Coquille River Subbasin Plan

Prepared for: **NOAA Fisheries Service**
June, 2007
Order No. AB-133F-05-SE-4942

Prepared by: **Coquille Indian Tribe**

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This Subbasin Plan merely guides coho salmon habitat restoration, and although it mentions other species, restoration priorities and activities are not required or limited by this document. Additionally, the restoration priorities and actions provided in this document are only recommendations.

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Development of this document relied on the participation of several organizations and individuals. They are listed below in alphabetical order by agency or group. Some individuals participated in work groups aimed at data analysis and use while others reviewed the document for completeness, accuracy or compliance to agency policy.

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Acronyms

BLM	Bureau of Land Management (USDI)
Btu	British thermal unit
CAFO	Confined Animal Feeding Operation
CCA	Oregon Coastal Coho Assessment
CCP	Oregon Coast Coho Conservation Plan
cfs	cubic feet per second
CWA	Coquille Watershed Association
CWAP	Coquille Watershed Action Plan
CWHIP	coho winter high intrinsic potential
DO	dissolved oxygen
EPA	Environmental Protection Agency
ESA	Endangered Species Act
ESU	evolutionarily significant unit
FS	Forest Service (USDA)
HIP	high intrinsic potential
HUC	hydrologic unit code
IMST	Independent Multidisciplinary Scientific Team
KEC	key environmental correlate
LWD	large woody debris
NFCP	National Fish Conservation Policy
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NRCS	Natural Resources Conservation Service
O&C	Oregon and California
OC	Oregon Coast
ODA	Oregon Department of Agriculture
ODEQ	Oregon Department of Environmental Quality
ODF	Oregon Department of Forestry
ODFW	Oregon Department of Fish and Wildlife
ODSL	Oregon Division of State Lands
ONCC TRT	Oregon/Northern California Coast Technical Recovery Team
OWEB	Oregon Watershed Enhancement Board
PBTP	persistent bio-accumulative toxic pollutant
PFMC	Pacific Fisheries Management Council
STP	sewage treatment plant
SWCD	Soil and Watershed Conservation District
TMDL	total maximum daily load
USACE	United States Army Corps of Engineers
USDA	United States Department of Agriculture
USDI	United States Department of Interior
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
VSP	viable salmonid population

Contents

Figures

Tables

1. Executive Summary

1.1 Introduction

This document was written as a planning tool for those involved in the conservation of native fish within the Coquille Subbasin. Native fish populations declined greatly during development of the state. While the Oregon Plan, and now the 2007 Coho Conservation Plan, provides statewide guidance and funding for restoring salmon and watersheds, subbasin scale plans, such as this document, are needed to identify site specific conditions and problems and to implement solutions to restoration.

Restoring the native fish populations of the subbasin is a complex endeavor that requires a blend of applied science, local involvement, and adaptive management. This was accomplished by incorporating the principles on conservation biology throughout the planning process.

1.1.1 Scope

The Subbasin Plan addresses a drainage area of more than 1,000 square miles. It acknowledges, but does not fully address, issues occurring outside the subbasin, such as commercial fishing, changes in ocean productivity and global warming. These are addressed to a greater degree in other regional-scale planning efforts.

1.1.2 Lead Entity

The Coquille Indian Tribe was instrumental in securing funding through the Pacific Coastal Salmon Recovery Funds and the National Fish and Wildlife Foundation to complete the plan. It completes the final phase of a subbasin planning effort they began in 2005 with the Coquille Basin Limiting Factors Report. They will be the keeper of the plan and will provide copies of the document and its reports to the public through their website at coquilletribe.org. They have a cultural interest in seeing salmon and lamprey runs increase and in improving lands they manage within the subbasin.

1.1.3 Focal Species

The Coquille coho salmon were selected as the focal species because: of concerns over their population viability; their entire population lives within the Coquille Subbasin; they are ecologically, culturally, and economically important; and they serve a diagnostic function. The plan discusses the viability of the Coquille coho population and identifies the threats and factors limiting its recovery. The plan also addresses Pacific and brooks lamprey, spring-run Chinook salmon and beaver and provides interim conservation measures which should be implemented until more information is known of their viability.

1.1.4 Public Involvement

Involving the local public in restoration planning, implementation and monitoring is an important principle of conservation biology. Completion of each section of the plan relied on the involvement of 38 official participants representing four federal agencies, five state agencies, one Indian tribe, two conservation groups, a watershed association, and a private timber company.

A draft of the plan underwent a formal public review during January and February, 2007. Public notices were posted in local newspapers and on radio. Electronic and hardcopy documents were made available at the offices of the Coquille Indian Tribal Office, Coquille Watershed Association, and the Coos County OSU Extension Service. While not all reviewers were in full agreement, the vast majority of public comment encouraged implementation of the plan.

Although the participating agencies and conservation groups collaborated in development of the plan and committed to participate in its implementation, their future support is entirely voluntary. Because the plan is intended to be consistent with federal, state agency and tribal policies and programs, it can be used to advance mutually-shared goals, increase efficiency and accountability, and to leverage funds.

1.1.5 Implementation Timeline

Implementation of the Subbasin Plan should begin immediately. The schedule for completion of individual planned actions, including restoration work, assessments, research, monitoring, evaluation, and reporting, is provided in Chapter 6. The overall timeline is 25-years, only half that proposed for completion of the CCP (2007).

1.2 Key Findings

Many of the findings presented in this document were brought forward from prior assessments conducted by the State and others. The Subbasin Plan provides an analysis of coho population viability, threats, and limiting factors.

1.2.1 Viability of the Oregon Coast Coho

In 2005, the State conducted a viability assessment of the entire coho Evolutionary Significant Unit (ESU) which evaluated the status of each of the constituent populations. This assessment rated the ESU as *viable,* which means the ESU as a whole will persist into the foreseeable future. However, this level of viability is not high enough to provide for environmental, cultural, and economic benefits (e.g., carcasses enrichment; recreational, cultural or commercial fishing) as described in the Oregon Plan. The State determined work must be completed to increase the abundance of coho within the ESU and that this work should result from implementing subbasin plans, such as this document.

1.2.2 Viability of the Coquille Coho Population

The State evaluated the Coquille population and determined that it "passed" all of their viability criteria as an independent population. Like the ESU, it was found to be viable, but adult abundance was not high enough to meet the goals under the Oregon Plan.

1.2.3 Factors Limiting Abundance of the Coquille Coho Population

Limiting factors are the physical, biological, or chemical features (e.g., inadequate spawning habitat, insufficient prey resources, high water temperature) experienced by fish at the population, intermediate (e.g., stratum or major population grouping), or ESU levels that result in reductions in viable salmonid population parameters (i.e., abundance, productivity, spatial structure, and diversity) at any life stage. *Key limiting factors* are the limiting factors with the greatest impacts on a population's ability to reach its desired status. The *desired* *status* refers to the population size needed to meet the Oregon Plan and the 2007 Coho Conservation Plan goals. For the Coquille population, the desired status is 8,400 - 67,900 returning adults, depending upon ocean conditions. This is roughly twice the level of recent years and 10% of historic levels.

The State determined the primary limiting factor reducing adult abundance of the ESU and the Coquille population was the “loss of stream complexity”. Stream complexity was defined as the variety of physical habitat conditions that provide overwinter shelter conditions. The State describes habitat conditions that create sufficient shelter for wintering juvenile coho as having one or more of the following features: large wood; a lot of wood; pools; connected off-channel alcoves, beaver ponds, pasture trenches, lakes, reservoirs, wetlands and well-vegetated floodplains; and other conditions afforded by complex channel form. The State further noted that water quality (i.e., water temperature) was limiting survival of summer parr, but this condition was not currently preventing the population from reaching the desired status.

A more comprehensive Limiting Factors Analysis was completed as part of the Subbasin Plan. While the results of this assessment were consistent with the findings of the State, it provided additional detail. The Subbasin Plan determined that three factors were responsible for reducing adult abundance: “depleted slow-water refugia”, “depredation by exotic fish”, and “fishing-related mortality”. Of these, only depleted slow-water refugia are considered to significantly reduce adult abundance. Note that the term, “depleted slow-water refugia”, is roughly synonymous with the State’s term, “loss of stream complexity”. Consistent with the findings of the State, only depleted slow-water refugia were determined to be a key limiting factor. Also consistent with the State’s analysis, was the determination that “elevated water temperature” was reducing abundance of summer parr, but was not preventing the population from reaching the desired status.

1.2.4 Threats which Reduce Abundance of the Coquille Coho Population

Threats are the human actions or natural events (e.g., road building, floodplain development, fish harvest, hatchery influences, and volcanoes) that cause or contribute to limiting factors. Threats may be caused by the continuing results of past events and actions, as well as by present and anticipated future events and actions. The identified threats are:

- floodplain development
- exotic fish management
- fishing
- forestry
- historic channeling for navigation
- road management
- historic large woody debris removal

1.3 Planned Actions

Two types of actions are planned: conservation actions and interim conservation measures. Conservation actions are the habitat restoration and population management activities which must be accomplished to conserve the Coquille coho population. Interim conservation measures are the short-term actions needed to initiate conservation of other native fish populations until further information is known.

1.3.1 Actions Needed to Conserve the Coquille Coho Population

Conservation actions are grouped into four strategies, each of which addresses the limiting factors and threats identified in the Limiting Factors Analysis. They are summarized as follows:

- *Restore slow-water refugia for winter parr* - Annually, complete ≥ 6.7 miles (167 miles over 25-years) of restoration work on currently degraded overwintering habitat.
- *Restore water temperature for summer parr* - During the period 2008 - 2032, complete work to restore water temperature on 120 miles of summer parr habitat.
- *Improve management of coho fishing* - Support research and management which maintains or improves the ability to identify and control the appropriate level of fishing-related mortality so that it does not prevent or retard attainment of the desired status.
- *Improve management of coho predation* - Support research and management which maintains or improves the ability to identify and control the appropriate level of mortality, by exotic fish and other native predators, so that it does not prevent or retard attainment of the desired status.

Of the four strategies, only Strategy 1 must be fully implemented to achieve the desired status. The viability of the coho population is dependant upon a relatively small proportion (i.e., approximately 20%) of stream habitats, 70% of which are located on private agricultural and timber lands. Therefore, landowner understanding, support, and participation are essential. Implementation of this strategy should begin immediately and focus primarily on the Lower Coquille and North Fork Watersheds.

1.3.2 Actions Needed to Conserve Other Native Fish Populations

Interim conservation measures were developed for three native fish species. They are summarized as follows:

- *Pacific and brook lamprey* - By 2011, complete a viability assessment on the Coquille Subbasin's Pacific and brook lamprey populations. When completed, take measures to correct viability concerns and provide conservation recommendations to those involved in activities affecting these species. From 2010 – 2032, restore passage through all high priority man-made barriers.
- *Spring-run Chinook* - By 2008, complete a viability assessment on the Coquille subbasin's spring-run Chinook population. When completed, take measures to correct viability concerns and provide conservation recommendations to those involved in activities affecting this species. By 2009, determine the distribution, use, condition and restoration potential of all summer holding pools within the subbasin. Collect the summer 7-day maximum and minimum average water temperature within each holding pool and its connected tributaries. By 2011, establish the restoration priority of all holding pools within the subbasin. By 2011, begin restoration of at least one high priority holding pool habitat and complete the remaining high priority sites by 2032.

1.4 Research, Monitoring, and Evaluation

This plan will be implemented using an adaptive management approach that relies on the findings of research, monitoring and evaluation. Much relevant research, monitoring and evaluation is already taking place under various State and federal programs and will periodically be incorporated into the plan. This information will help resolve uncertainties concerning the desired status, identification of limiting factors, and the findings of prior research. It will also serve to monitor progress toward achieving the four strategies and the interim conservation measures.

1.4.1 Research Needs

There are three research projects, listed in priority order:

- Identify and measure the specific winter habitat components which most affect survivorship of the winter parr and smolt life stages. Determine the appropriate metric by which overwintering habitat conditions should be measured and evaluated.
- Determine the amount of high quality overwintering habitat which currently exists in the subbasin and the number of smolts produced per mile in the lower 30-mile reach of the Coquille River.
- Determine the amount of use that tidal and estuarine areas receive by rearing coho, particularly winter parr, and the restoration potential of these areas. This includes an evaluation of restoring access through tide gates and other water control devices.

1.4.2 Monitoring Program

Implementation monitoring will occur as part on each completed project. Effectiveness monitoring will be accomplished using a combination of project-level monitoring and broad-scale monitoring conducted under the various State programs. Effectiveness monitoring will address beaver management, water temperature, and spring-run Chinook holding pools.

1.4.3 Adaptive Management Plan

Specific research and monitoring information will be routinely analyzed to determine if changes in management are warranted and how to best proceed. This will be accomplished primarily through the use of the Annual, Six-, 12-, 18- and 24-year Reports. Each report identifies the specific conditions under which a revision of the plan would be required.

1.5 Consistency with Related Mandates and Processes

A key goal throughout the planning process was to maintain consistency with federal, state and tribal entities. The Subbasin Plan was developed using the guidance provided in the Technical Guide for Subbasin Planners and the Oregon Specific Guidance.

1.5.1 Endangered Species Act

The focal species, coho salmon, was federally listed as Threatened under the Endangered Species Act at the time the Subbasin Plan was being prepared. However, it is no longer listed. This plan is intended to conserve coho at the population scale. In doing so, it will improve the overall viability of the ESU.

1.5.2 Clean Water Act

In 2000, Oregon Department of Environmental quality (ODEQ) worked with partners to develop the South Fork Coquille Water Quality Management Plan as part of their total maximum daily load (TMDL) process pursuant to Section 303(d) of the Clean Water Act. The plan was approved by the Environmental Protection Agency in 2001. The 303(d) listed parameters are temperature and habitat modification. The Subbasin Plan contains conservation actions which address these parameters.

ODEQ also issued a grant to the Coquille Watershed Association to complete a riparian shade analysis of the subbasin. These data, together with water temperature data, were used in the Subbasin Plan to determine the best sites for restoring water temperature. Thus, implementation of the Subbasin Plan will help achieve TMDL goals for water temperature throughout the subbasin.

1.5.3 Tribal Responsibilities

The Coquille Indian Tribe is the Bureau of Indian Affairs recognized Native American tribal entity of the Coquille people, who have traditionally lived on the southern Oregon Coast. They are members of the Confederated Tribes of Siletz, based in Siletz, Oregon and own 6,512 acres of non-contiguous reservation lands in southern Coos County. Their Tribal office is in Coos Bay, Oregon. They were lead entity in development of the Subbasin Plan. As such, it is consistent with their policies.

1.5.4 Federal Land Management Planning

Both the BLM and FS were involved in development of the Subbasin Plan. Because the Subbasin Plan was written to be consistent with their land use plans, opportunities exist to achieve mutual goals through sharing of data, technical expertise, restoration resources, and funds.

1.5.5 State Planning

The Subbasin Plan is intended to be consistent with, and supportive of, the Oregon Plan, Native Fish Conservation Policy, Fish Hatchery Management Policy, Amendment 13 (i.e., as it relates to the State’s role in salmon harvest), and the Coho Conservation Plan. Many of the findings of the State were incorporated into the Subbasin Plan. All monitoring conducted under the Subbasin Plan is intended to meet protocol developed by the Oregon Watershed Enhancement Board (OWEB) so that it can be shared by all entities involved in fisheries restoration throughout the ESU.

2. Introduction

2.1 Background

Salmon populations have declined dramatically throughout the Pacific Northwest with the Coquille coho population at a fraction of its historic level. At the same time, many of the subbasin's rivers and streams do not meet water quality standards necessary to provide for beneficial uses. There is a need to restore the ecological processes that form and sustain healthy fish habitats, including the level of water quality needed to support the economy and quality of life of the people of the subbasin. In the past, the Coquille Watershed Association, Oregon Department of Fish and Wildlife (ODFW), Bureau of Land Management (BLM), and others have responded to this need by independently completing restoration work based on watershed and smaller-scale assessments. However, fish populations, water quality, and human communities also function at larger scales. Therefore, to improve overall the efficiency and effectiveness of this restoration effort, a broader view is needed. This document provides a subbasin scale assessment and strategy for conserving the native fish populations and improving water quality throughout the subbasin.

Implementation of the Coquille River Subbasin Plan (Subbasin Plan) will help restore the ecological processes that form and sustain healthy fish habitats, including the level of water quality needed to support the economy and quality of life of the people of the subbasin. The Oregon Plan for Salmon and Watersheds (Oregon Plan) describes innate connection between salmon and people in its overall philosophy as follows:

> *"Salmon live everywhere we do, following rivers that take them through our cities, working forests and farm lands, and coastal estuaries. All of us - private citizens, sport and commercial fishing interests, the timber industry, environmental groups, agriculture, utilities, businesses, tribes, and government agencies - must work together to make sure both people and salmon can thrive over the long term".*

Watershed restoration is not new to the subbasin. The Coquille Watershed Association has been a leader in watershed assessment, restoration, monitoring and environmental education. This document provides the much needed analysis from which subbasin-wide priorities and strategies for conserving coho and other native fish species were, and will continue to be, developed. Because it is the first subbasin plan to be completed for the Mid-south Coast coho population strata, it will play a key role in implementing the State's new Oregon Coastal Conservation Plan (CCP 2007) and the Oregon Plan. Because it restores the natural processes which create and maintain healthy fish habitats, its implementation will benefit a wide array of aquatic and riparian dependant fish and wildlife species.

2.1.1 What is a Subbasin Plan?

Subbasin plans are scientifically-based, locally developed strategies for restoring fish and wildlife habitats. They provide the necessary assessment and guidance needed to implement restoration actions at the subbasin scale. In effect, they are the building blocks of restoration, providing the foundation for broader-scale restoration efforts. State-wide, dozens of subbasin plans have been completed. Subbasin plans involve those interested in recovery of species-federal land managers, fish and wildlife managers, water quality agencies, local governments, interest groups and stakeholders. Although many natural resources agencies and conservation groups collaborated in development of this document and committed to participate in its implementation, their future support is entirely voluntary. Subbasin plans are developed to be consistent with federal, state agency and tribal policies and programs and to integrate their programs to advance mutually shared goals, increase efficiency and accountability, and to leverage restoration funds.

This Subbasin Plan carries no weight of law, nor is it a regulatory document. It does, however, encourage the full implementation of the existing laws and regulations affecting aquatic resource management and the continued improvement of existing protections. Some subbasin plans serve as Endangered Species Act (ESA) recovery plans, although this document does not, because the Oregon Coast (OC) coho is not currently listed under the ESA. Subbasin plans do not address factors outside the subbasin, such as commercial fishing, ocean conditions and global warming. These issues are addressed in regional scale planning efforts.

2.1.2 Who Prepared the Subbasin Plan?

The Subbasin Plan was drafted by the Coquille Indian Tribe. It completes the final phase of a subbasin planning effort which they began with the completion of the Coquille Basin Limiting Factors Report in 2005. This report was updated and expanded for inclusion in the Subbasin Plan. Portions of it were incorporated into Chapter 3 and in Appendices A.1-A.4 to form a single, seamless planning document.

2.1.3 Funding

Funding for writing the Subbasin Plan was secured from two sources. First, the Pacific Coastal Salmon Recovery Fund, which was established by Congress in FY 2000 to provide grants to the States and Tribes to assist state, local, and tribal salmon conservation and recovery efforts. These funds were dispersed by the NOAA Fisheries Service. The second source was the National Fish and Wildlife Foundation, a private, nonprofit, tax-exempt organization chartered by Congress in 1984.

Funding for implementation will come from a variety of sources. The Coquille Watershed Association has committed to completing the bulk of the planned actions on private lands. Much of their work will be funded through grants, fund-raising activities and donations. The ODFW, Forest Service (FS), Bureau of Land Management (BLM) and the Coquille Indian Tribe have also committed to funding specific planned actions. These will be accomplished through a combination of agency funds, grants and cooperative agreements. ODEQ will continue to collect and analyze water quality data and resolve water quality problems using a combination of agency funds and grant monies. Much of this work will involve the Coquille Watershed Association and other participants of the Subbasin Plan. The Natural Resources Conservation Service (NRCS) and Coos County Soil and Water Conservation District (SWCD) will continue to fund projects on private lands through their cost-share and lease programs. Some forest and agricultural landowners will choose to improve their wetlands and riparian areas using private funds or other programs. Because the Subbasin Plan is aligned with the overall conservation and restoration goals of all its participants, it can accomplish actions which achieve mutual or multiple goals.

2.1.4 How the Plan will be Used

The Subbasin Plan will be used as a planning tool by those involved in Coquille River watershed restoration. For the Coquille Watershed Association, it provides a long awaited subbasin, watershed, and stream reach scale prioritization useful in selecting projects sites for restoration. The Subbasin Plan also provides credence that adequate assessment and planning were involved in development of planned actions. The BLM, FS and Coquille Indian Tribe will use it to direct their restoration activities. ODEQ will use it to accomplish long-term water quality goals.

The Subbasin Plan will be used to periodically collect specific information needed to track the success of the restoration effort over time and, if warranted, change course through a revision of the document. Monitoring and accomplishment reporting will follow OWEB protocol to ensure compatibility with other local or regional fisheries conservation efforts. A current copy of the Subbasin Plan will be available to agencies and the public through website links of many participating entities.

The Coquille Indian Tribe has agreed to be the keeper of the Subbasin Plan. They will complete the required reports and update or revise the document as needed. Updates will include changes in land use planning requirements, agency regulations, status of fish and wildlife species and findings from relevant scheduled or unscheduled monitoring and research.

