown stands (low basal area) tend to have higher live crown ratios and lower shade than dense stands (high basal area) with low crown ratios**.** Shade is expected to increase as a stand grows after harvest or disturbance, and is maximized during the stem exclusion stage (i.e., limited to no understory development such as herbs, shrubs, and seedlings). For the stand to move into the understory reinitiation stage, and later into older forest structure, light must filter through the forest canopy. Shade levels will vary as overstory trees succumb to age or disease, as suppressed trees are released, or die, and disturbances create openings.

Basal area alone is not predictive for shade. However, combined with other stand structure parameters, increasing basal area in western Oregon could result in higher shade on east-west flowing streams. The lower basal area requirements on small and medium streams are predicted to provide less shade than on large streams, particularly if the trees had larger diameters and higher live crown ratios. ODF's analyses suggests an increase in basal area on small and medium streams, as is being considered by the Board of Forestry, is likely to result in increased shade on small and medium streams.

Conversely, the analyses also highlight the potential downfalls of managing strictly for shade. If shade were the primary goal, the riparian area would be managed towards the stem exclusion stage. The stem exclusion stage is likely to promote small diameter trees

of poor vigor and, therefore, is unlikely to meet the other important functions of riparian areas. Managers must carefully consider their objectives for stream shading in relation to stand structure and the myriad of other "goods" produced by a riparian stand.

Roads and Landslides

ODF has strong regulatory (FPA) and management programs (FMP) that require notification of road construction in and around critical locations such as streams and landslide-prone areas. The regulations are an enforceable Best Management Practices program designed to minimize effects on water quality and aquatic habitat. The regulatory program reduces sediment inputs from roads no longer in use by requiring maintenance or proper vacating practices. The FPA and FMP reduce the threats associated with landslides with a systematic approach for identifying high landslide hazard locations. These programs reduce the threats associated with road-related landslides by avoiding road locations in critical landslide-prone areas, decreasing disturbance area associated with roads, and reducing hydrologic connectivity to streams. Forest Practice rules require traffic control during wet periods when hauling is contributing to erosion and delivery of sediment to streams and the use of high-quality rock surface on roads.

There are non-regulatory actions identified under the Oregon Plan relating specifically to roads. The program is referred to as the road hazard and risk reduction project (RHRR). The three major elements of the project are (1) surveying roads using the Forest Road Hazard Inventory Protocol, (2) prioritizing problem solutions, and (3) repairing problem sites identified through the protocol. Examples of activities include road condition surveys, fish passage improvements, replace structures to provide passage of the 50-year peak flow, increase number of cross drains, use of durable surfacing (now required by law), rock ditches, sidecast pull back, reconstruction on legacy roads, and vacate, close, and relocate roads. Landowners also voluntarily retain trees on small non-fish bearing streams to increase potential large wood delivery to fish bearing streams when landslides and debris flows occur.

The RHRR project reduces the threats from roads by conducting detailed surveys to identify hazards and risks to streams, and specific repairs that are above and beyond FPA road maintenance minimums and towards new road standards. This project has been applied extensively on Private Industrial (32% of the ESU) and State (9% of the ESU) forestlands, for a total of 41% of the ESU. These activities have been applied on limited non-industrial forestlands (20% of the ESU). Any road repair activities that might have occurred on Federal lands (38 percent of the ESU) were not consistently reported to the Oregon Watershed Enhancement Board and therefore are difficult to compare. Monitoring and research demonstrate that requirements such as durable surfacing can reduce sediment delivery by 75 to 90 percent or more. Monitoring suggests that the numbers of road-related landslides has decreased although they remain larger than non-road related landslides. Rule revisions currently in draft format would potentially decrease threats associated with landslides by increasing large wood delivery from small non-fish bearing streams during episodic events when sediment is also delivered by

debris flows. Harvest restrictions currently emphasize public safety. The management approaches that address landslides for public safety may be at odds with goals for aquatic habitat. However, one commonality is the retention of large trees along depositional reaches of debris flow paths and potential harvest restrictions around landslide prone areas. Watersheds designated as Salmon Anchor Habitat, under the state FMP may further reduce threats associated with landslides by increasing retention of trees along non-fish bearing streams which could increase large wood recruitment associated with debris torrents. ODF has a strong monitoring program that facilitates rule revision processes to improve resource protection.

The same principles apply for reducing road-related sediment with non-regulatory actions as with regulatory programs (see the discussion in Part 4 (D) Chapter A1 Forest Practices Act). The added value of the non-regulatory programs is the application of well-understood BMPs to roads that are not regulated by the regulatory programs and/or additional practices that are not required by the regulatory program. The added benefits include:

- Identifying hazards to aquatic ecosystems (critical locations such as streams and landslide-prone areas) with the use of a common field protocol;
- A commitment to repair and improve problems;
- And, additional decreases in sediment input to streams and barriers to fish passage beyond that required by law (*road conditions surveys, prioritization, and improvements*).

The same principles apply for reducing landslide-related threats with non-regulatory actions as with regulatory programs (please see the discussion on how regulatory programs are reducing the threat). The added value of the non-regulatory programs is the application of additional practices that are not required by the regulatory program such as leaving trees along small non-fish bearing streams. There is no scientific or monitoring data on whether or not the Oregon Plan measure to leave trees on small Type N streams is effective at reducing the threats to coho associated with debris flows. However it stands to reason that in the event of a debris torrent, a landslide that contributes wood as well as sediment and boulders could better mimic historic processes.

Effectiveness of Forest Management Programs That Address Threats to the Oregon Coast coho ESU

Current forest management programs have the potential to impact coho salmon through changes to instream habitats, riparian conditions, water quality and fish passage. Based on the existing regulatory programs described above, the state contends there is a low risk that key parameters of forestland habitat (e.g., large trees in riparian areas, shade) in this ESU are likely to deteriorate in the foreseeable future.

The state has provided several documents to address the certainty and uncertainty of our conclusion that existing forestry-related regulatory programs create a low risk that key parameters of forestland habitat (e.g., large trees in riparian areas, shade) in this ESU are

likely to deteriorate in the foreseeable future (Part 4(D) ODF Chapter B1, Part 4(D) ODF Chapter B2, Part 4(J) OP TR1, Part 4(J) OP TR2, Part 4(J) OP TR3, and Part 4(E)). The documents discuss available research and monitoring on land use and cover patterns and effectiveness of roads, landslides, fish passage and riparian management regulatory programs on state, private, and federal forest land. We find no empirical data or modeling results to suggest that upland or riparian conditions are going to decline in the near-term (5-20 years) or long-term (100 years). Indeed, it is far more likely that the inputs necessary for proper function will improve stream complexity under the current programs addressing forest practices on federal, state and private lands. For example, the availability of large conifers in riparian areas for recruitment to stream channels is likely to increase across all ownerships, based on unpublished data from the CLAMS project. The rate of increase varies across the range of ownerships, with increases greatest on federal lands and lower on private lands.