2.1.5 Relationship to the State's Coho Conservation Plan

On February 26, 2007, the State, under its Native Fish Conservation Policy, produced the Oregon Coast Coho Conservation Plan for the State of Oregon (CCP 2007), an ESU-scale plan for conserving the Oregon Coast (OC) coho. It includes: 1) an assessment of the health of 56 coho populations as a basis for an overall viability determination of the ESU; 2) an assessment of limiting factors affecting each of the 21 independent coho populations; 3) an assessment of measurable population and ESU scale viability criteria; 4) modifications to their hatchery programs to minimize adverse impacts to wild stocks and to support targeted sport and commercial harvest; 5) strengthened harvest management; 6) estimates of habitat restoration needed for each independent population; 7) a research, monitoring and evaluation plan; and 8) increased financial and technical support to community-based conservation groups and individuals to implement the plan. Thus, the CCP (2007) does not implement local habitat restoration work. Instead, it establishes the direction and sideboards that local conservation entities need to effectively address population-specific limiting factors within their watersheds.

The CCP (2007) provides the conservation groups and individuals of the subbasin the information they need to effectively and efficiently address the limiting habitat factors affecting the Coquille coho population. Several state agencies actively participated in development of the Subbasin Plan by providing field data related to coho population viability, habitat conditions, and habitat restoration potential and by reviewing the document as it was developed. ODFW, in particular, also accepted responsibility to accomplish many of the planned restoration actions.

The Subbasin Plan incorporates many of the scientific findings found in the CCP (2007) which relate to the viability of the Coquille coho population. Its vision of the subbasin incorporates language from the CCP (2007) relating to the desired status and proposed improvements in hatchery programs, fish harvest, and beaver management. The Subbasin Plan generally accepts the findings related the limiting factors, although it uses a different approach and terminology in its analysis. The Subbasin Plan proposes to reach the desired status in 25 years, rather than the 50 year timeframe of the CCP (2007). The Subbasin Plan used site specific information to change the predicted amount of overwintering habitat which must be improved to achieve the desired status.

The Subbasin Plan includes an Adaptive Management Plan which relies, in part, on information collected, analyzed and published under the CCP (2007) and other State and federal programs. Specifically, relevant information relating to research, monitoring and evaluation, and biological performance will be tracked in the Subbasin Plan as a means of updating the plan, tracking success and, if warranted, changing course.

2.2 Document Overview

The following section briefly describes the layout of the document; the contents of each chapter; the ecological basis for restoration; and the goals and objectives of the plan.

2.2.1 Format

This document was formatted to meet the frameworks provided in the Technical Guide for Subbasin Planners (Northwest Power Planning Council 2001) and the Oregon Specific Guidance (Oregon Subbasin Planning Coordination Group 2002). It assesses all five 5^{th} field hydrologic unit code (HUC) watersheds within the Coquille River Subbasin: East Fork Coquille River, Lower Coquille River, Middle Fork Coquille River, North Fork Coquille River and South Fork Coquille River.

The document is comprised of six chapters: *Executive Summary; Introduction; Subbasin Assessment; Coho Salmon; Inventory of Existing Activities;* and *Management Plan.* The *Executive Summary* summarizes the purpose and need for action; major findings; planned actions; and timeline.

The remainder of *Chapter 2* provides the necessary context of the Subbasin Plan. It defines what a subbasin plan is and is not, who funded its development, the ecological framework upon which it was written, and how it will be implemented. It describes the public participation process used and how the Subbasin Plan will be reviewed and revised in the future. How this Subbasin Plan contributes to the implementation of the CCP (2007) and the Oregon Plan is also discussed.

Chapter 3 – Subbasin Assessment describes the natural resources of the subbasin and their current condition and trend. It provides a brief history of how the subbasin was altered through development. How land ownership patterns and land use practices affect management of the natural resources of the subbasin is described. Stream survey data from 132 streams (i.e., 55% of all streams within the subbasin) is referenced and included in Appendix A.2. Fish, wildlife and plant species of special cultural, scientific or commercial interest are listed.

Much of this background information provides the basis for analysis conducted in the next chapter.

Chapter 4 – Coho Salmon introduces the focal species. It describes the management status, population structure, life history requirements, and habitat preferences and tolerances of coho. The viability of the population is assessed based on findings from the CCP (2007) and other information brought forward from Chapter 3. The threats and limiting factors affecting coho conservation within the subbasin are identified. A working hypothesis is developed which provides the scientific basis for the restoration effort. Opportunities to address the two most important limiting factors are discussed.

Chapter 5 – Inventory of Existing Activities describes the legal protections, management programs and management plans currently affecting water quality, fisheries and watershed conditions within the subbasin. This information provides insight into the progress being made to protect water quality and restore degraded historic conditions and what is needed to further improve existing conditions. A list of the restoration and conservation projects implemented to date to improve water quality and fish habitat within the subbasin is also provided.

Chapter 6 – Management Plan begins by describing the principles of conservation biology used in the Subbasin Plan as the framework for embarking upon the restoration effort. A vision for the subbasin, including desired future conditions for coho, is developed along with the actions needed to achieve the desired conditions. In addition, interim conservation measures to conserve spring-run Chinook, Pacific lamprey and brook lamprey are included. This chapter also includes a research, monitoring, and evaluation section which describe how information will be used for adaptive management. Finally, a consistency check with the other planning efforts, the ESA, and the Clean Water Act is provided.

2.2.2 Guiding Conservation Principles

An important aspect of restoration planning is the application of the principles of conservation biology. The conservation principles that form the foundation of the Subbasin Plan are to:

- be spatially and temporally explicit;
- provide for the needs of all life stages of all native fish;
- conserve and restore important ecological processes;
- protect and restore genetic integrity;
- focus investments in areas that yield the greatest benefit;
- involve the local community; and
- monitor results and adapt accordingly.

2.2.3 Goals and Objectives

The overall goal is to conserve the native fish populations of the Coquille Subbasin. Specific objectives of the document are to:

- identify the threats and factors limiting the conservation of the Coquille coho population and create strategies to address the them;
- identify interim actions for conserving other natives fish species;
- provide restoration priorities;
- define objective, measurable goals and a means to track success;
- be adaptive; and
- create and share information useful to other local and regional conservation efforts.

2.3 Public Involvement

To enlist and organize the knowledge of those involved in salmon conservation in the subbasin, a planning group was formed in October, 2005. The kick-off meeting was advertised through the Coquille Watershed Association and professional agency networks and was open to all interested publics. The purpose, objectives and timeline for the planning effort were described. Participation to collaborate in development of the plan was extended to all those present and to their associates. Some members chose to participate in one or more of the working groups while others provided data or reviewed drafts for technical adequacy or compatibility with agency policy and regulations. Drafts of each chapter were submitted to team members for review as they were prepared. The list of contributors is included at the front of this document. It includes a total of 38 people representing the Coquille Indian Tribe, Coquille Watershed Association, Coos County SWCD, two conservation groups, farming, private timber production, six state agencies, and three federal agencies.

The document utilized existing data from a variety of sources. The ODFW Coho Winter High Intrinsic Potential (CWHIP) model was used to identify potential sites for restoring slow-water refugia within overwintering sites- the key factor limiting conservation of the Coquille coho population. The Subbasin Plan also incorporates ODEQ temperature and riparian shade analysis data to identify opportunities to improve water temperature – a factor limiting survival of summer parr.

The Coquille Watershed Association fully participated in development of the Subbasin Plan. Their Coquille Watershed Action Plan (CWAP), together with their monitoring and project database, provided valuable baseline watershed information for this document. While they have accomplished much habitat restoration in the past, it was completed without a subbasin-wide strategy. Because the Subbasin Plan provides a subbasin-wide prioritization of water quality and fish habitat restoration work, it will be incorporated into a revision of their Action Plan.

A draft of the Subbasin Plan was submitted for public review from January 15 to February 2, 2007. This was accomplished through public notices in the local newspapers and radio station. Paper and electronic copies were made locally available through the Coquille Tribe, Coquille Watershed Association, and the Coos County OSU Extension Service. When requested, responses to comments were provided in writing or in person. Overall, public comments were supportive; many coming from those with previous positive experience with the Coquille Watershed Association. The primary public concern was that the scope of the document precluded actions to address potential threats related to declines in ocean productivity, marine predation, and predation by striped bass and pinnipeds, all of which they feared may off-set many of the benefits of planned actions to restore freshwater habitats within the subbasin. The Subbasin Plan acknowledges that while ocean productivity and marine predation are indeed important aspects of an ESU-scale conservation effort, they are outside the scope of subbasin plans and, therefore, are addressed under larger scale programs. The issue of striped bass predation was already adopted the State as a needed research topic and the Coquille Subbasin would be an excellent location for this research. Two people stated they did not believe coho were native to the subbasin. Based on a review of the literature, we found no scientific evidence which supported their hypothesis and all evidence suggested coho are native.

The second phase of public involvement will occur during the implementation effort. Because the majority of the land where restoration work is proposed is privately owned, landowner understanding, support, and participation is critical. The NRCS, Oregon Department of Agriculture (ODA), ODFW, OWEB and the Coquille Watershed Association will continue to provide the high level of technical and financial support that landowners have experienced in the past. The Coquille Indian Tribe will provide paper and electronic copies of the Subbasin Plan and its reports to all interested publics.

2.4 Revising and Updating the Plan

The Subbasin Plan is intended to be a working document. Section 6.5.3 outlines the approach to be used to update and revise the plan. Required Annual, Six-, 12-, 18- and 24-year Reports describe what information will be collected, how it will be evaluated, and the conditions under which the plan should be revised.

3. Subbasin Assessment

3.1 Subbasin Overview

This chapter describes the natural resources of the subbasin and how they are affected by the people living in the area. It provides some of the background information used in determining the threats and limiting factors affecting coho, the habitat alterations affecting other native fish, and what actions are necessary to conserve these species.

3.1.1 General Description

The Coquille River Subbasin comprises 1,059 square miles in southwestern Oregon and is the largest completely coastal river subbasin in the state (Fig. 3-1). The total drainage area is exceeded in Oregon only by the Columbia, Rogue and Umpqua River basins. The subbasin is bordered by the Coast Range to the east and the Klamath Mountains to the south. The Coquille River forms an estuary in its lower ten miles before converging with the Pacific Ocean in the west. The mainstem portion of the river is tidally influenced for approximately 40 miles, from the city of Bandon on the Pacific coast to immediately upstream of the town of Myrtle Point. The forested uplands have historically been utilized for timber production, while the alluvial valleys support agricultural operations, both historically and currently. It occupies a fairly depopulate portion of the state, as only 1.7% (63,019) of Oregon's population resides in Coos County.

Location

The subbasin is bordered by the north end of the Klamath Mountains to the south and the Coast Range to the north and east. The western boundary is the Pacific Ocean. The majority lies in Coos County, Oregon, while the remainder is in Douglas County and a small portion of Curry County. The adjoining coastal rivers subbasins to the north and south are the Coos River and the Sixes River, respectively.

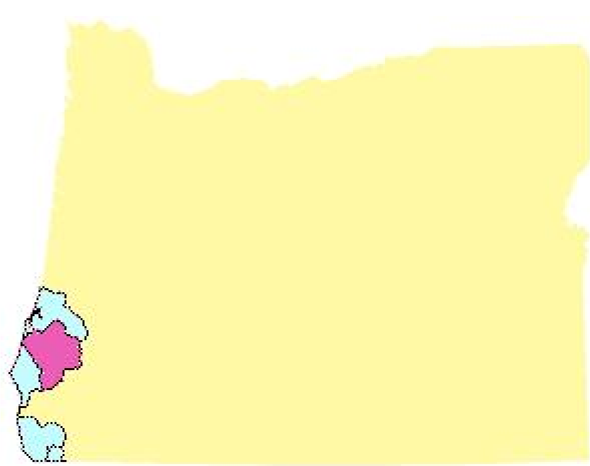


Figure 3-1. Location of the Coquille River Subbasin, shown in purple. From Ecotrust (1997)

Size

The subbasin occupies 1.1% of the state. The South Fork of the Coquille River is the longest river reach with a distance of 63 miles from headwaters to its confluence with the North Fork. The mainstem Coquille River channel length is 36.3 miles. When combined with its four major tributaries, the East Fork, North Fork, Middle Fork, and South Fork, the total river length is 226.5 miles.

Geology

Fig. 3-2 portrays the geology of the subbasin. The subbasin drains a geologically complex region of the Klamath and Coast Range Provinces characterized by a relatively narrow coastal plain and narrow alluvial valleys extending into a mountainous interior with elevations ranging from sea level to 4,075 feet at Ophir Mountain (CWA 1997).

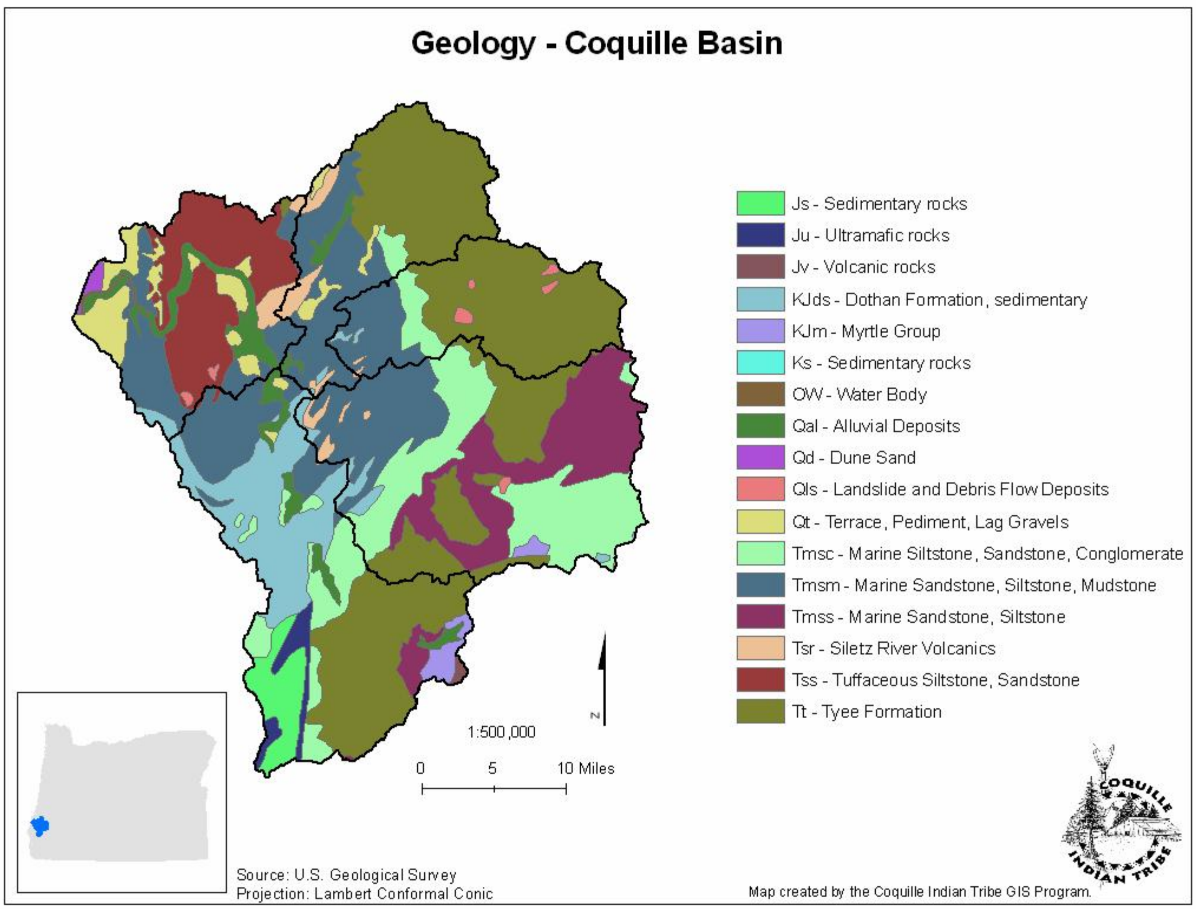


Figure 3-2. Geology of the Coquille Subbasin.

Moving up the Coquille River from the coastline to the coastal mountains, land surfaces and elevations change from dunes and marine terraces (5%), to flood plains and stream terraces (4%), to low hills (28%), and finally to mountains (63%) (United States Department of Interior (USDI) 1994). The 4% of the subbasin in floodplains and terraces historically provided highly productive areas critical to salmonid fish species (USDI 1994).

The subbasin is naturally sediment productive due to the interplay of terrain, geology, and precipitation (ODEQ 1992). Heavy seasonal rainfall combined with steep, thinly soiled slopes on unstable bedrock leaves the drainage highly susceptible to earthflows, debris slides, erosion, and flash flooding (CWA 1997). The subbasin lies within two major geologic provinces and is dominated by marine sedimentary rocks. The headwaters of the South Fork of the Coquille lie in the northwestern corner of the Klamath Mountain Province (CWA 1997). This is a hard rock system composed of volcanics, diorite, and serpentine rocks (CWA 1997). Fault contacts exist between the volcanic rocks, leading to instability in the area and resulting in earthflows, debris slides, and slumps (State Water Resources 1963, Ricks 1992 *in* CWA 1997). The remainder of the subbasin lies in the southern part of the Coast Range Province (CWA 1997). This province is composed primarily of steeply sloped sandstone (Non-point Source Effort 1992 *in* CWA 1997)). A major geologic formation present within the Coast Range area of the subbasin is the Tyee, which is composed of thick sequences of bedded sandstone, susceptible to mass movement, rapid erosion, flash flooding, and landslides (CWA 1997).

Based on the CWA (1997), fluctuating sea levels and continued uplifting and infilling of the river channel have resulted in marine and alluvial sediment deposition and terrace formation through the lower Coquille River drainage. The towns of Myrtle Point and Coquille are situated on these alluvial deposits, while Bandon is perched on a marine terrace. The unconsolidated to semi-consolidated deposits that form these terraces are subject to severe streambank erosion during high winter flows.

Climate and Weather

Fig. 3-3 depicts the precipitation zones within the subbasin. The local climate is humid with a predominant marine influence and moderate year-round temperatures (CWA 1997). Average annual rainfall ranges from a low of 45 inches in the Camas Valley area to approximately 120 inches in the headwaters of the South Fork (CWA 1997). Approximately 90% of the average annual precipitation occurs between October and April, with 50% occurring during November-January (USDI 1997). Although heavy rainfall occurs with winter storms, most of the precipitation is of low intensity and commonly occurs as "drizzle" (USDI 1997). Precipitation during the May through September summer months is only about 10% of the annual average; the dry season precipitation being approximately 7-8 inches (Oregon State University 1982 *in* USDI 1997). Temperatures are generally quite mild; maximum temperatures seldom exceed the low 90's, nor do they fall much below freezing (USDI 1997).

Rainfall is quite variable and appears to be a function of cyclical patterns occurring on 20 to 30 year intervals (CWA 1997). Due to the typically southern winter storm track and the orientation of the ridges in the drainage, the East and South Forks of the Coquille River receive the most rainfall (CWA 1997). Between 75 and 120 inches fall annually east of China Creek in the East Fork Coquille River drainage; the high elevations of the South Fork Coquille River drainage; the headwaters of Myrtle and Rock Creeks in the Middle Fork Coquille River drainage; and the headwaters of Middle and Cherry Creeks in the North Fork Coquille River drainage (CWA 1997). The rest of the subbasin receives between 50 and 75 inches per year, with the exception of the Camas Valley area, which receives somewhat less than 50 inches (CWA 1997).

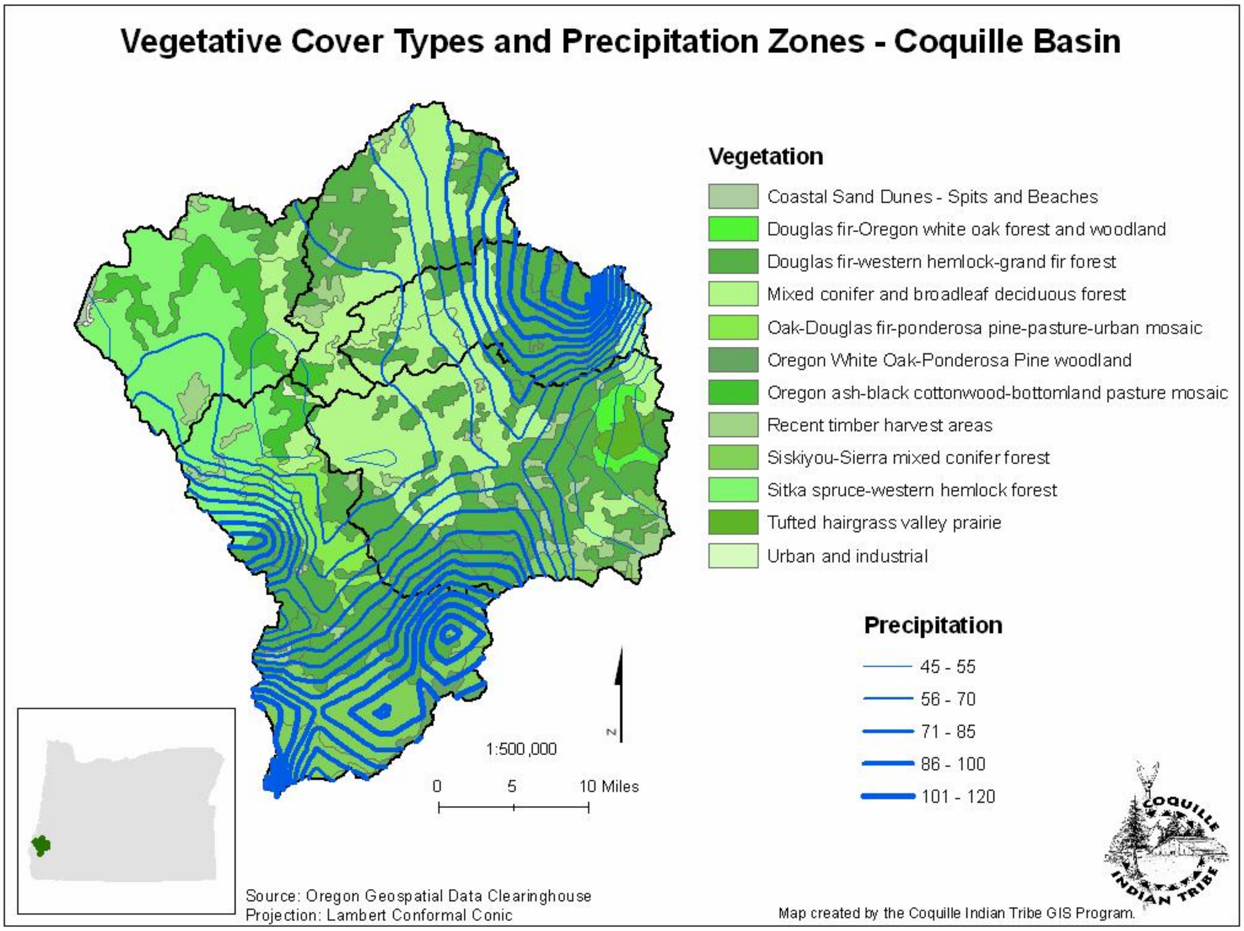


Figure 3-3. Vegetation and precipitation zones within the Coquille River Subbasin.

Cool, moist air masses lifting over the Coast Range can produce snow over 1500 to 1800 feet elevations (USDI 1997). These are intermittent snow packs, usually persisting on the ground for only a few weeks or melting quickly with warm winds and rain (USDI 1997). Extra water storage as snow water equivalent can elevate river flows, resulting in flooding (USDI 1997).

Based on the USDI (1997), maximum precipitation periods are infrequent, but are responsible for high runoff, which results in flooding, watershed erosion, landslides, and debris torrents. High precipitation with the melt of existing shallow snow packs can aggravate flooding. Analysis from local National Oceanic and Atmospheric Administration (NOAA) Cooperative Weather Stations indicate that damaging storms have a return interval of five years or more, and could be expected to have daily precipitation of at least four inches. Cumulative precipitation of nine inches or more in several days has been correlated with a higher incidence of landslides and torrents.

Land Cover

Fig. 3-3 shows the vegetation zones within the subbasin. The majority of the subbasin is contained within Sitka spruce and western hemlock vegetation zones, although the headwaters of the Middle Fork Coquille River drainage are located in the Umpqua Valley vegetation zone, and the South Fork Coquille River drainage originates in the mixed evergreens and hardwoods zone (Lawson et al. 2004). The most prominent subclimax forest type is Douglas-fir – western hemlock – grand fir. Approximately 70% of the watershed is forested (CWA 1997). Prior to European settlement, much of the forest canopy was old growth. The vast majority of the old growth forest canopy has been logged and is now characterized as second-growth forest. In some areas, the second-growth forest has been harvested, leaving an early seral plant community comprised of sapling trees and shrubs.

Ecoregions are representations of the integration of vegetation, geology, soils, precipitation, and evaporation potential and, depending on the scale at which they are defined, may be utilized as indicators of differing potential for development of quality habitat (Lawson et al. 2004). On a broad scale, the subbasin lies within the Coast Range and Klamath Mountain ecoregions (Lawson et al. 2004). These large Level 3 ecoregions are further divided into several Level 4 ecoregions, six of which are occupied by the Coquille River and its tributaries (Lawson et al. 2004). The greater part of the watershed is located within the Mid-Coastal Sedimentary ecoregion, while segments of the Middle Fork, South Fork, and Lower Coquille River occupy sections of the remaining five Level 4 ecoregions: Umpqua Interior Foothills, Inland Siskiyous, Southern Oregon Coastal Mountains, Coastal Uplands, and Coastal Lowlands (Lawson et al. 2004).

The steep slopes above the valley areas are sparsely populated. Timber production, agriculture, and some mining are the predominant land uses. The upper watersheds of all four forks of the Coquille River and most tidewater streams support commercial forests (CWA 1997).

Fish and Wildlife Habitat

Biologists estimate there are 151 bird, 14 amphibian, 14 reptile and 57 mammal species utilizing habitat within the subbasin. Of these, 48 species (seven amphibians, four reptiles, 11 mammals, and 26 birds) are classified as Species of Concern (USDI 1997). In addition, the Coquille Valley serves as one of the largest wintering duck concentration areas in the coastal region of the Pacific Northwest (Lowe 1997 *in* USDI 1997).

In 1993, the Forest Ecosystem Management Assessment Team identified six "Key Watersheds" within the Coquille watershed which became part of an aquatic conservation strategy in the Northwest Forest Plan (United States Department of Agriculture (USDA) 1994 *in* CWA 1997). These drainages include: Rowland Creek, Baker Creek, Salmon Creeks, a portion of the upper South Fork drainage, the headwaters of Cherry Creek, and the North Fork of the Coquille River (CWA 1997). Key Watersheds serve as refuge areas critical for maintaining and recovering habitat for at-risk stocks of anadromous salmonids on federally administered land (CWA 1997). These six drainages were further designated as Tier 1 watersheds, selected because they directly contributed to anadromous salmonid conservation (CWA 1997) (see Sections 5.1.3, 5.2.7 and 5.3.7).

The Key Watersheds within the South Fork Coquille River watershed analysis area are not only areas critical for salmonid conservation, but are also of value as “connectivity areas” between the forests in the Middle Fork Coquille River watershed to the north and the Siskiyou National Forest to the south. While the aquatic portions of these areas are important, their primary significance lies in their value to terrestrial species such as the northern spotted owl and the marbled murrelet. The Rowland-Baker-Salmon Key Watershed is strategically located to include habitat for other Special Status Species such as the Del Norte salamander, red-legged frog, and others. This area is believed to be a critical connectivity corridor for some species occurring in both the Coast Range and Klamath Mountain ecological provinces.

Population and Land Use

History of the Native People - The major valleys within the subbasin supplied a wide range of resources useful to hunter-gatherer populations in prehistoric times, namely, the Coos and Upper Coquille Indian Tribes. Salmon and Pacific lamprey were important food sources and trade items for the Native people of the Pacific Coast. According to archeologist Dr. Scott Byram (2002), Pacific lamprey was the trade mark commodity traded by the Native people inhabiting what is now known as the Coquille River valley. Pacific lampreys were called “scoquel” or “coquel”, depending upon dialect, by the Pacific Coast traders. In those days, it was common practice for traders to name the Native people and the place where the commodity originated after the commodity they traded. Because Pacific lamprey was the common trade item of the Coquille River valley, the names “scoquel” and “coquel” were attached to the Native people and the river of that area (Byram 2002). Either out of neglect or by intention, European settlers later changed the spelling to “Coquille” in about 1852. The original pronunciation, “ko-kwell”, is still in use by many of the Native people and pioneers of the Coquille River valley. However, over time, the more popular wide-spread pronunciation became “ko-keel”.

Archaeologists Byram and Erlandson conducted studies of a prehistoric fishing site known as the Osprey site, located in the estuarine reach of the Lower Coquille River. The following information is paraphrased from their 1996 work. The fishing site was used from before 1100 A.D. to the mid-1800’s, a period when hundreds of Native people lived in the lower Coquille River valley. Based on artifacts found at the site, it appears that weirs were constructed at the mouths of tidally-influenced sloughs to catch fish using tidal action. Fish would enter the sloughs at high tide by swimming over the weirs and then become trapped behind the weirs as the tide dropped. These fish would then be netted at low tide. A variation of this technique involved the use of weirs to guide fish into a large basket trap during a receding tide. The basket traps had an internal funnel design similar to that of modern-day fish traps. The construction design of the weirs and traps was often modified to catch small or large fish, or even crabs. The Native people also used spears and hooks to capture fish in the estuary. Canoes were used as fishing platforms and to haul fish. According to interviews with Indians elders, large runs of fish occurred yearlong, including two kinds of herring, three kinds of salmon, two kinds of smelt, and one unidentified fish. Elders also described the construction and use of large river weirs upstream of tidewater.

The Coquille Indian Tribe signed two treaties with the United States (USDI 1997). On September 20, 1851, it ceded the lands from the mouth of the Coquille River to the summit of the Coast Range and south to the Rogue River watershed (USDI 1997). On August 23, 1855, the Tribe ceded the entire Coquille River watershed to the United States (USDI 1997). Although the United States Senate never ratified either treaty, the land taking became an accomplished fact when members of the Coquille Indian Tribe were forcibly removed to the Siletz Reservation in 1856 (USDI 1997). In 1954, federal legislation severed the trust relationship between the federal government and the tribes of western Oregon. The Coquille Indian Tribe, which regained federal recognition in 1989, consists of Miluk Coos and Upper Coquille Athapaskan people.

In United States Court of Claims testimony (Federal Supplement 1945:945 *in* USDI 1997), anthropologist John P. Harrington described the boundaries of the traditional territory of the Coquille Indian Tribe as extending throughout the entire Coquille River watershed (Hall 1995:26 *in* USDI 1997). In 1996, Congress created the "Coquille Forest", composed of 5,400 acres of BLM land in the Middle Fork Watershed (USDI 1997).

European Settlement – The earliest European visitors were believed to be fur trappers, traders and explorers. The Coquille River Valley, then a flooded woodland for nine months of the year, provided abundant beaver for the fur trading industry. Early surveyors reported using boats and canoes to make their way up the Coquille River Valley by moving from one beaver pond to the next (Benner 1997). European settlement began in the mid 1850's. As the Euro-American population increased, it moved away from fur trading and diversified into fishing, forestry, agriculture and support services. The tidal section of the Coquille River was dredged and maintained for commerce and travel. By 1878, steam boats could travel to the population centers of Myrtle Point and Coquille (Benner 1997). The Middle Fork Coquille River has been a travel route between the Coos Bay and Roseburg areas since the late 19th century, and today, State Highway 42 is one of the major travel routes to and from the subbasin. As elsewhere in the Coast Range, logging opportunities first drew Euro-Americans to settle along the Middle Fork Coquille River. Many of the known historic resources on upland BLM lands are remnants of early logging and homesteading.

Today, the majority of the 16,801 people inhabiting the subbasin are clustered around the cities of Bandon, Coquille, Myrtle Point and Powers. The more densely populated valley areas are confined to the flood plains along the mainstem Coquille River, the four forks of the Coquille River, and larger order streams (CWA 1997). In 2000, 90 percent of Coos County residents were whites, 3.4 percent were Hispanic, and 2.4 percent were Native American (U.S. Census Bureau 2000). Table 3-1 shows seven ethnic categories making up the population.

Table 3-1. Ethnic diversity in Coos County.

Category	Percent of Total Population
White	90.2
Hispanic	3.4
Native American	2.4
Asian	0.9
African American	0.3
Hawaiian, Pacific Islander	0.2
Other	2.6

Source: U.S. Census Bureau 2000.

Approximately 40% of the watershed is private industrial forest land. Federal, state, and county lands occupy about 30% of the watershed. The BLM and FS administer the largest of these public holdings. Another 30% of the subbasin is in smaller non-industrial private holdings. Agriculture and range comprise 7%. Tribal ownership is 1%.

There are 748 farms in Coos County (Peters 2005). Because many farms also include range and timber lands, they comprise a total of approximately 144,000 acres or 14% of the area of Coos County. Table 3-2 shows land use zoning within the subbasin.

Table 3-2. Land use in the Coquille Subbasin.

Zoning Designation	Percent of Subbasin Area
Forest	91.5
Agriculture	5.3
Range	1.4
Urban and built up	1.4
Other	0.3

From Ecotrust (1997)

Economy

Forest products, tourism, fishing and agriculture dominate the Coos County economy. Boating, dairy farming, myrtlewood manufacturing, shipbuilding and repair, and agriculture specialty products, including cranberries, also play an important role. The International Port of Coos Bay, considered the best natural harbor between Puget Sound and San Francisco, is the world's largest forest products shipping port. Its economy continues a long struggle, which began in the early 1980's, when timber production on federal lands diminished significantly due to several forestry-related environmental issues (Helvoigt 2000 *in* USDI 2002).

The 2000 Coos County census reports it has 63,019 residents. According to the Oregon Employment Department, the unemployment rate in the County is approximately 8.7%, as compared to the state's average unemployment rate of 7.4%, and the national average of 5.4% (Oregon Employment Department 2004). Historical data indicates the county's unemployment statistics are approximately double those of the national average (Coos/Curry/Douglas 2000).

As shown in the Coos County Budget, the county's current tax structure includes real estate taxes, timber taxes and county fees. The county receives gross tax receipts for the general fund in the amount of approximately $2.96 million per year. Payments-in-lieu-of-taxes to the county are approximately $6,752 per year.

In the past, additional general fund revenue was provided to the county from Oregon and California (O&C) lands timber revenues and from federal lands timber revenues (from the sale of timber on BLM and U.S. Forest Service lands); in 1991, these amounted to 19%and 22%, respectively, of the county's total annual budget (Maxwell et al. 1999). Presently, this federal timber revenue is replaced by federal appropriations under temporary federal appropriations. Total personal income of the county is approximately $1.1 billion, which equates to an average annual per capita personal income of $17,547; this is approximately 84% of the Oregon average annual per capita personal income (US Census Bureau 2000).

Land Ownership

Approximately 72% of the land is privately owned and 28% is in federal ownership. Federal ownership includes BLM (25%), Coquille Indian Tribe (1%), FS (1%), and other (1%).

Some of the federal lands are managed under the O&C Lands Act of 1937. The intent of the act was to provide a future source of timber which would contribute to local economic stability. It was assumed that providing this continuous source of timber through reforestation and regulated harvest would also protect watersheds and help regulate stream flows (43 U.S.C. §1181a). The O&C Lands Act also required that 50 percent of the revenue generated from management of the lands be returned to the 18 counties that contained revested lands. The revenues are divided annually by the percent of the assessed value of the lands in each county as they were in 1915. In general, O&C land is located in the odd-numbered sections and private land is located in the even-numbered sections. This creates management challenges for both the private landowners and the O&C land managers. The spatial pattern of land ownership is shown in Fig. 3-4.

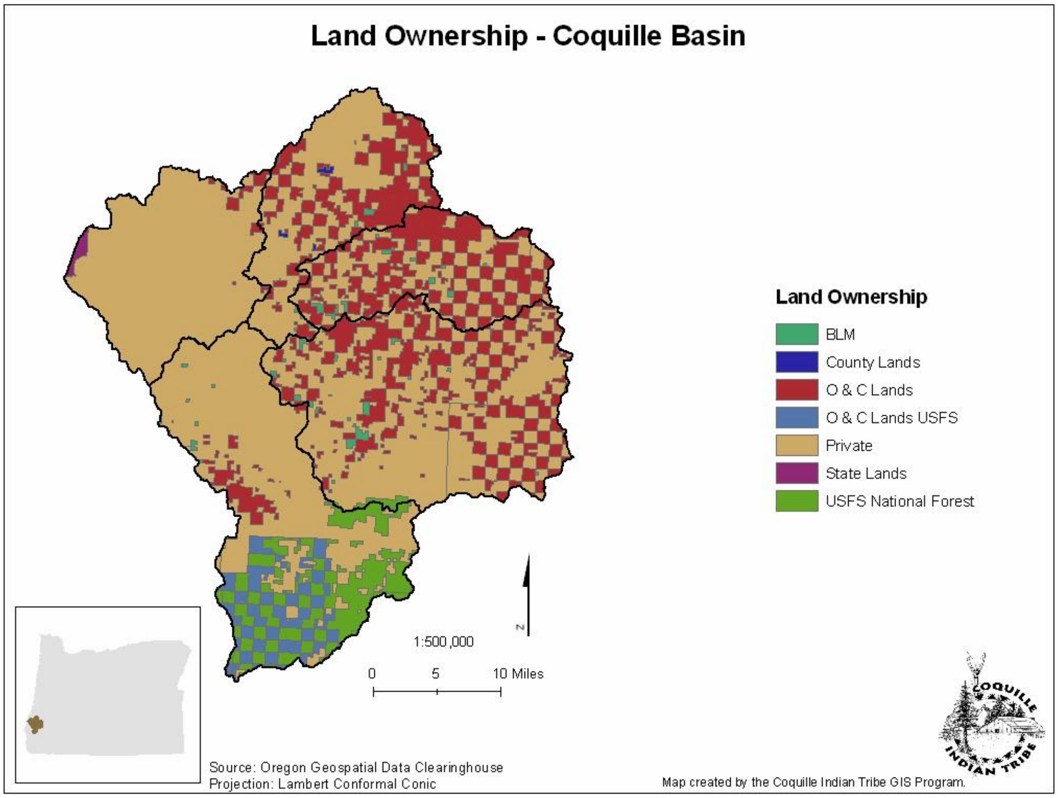


Figure 3-4. Land ownership pattern in the Coquille Subbasin.

Human Disturbances

There is evidence that early Native American tribes intentionally used fire to manipulate vegetation at the landscape-scale. They likely used other land use techniques, but little evidence remains.

When European settlers began inhabiting the subbasin, the extent and pace of human disturbance to the aquatic and terrestrial environments increased rapidly. Early logging practices focused on the removal of riparian timber first in order to facilitate removal of higher elevation timber. Streams were used to transport logs, and as such, much of the timber harvested was adjacent to stream channels. Furthermore, in the era of splash damming, riparian vegetation was removed to facilitate log transport. As logging technology and transportation improved, timber harvest proceeded to progressively harder-to-reach areas, including riparian areas in steep first and second order drainages, leaving few areas untouched (USDI 1994). The substantial bank erosion and stream scouring elicited concern from landowners and the practice was eventually abandoned.

Since the 1860s, a large portion of the flood plain has been cleared for pasture and crop production (USDI 1994). Nearly all of the Coquille River Valley was converted from a hardwood dominated floodplain to crop and pasture lands. Because beaver constructed ponds which flooded the valley bottoms during summer, they were considered a nuisance in many areas. Beaver rely on hardwoods for food and for constructing dams and lodges. As hardwoods were removed to make way for pastures and crops, beaver turned to crops as a food source. Beaver also dammed culverts and tide gates and caused other conflicts with agriculture and roads. Eventually, they were eliminated and their ponds were drained throughout most of the subbasin.

The composition, structure, diversity and function of riparian vegetative communities have changed as well. Over the last 100 years, much standing and downed conifers were removed from streams and roads were built in the majority of riparian areas (USDI 1994). Since red alder responds to major disturbance activities such as logging and road building, many of the affected riparian areas converted from mixed conifer stands with a hardwood understory to red alder-dominated stands with a shrub understory (USDI 1994). Aerial photographs indicate there is inadequate canopy cover throughout many stream reaches of the Coquille River system and there is inadequate recruitment of large woody debris from the riparian areas through most of the drainage due to the scarcity of mature conifers (USDI 1994). Quantitative shade analyses have been conducted on all of the watersheds of the Coquille River (see *Riparian Resources*, below).

One of the greatest manifestations of human disturbance has been the construction of the subbasin's extensive road network. The road network throughout the subbasin is estimated to be 2,383 miles (Ecotrust 1997). On average, there are 2.5 miles of road for every square mile of land in the subbasin (adapted from Ecotrust 1997). Roads which are poorly located or maintained cause many adverse impacts: 1) increase the volume and rate of runoff, which in turn can increase sediment, pollutants and water temperature; 2) cause mortality to fish and wildlife and fragment their habitats; and 3) expand the dispersal of invasive plant species (Pacific Northwest Ecosystem Research Consortium 2002).

Between 1881 and 1902, the US Corps of Engineers (USACE) conducted dredging operations to improve navigability of the Coquille River above the city of Coquille (CWA 1997). During this time, the Coquille River was navigable and used heavily for commodity transport up to the town of Myrtle Point (CWA 1997). The Corps ceased dredging operations after 1902 (CWA 1997). Further, local efforts to improve navigability facilitated the establishment of the Port of Coquille in 1911 which conducted stream-clearing operations that included riparian vegetation removal and intentional bank destabilization and incision to enable navigation between the cities of Coquille and Myrtle Point from 1915 to 1923 (CWA 1997). These activities continued on the North Fork of the Coquille River until the advent of World War II and did not resume until the mid-1960s, when stream clearance actions were engaged to "bring the system up to navigation standards" on the four main forks of the Coquille River above tidewater (Farnell 1979 *in* USDI 2001). While these more recent actions were primarily intended to prevent flooding and bank erosion, they permitted two-way boat traffic on selected segments of the Coquille River (USDI 2001).

Most portions of the Coquille River system are impacted by human developments and activities. Much of the mainstem and major tributary channels are impinged upon by road fills. This caused many streams to deeply down-cut and become separated from their floodplains, thus increasing flow velocities, simplifying the hydrological characteristics within the channels, and expediting the flow of once-retained woody debris, sediments and nutrients out of the system.

In addition, splash damming practices reduced stream habitat complexity, destabilized banks, incised and scoured channels and accelerated sediment delivery and transport. At least 25 splash dams were operated in the subbasin which included eight on the North Fork, four on the East Fork, and three on the Middle Fork. Single splash dams were also operated on Middle, Elk, Big, Sandy, and Cherry Creeks. Myrtle and Rock Creek had two dams each and Dement Creek had one (Coquille Watershed Action Plan 2003). The operation of these dams was largely responsible for large-scale decreases in channel complexity in the Coquille River system.

3.1.2 Water Resources

Hydrology

Based on United States Geological Survey (USGS) nomenclature, the Coquille River subbasin lies within the Southern Oregon Coastal Basin and is comprised of five HUC-5 watersheds. The USGS has recently revised some of the names and boundaries of the watersheds and subwatersheds. The watershed previously called the Mainstem Coquille is now officially the Lower Coquille watershed.

Major tributaries of the mainstem Coquille River are the North Fork, South Fork and Middle Fork. The North Fork includes the East Fork drainage. The North Fork and Middle Fork tributaries have their headwaters along the western slopes of the Coast Range. The South Fork heads in the northern Siskiyou Mountains. The relatively high gradient stream reaches are very responsive to precipitation events.