Riparian Areas

Leaving riparian buffers along streams are now a common approach to protecting aquatic habitat. However, the practice is generally less than 30 years old. Prior to the early 1970s there were no regulatory requirements for the retention of riparian vegetation. With the implementation of the Oregon Forest Practices Act in 1972, minimal buffers were required on forestland streams "important for fish." By the mid-1980's more substantial buffers that required retention of some conifers were in place for streams "important for fish" on forestland. It was not until 1994 that riparian management areas requiring substantial conifer retention were in place for "all fish-bearing streams." Requiring riparian management areas along "all fish-bearing streams" versus just streams "important for fish" likely increased streams receiving riparian protection on private forestlands by 30 percent. Buffers along streams in agricultural and urban settings are even more recent. Thus, for many lands where land use conversion or timber harvest has occurred n the ESU, it is now reasonable to expect that the majority of vegetation is less than 40 years of age and reflects a likely bias toward hardwood composition. Although second growth trees may recruit wood into streams at a higher rate than more mature stands, the total volume of wood is less, smaller in diameter, more highly mobile and more subject to decay than in mature forests. Conversely, where timber harvest or land use conversion has not occurred, due to fire suppression and/or reductions in beaver populations, both understory and overstory vegetation composition are likely also different. The implications for these differences are unknown, but may result in higher levels of shade, and/or lower levels of large wood recruitment than if fire suppression didn't occur or beaver populations were greater.

Re-establishing riparian function by way of riparian buffers is expected to take 50 to 100 years. Therefore it is unreasonable to expect a signature in the status and trends as a result of management changes that began within the last 30 years. However, it is reasonable to expect that conditions will continue to improve under current management practices and even more as the practices continue to adapt to new information. As a result, Oregon does not believe that forest practices are a significant threat to the viability of the Oregon Coast coho ESU. Where the joint state/federal effort to develop a

conservation plan for the ESU identifies constraints to meeting *desired conditions* that relate to forest management, the State will seek solutions that address these needs.

Finally, adaptive management principles are in place on state and private forest land to address uncertainties with regard to riparian management rules and strategies. The adaptive management programs are described in detail in the state reports. As an example, private and state forests programs at ODF have an ongoing study in the coast range to evaluate the effectiveness of the forest practice rules and FMP strategies. Preliminary results from this study describing baseline conditions will be available in 2005.

Roads

The vast majority (70%) of the ESU is comprised of private industrial and federal forest ownership. An estimated 32% of the ESU is in private industrial forest ownership and 38% is in Federal ownership. Information on the effectiveness of road construction and maintenance practices suggests that existing forestry-related regulatory programs for road construction, management, and restoration are effective at minimizing sediment delivery to streams, minimizing the size and occurrence of road-related landslides, and improving fish passage (Part 4(D) ODF Chapter B2, Part 4(J) OP TR1). Old roads make up the majority of roads, and while there have been many improvements reported, we have little data on road conditions neither at a landscape scale nor across ownership boundaries. This data gap was anticipated by the Oregon Plan Road Hazard Identification and Risk Reduction project, with a plan for monitoring in 2007.

Landslides

Harvest restrictions around landslide prone areas and along debris flow paths vary across forest ownerships. However, all forest ownerships have increased regulatory leave-tree requirements as compared with early forest-management practices ((Part 4(D) ODF Chapter B2). While it stands to reason, that such increases will increase large wood delivery to streams during debris flow events, no monitoring or research are currently available on the effectiveness of these strategies.

Fish-Passage

Oregon submitted two reports on the effectiveness of fish passage strategies (Part 4(D) ODF Chapter B2, Part 4(J) OP TR2). Oregon has incorporated state of the art science on fish passage into guidelines for complying with the laws and non-regulatory measures. Limited monitoring, research, and literature reviews suggest strategies within Oregon guidance have a high degree of certainty to pass fish. The certainty of these conclusions is high in part because of the availability of monitoring data specifically targeted to evaluate current strategies. Uncertainties are associated with the amount and types of data available (e.g. physical attributes of the crossing rather than actual fish movement), and limited information on long-term effectiveness.

Conservation Efforts Directed at Water Quality

This discussion of water quality programs in the Oregon Coast coho ESU is based on supporting documentation found in Parts 4(A) Agriculture and (B) Water Quality of the Oregon Coastal Coho Assessment.

The State's analyses of risk factors to the viability of the Oregon Coast coho ESU concluded that across the ESU as a whole, winter habitat (i.e. habitat complexity) is a higher priority for restoring coho populations than water quality, with the exception of the Umpqua populations (See Part 1 Synthesis Report). Further analysis demonstrated that for summer rearing to become the primary life cycle bottleneck in all populations except the Umpqua, the proportion of stream miles that exceed the temperature standard (assuming exceeding the water temperature standard results in zero smolt production) would have to reach 68% on average (current ESU average = 54%). This translates into a 26% increase in the miles of streams that would have to exceed the temperature standard relative to current conditions (ODFW, unpublished data). This is not to say that there are not significant water quality problems in coastal watersheds that need to be addressed through the Clean Water Act; they are just not the primary constraints to meeting viability criteria for the populations that make up Oregon Coast coho ESU.

State Programs That Address Water Quality Threats

ODEQ has responsibilities for protecting Oregon's waters from point source and nonpoint source pollution and restoring Oregon's waters when water quality standards are not being met. The general framework for this program is (1) identify water quality goals (standards), (2) prevent pollution and protect water quality by administering permits and various technical and financial assistance programs, (3) monitor and assess water quality, and (4) implement and oversee efforts needed to restore water quality when standards are not being met. ODEQ carries out its responsibilities through a variety of programs and activities that are briefly described below.

Water Quality Standards

ODEQ establishes water quality standards to protect beneficial uses of the State's waters, such as fish and aquatic life, recreation, irrigation and domestic water supply. The standards are established at the levels needed to protect the most sensitive beneficial uses. For example, cold water species such as salmonids are generally the most sensitive to water temperature, so the temperature standard is established based on the need to protect salmonid spawning, rearing and migration.

Point Source Permits

ODEQ issues and enforces point source permits under its delegated Clean Water Act authorities to ensure that the wastewater discharges into waters of the state do not cause a violation of water quality standards. The permits set limits for the discharge of pollutants from each source. ODEQ also implements state laws that protect groundwater quality by

requiring permits for installing subsurface sewage disposal systems (septic systems) and for the application of wastewaters to land. ODEQ periodically inspects permitted facilities to ensure compliance and responds promptly to incidents of non-compliance. More information on ODEQ's permit program can be found at: http://www.deq.state.or.us/wq/wqpermit/wqpermit.htm

Nonpoint Sources

ODEQ protects Oregon's waters from nonpoint source pollution by providing technical assistance and financial incentives for nonpoint source pollution control activities. The program is guided by a 5-year plan that ODEQ develops and EPA approves. The plan encompasses the elements described under section A.5 of Part 4(B) Water Quality.