The mainstem of the Coquille River is formed by the confluence of the North and South Forks near Myrtle Point. It flows 36 miles to the Pacific Ocean, draining 172 square miles (CWA 1997). It has a very low gradient, meandering channel that is deeply cut into the valley (CWA 1997). Prior to European settlement of the subbasin, riparian vegetation was diverse and abundant. Therefore, channel migration was likely slow and induced by debris blockages occurring at bankfull flows, rather than by lateral scour of the stream bank. These debris blockages maintained floodplain roughness and channel sinuosity. The entire mainstem is tidally influenced, with saltwater intrusion ending near the city of Coquille at river mile-25, while the head of tide occurs near Myrtle Point at river mile-38 (CWA 1997). The characteristics of watershed hydrology are summarized in Table 3-3.

Table 3-3. Length, gradient, drainage area, and estimated flood discharge of the Coquille River watersheds.

Watershed	Length (mi.)	Gradient (ft./mi.)	Drainage Area (mi.^{2})	Estimated Flood Discharge at 10 yr. Interval (ft.^{3}/sec.)
Lower	**36.3**	**<1**	**172**	**No data**
North Fork	**53.3**	**30**	**154**	**28,000 near Myrtle Point, OR**
East Fork	**33.8**	**70**	**35**	**No data**
South Fork	**62.8**	**47**	**288**	**28,000 at Powers, OR**
Middle Fork	**40.3**	**35**	**310**	**25,000 near Myrtle Point, OR**
Subbasin Total	**226.5**	**NA**	**959**	**81,000 1]**

1] Value does not include discharges from the Lower and EF Coquille River watersheds. Adapted from ODFW Draft Coquille Basin Fish Management Plan 1992.

The hydrologic characteristics of the subbasin are controlled by precipitation and are typical of the Coast Range, resulting in a seasonal pattern of winter floods and summer shortages. Thus, the peak flows, low flows, annual flows and groundwater levels are all dependent on the amount, intensity and distribution of rainfall. Fairly continuous rainfall from November to March causes the ground to become saturated. Runoff is very rapid because of poor water storage in the steep, thin soils of the upper elevations of the subbasin. Floods are likely to occur during this period, but may occur as early as September or as late as May. Very little rainfall occurs in the late summer and early fall. This condition combined with a lack of snowpack and poor water storage in the upper watershed, results in late summer and early fall flows that are a fraction of winter discharges.

Average annual rainfall ranges from a low of 45 inches in the Camas Valley area to approximately 120 inches in the headwaters of the South Fork, with very little of the precipitation falling as snow (CWA 1997). Rainfall from year to year is quite variable and appears to be a function of cyclical patterns occurring on 20- to 30 year intervals (CWA 1997).

The Coquille River has a mean annual discharge of 3,288 cubic feet per second (cfs) (EPA 1988), which is equivalent to 2,400,000 acre feet of water per year. Approximately 90% of the annual discharge is recorded in the months of November through April, and less than one percent during August and September. For example, for the period of 1930 to 1961, the average monthly discharge at the mouth of the Coquille River in September was 130 cfs, while in February it averaged 8,250 cfs (USGS 1984).

Water withdrawals for municipal, domestic and irrigation use exacerbate the natural pattern of low summer flows. The cities of Bandon, Coquille, Myrtle Point, Powers, and a multitude of individual homes are served by surface water withdrawals. The amount of land under irrigation has increased from 10,150 acres in 1992, to 10,848 acres in 2002 (Peters 2005) (see Section 5.1.2).

There are no federally constructed dams within the subbasin, but many streams were diked or straightened to promote rapid drainage of agricultural lands along the low gradient reaches of the Coquille River and its tributaries. The NRCS funded 75% of the costs of constructing emergency flood control measures mostly in the Beaver Slough Drainage District for repair, restoration and straightening of levees and other flood control works. Most of the productive wetlands in the Beaver Slough drainage have recovered through a combination of restoration efforts and natural processes. Local Drainage Districts constructed levees to prevent flooding of several tracts in the lower Coquille River watershed. In 1942, for example, a district drained 5,100 acres by constructing canals and outlet conduits with tide gates. In addition, private land owners have installed and maintained drainage conduits (Corps et al.1972). The Coquille Watershed Association has information relating to the locations of tide gates and is currently developing pilot activities to achieve a better understanding of tide gates and related issues. These projects seek to find which installations are problematic and which are not. Examples of pilot projects include retrofitting, block and tackle, and pet door installations in the Hatchet Creek and Red Creek areas.

Many mountain tributary streams no longer access their floodplains. This loss of connectivity to floodplains and wetlands has resulted in accelerated sedimentation into tributary stream channels, decreasing the natural application of upland sediments to wetlands through flood events.

The mainstem of the Coquille River has retained access to its floodplain, although the connectivity is somewhat reduced due to channel degradation caused by historic log transport and riparian vegetation removal. Dikes are maintained to accommodate roads, power lines, and agricultural activities, but have relatively little effect on the mainstem river processes.

Water Quality

Appendix A.1 contains a list of stream reaches that failed to meet ODEQ water quality requirements and therefore, are considered water quality limited. It also contains stream reaches with a "needs data" status.

Permitted point sources in the subbasin are regulated by individual and general National Pollution Discharge Elimination System permits and by Water Pollution Control Facilities permits. For Water Pollution Control Facilities permits, disposal of wastewater is typically accomplished through subsurface disposal and irrigation. These permits do not allow direct discharge to surface waters.

There are ten active Water Pollution Control Facilities permits in the subbasin. Industrial sources in the subbasin that hold National Pollution Discharge Elimination System or Water Pollution Control Facilities permits include: cooling water, filter backwash, fish hatchery, seafood processing, manufacture and storage of forest products, mining, oily stormwater runoff, and fresh pack food processing.

Municipal Sewage Treatment Plants (STPs) in the subbasin are located at the cities of Bandon, Coquille, Powers, and Myrtle Point and operate under individual National Pollution Discharge Elimination System permits.

Studies have found that effluent from both the Myrtle Point and Coquille STPs contribute to reductions in instream dissolved oxygen (DO) levels resulting in DO standards violations. In addition, the Myrtle Point STP facility often discharges partially treated sewage during rainfall events. The treatment facilities for both Myrtle Point and Coquille are currently operating under Mutual Agreement and Orders which describe interim effluent limits and provide timetables for complying with State regulations. ODEQ is currently working with these sources to develop facility plans which will satisfy TMDL requirements. The nonpoint source contribution to reductions in DO has not yet been determined, but will be further characterized in late 2007.

While studies indicate that the City of Bandon and the City of Powers STP discharges do not measurably affect DO in the lower Coquille River and the estuary, they do have additional impacts. Surveys have indicated that the Powers STP effluent is poorly mixed during low-flow periods. Monitoring also indicated inadequate disinfection and at times elevated levels of chlorine residual. The Bandon STP is currently not able to meet assigned bacterial effluent limits. Both the City of Powers and the City of Bandon STPs are currently operating under Mutual Agreement Orders which describe interim effluent limits and provides timetables for complying with State regulations.

The majority of the following text has been adapted from the CWAP, unless otherwise stated.

Low Dissolved Oxygen Levels - DO is important for maintaining a healthy and balanced distribution of aquatic life, and was one of the earliest measures chosen for protecting water quality. Salmonid species are the most sensitive to decreases in DO concentrations. In particular, the juvenile stage of salmonids is sensitive to even a slight reduction in DO during emergence (1992-1994 Water Quality Standards Review – Final Issues Paper, June 1995 *in* CWA 1997). Water quality often suffers behind tide gates as an artificial head of tide is formed. Waters behind closed tide gates can display elevated temperature and poor DO levels.

Current data indicates the majority of the medium and high gradient reaches of the Coquille River system have DO levels which meet ODEQ standards. However, marginally low DO levels in upland reaches become cumulative and are exacerbated as a result of heavy organic loading in the head of tide area.

Organic material held in fine sediments results in an elevated sediment oxygen demand (ODEQ 1992). Oxygen carried in the water is absorbed by this organic material and leaves water low in DO. As water temperatures increase, water holds even less oxygen. Point sources of organic materials includes sewage treatment plants, other permitted National Pollution Discharge Elimination System Sites and Confined Animal Feeding Operations (CAFO). Examples of non-point sources of organic material include in-channel stock watering and improperly maintained septic tanks and drain fields. The towns of Coquille, Myrtle Point, and Powers are upgrading their sewage treatment facilities to reduce the discharge of oxygen-reducing substances. Bandon has completed upgrades necessary for their facility. The TMDL study conducted by ODEQ resulted in the establishment of waste load allocations for these facilities. Decreasing stream temperatures improves DO saturations. Continuous monitoring will be required to determine if diurnal fluctuations in DO are problematic.

Oil and Toxins - Toxic substance concentrations (or combinations) may be harmful, or may chemically change to harmful forms in the environment. They may also accumulate in sediments or bioaccumulate in aquatic life or wildlife to levels that adversely affect public health, safety, or welfare; aquatic life; or wildlife (Oregon Administrative Rules Chapter 340, Division 41, Section 325 (2)(p), ODEQ, 1996 *in* CWA 1997). Toxic substances may have been introduced from a variety of point and non-point sources in the watershed such as cumulative storm water discharges, spillage, and minor industrial sources. Little is known about their fate or transport in the system (Near Coastal Waters Pilot Project "Action Plan for Oregon Estuary and Ocean Waters" 1991 *in* CWA 1997).

Sediment/Turbidity - Sediment deposition can fill pools, cover spawning gravels, reduce DO within the water column and gravels, temporarily block upstream adult migration, reduce aquatic invertebrates used as food by fish, increase the channel width to depth ratio, and elevate stream temperature. Prolonged periods of extreme turbidity can reduce the feeding ability of fish and can cause gill abrasion and other adverse effects.

The subbasin is naturally sediment productive due to the interplay of terrain, geology, and precipitation (ODEQ 1992 *in* CWA 1997). Heavy seasonal rainfall combined with steep, thinly soiled slopes on unstable bedrock leave the drainage highly susceptible to earth-flows, debris slides, erosion, and flash flooding.

Excessive sedimentation from erosion in the watershed was identified as a potential cause for concern by the Soil and Water Conservation District (1983) and in the Preliminary Statewide Non-point Source Assessment (ODEQ 1988 *in* CWA 1997). Elevated turbidity and sediment loads in all zones can be attributed to the effects of soil disturbing activities such as management practices associated with road building, timber harvest, agriculture and active bank erosion above the head of tide.

Temperature - Warm season water temperatures appear to be one of the most critical, potential limiting factors in the Coquille drainage: 21 out of the 25 303(d) listed stream segments are listed for temperature. In addition, elevated water temperatures work in concert with other limiting factors to exacerbate their impacts. Salmonids and some amphibians appear to be of the most temperature-sensitive species. Stream temperatures during the salmonid spawning, incubation and emergence life stages are desirable, but are elevated during the summer rearing life stage.

Stream temperature is typically measured as the 7-day moving average of the daily maximum temperatures. If there is insufficient data to establish a 7-day average of maximum temperatures, the numeric criterion is applied as an instantaneous maximum. The ODEQ and Coquille Watershed Association have access to temperature monitoring data for selected streams. These data sets are valuable for future monitoring efforts, such as Water Quality Management Planning, and for establishing restoration priorities (see Section 4.7.3). Also, values for diurnal changes in temperature (i.e., delta-T) can assist in: 1) determining where excessive warming is occurring; 2) determining how area streams might be cooled; and 3) selecting sites for restoration.

Many of Oregon's streams warm during the summer to temperatures above those considered optimal for native cold water fish species. This is due to a combination of natural factors exacerbated by human activities. The natural stream temperatures are somewhat higher in the subbasin than those in Washington, British Columbia, or Alaska, where the same cold water fish species occur (1992-1994 Water Quality Standards Review – Temperature – Final Issue Papers, June 1995 *in* CWA 1997). Stream temperatures also exhibit natural geographic variability, which is a result of elevation, gradient, time of exposure to air temperatures, amount of ground water inflow, channel orientation and shade. Removal of riparian vegetation through livestock grazing, timber harvest or land clearing; stream channel alterations; water diversions; wetland drainage or filling; diking; reservoir construction; and point-source discharges, may increase stream temperatures if not conducted in a manner designed to maintain or improve water temperature. Most of these problems are on private lands and many are voluntarily being addressed by landowners through their use of best management practices or participation in conservation programs sponsored by the NRCS, Coquille Watershed Association and other entities.

Federal law requires that water bodies that appear on the 303(d) list be managed to meet state water quality standards. The ODEQ's comprehensive approach for protecting water quality includes developing TMDLs for both point and non-point sources. ODEQ is committed to having federally approved TMDLs on all waterbodies listed on the 1998 303(d) list by the end of the year 2007.

3.1.3 Streams

The subbasin contains approximately 241 fish-bearing streams. ODFW surveyed 132 (i.e., 55%) of these streams under their Aquatic Habitat Inventory project. An evaluation of their data was conducted by the Coquille Indian Tribe and published in the 2005 Limiting Factors Report. Note that the 2005 analysis did not use the same techniques for determining limiting factors that were used in the Subbasin Plan (see Section 4.5). However, it provides useful information on the relative condition of six habitat attributes, by reach, on 103 streams (see Appendix A.2, A.3 and A.4). This assessment found that riparian vegetation condition, particularly the presence of large conifers, was poor throughout the subbasin. The historical removal of riparian vegetation and disconnection of the floodplain in many cases has severely impacted stream functions relating to riparian vegetation development; regulation of water temperature; bank stability; pool formation; delivery, retention and transport of woody debris and sediments; and floodplain inundation (see section 3.1.4). The report noted that reaches that provided quality spawning habitat were not isolated from reaches that contained quality rearing habitat.

3.1.4 Riparian Resources

Riparian areas are the areas immediately adjacent to streams, rivers and wetlands. Although they occupy a relatively small percentage of a watershed, riparian areas greatly influence the presence of fish and wildlife. Riparian areas serve several ecological functions: 1) provide vegetation that shades streams and contributes nutrients (e.g., nitrogen) organic matter and wood used by riparian and aquatic organisms for food and shelter; 2) contribute wood which maintains channel form and complexity; 3) collect nutrients and sediment and filter pollutants from nearby runoff; 4) provide a high level of biodiversity; and 5) link land and water habitats by capturing the interdependencies of physical, biological and chemical processes.

Early historical accounts identified portions of the Coquille River as a deep meandering river (CWA 1997). Streambank erosion is a natural process associated with the lateral migration of meandering river channels. However, long-term land uses have increased the amount of stream bank erosion (see Section 4.5.2). The historic use of splash dams and the long-term removal of in-stream wood and boulders have resulted in the destruction of riparian vegetation, including large conifers, and channel down-cutting and simplification of in-stream habitats. Modification of waterways for navigability, including channeling and dredging, has given rise to increased peak flows and sedimentation (CWA 1997).

The Coquille Watershed Association, under a grant with ODEQ, completed a riparian shade analysis throughout the subbasin. The shade assessment modeled the current amount of the stream channel shaded and the potential or target shade amount. The potential or target shade amount was based on an evaluation of the potential riparian plant association for each stream reached modeled. For example, a Douglas-fir/western hemlock riparian plant association would have greater potential to produce shade than a meadow-shrub riparian plant association, all else being equal. These data are listed by subwatershed in Appendix A.3.

Findings from the Clearwater BioStudies Report (2001) are summarized as follows:

- Variable but low existing and potential shade levels occur along the mainstem South Fork.
- More variable, but generally higher, levels of existing shade occur along streams in the three tributary watersheds than along the mainstem. Estimated levels of existing shade vary from 22% to 95% among the 86 tributary reaches modeled.
- Consistently high shade potentials occur along all of the tributary streams. Estimated shade potentials varied from 86% to 95% among the 86 tributary reaches modeled.
- Stream segments with significant scopes for improvement in shade conditions exist throughout most of the mainstem Coquille River and at locations within each of the tributary watersheds.
- More extensive opportunities for improving shade conditions exist in the Dement Creek system than in the other two tributary watersheds.
- Multiple east-west trending segments of the Lower South Fork Coquille River have very low shade potentials related to high natural exposure to mid-summer sun.

3.1.5 Wetland Resources

Much of the tidal and freshwater marshes that occupied much of the Coquille River valley were drained and converted to farmland by 1870. Today, only 373 acres or 3-4% of the marshes remain (ODFW Draft Coquille Basin Fish Habitat Management Plan 1992). The following information regarding wetland resources was obtained from the CWAP (1997) and Benner (1997). Wetlands provide unique and significant ecological functions, including flood detention, cooling and filtering of overland flow, nutrient cycling, and unique and productive aquatic and terrestrial habitats. In the mid-1800s, the valley's landscape features included vegetation communities associated with lands annually inundated with water from periodic river flooding, persistent coastal rainfall, and surface and subsurface runoff from the uplands.

Original notes from surveys of the Coquille River Valley between 1857 and 1872 provide information on historical features of the valley. The tidal section of the Coquille River at that time was linked with over 20,500 acres of bottomlands, 70% of which were marshy in character (Benner 1997). Of these 14,350 acres of marshland, 87% were densely covered with trees and shrubs, and the balance was grassy marsh. Over-story plants included myrtle, alder, maple, ash, and spruce, with an under-story of salmonberry, willow, crab-apple, and coarse grass. In some instances, swampland was covered with a dense thicket of willow and alder brush, rather than trees. The current estuary of the Coquille River is one of the smaller in the state containing 380 acres of tidelands, and 383 acres of permanently submerged land.

The influences of the historical marshland features on the landscape and its resources are broad in scope. The marshlands served as a source and regulator of nutrients, including regular inputs of leaves and other organic materials that were consumed by aquatic insects and other invertebrates. The trees and shrubs trapped and deposited sediment on the bottomlands, and standing trees on floodplains trapped woody debris transported during bankfull events. The complex habitat structure created by the vegetation and down woody debris enhanced tidal creek habitat diversity and provided abundant cover for fish during flood periods.

3.1.6 Fish, Wildlife and Plant Resources

The subbasin has a rich assemblage of fish, wildlife and plants. A number of species are recognized as regionally or locally important by virtue of their role as indicator species or concerns for their viability, while others are ecologically, culturally or economically important. Some species, such as anadromous salmonids, fall into more than one of these categories. In a general sense, residents of the subbasin consider native fish and wildlife to have a higher intrinsic ecosystem value than nonnative species. Resident fish, such as coastal cutthroat trout, are becoming more appreciated by today's culture as inhabitants of cold, clean systems. In terms of wildlife, bald eagles and black-tailed deer are considered important to most subbasin residents. Beaver, once a keystone species within the subbasin, helped create and maintain habitats used by coho and other wildlife. Some introduced species appear to be relatively benign, while others have produced significant undesirable environmentally consequences.

Priority Species and Habitats

A 1992 study of factors limiting natural production of native anadromous fish in Oregon coastal streams (USFWS, ODFW, FS, BLM, Humboldt State University) indicated that spawning and rearing habitat are moderately-to-highly limiting in the Coquille system. The mainstem Coquille River historically functioned as a rearing area for juvenile salmonids, but current conditions have severely reduced the ability of juveniles to rear in this zone (Reeves et al. 1992, USACE 1972, ODEQ 1992, ODFW 1992).

In February 1997, a revised and updated draft of the Oregon Plan was presented at Legislative hearings. The Legislature addressed concerns and made needed changes to the Oregon Plan and a final draft was completed March 10, 1997. The final draft was submitted to the National Marine Fisheries Service (NMFS) in late March 1997. The Plan identified Core Areas for coho, fall-run and spring-run Chinook, and winter steelhead. These Core Areas were defined as stream reaches that were most critical to the survival of the identified salmonid species. Although it is recognized that salmonids require entire healthy stream systems, Core Areas were designed as a planning tool for agencies and others interested in protection and restoring the highest priority stream reaches. Agencies were to ensure they did not authorize activities that were harmful to Core Areas and, to the extent practical, were to protect and restore these areas. Table 3-4 contains additional information about these areas in the subbasin.

Table 3-4. Core Area miles by percent anadromous salmonid habitat and subbasin miles.

Species/Race	Core Miles	Watershed	Core Area Habitat	
			% Anadromous Salmonid Habitat	% of Subbasin
Coho salmon	125.8	NF,EF,MF,SF	26	10
Fall-run Chinook salmon	80.7	NF,EF,MF,SF	17	7
Spring-run Chinook salmon	25.8	SF	5	2
Winter-run steelhead	66.4	SK	14	5
Total Core Miles	211.5*	--	44*	17*

* Species areas can overlap. From CWA (1997)

Species of Concern to State or Federal Agencies

Regionally, the subbasin is located within the ODFW Oregon Coast Species Management Unit for fisheries. Four anadromous salmonids occur within the subbasin: OC coastal cutthroat trout, OC Chinook salmon, OC coho salmon, and OC steelhead trout. Of these fish species, the conservation of coho, cutthroat and steelhead are of greatest concern in the subbasin. Coho are classified as an ODFW “sensitive species”, subcategory “critical”, a FS “sensitive species”; and a BLM “special status species”. Coho were previously listed as “threatened” under the ESA, but their status was recently determined to be “not warranted” (see Section 4.1).

Three avian species – bald eagle, marbled murrelet and northern spotted owl - are listed as threatened by the ODFW and are also federally listed as threatened and under the ESA. In addition, the State lists five species as critical (i.e., western pond turtle, northern goshawk, Pacific big-eared bat, fisher) and 10 as vulnerable (i.e., southern torrent salamander, Del Norte salamander, tailed frog, pileated woodpecker, Stellar sea lion, fringed myotis, American marten, steelhead, Pacific lamprey, coastal cutthroat). Special Status species are listed in Table 3-5).