This program focuses on working with a variety of partners in both regulatory and non-regulatory cooperative activities. ODEQ's partnership with local entities and associations has facilitated fruitful and productive relationships with private landowners and other land managers and leveraged additional resources to address nonpoint source problems. For example, ODEQ's nonpoint source grants (Section 319 grants) require a 40% local match. In addition, the framework for nonpoint source protection at the local level that ODEQ has helped to create has enabled watershed councils and other groups to secure additional state and federal funding for watershed enhancement projects. All of these activities increase awareness and understanding of the importance of watershed protection and prompt more citizens to take actions that improve water quality, which will ultimately contribute to broad scale watershed improvements. More information on ODEQ's nonpoint source program can be found at: http://www.deq.state.or.us/wq/nonpoint/nonpoint.htm

Water Quality Monitoring

ODEQ implements two primary monitoring programs that assess the status and trends of the water quality: a statewide ambient monitoring program focused on large rivers and a network of randomly selected sites on wadeable streams (1st through 3rd order). These are described in more detail in Section B-1 of Part 4 (B) Water Quality Report. ODEQ also collects water quality data through a variety of special studies, such as those needed for developing TMDLs and permits. Every two years (as required by EPA under Section 303(d) of the Clean Water Act), ODEQ prepares a report of statewide water quality conditions and identifies water bodies that are not meeting water quality standards. ODEQ uses water quality data to identify water quality problems and design appropriate responses to resolve those problems. ODEQ is also beginning to make more use of biological data to provide an integrated assessment of aquatic conditions and to identify the stressors that may be contributing to impairments. More information on ODEQ's water quality monitoring program can be found at: http://www.deq.state.or.us/lab/wqm/watershed.htm

Total Maximum Daily Loads

Waterbodies that are identified through the 303(d) process described above as being impaired are addressed through the development and implementation of a Total Maximum Daily Load (TMDL). A TMDL is a determination of the total amount of a pollutant the waterbody can assimilate and still meet water quality standards. The TMDL allocates the pollutant load among point sources, nonpoint sources, background levels, reserve capacity and a margin of safety. This information is used to guide TMDL implementation efforts. More information on ODEQ's TMDL program, as well as links to completed TMDLs, can be found on ODEQ's website at http://www.deq.state.or.us/wq/TMDLs/TMDLs.htm.

TMDL Implementation

Once water quality problems are "diagnosed" and load allocations are made through a TMDL, water quality impairments are addressed in a variety of ways.

- ODEQ revises point source permits if necessary to reduce the pollutant load arising from point source discharges.
- The Oregon Department of Agriculture works with local stakeholders to develop and implement Agricultural Water Quality Management Area Plans (AWQMAPs) to address the pollutant load reductions required by the TMDL.
- Pollution controls on state, private and some federal lands forestlands are addressed under the Oregon Forest Practices Act or alternatively through non-regulatory measures, especially when dealing with legacy issues. Federal land managers (BLM and USFS) develop and implement Water Quality Restoration Plans to address the TMDL as described in a Memorandum of Agreement between each agency and ODEQ.
- Municipalities address pollution carried into waterways by storm water runoff either through their NPDES Storm Water permit or through implementing a TMDL Implementation Plan that they are required to develop and submit to ODEQ within 12-18 months of completion of a TMDL.
- ODEQ assists those responsible for implementing TMDLs through targeted financial assistance (non-point source grants and Clean Water State Revolving Fund loans) and technical assistance (participation on committees convened to review and revise AWQMAPs or develop other watershed restoration plans; consultations with watershed councils and land owners on the design of restoration projects; assisting small communities with the development of TMDL Implementation plans and identification of effective strategies; etc.).

The Oregon Department of Agriculture (ODA) has specific legal authorities and is responsible for addressing water pollution associated with agricultural lands and activities through Agricultural Water Quality Management (SB 1010), Confined Animal Feeding Operation (CAFO), Pesticides, Weed Control and Invasive Species, and Soil and Water Conservation Districts. These programs collectively work with the agricultural community and general public to develop and implement economically viable, basin-

specific strategies that protect the waters of Oregon from agricultural impacts while allowing for a viable agricultural industry.

The following sections briefly describe the legal and institutional framework of each of these programs and how they address threats to the Oregon Coast coho ESU.

Agricultural Water Quality Management (SB 1010)

The SB 1010 process is triggered in an area when state or federal law requires a water quality management plan. Area plans and rules identify local water quality problems associated with agricultural lands, conditions in the watershed that need to be addressed to meet water quality standards, and ways to correct those problems.

The state Board of Agriculture provided ODA with the following policy directions for area plans and rules development around the state:

- Develop goal-oriented approaches, not prescriptive approaches.
- Accommodate differences between geographic areas.
- Focus on non-regulatory initiatives and approaches to plan goals
- Provide clear enforcement provisions to be utilized where needed as a backstop.
- Proactively address agricultural water quality issues.
- Address fish habitat concerns related to water quality so as to provide the broadest possible protection for farmers and ranchers relative to both water quality and fish regulatory programs.

A goal-oriented approach, which is also referred to as an outcome-based approach, refers to identifying conditions on the land that are needed for prevention and control of water pollution. This is in contrast to a practices based approach, in which the program identifies specific practices that must be used by landowners. The state chose a goal-oriented approach because it believed that a prescriptive approach would not be effective in light of Oregon's diversity of geography and crop production. One important advantage of a goal-oriented approach is that landowners often voluntarily go above and beyond the minimum requirements of a practices-based approach. In a practices-based approach, landowners often feel that traditional regulatory language does not allow them much opportunity to respond to requirements, whereas an outcome-based approach can encourage individual initiative and creativity.

Confined Animal Feeding Operation Program (CAFO)

The state's policy is to protect the quality of the waters of this state by preventing animal wastes from discharging into waters of the state. In further defining the state's CAFO program, process wastewater includes any water that comes into contact with any raw materials, products, or by products including manure, litter, feed, milk, eggs, or bedding. Wastewater treatment works and/or disposal systems are defined in OAR 603-074-0010(24) as all or any part of a system or systems used in connection with a CAFO or holding operation for the collecting, conveying, storing, treating, or stabilizing of manure,

litter, process waste water or contaminated storm water runoff.

The CAFO program was expanded by the state legislature in 2001 to bring the program into compliance with EPA's CAFO regulations. This has expanded the types of CAFOs that must have a permit to be consistent with EPA's definition. The new definition removes the exclusion of larger CAFOs that have facilities where animals are confined for four months or less duration and facilities without a prepared surface and without wastewater treatment works.

Pesticide Management

The ODA Pesticide Division regulates all activities of pesticide use in Oregon, not just agricultural use (ORS 634). The pesticide program is achieving the expectations of the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA), as it pertains to pesticide through the oversight of EPA (as laid out in an MOA between the two agencies). The label contains the guidelines and regulations as they relate to aquatic species and is the means by which this program addresses violations.

ODA is the EPA –designated agency to enforce FIFRA in Oregon. The State has had a Pesticide Control Act since 1973, which in part, allows ODA to further regulate pesticide use, across the entire state or within a specific area. The Oregon Department of Forestry (ODF) also administers the Forest Practices Chemical Rules, which are designed to protect water quality and other natural resources on forestland. These rules establish further requirements to ensure that forest use of pesticides, and petroleum and other chemical products, are not '…injurious to water quality or to the overall maintenance or terrestrial wildlife or aquatic life…"

Soil And Water Conservation Districts (SWCD)

Oregon's 45 Soil and Water Conservation Districts (SWCDs) are organized under Oregon Revised Statutes (ORS) Chapter 568 and are governed by an elected board of directors who serve without pay. SWCDs identify and address natural resource concerns within their respective boundaries and work with local, state, federal and private interests to deliver conservation services. SWCDs provide direct technical assistance to landowners to plan, design, survey, and implement conservation practices and systems.

SWCDs also serve as Local Management Agencies (LMA) for the department and assist with development and implementation of agricultural water quality area management plans. The coastal SWCDs include Clatsop, Coos, Curry County, Lincoln, Siuslaw, Tillamook County, and Umpqua SWCDS. The coastal SWCDs have provided assistance to landowners that have contributed to streambank stability and improvement in riparian condition, livestock manure management, and education and outreach related to salmon and watersheds. Through these means the SWCDS effectively address riparian condition, sediment, water temperature, pH, dissolved oxygen, bacteria, and excessive nutrients from agricultural and rural lands.

Effectiveness of Water Quality Programs That Address Threats to the Oregon Coast coho ESU

Much of the water quality improvement that has occurred over the past several decades in areas such as the Oregon Coast coho ESU can be attributed to point source controls. The key remaining water quality problems – which largely relate to nonpoint source pollution and flow and channel modification – will take time to be resolved. At this time, we are not able to demonstrate an improving trend in water quality correlating to the timeline for implementation of the Oregon Plan, but there are some indications that improvements will occur. One sign of progress is reflected in the on-the-ground efforts of landowners and others and the partnerships being forged to conduct TMDL implementation activities. Another indication is found in the analysis of data from the Oregon Water Quality Index for watersheds where TMDLs have been in place for a longer period of time. These efforts are described below.

Near term indicators of success are best measured by changes in land management, improved riparian protections, level of participation in enhancement projects and an improved understanding of water quality through monitoring efforts. The following summary of TMDL and Agricultural Water Quality Management Plan implementation activities in the ESU illustrates how this is taking place.

TMDL Implementation Activities in the Coastal Coho ESU

To date, four TMDLs have been developed within the Coastal Coho ESU. These are the Nestucca, Tillamook, Nehalem, and North Coast Basins. The major water quality problems identified were stream temperature, bacteria, and sediment.

Each TMDL includes a Water Quality Management Plan (WQMP) that identifies specific actions needed to abate the aforementioned water quality problems and those responsible for implementing them. Highlights of TMDL implementation efforts in this area include:

- ODEQ works in partnership with the Oregon Department of Agriculture (ODA), local Soil & Water Conservation Districts (SWCDs), watershed councils, Tillamook Estuaries Partnership (TEP), Tillamook County Creamery Association (TCCA), the Oregon Watershed Enhancement Board (OWEB) and others on an aggressive riparian restoration program on agricultural lands that includes livestock exclusion, off-channel watering facilities, riparian planting, and barb placement to narrow and deepen river channels. As of November 2004, the effort has resulted in approximately 200 miles of riparian fencing, 250 miles of riparian plantings, and 6 channel barbs to narrow river channels.

- ODEQ works in partnership with watershed councils, TEP, Tillamook County SWCD and others to restore riparian areas on non-agricultural rural residential lands. As of November 2004, approximately 50 miles of streams and rivers have had riparian planting treatments.

- ODEQ works with watershed councils, the Oregon Department of Forestry (ODF), US Forest Service (USFS), Bureau of Land Management (BLM), private timber companies, and small woodlot owners to develop, implement and/or monitor water quality protection projects on forest lands.

- ODEQ has worked together with SWCDs, watershed councils and private landowners to replace 20 culverts and 10 tidegates. Through the TEP, the partnership also successfully negotiated and purchased 350 acres of wetlands in the lower Wilson/Kilchis Rivers area. The wetland will, when restored, filter bacteria, sediment, and nutrients now entering Tillamook Bay from agriculture and urban areas.

- ODEQ has joined with ODA, TEP, TCCA, Oregon State University Extension Service and others to establish a two year buffer strip effectiveness study to determine the most effective buffer width and type needed to abate runoff from agriculture lands.

- ODEQ coordinated efforts by the TEP and Tillamook County to inform and educate private landowners about on-site septic system maintenance and replacement. Efforts to date have included an information mailing to all on-site septic users and a non-regulatory program to inspect systems that may be failing. To date, approximately 8% of the systems have been inspected.

- North Coast TMDLs have identified urban stormwater runoff as a major area of concern. ODEQ worked in conjunction with the Oregon Economic and Community Development Department (OECDD) to inform local jurisdictions about stormwater concerns and form partnerships to address the problems. As of November 2004 the cities of Bay City and Tillamook have completed Stormwater Master Plans and the City of Wheeler has begun a study. It is anticipated that all cities and municipalities in the North Coast and Lower Columbia basins will have completed these plans within five years.

- ODEQ worked with and provided grant funds to the Port of Garibaldi to contain all of their surface runoff from the main port area, including a small hardwood processing plant. ODEQ is currently working with local governments, the OSU Coastal Rainstorming Project and other local partners to fund and implement BMPs necessary to abate the problems identified.

Water Quality Improvements in TMDL Basins

ODEQ used water quality information from the Oregon Water Quality Index (see Section B.1 of ODEQ's report for a description of this index) to look at water quality trends in basins where TMDLs have been developed and implemented. In general, water quality has improved across the state since the late 1980s. Nine out of ten OWQI sites with the greatest improvements in water quality from 1990 to 2003 are in watersheds where TMDLs have been implemented. While it is not possible to definitively determine the causes of the improvements, the information suggests that TMDLs are a contributor to this trend.

Implementation of Agricultural Water Quality Management Plans in the Oregon Coast coho ESU

ODA has adopted plans and rules for the basins associated with the Oregon Coast coho ESU. These are the North Coast, Mid Coast, Umpqua, the Coos and Coquille, and Curry County Agricultural Water Quality Management Areas. The plans and rules for these areas were adopted between 1999 and June 2004. All of these areas are subject to a waste management rule reflecting existing statute (Oregon Revised Statute 468B.025) that went into effect upon adoption and a riparian rule that is presently in effect for the Umpqua and North Coast planning areas, and will go into effect in 2005 for the Coos/Coquille and Mid Coast planning areas, and in 2007 for the Curry planning area.

The waste management rule prohibits the discharge of any wastes into waters of the state that causes a water quality violation or is in violation of any waste discharge permit. This rule is designed to ensure that concentrated nutrients, pathogens associated with high animal density areas, high sediment concentrations in run-off, toxics, or other potential pollutants are not readily transported to waters of the state. Wastes associated with livestock operations can include manure from seasonal feeding and birthing areas, gathering areas and corrals, rangelands and pasture, and any other situations not already covered by Oregon's Confined Animal Feeding Operation laws. Fecal coliform counts in field runoff that exceed state water quality criteria indicate noncompliance with the Waste Management Rule. Livestock grazing is allowed to the extent it complies with the area rules and does not lead to conditions that cause a water quality violation. Compliance with the Streamside Riparian Area Management Rule will help keep wastes from being carried into waters of the state. Wastes may also include excess sediment discharges. Landowners who are actively discharging significant quantities of sediment may be in violation of the Waste Management Rule.

The riparian rules vary marginally from basin to basin in the Oregon Coast coho ESU. The rules are designed to provide management direction to private landowners as they work to implement practices to meet the area rule in the respective basin and protect water quality. Specific emphasis is placed on the establishment and maintenance of vegetation that provides for streambank stability and shade consistent with site capability. Excerpts of the rules are found in Part 4 (A) ODA Agriculture Report and a complete listing of all of the rules and plans associated with each basin can be viewed at www.oda.state.or.us.

Since adoption of these plans and rules, ODA continues to work with the Local Management Agency to help the local agricultural community address agricultural water quality issues through technical assistance, incentives, and education. ODA and LMA implementation activities include education programs on successful agricultural conservation practices, assisting landowners with addressing water quality concerns, helping landowners' access programs to share the cost of water quality improvements, and monitoring the effectiveness of the area plan and rules. ODA's goal is to have 100% compliance by landowners with the Agricultural Water Quality Management program rules. While this expectation is high, the reality is that compliance with water quality laws is good conservation and good for the resource. Since land ownership is in a

constant flux, there will always be a need for an outreach and education and periodic compliance action.