Eighteen species are recognized as rare or significant to the subbasin. Each has special management status. Fall and spring-run Chinook are a commercially and culturally significant and enjoy special management consideration with the BLM, FS, and the Coquille Indian Tribe. Sixteen of these species are significant due to concerns over population viability. These are listed by species category, scientific name and management status in Table 3-5.

Table 3-5. Species with Special Status due to population viability concerns. 1]

Species Category	Common Name	Scientific Name	ESA Status	State Sensitive Species Status
Reptiles and Amphibians	Southern torrent salamander	*Rhyacotriton variegatus*		Vulnerable
	Del Norte salamander	*Plethodon elongatus*		Vulnerable
	Tailed Frog	*Ascaphus truei*		Vulnerable
	Western pond turtle	*Clemmys marmorata*		Critical
Birds	Bald eagle	*Haliaeetus leucocephalus*	Threatened	Threatened
	Northern goshawk	*Accipiter gentilis*		Critical
	Marbled murrelet	*Brachyramphus marmorata*	Threatened	Threatened
	Northern spotted owl	*Strix occidentalis*	Threatened	Threatened
	Pileated Woodpecker	*Dryocopus pileatus*		Vulnerable
Mammals	Steller sea lion	*Eumetopias jubatus*	Threatened	Vulnerable
	Fringed myotis	*Myotis thysanodes*		Vulnerable
	Pacific western big-eared bat	*Plecorus townsendii townsendii*		Critical
	American marten	*Martes americanus*		Vulnerable
	Fisher	*Martes pennanti*		Critical
Fish	Coho salmon	*Oncorhynchus kisutch*		Critical
	Coastal steelhead	*Oncorhynchus mykiss*		Vulnerable
	Pacific lamprey	*Lampetra tridentata*		Vulnerable
	Coastal cutthroat trout	*Oncorhynchus clarki clarki*		Vulnerable

1] The ODFW Special Status Species list is scheduled for revision in late 2006 or early 2007. From ODFW Sensitive Species List (1997).

Species of Cultural Significance

Many native species were also significant to tribal life. Table 3-6 lists species that have been historically documented as important resources throughout the ceded lands.

Table 3-6. Plant, fish and other aquatic species significant to Indian tribes.

Type of Use	Species
Plant Species used for Food	camas, braken fern, cattail, skunk cabbage, springbank clover, shore lupine, chocolate lily, tiger lily, columbine, wapato, Pacific silverweed, blackberry, black huckleberry, black-cap, red and blue elderberry, crab apple, salal, salmonberry, red huckleberry, thimbleberry, currant, goose berry
Plant Species used for Traditional Arts and Culture	red cedar, hazel, spruce, ash, maple, alder, chittam, Oregon grape, beargrass, tule, cattail, willow, cherry, eelgrass, sedges, red elderberry, ocean spray, cascara, Port Orford cedar
Fish and Other Aquatic Species Used for Food	salmon , lamprey, flounder, sturgeon, herring, California sea lion, Steller sea lion, harbor seal, whales, crabs, mussels, clams, seaweeds

From Coos, Lower Umpqua, Siuslaw Tribes cultural history (http://www.ctclusi.org/cultural_history.asp).

Species of Special Ecological Significance

Four species play key ecological roles within the subbasin- coho salmon, Pacific lamprey, western brook lamprey and beaver. These species are co-dependant components of regional biodiversity. Each plays a key role in providing for the health and sustainability of the ecosystems upon which they mutually depend. Changes in habitat quality for one species may well affect the others. For example, when beaver habitats were destroyed during urban or agricultural development of the valley and lowlands, it undoubtedly caused a reduction in coho populations (Pollock 2004).

Coho and fall-run Chinook salmon inhabit all five watersheds within the Coquille River subbasin. Spring-run Chinook occur in the North and South Forks of the Coquille River. Fry from Willamette spring-run Chinook stock, and probably other stocks, were planted in the subbasin for many years in an attempt to supplement the low population. However, the success and historical effect of those transplants have not been evaluated through genetic testing. Today, fewer than 500 spring-run Chinook return to the subbasin. Their low population size is likely attributed to natural limitations within the subbasin. Spring-run Chinook do not typically inhabit the entirely coastal basins of the Oregon Coast because of the general lack of snowmelt needed to sustain adequate summer flows and temperatures. Most of the river systems that historically had strong spring Chinook runs originate in the Cascades where the elevated late spring/early summer stream flows allow adult fish to enter the system and reach thermal refugia, where they hold until spawning in the fall.

Salmon play an important ecological role in the transport of energy and nutrients between the ocean, estuary and freshwater streams, supporting overall ecosystem health. All life stages provide nutrients and energy needed for healthy stream ecosystems. Today, only three percent of the marine-derived biomass once delivered by anadromous fish is currently reaching those watersheds (Cederholm et al. 2000). Research on the consumption of salmon by vertebrate wildlife has documented 137 species of birds, mammals, amphibians and reptiles are predators or scavengers of salmon (Cederholm et al. 2000). In oligotrophic streams, marine-derived nutrients from salmon carcasses increase the overall productivity of the system (Cederholm et al. 2000).

Pacific lamprey (*Lampetra tridentate*) and western brook lamprey (*Lampetra richardsoni*) inhabit the subbasin. Lampreys are remnants of the world's oldest vertebrates. Their physical appearance and lack of commercial importance has precluded them from the rigorous scientific study awarded other aquatic species such as native salmonids (Kostow 2002). Although relatively little is known of their population dynamics, recent records of declines have motivated the State to list the Pacific lamprey as a "vulnerable" species in 1997 (see Table 3-5).

Pacific lampreys are large, anadromous fish that parasitize other fish species, including salmon, while in the ocean and during the early stages of their return to freshwater. Western brook lampreys are small, non-anadromous and are not known to parasitize other fish species. Both species are an ecologically significant in the subbasin. Their larvae and eggs are nutritious food sources for predators and scavengers co-habiting the aquatic environment. Migrating juveniles and adult Pacific lamprey appear to be targeted by mammalian and avian species during migrations to and from the ocean (Roffe and Mate 1984, Merrell 1959 in Kostow 2002). In the ocean, adult Pacific lampreys are preyed upon by marine mammals and larger fishes (Beamish 1980 in Kostow 2002). Adults spawn in freshwater and die after spawning. Their carcasses provide an important source of energy for scavenger species such as sturgeon, and are also assimilated into the food web of river and stream systems through macroinvertebrates and other aquatic species. Pacific lamprey carcasses contribute marine-derived nutrients to the river system. Declines in Pacific lamprey and anadromous fish populations may have led to imbalances and disruptions in natural predator-prey systems and nutrient cycles (Kostow 2002).

Beaver (*Castor canadensis*) are a keystone species that once affected the structure and function of nearly all the low gradient stream systems in the subbasin. Beaver dams store water, nutrients and sediments; maintain the water table; create pool habitat; and enhance floodplain connectivity, thereby providing diverse habitats for a variety of aquatic and riparian-dependant species. In many Pacific Northwest coastal basins, there is a strong relationship between the abundance and distribution of beaver ponds and the level of coho smolt production (Pollock et al. 2004).

Beaver were once so abundant throughout Western Oregon, their pelts provided an important commercial trade network that influenced the distribution and rate of European colonization. The ensuing unregulated trapping and conversion of the valley wetlands for agricultural production marked the beginning of the decline in beaver populations. As beaver populations declined, so did their ecological legacy. The CCP (2007) recommends increasing beaver dams in suitable sites throughout the ESU as a means of increasing coho smolt production (see Section 6.3.1).

Introduced Species

The annual cost imposed by nonnative (i.e., exotic) species in the United States is estimated to be $123 billion (Oregon Progress Board 2000). Exotic species often compete with native species, impact food sources for native and commercial species, impede forest regeneration, increase unnatural wildland fire risks, and change the character of streambanks and streams.

Nearly 1,000 exotic species have been introduced to Oregon since about 1850. For example, the State of Oregon introduced turkey as game animals and private individuals introduced bullfrogs and many species of baitfish. Many exotic species are kept as pets or raised commercially, but these animals occasionally escape and establish breeding populations. Examples include nutria (*Myocastor coypus)*, snapping turtles (*Chelydra serpentina)*, and Asian carp (*Hypopthalmichthys nobilis* and *H. molitrix)*. Some species introduce themselves- for example, English sparrows (*Passer domesticus)* and European starlings (*Sturnus vulgaris*) flew into Oregon on their own. (Oregon Progress Board 2000 and Altman et al. 1997 *in* Willamette Restoration Initiative 2004*)*.

Fish - There are several important introduced fish species that inhabit the Coquille River and adjacent habitats, many of which pose predation or competition impacts to juvenile salmonids. These include the following: striped bass (*Morone saxatilis*), largemouth bass (*Micropterus salmoides)*, yellow perch (*Perca flavescens*), bluegill (*Lepomis macrochirus*), brown bullhead (*Ameiurus nebulosus)*, mosquito fish (*Gambusia affinis*) and American shad (*Alosa sapidissima*). The State introduced largemouth bass to the Tenmile Lakes, but the original introduction may have been by settlers. Sportsmen have reported catching smallmouth bass (*Micropterus dolomieu*) in the Coquille River, but their presence is currently unconfirmed by ODFW. Smallmouth bass were found to pose a known impact or risk to coho in the Umpqua River system (Introduced Fishes Impacts 2004). With the exception of striped bass and American shad, these introduced fish are adapted to a slow-moving, warm-water environment and have physiological mechanisms that enable them to tolerate higher pollution and lower levels of DO (see Section 6.5.2).

Wildlife - There are eight non-native wildlife species documented as inhabiting the Coquille River System. The house mouse (*Mus musculus*) and Norway rat (*Rattus norvegicus*) are most often found in and around human dwellings or structures. The Virginia opposum (*Didelphis virginiana*), a native of the eastern United States, was introduced into northwestern Oregon in the 1940s (Maser et al. 1981 – *in* USDA 1995). They have since spread south along the coast and are now a part of the Coquille River wildlife community, inhabiting the majority of available habitat within the watershed. Domestic swine (*Sus scrofa*) were released in the uplands surrounding the South Fork Coquille River upstream from Broadbent in the mid-1900s, resulting in established populations of feral swine. Feral swine have tremendous impacts on vegetative communities by decimating the understory and inhibiting forest regeneration by consuming acorns and conifer seedlings. They also contribute significantly to erosion and soil compaction, as well as surface water run-off, through the aforementioned activities in conjunction with the rooting, wallowing, and trampling typical of swine. Periodic releases have continued up to the late 1990s for recreational hunting purposes. Currently, state law prohibits the release of domestic swine.

European starlings and house sparrows are locally common in the vicinity of human habitation. In some cases, starlings establish wild populations and aggressively compete with native cavity nesters, particularly tree swallows (*Iridoprocne bicolor*), western bluebirds (*Sialia mexicana*), and some woodpeckers. Wild turkeys (*Meleagris gallopavo*) have been stocked periodically by ODFW and are present throughout the subbasin. This stocking program will likely continue, and the birds successfully propagate in the wild. Impacts of wild turkeys on native wildlife are thought to be slight, although in some cases there may be competition for acorns (USDA 1995).

The American bullfrog (*Rana catesbeiana*) is present in many of the ponds adjacent to the Coquille River and its tributaries, including Johnson Mill Pond, which is inundated each winter. Bullfrogs are prolific breeders, and provide a potential food source for numerous native predators, provided they develop an affinity for bullfrogs as a prey base. Evidence of great blue herons (*Ardea herodias*), raccoons (*Procyon lotor*), river otters (*Lutra canadensis*), pied-billed grebes (*Podilymbus podiceps*) and garter snakes (*Thamniophis sirtalis*) ingesting bullfrogs, or bullfrog tadpoles has been observed (Bouska 2004), so it is likely that other aquatic predators consume them as well. However, bullfrogs are voracious predators. Because of their relatively large size, they are capable of ingesting fairly large prey including ducklings, bats, various snakes, conspecifics (i.e., both tadpoles and metamorphosed bullfrogs), Pacific water shrews (*Sorex bendirii*), and small rodents (Bouska 2004). They can also prey on fish. As a result of this, and because of the competitive nature of their habitat requirements, bullfrogs are considered as a major factor in the decline of many native species, such as the red-legged frog (*Rana aurora)* and western pond turtle.

European green crab *(Carcinus maenas)* are confirmed in the Coquille estuary (Yamada et al. 2006). Based on the Washington Department of Fish and Wildlife Aquatic Nuisance

Species website, the first documented discovery in the North American West Coast was in San Francisco Bay, California in 1989. They have since spread northward to British Columbia. Because European green crabs are voracious predators that feed on many types of organisms, they have the potential to affect the oyster, clam, and mussel industry. They also have the potential to out-compete native crab species.

There is also great concern over invasion by other species (e.g., zebra mussel, mitton crab, New Zealand mudsnail, milfoil algae) in the future. These exotic species have the potential to adversely affect numerous native marine and freshwater plant and animal species, including salmonids.

Plants - Many problems are caused by introduced plant species in Oregon. Gorse (*Ulex europaeus)* is an invasive plant that poses a fire hazard that threatens homes and commercial timber lands. Tansy ragwort (*Senecio jacobaea*) poisons livestock. A variety of thistles (*Cirsium spp.*) decrease pasture and rangeland forage production. Scotch broom (*Cytisus scoparius*) interfers with reestablishing conifers on harvested lands and increases fire hazard. Purple loosestrife (*Lythrum salicaria*) and Japanese knotweed (*Polygonum cuspidatum*) eliminate native vegetation in wetlands. Hydrilla (*Hydrilla spp.*) clogs waterways (Oregon Progress Board 2000 and Altman et al.1997). Because all of these plants displace native plant species, they indirectly affect wildlife populations.

4. Coho Salmon

Coho salmon are the selected focal species within the subbasin. A focal species is a species with special ecological, cultural or legal status that can be effectively used to evaluate the health of the ecosystem and the effectiveness of the management actions. Of highest priority are species listed under ESA or those of which population viability is a concern (Technical Guide for Subbasin Planners 2001). Because of viability concerns of the Coquille coho population, they have special management status with ODFW, FS, BLM and NOAA Fisheries.

Of all the aquatic species within the subbasin, coho provide the highest level of diagnostic function. They can effectively be used as an indicator of the broader ecological health of the subbasin. The biological and physical processes that form and sustain healthy coho habitats are the same processes that affect chinook, lamprey and other native fishes.

Coho play a key ecological role and are culturally and locally significant. Coho are both predator and prey in marine, freshwater and terrestrial food webs; provide a nutrient source for terrestrial and aquatic biota; and deliver marine-derived nutrients to every watershed in the subbasin. Coho, chinook and Pacific lamprey share special cultural significance with the Coquille Indian Tribe.

This chapter focuses on understanding the life history requirements of coho, what is affecting the viability of the Coquille population, and what can be done to improve its viability. Understanding and measuring the viability of the population is the first step to assessing its current status, identifying factors limiting its recovery, and identifying changes to improve in viability. Five parameters of viable salmonid populations are described and evaluated. A single parameter is found to be significantly reduced and the habitat and management factors responsible are identified. Opportunities to address the habitat related factors are identified.

4.1 Population Structure

Coho are a widespread species of Pacific salmon, occurring in most river basins from Monterey Bay in California north through the Aleutian Islands in Alaska. NOAA Fisheries' 1993 review of West Coast coho populations identified six coho ESUs, including the OC Coho ESU. Based on this assessment, the OC Coho ESU was identified as encompassing all naturally spawning populations of coho in Oregon coastal streams south of the Columbia River and north of Cape Blanco (August 10, 1998, 63 FR 42587). This geographic area is termed a "recovery domain" for the purposes of NOAA Fisheries' salmon recovery work.

Habitat of the OC coho ESU consists of numerous stream and river systems draining west into the Pacific Ocean. These systems vary in size from 1 or 2 km to over 7000 km in length. All, with the exception of the largest, the Umpqua River, drain from the crest of the Coast Range. The Umpqua River transects the Coast Range and drains from the Cascades. This recovery domain includes numerous cities along the coast and inland including Tillamook, Lincoln City, Newport, Florence, Coos Bay, and Roseburg. It includes portions of the Siuslaw, Umpqua and the Rogue River-Siskiyou National Forests; the Coos Bay, Eugene, Medford, Roseburg and Salem BLM Districts, Coquille Forest, and the Tillamook and Elliott State Forests. This ESU also has substantial amounts of private forest land and agricultural land.

As a step in the ESA recovery planning process, members of the Oregon/Northern California Coast Technical Recovery Team (ONCC TRT) identified multiple populations of Oregon Coast coho salmon and classified them by *historical* population structure and interaction. This information is useful in assessing viability of present-day populations and in developing de-listing criteria as an overall recovery strategy. Their work is published in Lawson et al. (2007). Their approach compares the degree of isolation of a population and its historical abundance to determine the relative independence of each constituent population in relation to others in the ESU, regardless of its likely persistence. They concluded the ESU contained 57 historical populations, of which 35 were dependent; 13 were functionally independent, and eight were potentially independent (Lawson et al. 2007).

They found the Coquille population to be functionally independent. That is, it is a high-persistence population whose dynamics or extinction risk over a 100-year time frame is not substantially altered by exchanges of individuals from other populations. Lawson et al. (2007) proposes functionally independent populations are net “donor” populations that may provide migrants for other types of populations.

In 2005, the State completed the Oregon Coastal Coho Assessment (CCA). This document assessed all populations within this ESU using a different protocol provided in the Native Fish Conservation Policy (NFCP). They determined that OC coho function at three scales: 1) ESU (e.g., OC); 2) population strata (e.g., Mid-South Coast); and population (e.g., Coquille) as shown in Fig. 4-1. The Mid-South Coast population strata includes the Coquille, Coos, Floras and Sixes populations. ODFW determined the ESU contains 57 individual populations. Oregon adopted the Lawson et al. 2007 definition of population structure and determined 21 of the 57 populations are independent or potentially independent populations, including the Coquille population. Independent populations do not rely on straying from other populations to maintain population size during years of prolonged low ocean survival.

In addition to the naturally spawning populations, five hatchery populations are also considered part of the ESU. NOAA Fisheries has determined that these hatchery stocks reside within the historical geographic range of the ESU and do not exhibit substantial or extreme divergence from the local natural populations. These hatchery populations- North Umpqua, Cow Creek, Coos, Coquille and North Fork Nehalem, were included in the ESU in the June 2005 final status review and listing determination. The issue of how NOAA Fisheries will address these populations is described in NOAA’s June 2005 final hatchery listing policy (June 28, 2005, 70 FR 37204). In 2006, NOAA Fisheries determined the ESU did not warrant listing under ESA (Federal Register Vol. 71, No.12, January 19, 2006/Proposed Rules). This decision is currently contested in Federal Court.

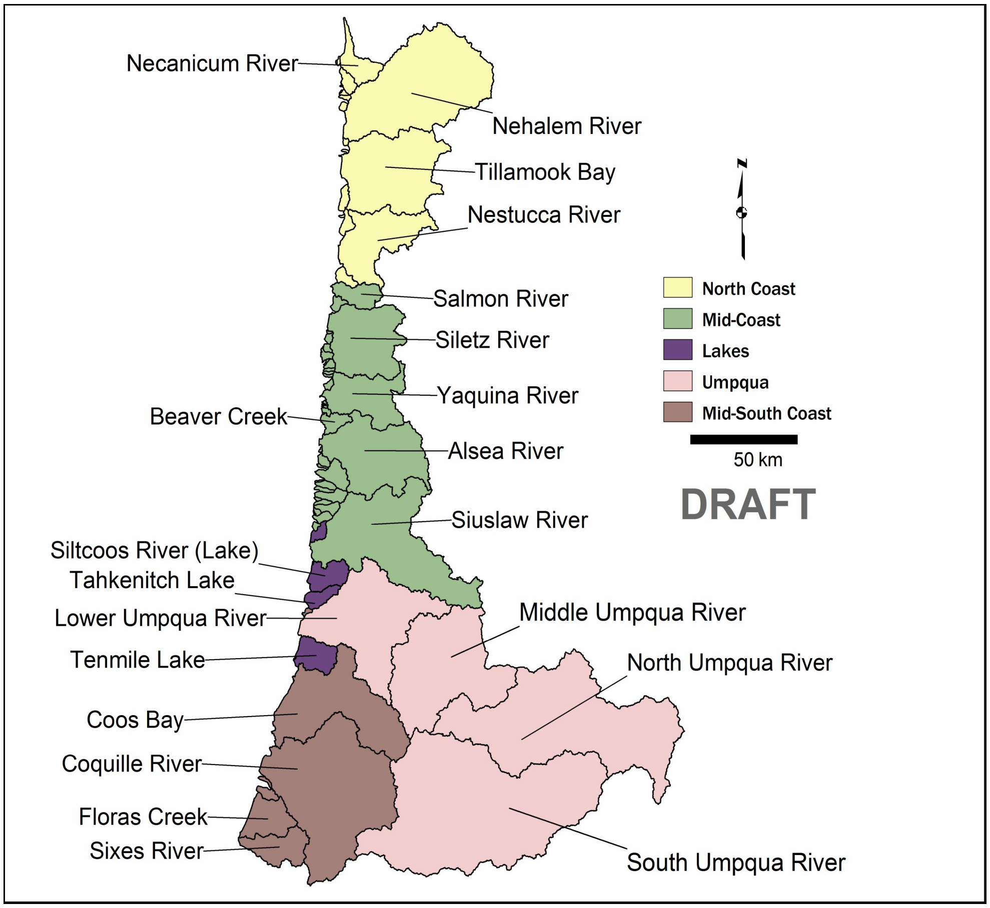


Figure 4-1. ESU, population strata and independent populations of Oregon coast coho salmon. From Oregon Coastal Coho Assessment 2005.

4.2 Life History

Following is a brief description, by life stage, of the characteristics of habitats, substrates and environmental conditions preferred by coho within the subbasin.