On a biennial basis, ODA has been and continues to review the implementation progress of the Area Plan and Rules to determine whether the plan is sufficient to meet and address water quality standards. Biennial reviews include review of compliance actions, outreach activities, on-the-ground projects that have been reported to the Local Management Agency (typically an SWCD), and any monitoring results that are available to evaluate the effect of the program. To date, biennial reviews for the Coho ESU planning areas have documented a large amount of relevant activity and indicated that no changes are needed to address rule or implementation deficiencies. For additional details on implementation of Area Plans and Rules, see Part 4(A) ODA Agriculture Report.

Agricultural water quality management plans have only recently been completed in the coho ESU and implementation is just getting started. As a result there has not been enough time to assess effectiveness. As Part 4 (A) indicates, the programs to address issues related to agricultural lands contain the structure and resources to conduct outreach to inform landowners of conservation and fish needs, to implement a regulatory compliance program for those instances where an enforceable backstop is needed, to establish a solid description of the conditions expected that is the foundation of the compliance program, and to provide for a review and monitoring program to determine program effectiveness and provide for modification in a timely manner when needed. Thus, even though it is a performance-based rather than a practices-based program, the framework and resources to effectively address issues is established and being implemented and is described in the existing report. Establishing rules to ensure riparian conditions that provide for streambank stability and shade is expected to result in substantial benefits (e.g., improved water quality and habitat complexity) to fisheries as conditions improve and water quality standards are met.

Summary

Oregon has both regulatory and non-regulatory programs in place to address point source and nonpoint source pollution in order to restore and maintain water quality. The State's goals over the near-term are to see improving trends in water quality conditions while longer time spans will be needed to achieve and maintain full compliance with water quality standards. Programs discussed in this report have been developed and implemented to assist the State in meeting water quality standards as required by the federal Clean Water Act, not to meet the specific needs of coho salmon. The direct linkage to salmonids and ultimately coho is that the State's water quality standards are designed to protect the needs of the most sensitive "beneficial uses". In many cases (i.e., stream temperature), the most sensitive beneficial use is salmonids.

The State has committed to monitoring the effectiveness of existing programs and seeking appropriate modifications through the conservation planning process when necessary. Monitoring information will inform these decisions, however, our current monitoring programs are either limited by the scale (both time and space) of inference or

in proof of concept (aerial photography and site capability), and some monitoring programs recently experienced reductions (see Part 4(B) Water Quality).

In summary, there are regulatory and non-regulatory water quality programs in place that require actions that are protective of water quality and have monitoring and periodic review elements that should identify when and where adjustments to programs may be needed. Threats from water quality remain a secondary consideration when considering freshwater habitat needs to meet viability criteria for the Oregon Coast coho ESU (for more details, see the discussion of current threats to ESU viability in Part 1). Where significant issues have been identified (Umpqua populations), management strategies to address these threats will be refined in the conservation plan under development for the ESU. In addition, while water quality is not a significant constraint to the viability of the ESU, water quality does have the potential to limit coho survival at local scales. Where local constraints to coho survival are identified, the State will work to focus regulatory and non-regulatory programs on theses issues.

Conservation Efforts Directed at Water Quantity

This discussion of water quantity programs in the Oregon Coast coho ESU is based on supporting documentation found in Part 4(I) Water Quantity of the Oregon Coastal Coho Assessment.

Overall, Oregon concluded that water quantity, in the form of low summer flows, was a low threat to ESU viability (see Part 1 (A) Synthesis Report). Water quantity was identified as a primary population bottleneck for 2 of the 21 populations (Middle and South Umpqua) and a secondary population bottleneck for no populations. The Oregon Department of Water Resources (WRD) regulatory and restoration programs are aimed at providing sufficient quantity of water for coho salmon. Overarching biological objectives are to 1) protect and maintain existing streamflows in areas providing significant salmon habitat value and 2) restore streamflows in areas providing significant salmon habitat value.

Maintaining streamflows occurs through the following regulatory programs:

a) Establishment of instream water rights;
b) Water distribution and regulation by priority date of water rights of record, including instream water rights;
c) Protection of instream water rights from injury during review of water right transfers; and
d) Public interest review, water right conditions, and water allocation policy in considering new out of stream water uses.

Restoring streamflows occurs through the following conservation programs:

a) Voluntary instream lease agreements;
b) Voluntary instream transfers; and
c) Allocations of conserved water.

WRD partnered with ODFW to combine assessments of streamflow needs for fish with streamflow restoration potential—to produce priorities for streamflow restoration in river basins. This joint prioritization effort was completed in 1998 for the Oregon Coast coho ESU. Priority flow restoration areas and the methods used to prioritize watersheds are provided at http://www.wrd.state.or.us/programs/salmon/priority.shtml.

Watershed councils, soil and water conservation districts, conservation groups and others are encouraged to use these priorities to guide their flow restoration efforts. WRD watermasters also focus their flow restoration efforts and other Oregon Plan activities in these high priority areas.

Effectiveness of Streamflow Protection and Restoration Programs That Address Threats to the Oregon Coast coho ESU

Based on the existing regulatory programs to manage and restore streamflow, along with supporting monitoring programs, the State concludes there is a low risk that summer streamflows in the Oregon Coast coho ESU are likely to deteriorate in the foreseeable future.

With respect to foreseeable increases in consumptive use, this determination is supported by the following findings:

- Based on consumptive use estimates and modeled streamflow, consumptive use of water is not a widespread issue in the ESU. Overall, 70% of the ESU area exhibited August consumptive use that was less than 10% of the 80% exceedance flow (for discussion on how exceedance flows are determined, see Part 4 (I) Water Quantity Report.
- While municipalities may continue to grow into their permitted water rights, the consumptive use estimates used in this analysis relies on the consumptive use of the full face value of active municipal rights. In this sense, the consumptive use estimates are highly conservative because they assume that the municipality is currently using the full amount of their active water rights. Our estimates did not include consumptive use for "non-active" municipal rights that are typically held for emergency and redundancy purposes.
- Consumptive use has not substantially increased since 1997. Overall, 93% of the total area of the Oregon Coastal coho ESU had no change in estimated August CU between 1997 and 2004. This demonstrates the effectiveness of existing regulations to protect streamflows during low flow months.
- New water rights are subject to water availability standards pursuant to the Oregon Water Resources Commission's (WRC) Water Allocation Policy under OAR Chapter 690, Division 410. For the purposes of this assessment, water availability at the 80% exceedance natural flow is used as proxy for the likelihood that new water uses would be permitted. At an 80% exceedance flow, water is not available for new water appropriations in August in 94% of the total ESU area. In addition to water availability, the water use must be consistent with administrative rules adopted by the Water Resources Commission that prescribe future allowable uses of water, must not

result in injury to existing water rights, and must be consistent with other rules of the Water Resources Commission. So, while future demand for water will likely grow, it is highly probable that these demands will have to be met from sources other than summer-time streamflows.

With respect to maintaining instream flows and flow restoration, this determination is supported by the following findings:

- Approximately 800 instream water rights, covering over 3,700 miles of streams, exist in coastal Oregon basins. When streamflow measurements indicate that the quantity of water in a stream is less than the instream water right, WRD requires junior water right holders to stop or curtail their use. Depending on the priority date of the instream water right, flows are either stabilized or may improve where instream water rights are in place.
- Since 1997, streamflow restoration activities coincide with areas of highest consumptive use. Streamflow restoration efforts since 1997 have been focused in the Umpqua and Mid-South monitoring areas with 66 projects and 25 cfs of water placed instream.

While it is conceivable that existing statutes and administrative rules regarding the issuance of new water rights and instream flow protection could be changed, there are no current efforts to do so. Based on data collected since 1997, we assume a high degree of certainty in our ability to implement/enforce existing regulatory and conservation plans and policies.

Actions by WRD Watermasters are the core mechanism for implementing these regulatory and conservation programs. Watermasters are funded through General Funds so there is a high level of certainty that these positions will continue to be funded. WRD ranks its field operations as a high priority and directly related to core program functions and WRD's mission so the certainty of continued funding is high.

Habitat Restoration Programs to Address Threats to Viability

This discussion of habitat restoration programs in the Oregon Coast coho ESU is based on supporting documentation found in Part 4(H) Restoration of the Oregon Coastal Coho Assessment.

Restoration work on private, state, and federal lands addresses the following limiting factors for the Oregon Coast coho ESU:

- Stream complexity (increasing wood, decreasing fine sediment, increasing off-channel rearing and shelter opportunity, increasing pool depth, etc.);
- Riparian condition (providing shade, lowering summer stream temperature, providing opportunity for future wood recruitment);
- Fish passage (allowing access to streams by adults and juveniles at a greater range of stream flows);

- Water quality (reducing fine sediment, lowering summer water temperature);
- Water quantity (providing additional flow in summer); and
- Nutrients.

Restoration programs are organized and conducted through many entities in Oregon. The following programs or independent actions apply specifically to the Oregon Coast coho ESU:

1. Watershed Councils;
2. Soil and Water Conservation Districts (SWCDs);
3. Oregon Department of Fish and Wildlife Western Oregon Stream Restoration Program;
4. Federal Lands Restoration (USFS and BLM);
5. State Lands Restoration (Oregon Department of Forestry);
6. State Roads Fish Passage Restoration (Oregon Department of Transportation); and
7. Private Landowner Initiative.

We define restoration actions as the variety of on-the-ground work that result in preservation, conservation, or restoration of watershed function that will support sustainability of native fish species, water quality, and watershed health. This category of action may occur on private, state, tribal, county, or federal land. Non-regulatory action on private lands is especially significant to efforts to restore the Oregon Coast coho ESU because the species is primarily distributed on private rather than public lands in the ESU. Restoration work is ultimately useful by improving the quality and quantity of habitat to support the needs for spawning, rearing and migration of the listed coho ESU. In this report, the term *restoration* refers to actions that will actively or passively result in conservation or re-establishment of watershed function that is consistent with sustaining native species (including the Oregon Coast coho ESU) and water quality.

Restoration Effectiveness

Assessing the overall impact of restoration activities on the condition of coho habitat is difficult, since most of the monitoring programs provide information on habitat status and trend but not on causality. Available information suggests that while many of the restoration activities have the potential to improve the condition of targeted habitats, the total miles of stream treated generally represent a small proportion of the total accessible to coho in the ESU. Specific goals and targets for restoration will be developed in the conservation plan being developed by NOAA Fisheries and the State of Oregon.

Monitoring and research of instream habitat restoration has shown that projects are generally successful at replicating levels found at less disturbed reference reaches and can result in increased overwinter survival of juvenile coho. A 2002 OWEB study (Bishaw et al., 2002) found that 45% of all riparian planting projects had a high survival rate. However, they suggested that the use of site preparation, post-planting maintenance, and tree protection increased the survival rates dramatically (to roughly 80% with high

survival rate). The same study evaluated fencing projects and determined that 83% of fences were intact. Of those sites with failing fences, 80% had low tree survival.

Since 1997, instream habitat restoration has been conducted in about 7% of the 6,575 stream miles accessible to coho in the ESU. Thus, broad-scale monitoring cannot yet detect an improving trend in the quality of instream habitat in the ESU. For some activities (e.g. riparian restoration) it may take years before the overall benefit of the restoration work is realized. At the current rate of restoration work (1%/year) it will require another 93 years to address the remaining coho streams. From an operational perspective, for many private lands the economic opportunity to conduct restoration occurs when other activities such as timber harvest are planned (logging equipment is on site that can deliver logs to streams that are otherwise inaccessible). For private forestlands, assuming a timber harvest entry every 50 years, it is feasible to double the restoration rate. Work by NOAA Fisheries evaluating restoration work done in Washington and Oregon concluded that work in Oregon appeared to have a moderate to high likelihood of effectiveness. Research by NOAA and others indicates that large wood placement can lead to higher densities of juvenile coho during summer and winter and cutthroat and steelhead during winter. While considerable resources have been expended to improve and restore coho habitat in the ESU, the effects of the restoration work cannot yet be detected, and it is too early for all the potential benefits to be realized.

Restoration investments to date: (1) have primarily addressed sediment delivery to streams (roads), fish passage, and habitat complexity (riparian and instream), (2) and have been well distributed across the ESU throughout the post-1997 Oregon Plan era. Oregon's broad-based restoration program can be an effective tool to address the primary risk factors identified by this assessment. Stream complexity was identified as the primary risk factor bottleneck for 13 of the 21 populations in the ESU. Oregon will need to consider whether or not to prioritize restoration investments in basins where populations did not pass criteria over restoration in basins where populations did pass viability criteria. On one hand, restoration to bring populations from failing to passing status would seem to be the most direct approach to strengthening ESU viability. On the other hand, restoration in populations that currently pass criteria, if directed to primary bottlenecks would also strengthen ESU viability. Oregon now has new tool to improve restoration investment decisions.

Effectiveness of Restoration Programs That Address Threats to the Oregon Coast coho ESU

Oregon retains solid, grassroots-based support for restoration activities in the ESU. In addition, the current program retains funding for program through 2014 from Measure 66. The program, in its many forms, continues to evolve in response to new information, such as watershed assessments, to take actions that will respond to watershed health and fish needs. Demands for funds from worthy projects continue to outpace available funds. A challenge to the various programs is to respond to findings in work like the Coastal Coho Assessment while balancing the needs of other species and other directives (water quality). Significant hurdles remain in evaluating the effectiveness of individual projects

as well as the overall program. Oregon has embarked on a path to implement an effectiveness-monitoring program and feedback from this program will be critical to the long-term support and effectiveness of restoration programs. Our expectation for the program is a strong commitment to funding while bringing more focused and structured efforts on the ground, targeted at the areas that most impair fish and watersheds.

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

Objectives and timelines for the conservation efforts described in this report are provided in the supporting technical reports developed by the Oregon Department of Forestry (ODF), Oregon Department of Water Quality (ODEQ), Oregon Department of Agriculture (ODA), Oregon Water Resources Department (OWRD), and Oregon Watershed Enhancement Board (OWEB) in support of this document.

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

The steps necessary to implement the conservation efforts described in this report are provided in the supporting technical reports developed by the Oregon Department of Forestry (ODF), Oregon Department of Water Quality (ODEQ), Oregon Department of Agriculture (ODA), Oregon Water Resources Department (OWRD), and Oregon Watershed Enhancement Board (OWEB) in support of this document.

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

Descriptions of parameters that demonstrate achievement for the conservation efforts described in this report are provided in the supporting technical reports developed by the Oregon Department of Forestry (ODF), Oregon Department of Water Quality (ODEQ), Oregon Department of Agriculture (ODA), Oregon Water Resources Department (OWRD), and Oregon Watershed Enhancement Board (OWEB) in support of this document.