4.2.1 Freshwater Life Stages

Spawning Migration

Unlike chinook and steelhead within the subbasin, coho have a rather simplified age structure. Based on the CCA (2005), approximately 80-90% of OC coho adults return to spawn as 3-year olds and the remaining 10-20% return as 2-year olds which are almost entirely precocious males (i.e., jacks).

Adults migrate into the Coquille River in the fall and exhibit strong homing to their natal stream. Upstream migration timing is subject to fluctuating environmental factors. Severe winter droughts may delay spawning in Oregon coastal streams until early March (A. McGie, personal communication *in* Groot and Margolis 2003). They may spend several weeks to several months in freshwater before spawning, depending on the distance they migrate to reach their spawning grounds and variations in flow. Coho tend to migrate when water temperatures are 7.2-15.6°C, minimum depth is 18 cm, and the water velocity does not exceed

2.44 meters per second. These conditions facilitate access to the smaller headwater tributaries favored by coho for their good spawning and rearing conditions (Reiser and Bjorn 1979, *in* Groot and Margolis 2003).

Spawning

Water temperature affects spawning timing. The preferred temperature range is 11.7^{o}-14.4^{o}C, with 19.9^{o}C being the maximum (Coquille Draft Coho HGMP 2001). The spawning season in the Mid-South Coast population strata, of which the Coquille population is part, is typically more protracted than the other Oregon coastal subbasins (Jacobs et al. 2002). Spawning typically occurs from mid-November through February, depending on water flow, although it may take place as late as March. The peak of spawning is typically late December.

There is an estimated 320 miles of coho spawning habitat in the subbasin (ODFW Draft Coquille Basin Management Plan 1992). Coho are described as being the least particular, with respect to site selection and habitat requirements, of all the salmonids and readily disperse into lesser habitat when optimal spawning sites are occupied. The range of documented water depths and velocities used by spawning coho are 4-35 cm and 25-91 cm/s, respectively (Spence et al. 1996). Coho spawn in perennial and intermittent streams. They are also quick to recolonize restored habitat, an encouraging characteristic for habitat restoration management (Jacobs et al. 2002).

Each female lays about 2,500 eggs. The quantity of accessible spawning gravels influences fry production. Coho prefer pea to orange-size gravel for spawning. Spawning gravels are recruited to healthy stream channels, primarily during bank-full events. Their transport and depositional rates are controlled by channel form and roughness, including the presence of woody debris and large substrates (e.g., boulders).

Adults die within two weeks after spawning. Carcasses provide an abundant nutrient source for aquatic biota, including juvenile salmonids. Channel roughness, particularly woody debris, plays an important role in nutrient retention.

Coho spawn and rear in all five watersheds within the subbasin. Spawning survey data is displayed in Fig. 8, Part 2 of the CCA (2005). This indicates a high variability in the number of adult spawners counted between watersheds and between years. However, some generalizations are noted. The East Fork and North Fork Coquille River Watersheds consistently produced the largest run sizes and run densities. The North Fork Coquille Watershed produces the highest number of summer-rearing juveniles and the South Fork Coquille Watershed produces the least. The Lower Coquille Watershed provides habitat for the highest number of overwintering juveniles and the South Fork Coquille Watershed provides the least.

Incubation to Emergence

Eggs hatch in 35-50 days, depending upon water temperature. The preferred temperature range is 4.4–13.3^{o}C. Alevins remain in the gravels two to three weeks prior to emerging as free-swimming fry. Excessive fine sediment in spawning gravel can reduce egg and embryo survival by reducing inter-gravel oxygen, preventing the flushing of biological waste, and preventing embryos from emerging.

Summer Rearing

Upon emergence, coho fry require abundant and diverse refugia to escape high stream flows and to hide from predators. Pools, beaver ponds, stream-connected wetlands and alcoves provide desirable refugia. These habitats also serve as important sources of food and nutrients to rearing salmonids and other organisms. Fry remain close to their natal area for the first several weeks. As they become proficient swimmers, they seek out the best habitats, either near by or in a completely different drainage.

The great diversity of habitats that occur within the subbasin likely provides for a wide variety of summer rearing life histories. Summer parr exhibit two generalized life history categories: stream rearing and tidal reach/estuarine rearing. There are certainly variations within each of these general categories. Variations to the general categories may be relatively static, or they may be flexible, adjusting to changes in environmental conditions.

The most common life history category within the subbasin is that of stream rearing. This type spends the summer rearing in small to mid-size streams, although research by Wigington et al. (2006) in an adjacent subbasin, documented some rearing in intermittent stream reaches as well. Other research has documented fry from smaller tributaries moved upstream or downstream to rear, occupying areas that may not be accessible to adult coho (Groot and Margolis 2003). Middle Creek, in the North Fork Watershed, is one of the highest coho producing streams in the subbasin and is, therefore, considered a good example of summer rearing habitat. Stream rearing summer parr generally seek out low gradient (i.e., <3%) streams with relatively constant and moderate base flows, cold water, or accessible areas of cold water refugia, and complex channels with abundant pools and hiding cover. Rearing densities have been documented to be higher in unconstrained reaches of structurally complex streams (Scrivener and Andersen 1982 in Groot and Margolis 2003).

The second life history category involves summer parr which move downstream in May and June to the tidal and estuarine reaches of the system. Monitoring indicates some juveniles migrate back upstream to desirable stream habitats as water temperatures increase, and some remain through the summer and fall. Those that migrate back upstream may not necessarily return to their natal stream. Those that remain may utilize primarily the tidal reach while others may use primarily the estuary. Miller and Sadro (2003) researched juvenile coho life history associated with the stream-estuary ecotone of Winchester Creek in South Slough (Coos Bay Subbasin) from 1999-2001. Their findings reveal that coho rearing use of the tidal reach is complex. They noted nearly half of each brood year moved from Winchester Creek to the estuary as subyearlings. Some of these 0-age class fish overwintered in the ecotone while a portion of them reared in the tidal reach from spring through fall. Some of the estuarine-rearing individuals exhibited rapid growth and signs of smoltation, indicating they may have entered the ocean a year earlier than those exhibiting a more typical life history. It is plausible that similar life histories occur within the Coquille River system.

Summer parr in rivers and streams are best adapted to low velocity waters and prefer pools. However, they also utilize riffles, but do not compete well with cutthroat trout that are associated with riffle habitats (Groot and Margolis 2003). Pools 10-80 m3 are optimal, provided there is adequate riparian cover and shade (Groot and Margolis 2003). Summer parr prefer shallow water, but this characteristic makes them vulnerable to displacement by flooding (Groot and Margolis 2003), lethal temperatures, and low DO.

Water discharge rate and temperature affect summer parr survival. If flows are too low, less rearing habitat is available and stranding in isolated pools increases. As temperature increases, the level of DO available to metabolize food, avoid predators, and suppress disease is reduced. As temperatures rise above desirable levels, summer parr seek adequate thermal refugia such as sources of ground water inflow and mouths of cold water tributaries. In stream reaches where cold water refugia are absent or of poor quality, summer parr must move elsewhere to survive. Studies by Frissel in southwest Oregon streams found coho, cutthroat and steelhead juvenile densities declined as temperatures rose above 17^{o}C and coho juveniles were absent from waters that reached 21-23^{o}C, except where they had access to cold water refugia (1992). Similarly, studies in northern California streams by Welsh et al. (2001) and Hines and Ambrose (1998) found coho did not persist where the moving weekly maximum temperature exceeded 18.2C^{o}. ODEQ established a standard of ≤18^{o}C for salmonid rearing. Optimum conditions for salmonids vary with food availability, competition, environmental adaptation and other factors. For this reason, not all research findings are identical. As a general rule, optimal growth for summer parr occurs at 10-16^{o}C. However, physiological stress increases when temperatures exceed 14^{o}C for prolonged periods. Prolonged temperatures greater than 25^{o}C are lethal (Groot and Margolis 2003). Fig 4-2 shows generally ideal conditions for coho rearing.

Fig. 4-2. Ideal coho rearing habitat is characterized by pools with abundant woody debris, clean substrates and good water quality.

Overwintering

At least two overwintering life history strategies exist within the subbasin– stream rearing and tidal/estuary rearing. Stream overwintering, the most common life history strategy, occurs primarily in the lower stream reaches where deep pool habitat with adequate structural cover is available. However, studies by Wigington et al. (2006) and Ebersole (undated) documented overwinter use in relatively small intermittent channels provide high smolt production. Few winter parr use the mainstem rivers, although this was likely common historically when these reaches accessed well vegetated floodplains, alcoves and connected wetlands. Their specific movements within the rivers and streams of the subbasin have not been thoroughly studied, although winter parr in other river systems have been documented to use a diversity of stream types. Winter parr may migrate to other stream drainages within their natal watershed or to other subwatersheds to seek suitable overwintering habitat. Thus, a high quality overwintering habitat may support fry from multiple watersheds or subwatersheds. It is also plausible that annual patterns of migration to overwintering habitats may vary based on variations in weather, streamflows and habitat conditions.

Not much is known of the life history requirements of the tidal/estuary overwintering life history form(s). It is uncertain where these individuals summer, which watersheds they originate in, or what influences their population size. Research by Miller and Sadro (2003) in Winchester Creek and South Slough documented use of recently restored salt marshes and of a variety of off-channel habitats, including a beaver pond.

Stream rearing winter parr require slow-water habitats with abundant cover. The optimal water temperature range is 10-16^{o}C. Streams with ideal overwintering habitat typically have unconfined channels with well vegetated floodplains. They also have complex channels with large pools and abundant in-stream cover in the form of woody debris, boulders and rubble, undercut banks, protected slow-flowing side channels and connections to off-channel habitats such as spring-fed ponds, beaver ponds, and alcoves (Groot and Margolis 2003). These channel characteristics provide slow-water refugia critical to their survival during high flow events.

Smolt Migration

The majority of smolts spend a year-and-a-half rearing in freshwater. From February through May of the following year, smolts begin their migration from overwintering sites to the estuary, and ultimately, on to the ocean. Their estuarine stay is typically two to three weeks, presumably the time required for acclimation to salt water. Smolts have been documented to migrate at temperatures of 2.5-13.3^{o}C, but most migrate before temperatures reach 11-12^{o}C.

4.2.2 Marine Life Stages

Rearing to Adulthood

Ocean migration patterns of juvenile and adult OC coho are not well known. It is thought the juvenile migration is initially northward from their natal stream and primarily coastal. Juveniles spend 16-20 months rearing in the ocean. After the first summer, a small proportion of the males reach sexual maturity early, after approximately only six months in the ocean, and spawn as two-year olds. Adults mature at sea until the fall of their third year. At this time, they begin their spawning migration.

4.2.3 Survivorship

Freshwater Rearing

Mortality occurs at all life stages. Table 4-1 provides a general view of survivorship for the egg through smolt life stages, averaged for brood years 1997 to 1999.

Table 4-1. Survivorship for the egg through smolt life stages of coho.

Life Stage	Eggs	Fry	Parr	Smolts
Number (millions)	4.84	3.15	0.64	0.18
Survival 1] (%)	NA	65	13	4

1] Based on number of eggs. Values averaged for brood years 1997-1999. From Coquille Coho HGMP (2001).

Ocean Rearing

Survival conditions for coho in the marine phase of their life history can cause wide fluctuations in subsequent adult returns and spawner abundance (Nickelson 1986). Smolt to adult survival rates between a high year and a low year are typically in the range of ten-fold (CCA 2005). Based on ODFW records dating back to 1960, marine survival of OC coho varied from a high of nearly 12% in 1970 and 1975 to a low of less than 1% during the period 1991-1998.

4.3 Key Environmental Correlates and Optimum Conditions

This section reviews the life history requirements of coho within the subbasin and assesses the environmental conditions to which their presence or abundance significantly correlate. These relationships are referred to as to key environmental correlates (KECs). Eight categories emerged. One or more parameters were then assigned to each category to define the specific habitat characteristic that related to presence and absence. It should be noted, however, that individual habitat components rarely operate independently. For example, pools in association with abundant woody debris and desirable water quality, have a much higher correlation to coho presence that pools unassociated these habitat components (see Section 4.2). Where data were available, optimum conditions relating to each KECs were also described. The findings are summarized in Table 4-2.

The Aquatic Habitat Inventory Analysis, found in the Limiting Factors Report (2005) and in Appendix A.2 of this document, was the primary data source used to describe and evaluate the various parameters. This data set includes measurements of more than 100 subbasin streams.

A variety of habitat and management conditions exist within the subbasin which have the potential to reduce population viability. Because specific conditions affect different aspects of viability, information from this section provides a reference for evaluating the cause and effects relationships discussed in Sections 4.4 and 4.5.

4.3.1 Water Quality

This category includes a single parameter directly linked to the reproduction, growth and survival of salmonids. DO and pH were not selected as parameters for this category because water temperature or stream shade were generally considered much better indicators of coho presence and measurements of DO and pH were scarce.

Water Temperature/Percent Stream Area Shaded

Water temperature can be directly measured or a surrogate measurement of stream area shaded cane be used. In late summer, stream temperature typically increases in response to increased sun angle and reduced flows. Elevated stream temperature causes salmonids to seek out stream reaches with cooler temperatures. If habitats with cooler temperatures are not available, mortality of summer parr increases.

Based on the CCA (2005), elevated water temperature in summer rearing habitat is the single most important water quality parameter affecting survival of summer parr in the subbasin. Because elevated water temperature is cumulative, the lower elevation stream habitats tend to be the first to become uninhabitable by summer parr. Although elevated water temperature may result in some direct or indirect mortality, it is not limiting smolt production at the subbasin scale.

4.3.2 Water Quantity

A sufficient amount of water must be present in a stream to support stream functions relating to channel formation; bank stability; delivery and transport of nutrients, sediments and woody debris; and floodplain connectivity. The amount of water in a stream channel affects the overall productivity of the stream, including its riparian habitat, water quality and associated aquatic biota.

Velocity

This parameter relates to the speed of the stream flow in specified coho habitats and seasons. Because flow velocity during adult migration was determined to be a KEC, it was evaluated against existing conditions and was generally found to be adequate.

Depth

This parameter relates to the depth of the stream flow in specified coho habitats and seasons. It was generally found to be adequate.

Volume

This parameter provides a qualitative description (i.e., high, moderate or low) of the amount of stream flow in specified coho habitats and seasons as related to natural conditions.

Seasonal Variation

This parameter provides a qualitative (i.e., high, moderate or low) description of the relative amount of difference between stream flow volume in specified coho habitats and seasons. Water withdraws for municipal, domestic and agricultural uses reduce streamflows in some stream reaches during summer and fall. In addition, streamflows in some streams are reduced during summer and fall due to the loss of stream function (e.g., down-cutting).

4.3.3 Dispersal

Native fish populations have adapted to all suitable habitats available to them within the subbasin. Blocking access to historic dispersal habitats reduces or eliminates specific life history adaptations from the population, thus reducing the viability of the population. Restoring connectivity to healthy spawning and rearing habitats can increase survival of the affected life stage. The amount of recovery in life stage adaptation is controlled, in large part, by the type and amount of habitat blocked and the duration of the blockage.

Number of Man-made Barriers

This indicator represents the number of road crossings, dams, tide gates, dikes or other man-made features that block access of any coho life stage to its historic habitat. This parameter is measured at flow volumes when coho are present.

Nearly all culverts and dams on historical coho producing streams have been surveyed. Numerous barrier culverts, small dams, tide gates and dikes have been replaced or modified to pass all life stages of salmonids at flows when the species are present. Some man-made barriers reduce floodplain connectivity and block access to historic overwintering habitat. Some barriers still remain (e.g., Coal Creek culvert) and others are periodically discovered, but most of the major barriers have been addressed (see *Distribution* in Section 4.4.2).

4.3.4 Substrate Character

Percent Fines in Riffle Units

This parameter relates to the level of fine (i.e., <4 mm diameter) sediment particles deposited in the interstitial spaces of spawning gravels. It is measured as the percent of fines of all sediments in riffle units. As the amount of fines in spawning gravels increases above natural levels, egg to fry survival decreases proportionately.

Many surveyed stream reaches have increased levels of fine sediment in spawning gravels sufficient to lower egg to fry survival. Elevated levels of fine sediment within overwintering habitats can also reduce juvenile survival when it is fills interstitial spaces used as velocity refugia or increases turbidity sufficient to reduce inhibit feeding behavior.

Percent Gravel in Riffle Units

This parameter is a measurement of the amount of gravel substrate suitable for spawning within coho streams. Suitable spawning gravel is defined by ODFW as rock 4-64 mm in diameter in riffle units. Some stream reaches have decreased levels of spawning gravel due to splash damming and other management activities.

Percent Large Substrates

This parameter relates to the amount of rubble, large rock and boulders as a percent of total substrates in overwintering habitats. Some stream reaches have decreased levels of large substrate due to splash damming and other management activities.

4.3.5 Channel Form

The presence of abundant and diverse channel form has been closely linked to survival of juveniles. Off-channel habitats are important to survival during the overwintering period. This includes side-channels, connected wetlands, beaver ponds, and well vegetated floodplains that provide protection from high stream velocities and predators, as well as areas of important food sources and nutrients. During summer, juvenile coho seek out stream reaches with diverse habitats, including areas of cold water in-flow.

Cold-Water Refugia

This parameter describes the relative amount of cold-water refugia accessible during the summer rearing period. The loss of connectivity to cold-water refugia within summer rearing areas can reduce summer parr survival if stream temperatures remain elevated for extended periods. The loss of cold-water refugia is likely a problem in some stream reaches.

Slow-Water Refugia

This parameter describes the relative amount of slow-water refugia accessible during the overwintering period. Much of the slow-water refugia in the lower river reaches were lost during development of the area for agriculture and urban development.

4.3.6 Pools

Pools are a key habitat component. When combined with other habitat attributes, such as woody debris and shade, pools serve as important coho rearing habitats during both the summer and overwintering life stages. The quality, quantity, distribution and diversity of pool habitats have been documented to affect the growth and survival of rearing coho and other salmonids. The two selected parameters best reflect habitat potential for coho.

Frequency - Percent of Total Habitat Area

This parameter refers to the percent of pool area occupying an entire habitat area. Abundant pool habitat provides slow-water refugia in areas used by winter parr and often provides cold-water refugia in areas used by summer parr. There is a general loss of pool frequency throughout the subbasin. The use of splash dams and similar historic forestry practices reduced pools within mountain streams. Agricultural and urban development, including the eradication of beaver, greatly reduced pools along much of the lower gradient stream and river reaches.

Volume

This parameter measures the volume, in cubic meters, of pool habitats. Because large pools are used by both summer and winter parr, a loss of pool size can reduce carrying capacity of summer or winter parr. There is a general loss in pool size due to historic logging and floodplain development.

4.3.7 Woody Debris

This category relates to all wood within the active floodplain. When combined with other habitat attributes such as pools or shade, woody debris provides important stream channel diversity within summer and overwintering habitats. Woody debris functions to sort and retain spawning gravel; stabilize banks; and provide shade, nutrients and cover for salmonids. The quality (e.g., size and plant species), quantity and distribution of woody debris affect the production, growth and survival of rearing salmonids. Because large riparian conifers are the primary future source of woody debris, their presence is an indicator of future levels of woody debris.

Large Woody Debris Volume

This parameter refers to the volume of large woody debris (LWD) >20 m^3 per 100 m of stream length. The loss of woody debris within salmonid habitats can reduce the carrying capacity of all freshwater life stages by limiting spawning gravel, escape and feeding cover, shade, food sources, and pools. Due to historic logging and stream clean-out practices, together with floodplain development, woody debris is greatly reduced throughout much of the subbasin, particularly in the lower gradient stream reaches.

Large Riparian Conifers

This parameter is a measurement of the number of riparian conifers >0.5 meter (m) diameter at breast height per 305 m of stream length. This is not intended to diminish the value of riparian hardwoods which provide streambank stability, in-stream structure, and nutrients to stream ecosystems. However, large riparian conifers provide a better overall metric for all but the lower reach of mainstem Coquille River, which historically supported a combination of hardwood and conifer species. Large riparian conifers have been depleted along much of the mountainous stream habitats. The loss of riparian conifers within summer rearing areas has likely reduced the distribution and survival of summer parr at the stream reach scale.

4.3.8 Ocean Productivity

This category is closely linked to marine survival of salmon, although the ecological relationships are not well understood. Ocean productivity is known to be cyclic and influenced by changes in weather that affect oceanic currents. A direct and reliable measurement of ocean productivity, as related to coho growth and survival, has not been developed. However, a surrogate parameter is used.

Percent Survival

This parameter is the percent of coho that survive the marine rearing life stage. It is not intended as a measure of smolt fitness. Recent smolt-to-adult survival rates for the Coquille population range from roughly 1-12%. Survival rates >6% are generally considered desirable.

4.3.9 Data Gaps

The effects of many other environmental conditions on coho presence within the subbasin are relatively unknown. These include: presence of pesticides and persistent bio-accumulative toxic pollutants, predation, presence of carcass-derived nutrients, estuary conditions, presence of hatchery fish, nearshore conditions, marine conditions, El Nino/Southern Oscillation, and climate change. These are discussed briefly in Appendix A.5. Some of these topics are addressed as research needs (see Section 6.5).

4.3.10 Summary

Seven life stages were evaluated for their KECs. Eight KEC categories, including 16 parameters were defined. Optimal conditions for each parameter were determined from a search of the literature, including the Limiting Factors Report (2005) (see Appendix A.2). Optimal conditions represent the habitat characteristics which provide the highest level of survival and overall population health. Table 4-2 lists the KEC categories, parameters and optimum conditions for each life stage.

Table 4-2. Key Environmental Correlates and Optimum conditions by life stage.