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 provided.

Descriptions of monitoring and reporting progress on implementation and effectiveness of the conservation effort described in this report are provided in the supporting technical reports developed by the Oregon Department of Forestry (ODF), Oregon Department of Water Quality (ODEQ), Oregon Department of Agriculture (ODA), Oregon Water Resources Department (OWRD), Oregon Watershed Enhancement Board (OWEB), and the Oregon Department of Fish and Wildlife in support of this document. In addition, Oregon developed a strategy to develop and implement a statewide Monitoring Program in coordination with state natural resource agencies for activities conducted under the

Oregon Plan for Salmon and Watersheds in 2003. This Strategy describes an overall framework for structuring this cooperative effort and provides direction to help integrate Oregon Plan programs and monitoring with region-wide watershed enhancement and salmon recovery efforts (http://oregon.gov/OWEB/docs/pubs/MonitoringStrategy.pdf)

The Ability of Oregon's Monitoring Programs to Detect Change

Oregon's investment in a rigorous and well-defined monitoring program over the last 7 to 14 years now provides the State with a baseline to assess future changes in fish populations, aquatic and riparian habitats and water quality. With each year of additional data, our ability to detect smaller changes increases significantly. At the ESU-scale, we can detect small annual changes (10%) for the majority of variables. At the monitoring area scale, our capacity is to detect change varies by individual monitoring areas. At the coho populations scale, we currently lack any capacity to detect changes in aquatic and riparian habitats and water quality and limited capacity to detect trends in adult spawners. A more thorough discussion of these results can be found in Parts 4 (B) ODEQ Water Quality Report and 4 (C) ODFW (3) Habitat Report.

To assess the ability of Oregon Plan monitoring programs to detect change over time, we used the computer program TREND (Gerrodette 1993) to calculate the amount of change in coho spawners, instream habitat, riparian conditions, and water quality that Oregon Plan monitoring programs can detect with 10 or 15 years of sampling. For coho spawners, instream habitat, riparian conditions, and water temperature, this equates to an additional three to eight years of monitoring for on-going programs. For the remaining water quality variables, the current monitoring design began in 1994, meaning that the 10 year monitoring milestone has already been achieved and the 15 year monitoring milestone will be achieved in 5 years.

Instream and Riparian Habitat Monitoring Trend Detection Sensitivity

At the ESU scale, the current instream habitat and riparian monitoring design will be able to detect relatively small annual changes for all but two variables; % slackwater pools and conifers > 90cm DBH in the next 3 to 8 years (Table 2). The low occurrence of these two variables across the ESU leads to high variability in our annual estimates for these variables, an issue that will be difficult to address with our current sample design. With three more years of data we will be able to detect an annual change of 10% or less for 8 of the 14 variables. In eight years, we will be able to detect an annual change of 10% or less for 10 of the 14 variables (5% or less for 8/14). Overall, we submit that our monitoring program demonstrates significant capacity to detect meaningful changes in instream habitat and riparian conditions at the ESU scale.

The current monitoring program varies in its capacity to detect change in instream habitat and riparian conditions at the Monitoring Area scale. For the North Coast and Mid-Coast Monitoring Areas (Tables 3 and 4), the State will have the capacity to detect annual changes of 10% or less for the majority of the variables in 8 years. However, for the Umpqua and to a lesser extent the Mid-South Coast monitoring areas, our current

Table 2. The minimum detectable change in instream habitat and riparian variables based on monitoring conducted over the range of coho in the Oregon Coast coho ESU. Change detection was based on the variation observed in parameters collected from 1998-2003. Minimum rates of change were determined with a 5% probability of a Type 1 error (alpha = 0.05) and an 80% probability of trend detection (power = 0.8). Sample intervals of 10 and 15 years will be achieved by OPSW monitoring in 2008 and 2013.

Variable	1998 value	Minimum annual change detectable after 10 years of monitoring	Minimum annual change detectable after 15 years of monitoring
% Bedrock	2.3%[a]	0.4%	0.2%
% Fine Sediment in Riffles	20.3%[a]	1.8%	0.8%
% Gravel in Riffles	32.1%[a]	1.9%	1.0%
% Pools	32.8%[a]	3.0%	1.3%
% Shade	79.0%[a]	2.4%	0.8%
% Side Channel	1.3%[a]	1.2%	0.3%
% Slackwater Pools	4.8%[b]	-[d]	892%
Conifers > 50cm dbh	104.8/mile[b]	14.7/mile	6.3/mile
Conifers > 90cm dbh	80.8/mile[c]	-[d]	-[d]
Deep Pools	6.1/mile[b]	0.24/mile	0.12/mile
Key Pieces Large Wood	2.3/mile[a]	1.1/mile	0.4/mile
Large Wood Volume	155 m^3/mile[a]	6.2m^3/mile	3.1m^3/mile
Number Pieces Large Wood	168.6/mile[a]	10.1/mile	5.1/mile
Total Conifers	858.9/mile[a]	85.9/mile	42.9/mile

[a]Median value, [b]75th percentile value, [c]75th percentile - 1999 data, [d]Annual variability too high for sensitivity analysis

Table 3. The minimum detectable change in instream habitat and riparian variables based on monitoring conducted over the range of coho in the North Coast Monitoring Area. Change detection was based on the variation observed in parameters collected from 1998-2003. Minimum rates of change were determined with a 5% probability of a Type 1 error (alpha = 0.05) and an 80% probability of trend detection (power = 0.8). Sample intervals of 10 and 15 years will be achieved in 2008 and 2013.

Variable	1998 value	Minimum annual change detectable after 10 years of monitoring	Minimum annual change detectable after 15 years of monitoring
% Bedrock	0.4%[a]	0.3%	0.1%
% Fine Sediment in Riffles	29.3%[a]	11.5%	4.1%
% Gravel in Riffles	29.5%[a]	1.8%	0.9%
% Pools	24.1%[a]	1.4%	0.7%
% Shade	77.7%[a]	1.6%	0.8%
% Side Channel	4.3%[a]	0.8%	0.3%
% Slackwater Pools	3.1%[b]	-[c]	-[c]
Conifers > 50cm dbh	263.3/mile[b]	39.5/mile	18.4/mile
Conifers > 90cm dbh	0/mile[b]	-[d]	-[d]
Deep Pools	6.1/mile[b]	0.7/mile	0.3/mile
Key Pieces Large Wood	5.6/mile[a]	3.6/mile	1.1/mile
Large Wood Volume	254.1 m^3/mile[a]	50.8 m^3/mile	20.3 m^3/mile
Number Pieces Large Wood	208.9/mile[a]	14.6/mile	6.3/mile
Total Conifers	666.1/mile[a]	206.5/mile	79.9/mile

[a]Median value, [b]75th percentile value, [c]Annual variability too high for sensitivity analysis,
[d]Sensitivity analysis not possible due to zero estimates for each sample year

Table 4. The minimum detectable change in instream habitat and riparian variables based on monitoring conducted over the range of coho in the Mid-Coast Monitoring Area. Change detection was based on the variation observed in parameters collected from 1998-2003. Minimum rates of change were determined with a 5% probability of a Type 1 error (alpha = 0.05) and an 80% probability of trend detection (power = 0.8). Sample intervals of 10 and 15 years will be achieved by OPSW monitoring in 2008 and 2013.