Life Stage	Category	Parameter	Optimal Condition
Spawning migration	Water quality	Temperature (C°)	7.2 - 15.6
	Water quantity	Velocity (m/second)	≤2.44
	Dispersal	# man-made barriers	0
Spawning	Water quality	Temperature (C°)	4.4 – 9.4
	Water quantity	Depth (cm)	≥18
		Velocity (m/second)	2.5 – 9.1
	Substrate character	% gravel in riffle units	≥35
Incubation and emergence	Water quality	Temperature (C°)	4.4 – 13.3
	Substrate character	% fines in riffle units	≤12
	Water quantity	Volume	Moderate
		Seasonal variation	Low
Fry and Summer parr	Water quality	% stream area shaded and Temperature (C°)	>70 and 10-16
	Water quantity	Volume	Moderate
		Seasonal variation	Low
	Riparian vegetation	Large conifers (# / 305 m)	>150
	Woody debris	LWD volume (m^3 / 100 m)	>20
	Pools	Frequency (%)	>35
		Volume (m^3)	10-80
	Dispersal	# man-made barriers	0
	Channel form	Slow- & cold-water refugia	Abundant
Winter parr to smolt	Pools	Frequency (%)	>35
		Volume (m^3)	10-80
	Riparian vegetation	Large conifers (# / 305 m)	>150
	Woody debris	LWD volume (m^3 / 100 m)	>20
	Channel form	Slow-water refugia	Abundant
	Substrate character	% large substrates	Variable
	Dispersal	# man-made barriers	0
Smolt migration	Dispersal	# man-made barriers	0
	Water quantity	Volume	Normal
	Water quality	Temperature	≤12°C
Marine rearing	Ocean productivity	% survival	>6

4.4 Population Viability Assessment

Understanding and measuring the viability of an ESU or an individual population is critical to assessing its current status, identifying factors limiting its viability, and identifying changes in viability necessary to achieve a desired status.

4.4.1 Findings of the Oregon Coastal Coho Assessment

While a number of approaches were available to assess risks at the species and population levels, the State chose an approach which relied heavily on the work of McElhany et al. (2000). This approach, referred to here as the Viable Salmonid Population (VSP) model, is based on the concept that the status of an ESU can be stated in terms of the distribution and frequency of *existing* viable populations within the ESU. McElhany et al. (2000) defines a viable salmonid population as follows: an independent population of any Pacific salmonid (genus *Oncorhynchus*) that has a negligible risk of extinction due to threats from demographic variation (random or directional), local environmental variation, and genetic diversity changes (random or directional) over a 100-year time frame.

The VSP model process identifies and evaluates all independent and dependent populations within an ESU and then measures the viability of the ESU based on the viability of the constituent populations. However, rather than identifying and evaluating populations within the ESU based on their existing condition, as per McElhany et al. (2000), the CCA (2005) adopted the work of Lawson et al. (updated in 2007) which defines populations based on their *historic* population structure and interaction (Fig.4-1).

The CCA (2005) evaluated each individual population using the four VSP parameters recommended by McElhany et al. (2000): abundance, population growth rate (productivity), population spatial pattern (distribution), and diversity. Abundance is the number of naturally-produced spawners. Population growth rate (productivity) relates to the number of recruits (progeny) produced per spawner (parent). Population spatial pattern (distribution) is the distribution of naturally-produced spawners among habitats within a population's home range. Diversity is expressed as indices of genetic variability related to a population's ability to adequately respond to unpredictable natural variations in the environment and retain those adaptive genetic characteristics that promote optimum survival in basin specific habitats.

The CCA (2005) also included a measure of persistence, an NFCP requirement. A forecast of extirpation risk is critical to understanding the present condition of a population. The definition used in the CCA (2005) is a forecast of future population health, stated in terms of the probability of extirpation. This definition varies somewhat from that used by Lawson et al. (2007) (see Section 4.1). The CCA (2005) described the viability status of the ESU using a classification system which describes six conceptual steps of biological status for a species as follows:

- *Pristine* - All historical populations within the ESU are healthy and adverse impacts from human activities are insignificant at the population and ESU scale.
- *Broad-sense recovery or Oregon Plan recovery* - Populations of naturally produced fish comprising the ESU are sufficiently abundant, productive, and diverse (in terms of life histories and geographic distribution) that the ESU as a whole will: a) be self- sustaining, and b) provide environmental, cultural, and economic benefits.
- *Viable* - Populations of naturally produced fish comprising the ESU are sufficiently abundant, productive, and diverse (in terms of life histories and geographic distribution) that the ESU as a whole will persist into the foreseeable future.
- *Threatened* - The ESU is likely to become endangered within the foreseeable future throughout all or a significant portion of its range.
- *Endangered* - The ESU is likely to become extinct within the foreseeable future throughout all or significant portion of its range.
- *Extinct* - An ESU contains so few members that there is no chance their evolutionary legacy will ever re-establish itself within its native range.

The criteria used in the CCP (2007) to determine is the ESU if viable is: at least 50% of all the populations within the ESU are classified as passing the viability criteria and each ESU stratum contains at least two of these passing populations. Of the ESU's 21 independent populations, 14 passed all population criteria. In addition, at least two independent populations passed all criteria in each of the five strata. Therefore, the ESU met the quantitative standard for a classification of "Viable".

Further, the CCA (2005) determined the Coquille population "passed" all of the conservation risk thresholds, indicating it is also "viable". Because it ranked relatively high against other independent populations within the ESU, it may serve an important ecological role in the overall long-term sustainability of the Mid-South Coast population strata and the ESU.

4.4.2 Viability of the Coquille Population

Following is a discussion of the five VSP parameters evaluated in the CCA (2005) and the CCP (2007). The Subbasin Plan also expands the discussion of the VSP distribution parameter to also consider the distribution of the fry, summer parr and winter parr life stages.

Abundance

Abundance refers to the number of naturally produced spawners (i.e., the progeny of naturally spawning parents).

Metric - The average abundance of wild spawners for the years 1993 to 1999 minus the minimum viable abundance level for the population equivalent to a spawner density of five fish per stream mile.

Evaluation thresholds:

Pass - The test metric is a positive number
Fail – The test metric is a negative number.

Finding – The Coquille population passed with a test metric of +4687 (CCP 2007).

Discussion – The historic abundance data spans many generations and environmental conditions such as variations in ocean conditions and changes in climate. Although the methods of estimating escapement numbers are not comparable between historical and recent periods and marine survival rates are not constant, some inferences can be made. Data suggests that current abundance of OC coho at the ESU scale may be less than 5% of historic levels. At the Coquille subbasin scale, Lawson et al. (2007) estimated the historic population of adult spawners to be 417,000, based on a 10% oceanic adult survival rate. Note that a 10.3% average marine survival rate is considered a "medium" category for marine survival (Table 6-1). Based on gillnet landing data, ODFW estimated the run of wild coho "may have been as large, or larger, than 70,000 fish per year" prior to the 1920's (BLM 1994). Historical accounts of packed and landed coho on the Coquille River indicate a peak season in 1908 of approximately 121,000 fish. Assuming landings were 40% of the total population (Oregon Plan 1997), the adult Coquille coho population in 1908 was estimated to be approximately 302,000 fish. Note here the complete lack of reference to what the expected average marine survival rates were during this period. Counts from spawning surveys conducted in the Coquille River since 1958 vary considerably, but a decline is evident over the long-term. Fig.

4-3 provides a generalized view of estimated spawner abundance of the Coquille coho population over time using available data. Note that the average estimated population from 1990 to 2003 is 8,500, roughly 2% of the theoretical pre-1908 estimated population. This general condition is similar to that produced using other data sets at the ESU scale.

This VSP parameter "passed" the evaluation threshold. However, because the abundance of the Coquille population: 1) is at a small fraction of its historic level; 2) is roughly half its desired status level (see Section 6.2.2); 3) has remained depressed for many years; and 4) is unlikely to increase without human intervention, it is considered *reduced.* The factors responsible for reducing abundance will be evaluated in Section 4.5.

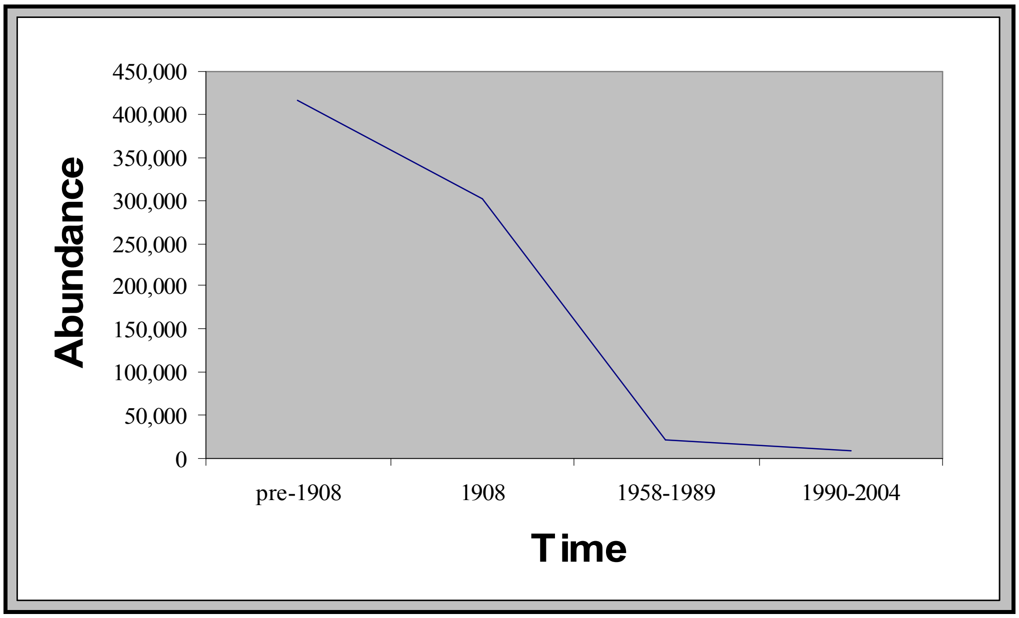


Figure 4-3. Generalized view of the Coquille coho population at selected times.
From Lawson et al. 2007; Oregon Coastal Salmon Restoration Initiative (draft 2/1997); and Coast Coho Assessment 2005.

Productivity

The following discussion is based on the findings from the CCP (2007). Productivity relates to the ability of a population to produce sufficient offspring over time without supplementation. The higher the productivity value is, the greater the population's resiliency and likelihood of persistence. Productivity values tend to be lowest when the population is decreasing or has reached carrying capacity with its habitat and highest when the population is increasing. Productivity is measured by the number of adult recruits (R), or progeny, produced per parent spawner (S). The R/S ratio is calculated by dividing the number of recruits (fish that survive to spawn) by the number of spawners three years previously (i.e., the parents). Only naturally produced fish are counted as recruits. However, both natural fish and hatchery fish (if present) are counted as spawners.

Metric - The annual estimates of number of naturally-produced recruits per spawner.

Evaluation Thresholds:

Pass – Over a 12-year period, R/S values, standardized to a spawner density equal to the spawner abundance goal for each marine survival category, are statistically greater than or equal to 1.0.

Fail – Over a 12-year period R/S values, standardized to a spawner density equal to the spawner abundance goal for each marine survival category, are statistically less than 1.0.

Finding – The Coquille population passed the threshold with a value of 1.17 recruits/spawner (CCP 2007).

Discussion – Productivity is difficult to accurately measure because of the effects caused by both the natural fluctuations in marine survival and by spawner density (i.e., density dependence of juveniles). Therefore, to be meaningful, R/S values must be standardized for both marine survival and spawner density. ODFW is still working on developing an appropriate index to account for variations in marine survival conditions, particularly for southern coho populations such as the Coquille (CCP 2007). In the meantime, estimates of productivity conducted by ODFW should be tacked (see Section 6.5.3).

The observed R/S ratio was >1.0. Studies indicate that many more summer fry are produced than what the overwintering habitat can support. Additional production of summer parr would not increase recruits. Only increased survival of winter fry would increase the number of recruits. Although productivity is somewhat affected, it will not be evaluated in the limiting factors analysis. This is because the technology for meaningfully estimating productivity is not yet developed and the threats and limiting factors, as they relate to survival of winter fry, are identical to those which reduce abundance, a VSP parameter already selected for further evaluation.

Distribution

The number and distribution of naturally produced spawners and juveniles within the historic home range are good indicators of population resilience to both spatial and temporal variability in habitat conditions (Williams and Reeves 2003). This VSP parameter was referred to as "population spatial pattern" by McElhany et al. (2000) and can be used to evaluate the spatial pattern of other life stages.

Metric - The percentage of the potential coho habitat, partitioned into HUC-6 subwatersheds, that was occupied from 1989 to 2000.

Evaluation Thresholds:

Pass – Greater than 50% of the HUC-6 subwatersheds are occupied.

Fail – Less than or equal to 50% of the HUC-6 subwatersheds are occupied.

Finding – The Coquille population passed the threshold with a value of 83% (CCP 2007).

Discussion - Coho spawners were found to occupy 30 of the 36 HUC-6 subwatersheds. The occupied subwatersheds are thought to be the same as were used prior to European settlement. In other words, there was no net loss of spawning use when measured at the subwatershed scale.

The Subbasin Plan expanded this analysis by also evaluating the distribution of summer parr and winter parr at the HUC-6 scale. This evaluation was conducted my simply comparing the known or suspected distribution of summer and winter parr with the suspected distribution prior to European settlement. The evaluation determined that the distribution of summer and winter parr was not reduced. Smaller scale (e.g., HUC-7 or stream reach) reductions in the occupancy by both summer and winter parr were apparent, but these reductions did not encompass an entire subwatershed. Also, the distribution of summer and winter parr within the estuary is likely reduced, but this too was not detected in the subwatershed-scale analysis. The lack of knowledge of parr use of estuaries was identified as an ESU-scale data gap in the CCP (2007) and a research need in the Subbasin Plan (see Section 6.5.1). Based on this HUC-6 evaluation, the distribution of spawners, summer and winter parr is likely not significantly reduced. Therefore, this VSP parameter will not be evaluated further.

Diversity

This indicator was used in the CCA (2005) as a measure of the number, proportion, type, and persistence of life history strategies employed by a population that promote optimum survival in subbasin-specific habitats. Diversity is controlled by a variety of forces including: evolutionary legacy, immigration from other populations, mutation, selection, and random loss of genetic variation due to small population size. The CCA (2005) used this parameter in an attempt to identify a rate at which genetic variation can be lost without causing a risk to a population's short-term persistence.

Metric - The average of the100-year harmonic means of spawner abundance as forecasted from a population viability model is greater than the critical threshold of 600.

Evaluation Thresholds:

Pass – If 100-year harmonic mean is greater than 600.
Fail – If 100-year harmonic mean is less or equal to than 600.

Finding - The forecast value of the Coquille population was 12,439, well above the evaluation threshold value of 1200 (CCP 2007).

Discussion – Hatchery supplementation can reduce diversity. The subbasin's native coho population has been affected by hatchery supplementation. From 1918 to 1958, 6.5 million presmolts and fry, from Columbia River stock, were released into the subbasin. Smolts, from adults returning to the Bandon Hatchery, were also reared and released into the subbasin. Since 1990, the number of smolts released annually in the Subbasin varied considerably, but averaged 50,000. Releases of hatchery smolts were reduced beginning with the 1994 brood year. Stocking of coho smolts into the Coquille system is proposed to be eliminated because of the low survival of hatchery smolts.

A cursory review of long-term spawner abundance data for the Coquille population indicates hatchery-reared fish comprised 0-6% of the total adult spawners. Overall, historic hatchery management likely had a relatively small but negative effect on the genetic integrity of the native Coquille population. Discontinuation of the hatchery supplementation program in the subbasin and throughout much of the ESU will nearly eliminate future interactions between hatchery and naturally-spawned fish and should provide for natural development of adapted traits. Based on the above, together with a calculated diversity value well above the threshold value, it is assumed this VSP parameter is not greatly affected. Therefore, it will not be considered further in a limiting factors analysis.

Persistence

The definition of persistence used here is the same as that used by McElhany et al. (2000): a forecast of future population health, stated in terms of the probability of extirpation (see Section 3.4.1). ODFW used a TRT viability model to forecast the probability of extinction of the Coquille population.

Metric - The forecast probability of extinction based on results from a population viability simulation model.

Evaluation Thresholds:

Pass – If probability of extinction is <0.05
Fail – If the probability of extinction is ≥ 0.05

Finding – The Coquille population passed the threshold with a probability of extinction value of 0.000 (CCP 2007).

Discussion – The forecasted probability of extinction is extremely low. The status of this parameter indicates there are no factors limiting the continued existence of the population. Therefore, this VSP parameter it will not be evaluated further.

4.4.3 Summary

Based on the CCA (2005), the Coquille population “passed” all of the VSP parameters and was, therefore, determined to be in the category of “viable”. The Subbasin Plan concurs with this finding.

Of the five VSP parameters evaluated above, only one, abundance is markedly reduced. Productivity, while somewhat reduced, is closely linked to abundance. Because abundance is easier to measure than productivity, it will be evaluated further. The causes responsible for reducing abundance will be evaluated in Section 4.5.

4.5 Limiting Factors Analysis

Section 4.4 determined that adult abundance is reduced and is preventing the population from reaching the desired status. This section identifies the factors which are reducing this VSP parameter and the threats causing them. The primary information sources for this analysis are the Aquatic Habitat Inventory Analysis (see Appendix A.2), Stream Survey Data Analysis, the State’s CCA (2005) and CCP (2007); and data found in Sections 4.2 and 4.3. The findings from this section will be used in Chapter 6 to create a vision for the future, including a desired population status, and determine the actions necessary to reach it.

While this analysis focuses on limiting factors and threats operating within the subbasin, it is not intended to diminish the importance of broader-scale events relating to regional changes in geology or global changes in climate and ocean productivity.

4.5.1 Terminology and Definitions

The terminology used to describe the relationships between population viability and the conditions affecting population recovery has evolved over time and is still changing. Therefore, the terminology used in documents produced by different agencies, or by the same agency at different times, is not directly comparable. For example, the term "limiting factor" is used by ODFW, NMFS, NOAA Fisheries, and others, but has been applied differently by each entity over time. The Subbasin Plan uses the current NOAA Fisheries terminology relating to limiting factors analysis. In an attempt to reduce confusion, definitions of three terms used in the Subbasin Plan are provided below.

- *Threats* - the human actions or natural events (e.g., road building, floodplain development, fish harvest, hatchery influences, and volcanoes) that cause or contribute to limiting factors. Threats may be caused by the continuing results of past events and actions, as well as by present and anticipated future events and actions.
- *Limiting factors* - the physical, biological, or chemical features (e.g., inadequate spawning habitat, insufficient prey resources, high water temperature) experienced by fish at the population, intermediate (e.g., stratum or major population grouping), or ESU levels that result in reductions in VSP parameters (i.e., abundance, productivity, spatial structure, and diversity) at any life stage.
- *Key limiting factors* - are the limiting factors with the greatest impacts on a population's ability to reach its desired status.

4.5.2 Threats and Limiting Factors

Prior to European settlement, the subbasin contained an array of mountain, valley and estuarine streams. The natural structure and function of the estuary and various stream types provided highly abundant and diverse aquatic and riparian habitats. Streams accessed their floodplains and formed complex channels with abundant shade, woody debris and pools. Large woody debris was recruited to mountain stream channels and transported, over time, to lower stream reaches. Stream migration within the valley floodplain was relatively slow due to the broad floodplain and the abundance of trees and woody debris. All life stages of coho had access to a subbasin-wide network of diverse and productive habitats.

Beaver were a keystone species, shaping the landscape in ways that benefited many aquatic and riparian species, particularly coho. Beaver ponds created rearing habitat for summer and winter parr. Beaver dams increased water storage which improved late season flows and summer water temperature, benefiting summer parr production. Beaver ponds in the lowest gradient reaches, such as found in the Coquille River Valley, provided slow-water refuge from high winter flows- a habitat condition needed by coho during the critical overwintering period. Pollock et al. (2004) investigated the current and historic distribution and abundance of beaver ponds in a large Pacific Northwest drainage basin and demonstrated that the historic loss of beaver ponds has greatly reduced abundance of coho smolts.

However, as the subbasin was developed, the ecosystem was changed. Many human activities occurred which contributed to the reduction in coho abundance. Some of these initial impacts have already recovered; some are in the process of recovering and will eventually recover fully; some will slowly recover, but not fully; and others will never recover. Some of these legacy impacts have been partially addressed through improvements in management, but other impacts are not reversible. For example, the Coast highway, which traverses the Coquille River Valley and greatly altered coho habitat, is an essential part of the area's transportation system and will not likely be significantly changed. On the other hand, current road management practices throughout the subbasin have greatly improved and have successfully reversed some of the adverse impacts from the past.

It is not possible to precisely quantify the impact that each activity exerted on reducing coho abundance. However, based on a review of Sections 3.1, 4.2, 4.3, 4.4, 5.1, 5.2, 5.3 and A.1-A.7, it is possible to qualitatively describe the general impacts. This is required to identify the limiting factors. Seven threat categories have been identified as follows:

- floodplain development
- exotic fish management
- fishing
- forestry
- historic channeling for navigation
- road management
- historic removal of large woody debris

Each of these threat categories is discussed below, including its spatial context; the coho life stage affected; and the resulting limiting factor. All of these threats are now making strides to repair their legacy impacts and to minimize the impacts of their ongoing practices. This information is summarized in Table 4-3.