Variable	1998 value	Minimum annual change detectable after 10 years of monitoring	Minimum annual change detectable after 15 years of monitoring
% Bedrock	9.1%[a]	0.9%	0.5%
% Fine Sediment in Riffles	19.5%[a]	8.6%	2.9%
% Gravel in Riffles	39.1%[a]	2.3%	1.2%
% Pools	35.5%[a]	4.3%	2.1%
% Shade	79.7%[a]	3.2%	1.6%
% Side Channel	2.5%[a]	-[d]	-[d]
% Slackwater Pools	7.2%[b]	-[d]	14.8%
Conifers > 50cm dbh	96.5/mile[b]	25.1/mile	9.6/mile
Conifers > 90cm dbh	47.4/mile[c]	-[d]	-[d]
Deep Pools	5.4/mile[b]	0.2/mile	0.1/mile
Key Pieces Large Wood	2.1/mile[a]	16.7/mile	0.8/mile
Large Wood Volume	130.9 m^3/mile[a]	19.6 m^3/mile	9.2 m^3/mile
Number Pieces Large Wood	136.6/mile[a]	24.6/mile	10.9/mile
Total Conifers	764.9/mile[a]	252.4/mile	91.8/mile

[a]Median value, [b]75th percentile value, [c]75th percentile - 1999 data, [d]Annual variability too high for sensitivity analysis

monitoring does not appear adequate to allow us to detect significant changes for many of the instream habitat and riparian parameters.

At the scale of individual population units, the current monitoring program for instream habitat and riparian monitoring program is not adequate to detect meaningful changes. Based on the results brought forward by the Coastal Coho ESU Assessment, the State of Oregon is in the process of reviewing the instream habitat and riparian monitoring program to improve the change detection ability for the Umpqua and Mid-South Coast monitoring areas as well as the individual coho population units within the ESU.

Water Quality Monitoring Trend Detection Sensitivity

For most water quality parameters, the current monitoring program can detect relatively small annual changes at the ESU scale (See Table 9, Part 4(B) Water Quality Report). In three years, ODEQ will be able to detect a 10% or smaller annual change for 7 of the 10 water quality parameters. However, lack of adequate sample sizes precludes the ability to detect changes at finer spatial scales. The information provided by this assessment will help guide the State of Oregon in improving the spatial resolution of the OPSW water quality monitoring program.

Adult Spawner Monitoring Sensitivity

Due to the large influence of ocean conditions on coastal coho smolt to adult survival, temporal data on the abundance of coho spawners can naturally fluctuate widely regardless of our freshwater sampling design. We believe that a more meaningful characterization of current monitoring for coho spawner abundance is obtained by evaluating the average precision of the population estimates (Table 5). In 1998, ODFW set target goals for the precision of its coastal coho spawner monitoring program at + 20% at the ESU scale, 30% at the Monitoring Area scale, and 60% at the basin scale (Jacobs and Nickelson 1998). Based on these criteria, current sampling for adult coho spawners is meeting the precision goals for the ESU and Monitoring Areas and at half of the Population Units. The lack of adequate precision for some Population Units is primarily due to a lack of adequate sample sizes, an issue that ODFW is currently working on rectifying.

Table 5. Precision of adult coho spawner surveys. Precision is calculated by dividing the 95% confidence interval for an estimate by the estimate.

Spatial Scale	Average Precision (% of Estimate)	Average Sample Size
ESU	16%	412
North Coast	28%	120
Necanicum	52%	10
Nehalem	32%	58
Tillamook	54%	31
Nestucca	89%	18
Mid-Coast	24%	101
Salmon	70%	5
Siletz	50%	14
Beaver	97%	4
Yaquina	59%	11
Alsea	53%	18
Siuslaw	34%	41
Mid-South Coast	27%	85
Coos	44%	36
Coquille	29%	44
Floras	138%	3
Sixes	NA[1]	NA[1]
Siltcoos	NA[1]	NA[1]
Tahkenitch	NA[1]	NA[1]
Tenmile	NA[1]	NA[1]
Umpqua	25%	107
Lower Umpqua	29%	45
Midddle Umpqua	60%	21
South Umpqua	45%	41
North Umpqua	NA[1]	NA[1]

[1]No estimate of precision is available due to inadequate sample sizes.

Monitoring Needs

Although there is a considerable amount of effort and resources dedicated to monitoring in the ESU, there are three significant shortcomings. First, although monitoring is in place that enables statistically rigorous evaluation of the status and trend of coho populations, water quality, and habitat conditions, very little monitoring is in place that enables an assessment of the effectiveness of regulatory and restoration programs. Effectiveness monitoring has the potential to quantify the effects of specific practices or policies. In an effort to improve effectiveness monitoring in Oregon, OWEB is in the process of developing an effectiveness monitoring plan. Monitoring implemented as a result of this plan will be funded from a combination of sources including OWEB, NOAA Fisheries, BLM, and USFS.

Spatial resolution is the second shortcoming of existing monitoring programs. When the OPSW was implemented in 1997, most monitoring was designed to provide information at the ESU or monitoring area scale (previously gene conservation areas). For this assessment, the NOAA Fisheries TRT developed finer scale coho population units for which analyses would ideally be conducted. As evidenced by the information in this report, Oregon currently lacks adequate information at the coho population scale for several habitat parameters. In addition, funding for many of the monitoring programs have not kept pace with rising costs, resulting in cutbacks in some program sampling efforts. As a result, fewer sites are sampled each year by some programs, further diminishing the programs that have not kept pace with rising costs, resulting in cutbacks in some program sampling efforts. Continued funding and more efficient use of current resources will be a major agenda item for the Oregon Plan Interagency Monitoring team in the coming months.

Finally, in the process of conducting this assessment it became abundantly clear that an improved system is needed for information archiving and retrieval. The team members working on this assessment spent considerable time tracking down and formatting information at the expense of time spent analyzing the information. We need to be able to access and understand data being collected by a variety of entities at multiple-scales in order to take full advantage of our collective efforts. This is particularly true of data collected at finer scales. Two actions are being undertaken to address these issues. First, OWEB has contracted with ODFW's Natural Resource Information Program (NRIMP) to develop and maintain an Internet based data library. The goal is to have all entities conducting monitoring for the OPSW regularly post information to this site. Second, ODFW, ODEQ, and statisticians at Oregon State and Colorado State University have partnered to conduct a review of the statistical needs of the OPSW. The results of this review, which will include a development of needed statistical tools, will be published in a special issue of the journal Environmetrics.

6. Principles of Adaptive Management are Incorporated.

Adaptive management is a central element of numerous Oregon Plan programs and activities. Significant changes to a variety of State programs prior to and subsequent to

Oregon Plan implementation have occurred. For example, dramatic changes in harvest and hatchery management occurred in direct response to declining coho numbers. New fish management policies, hatchery management policies, continual examination of Forest Practices rules, revision of water quality standards, development of TMDL's and AWQMP, revised harvest management, revised monitoring programs are all examples of adaptive management in action. Finally, this assessment is probably the best example of adaptive management. State agencies and other Oregon Plan partners will use this assessment to make better decisions about how we implement the Oregon Plan in the future. In Part 1: Synthesis, the section on "Lessons Learned and Adaptive Management" discusses Oregon's approach to adaptive management and specific actions the State proposes to take in relationship to the Oregon Coast coho ESU. In addition, Part 3(B) Appendix A provides a detailed discussion of the statutory and programmatic requirements to conduct adaptive management.

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