Floodplain Development

This threat involves all aspects of altering floodplains for the purposes of agricultural and urban development. Activities include: channeling streams and diking and filling of stream-connected wetlands; altering water runoff patterns; withdrawing water from streams and ground water sources; removing stream riparian vegetation; removing woody debris from stream channels, floodplains and recruitment areas; and killing beaver and reducing their food supply. Much of these activities were focused in the Coquille River Valley, the area used by the majority of winter parr produced in the subbasin

Much of the tidal and freshwater marshes that occupied much of the Coquille River Valley were drained and converted to farmland by 1870. Today, only 373 acres or 3-4% of the marshes remain (ODFW Draft Coquille Basin Fish Habitat Management Plan 1992). Many dikes were constructed for flood control. Local Drainage Districts conducted most of the flood control activities, which included levee construction for flood control on several tracts in the Lower Coquille Watershed. In 1942, for example, a district drained 5,100 acres by constructing canals and outlet conduits with tide gates. In addition some private land owners installed and maintained drainage conduits (Corps et al.1972). Extensive channeling, diking, and filling of stream-connected wetlands and tidelands occurred through the 1960's under several federal programs and authorities. The majority of dikes were constructed by the early 1900's, but some construction continued until about 1960. By 1970, 94% of the tidal wetlands and 81% of the total estuary were lost. While most of these habitat alterations are being maintained to support today's agricultural industry, some productive wetlands, such as those in the Beaver Slough drainage, have been restored through the efforts of the Coquille Watershed Association, NRCS, private landowners and others.

Many other changes have resulted in improved conditions. Today, a 50' riparian buffer is required on agricultural lands (Coos County Zoning and Land Development Ordinance 2007). This allows for some recovery of streambank stability, water temperature, and recruitment of woody debris. Pesticides used today are much less harmful to aquatic life and are better regulated than in the past. Improvements in fertilizer and animal waste management have also improved water quality. Soil erosion is much better controlled today than historically. Some landowners have allowed beaver to reestablish into suitable areas and others have modified their tide gates to allow for fish passage. Also, several state and federal programs are now available to help landowners improve their lands for fish and wildlife.

<u>Limiting factors</u>: *depleted slow-water refugia* and *elevated water temperature -* The legacy impacts described above reduced slow-water refugia and stream shade. Research and modeling work by the State (CCA 2005) determined adult abundance is directly tied to smolt production (i.e., survival). In particular, smolt production is tied to habitat conditions experienced by winter parr (CCA 2005). Based on this work, the habitat feature most critical to winter parr survival, and adult abundance, is available slow-water refugia. Therefore, actions which reduce slow-water refugia needed for survival of winter parr, contribute to lower abundance.

Some summer parr currently use suitable habitats within the Lower Coquille Watershed. It is, therefore, plausible that the summer parr life stage may also be affected. Historic removal of riparian vegetation and straightening of stream channels to facilitate farming practices could certainly have isolated some cold water sources. In addition, withdrawal of water for irrigation reduced the water table which further reduced access to cold water refugia, decreased residual pool depth, and increased water temperature (see Section 5.1.2).

Based on the work done in the CCA (2005), water quality (i.e., elevated water temperature), was identified as the second most important limiting factor affecting nearly all populations within the ESU, including the Coquille population. The State determined elevated water temperature does not prevent the Coquille population from achieving the desired status. However, once the key limiting factor (i.e., depleted slow-water refugia) is improved, improvements in water temperature would allow the population to increase above the desired status level.

Exotic Fish Management

Many fish species have been introduced into the subbasin, either intentionally or accidentally, which have the potential to reduce abundance through predation or competition (see Section 3.1.3). To some extent, their impacts to coho abundance can be controlled through management. Depredation of juvenile coho by exotic fish during the winter parr and smolt migration life stages is well documented. Of primary concern are striped bass which were introduced into San Francisco Bay in 1879 and spread throughout much of the West Coast. They were first documented in Oregon waters in Coos Bay in 1914 (Introduced Fishes Impacts 2004). Anecdotal information from striped bass fisherman indicates striped bass target out-migrating salmon smolts within the mainstem Coquille River. Currently, ODFW manages striped bass under a coast-wide two fish per 24-hour bag limit where fish must be at least 30-inches in length - a regulation intended to perpetuate the striped bass fishery.

Monitoring of introduced fishes has been significantly reduced in recent years due to position cuts within ODFW. The Department recently conducted an assessment of introduced fish impacts to OC coho at three scales- ESU, monitoring area, and population. The results are published in the Introduced Fishes Impacts report (2004). At the ESU scale, ODFW concluded: 1) "Although predation and competition from introduced species may exert a source of mortality on localized stocks/populations of coho, evidence does not support that these impacts reduce the sustainability of coho at the ESU scale."; and 2) "Historic evidence does indicate that production of coho in the ESU could be greater in the absence of introduced fishes…." At the Mid-South Coast Monitoring Area scale (i.e., Siltcoos to Sixes), the report concluded: 1) "The major exposures to predation and competition are from striped bass in the Coos and Coquille rivers and from largemouth bass and other warm water species in the Lakes Complex."; and 2) "Although impacts undoubtedly occur, evidence indicates that, as a single factor, introduced fishes are not preventing the sustainability of coho in this Monitoring Area." At the Coquille population scale, the report concludes: 1) "Striped bass present the highest risk of impact.."; 2) "No recent research or population estimate has been conducted for striped bass in the Coquille, however anecdotal information from angler reports suggests a growing population; 3) "…environmental conditions may still be favorable for natural production and survival of striped bass"; and 4) "largemouth bass, yellow perch, mosquito fish, and brown bullhead are present in Johnson Mill Pond, near river mile-28. The pond is located within the floodplain of the Coquille River, and floodwaters overtop the dikes in this reach on the highest winter floods. Sloughs of the upper tidal portion of the subbasin (e.g., Fat Elk Slough, Beaver Slough) contain largemouth bass, bluegill and mosquito fish. These introduced fishes likely exert predation and competition on coho juveniles"; and 5) shad, while present, "are not believed to have a detrimental impact to coho salmon".

<u>Limiting factor</u>: *depredation by exotic fish* – Depredation directly reduces abundance. The level of depredation is not fully understood, but it is currently not considered a key limiting factor.

Fishing

From 1950 to 1983, harvest mortality exceeded 50% of the naturally produced coho adults within the ESU. Harvest rates of the Coquille population were at their highest in the 1970s. As the population declined, ODFW responded by increasing the annual hatchery smolt production to about five million. Since the 1970's, hatchery production accounted for approximately 70% of Oregon's ocean sport and commercial catch (ODFW 2005). But this program inadvertently encouraged the incidental over-harvest of wild stocks. In an attempt to protect wild stocks, hatcheries began marking (*i.e.* fin-clipping) smolts prior to release to enable selective harvest of hatchery fish. But hatchery and wild fish production continued to decline. After adoption of the Oregon Coho Management Plan (1982), the level and rate of harvest mortality on naturally produced adults dropped off markedly. In 1993, to further protect wild stocks, sport harvest in bays and freshwaters was greatly restricted. Harvest in the subbasin further declined to a level associated with incidental take occurring primarily with the chinook fishery. Then, in 2002, restrictions were placed on commercial harvest at sea through the federal Pacific Fisheries Management Council (PFMC) and the adoption of a habitat/harvest matrix known as Amendment 13. The effects of over harvest and hatchery supplementation on the viability of the Coquille population were never fully evaluated.

Currently, there is a very limited combined sport harvest of wild OC coho within Siltcoos and Tahkenitch Lakes. There has also been an ocean harvest quota of approximately 20,000 to 60,000 fin-clipped coho. This quota does not include incidental hooking mortality of wild coho, but the fishery considers it under the PFMC Amendment 13 matrix (see Section 5.1.1). The current total commercial and recreational direct harvest goal on naturally-produced coho is based on marine survival rates as described on Table 6-1. In 2005, the Independent Multidisciplinary Scientific Team (IMST) stated that reasonable estimates of incidental hooking mortality associated with commercial and sport harvest within the ESU are 8% and 13%, respectively. However, based on PFMC management studies, the total impact of all fisheries has been less than 15% since 1994.

<u>Limiting factor</u>: *fishing-related mortality* – Historically, fishing greatly reduced adult abundance, but currently it not a key limiting factor.

Forestry

This threat includes historic splash damming; removal of stream riparian vegetation; and removal of woody debris from stream channels, floodplains and recruitment areas. These practices occurred throughout much of the mid to lower elevation stream reaches of the subbasin.

Like other coastal river watersheds in Oregon, past logging practices destroyed much riparian habitat and greatly reduced fish production. Prior to forest road construction, the main forks of the Coquille River and their tributaries were the only effective options to logging companies for the transportation of logs down-river to mills, regional railroads, or main transportation routes. However, early transport of logs down the tributaries could only occur in the winter season during high flow events. A more convenient method of stream log transport was to augment the stream flow through the construction of wooden splash dams. These dams stored water that was released when needed to float the logs downstream. At least 25 splash dams were operated in the subbasin from 1910 to 1956 (Beckham 1990). This included eight on the North Fork, four on the East Fork, and three on the Middle Fork. Single splash dams were built on Middle, Elk, Big, Sandy, and Cherry Creeks. Myrtle and Rock Creeks had two dams each and Dement Creek, a tributary to the South Fork, had one. The last splash dam in the subbasin was operated in 1946 (ODFW Draft Coquille Basin Fish Habitat Management Plan 1992). This practice flushed riparian vegetation, stream sediments and LWD downstream and caused channels to scour to bedrock and lose connections to floodplains and wetlands. This loss of connectivity to floodplains and wetlands has resulted in accelerated sedimentation into tributary stream channels, which decreased the natural application of upland sediments to wetlands through flood events. The effects of splash damming are still apparent today.

Early logging practices also included downhill logging (i.e., dragging logs downhill), decking of logs in streams, building of roads and train tracks along stream courses, and harvest of riparian conifers. In most cases, the damaged riparian zones are recovering, although full riparian recovery may take centuries, or may not occur at all.

Today, Coquille Indian Tribe, BLM and FS lands require full riparian buffers intended to provide for all ecological functions. Timber harvest on State and private timber lands currently require variable-width buffers which provide for some, but not all, of the ecological functions needed to form and sustain desirable fish habitat (Powers 2005). A State commissioned review of the Oregon Forest Practices Act, determined that additional riparian, stream channel and water quality protection would greatly benefit recovery of salmon and steelhead (see Section 5.1.3).

Limiting factors: *depleted slow-water refugia* and *elevated water temperature* - The actions described above reduce slow-water refugia and stream shade and the ecological processes which form and maintain them. For a description of how depleting slow-water refugia and elevating water temperature reduced abundance, refer to the *Floodplain Development* section above.

Historic Channeling for Navigation

Early settlement involved the dredging and straightening of the mainstem Coquille River to accommodate commercial navigation up to the head of tidewater. Between 1881 and 1902, the USACE dredged the Coquille estuary to improve navigability. The Port of Coquille, established in 1911, cleared stream channels of large woody debris and removed riparian vegetation to encourage channel down-cutting. The Commission's upriver responsibilities included the improvement and maintenance of channels for navigational purposes, as well as log transportation. Because many of the tributaries were too narrow for use, the Port trimmed riparian trees and shrubs and removed in-stream boulders and woody debris along sections of the banks to open and widen the channels. The combined activities of the Port of Coquille and USACE resulted in an average of roughly eight snags per mile per year being removed from the channel below Myrtle Point. The Port of Bandon, the lower river port agency, was formed at about the same time as the Port of Coquille, and has periodically dredged and cleared the channel of large wood over the years. The effectiveness of the bank vegetation trimming was significant, and is best portrayed by Beckham (1974) as follows: the Port reported that on three miles of the East Fork "it formerly took about three days to work a drive of a thousand logs" through the segment, but after the channel work it took "about one and one half hours for an equal amount of logs to pass through." River transportation of logs continued in some tributaries until 1946 (see *Forestry*, above).

When commercial navigation up the mainstem was no longer needed, efforts to alter the river channel for commerce ceased. This is allowing the mainstem channel to begin recovery, although full recovery may take centuries or may not occur in some areas due to surrounding land management practices.

Limiting factors: *depleted slow-water refugia* – Past navigational practices widened and simplified the river channel and removed much of the woody debris and boulders which created slow-water refugia. For a description of how depleting slow-water refugia reduced abundance, refer to the *Floodplain Development* section above.

Road Management

This threat includes constructing and maintaining roads within the active floodplain, riparian zone, or recruitment zones of streams; side-casting fine material (e.g., dirt, silt, sand) into stream channels; removal of woody debris from stream channels; installing road culverts which do not pass all life stages of fish; and killing beaver.

Historically, roads were constructed with little regard to their effects on water quality, riparian and stream function, or fish habitats. Streamside roads inhibit natural stream channel migration; sediment, nutrient, and woody debris recruitment and transport; access to floodplains, side-channels, and off-channel habitats such as springs, wetlands and beaver ponds; and riparian vegetation development. Dirt, silt, and sand were side-cast into ditches or directly into stream channels. Salt, oil, and other chemicals from roads entered streams from ditches and where riparian vegetation had been removed or greatly reduced. Woody debris was routinely removed from forest streams and floodplains where it had the potential to clog a road culvert or cause an unwanted change in stream meander. In addition, beaver were killed when their dams blocked road culverts. These actions occurred throughout the subbasin and became cumulative within downstream reaches were coho overwintered.

Most of these practices changed over time due to the high economic and ecological costs involved in road relocation, obliteration, reconstruction and maintenance. Best Management Practices were developed to both reduce road construction and maintenance costs and to comply with new legal requirements such as the Clean Water Act and similar regulations. As a result, today's roads are much better built and located and thus, create fewer adverse effects. Conflicts with beaver still exist, but efforts are being made to coexist with beaver or to relocate, rather than kill, them.

Limiting factors: *depleted slow-water refugia* and *elevated water temperature* – The actions described above reduced slow-water refugia and stream shade and the ecological processes which formed and maintained them. For a description of how depleting slow-water refugia and elevating water temperature reduced abundance, refer to the *Floodplain Development* section above. Fig. 4-4 shows how streamside roads can prevent the recruitment of woody debris needed to create and sustain slow-water refugia. Historically, large wood deposited on roads was quickly salvaged. However, in this particular situation, stream restoration funds were used to place the woody debris into the adjacent stream.

Figure 4-4. Woody debris intercepted by road prism along Cherry Creek was placed into the stream channel using stream restoration funds. ODFW photo.

Historic Removal of Large Woody Debris

In the recent past, state agencies, federal agencies, and private industry actively removed logs, debris jams, and other naturally created wood structures from hundreds of miles of coastal streams, state-wide. The belief at that time was that these materials impaired or prevented the upstream and downstream passage of salmonids. Although many of the large jams did temporarily impair fish passage, we now know that eliminating this structure greatly reduced rearing habitat for juvenile salmonids as well as riparian and aquatic habitat diversity. This practice was relatively short-lived and limited in scope within the subbasin. Nonetheless, it likely depleted some stream reaches of large woody debris.

Limiting factors: *depleted slow-water refugia* – The actions described above reduced slow-water refugia and the ecological processes which formed and maintained them. For a description of how the depletion of slow-water refugia reduced abundance, refer to the *Floodplain Development* section above.

4.5.3 Summary

Four limiting factors were identified. Only one, depleted slow-water refugia, which resulted from five of the seven threats, was found to be key limiting factor- it prevents the population from reaching the desired status. Increasing slow-water refugia is, therefore, essential to achieving the desired status.

Elevated water temperature resulted from three threats. This limiting factor is not currently preventing the population from reaching the desired status. However, actions initiated now to restore water temperature would have two effects: 1) allow the population to increase above the desired status, once slow-water refugia are restored; and 2) help restore the ecological processes that also create and maintain slow-water refugia over time. For example, improving riparian vegetation and reconnecting wetlands and springs to stream channels, two typical objectives of improving water temperature, are also beneficial to restoring slow-water refugia.

Fishing-related mortality, the third limiting factor, though once a primary cause of reduced abundance, is currently of little consequence due to the combined management efforts of the federal Pacific Fisheries Management Council and the ODFW.

Depredation by exotic fish, the final limiting factor, is not likely a key limiting factor, but more study is needed (see Sections 3.1.3 and 6.5.1). The threats and limiting factors are summarized in Table 4-3.

Table 4-3. Threats and limiting factors which reduce abundance- listed by area and life stage affected.

Threat	Area Affected	Limiting Factor 1]	Life Stage Affected
Floodplain development	Primarily the Lower Coquille watershed	Depleted slow-water refugia*	Winter parr
		Elevated water temperature	Summer parr
Forestry	Throughout subbasin	Depleted slow-water refugia*	Winter parr
		Elevated water temperature	Summer parr
Road Management	Throughout subbasin	Depleted slow-water refugia*	Adult and Winter parr
		Elevated water temperature	Summer parr
Historic channeling for navigation	Lower Coquille watershed	Depleted slow-water refugia*	Winter parr
Historic removal of large woody debris	Throughout subbasin	Depleted slow-water refugia*	Winter parr
Exotic fish management	Lower Coquille watershed	Depredation by exotic fish	Winter parr
Fishing	Ocean and throughout subbasin	Fishing-related mortality	Marine rearing and spawning migration

1] * denotes key limiting factor.

4.6 Working Hypothesis

The purpose of the working hypothesis is to test the cause and effect relationships surrounding reduced adult abundance, so that appropriate actions can be proposed. As a working hypothesis, it is a dynamic tool that should be adjusted as new information becomes available through future monitoring and research. Much of the evidence supporting the hypothesis is found in the CCA (2005), IMST reports, ONCC TRT reports and the CCP (2007).

4.6.1 The Hypothesis

The hypothesis is as follows:

A single VSP parameter, adult abundance, is reduced by three limiting factors (i.e., depleted slow-water refugia, depredation by exotic fish, and fishing-related mortality). Adult abundance can be increased to the level described in the desired status (see Section 6.2.2).

The only key limiting factor is depleted slow-water refugia within overwintering habitat, which reduces survival of winter parr. Increasing slow-water refugia in overwintering habitat will, by itself, increase adult abundance sufficient to reach the desired status.

Efforts to reduce juvenile depredation by exotic fish would only slightly increase adult abundance, although more study is needed (see Sections 3.1.3 and 6.5.1).

Efforts to reduce excessive fishing-related mortality of wild fish would likely not significantly increase adult abundance. However, efforts to better define and achieve the appropriate level of harvest are needed in the long-term (see Section 6.5.1).

Elevated water temperature is a limiting factor which reduces abundance of summer parr. Efforts to improve water temperature would: 1) increase the abundance of summer parr, which would allow the population to increase above the desired status level once depleted slow-water refugia are restored; 2) help restore the ecological processes which create and maintain slow-water refugia over time; and 3) provide other social and ecological benefits.

4.6.2 Supporting Evidence

The evidence supporting the statement that abundance is the only VSP parameter affected is found in Section 4.4.2.

A premise of the hypothesis is that juvenile survival during a single life stage – winter rearing - is low. ODFW modeled the juvenile production capacities of summer and winter habitat for each independent population in the ESU. Summer parr habitat potential was calculated for all available habitats, and then reduced proportionally to reflect potential summer water temperature limitations. Winter habitat smolt potential was calculated for all available habitat and for only high quality habitat. The model predicted that during periods of good ocean survival rates, the temperature-limited summer parr capacity for the ESU was approximately 1.7 times higher than total winter smolt capacity. When only the smolt production capacity of high quality winter habitat was considered, the temperature-limited summer juvenile capacity was over six times higher. The evidence supporting the statement that the desired status is achievable is found in the CCP (2007).

The evidence supporting the statement that depleted slow-water refugia is the only limiting factor which prevents the population from achieving the desired status level is provided in the CCA (2005), CCP (2007) and Section 4.5.2. The CCA (2005) concluded the primary bottleneck for the Coquille coho population, and nearly all other coho populations within the ESU, was the loss of stream complexity. The State refers to a "population bottleneck" as the most significant limiting factors which currently impede a population from reaching its desired status. They refer to "stream complexity" as the variety of physical habitat conditions that provide overwinter shelter conditions sufficient to support sustainable coho populations through years of especially adverse ocean survival (CCA 2005). ODFW describes habitat conditions that create sufficient shelter for wintering juveniles as having one or more of the following features: large wood; a lot of wood; pools; connected off-channel alcoves, beaver ponds, pasture trenches, lakes, reservoirs, wetlands and well-vegetated floodplains; and other conditions afforded by complex channel form. This is consistent with the description of slow-water refugia used in the Subbasin Plan. The State concluded the loss of channel complexity is having the greatest impact on viability of the subbasin's coho population by reducing the carrying capacity of winter rearing habitats. Note that the State's use of the term, "limiting factors", is not identical to that used by NOAA Fisheries and the Subbasin Plan (see Section 4.5.1).

Secondly, the working hypothesis contends poor winter survival is due to the loss of stream complexity. Stream complexity affords slow-water refugia needed by winter parr. This finding was based on observations that habitats with higher levels of stream complexity provide higher levels of overwinter survival (CCA 2005).

The *Aquatic Habitat Inventory Analysis* (see Appendix A.2) provides a watershed, stream and stream reach scale assessment of the environmental characteristics of 110 important rivers and streams within the subbasin. It analyzes the relative condition of four aquatic and two riparian habitat elements generally recognized as indicators of desirable habitat conditions needed to fulfill the life history requirements of coho within the subbasin. It uses stream survey data to compare measurements of each of the habitat elements to expected benchmark values. While the analysis does not differentiate between coho summer and rearing habitats, it indicates a general reduction of large pools and woody debris in the lower stream reaches and a reduction of large riparian conifers throughout the entire length of many streams. Stream survey narratives further substantiate the contention that the ecological processes related to floodplain connectivity; the delivery and retention of woody debris; delivery and transport of nutrients and sediments; and riparian vegetation development have been degraded over historic conditions, particularly in the lower stream reaches. This indicates a broad scale reduction in slow-water refugia in areas historically used by winter parr and a reduction in shade-producing riparian tress in areas historically used by summer parr.

ODFW conducted an ESU-scale sensitivity analysis involving modeling to determine the effect of varying the levels of life cycle survival on the persistence of independent coho populations, including the Coquille population (CCA 2005). Their analysis assumed that changes in survival are carried throughout the life cycle, regardless of which stage it occurs. Based on the work of Nickelson and Lawson (1998), they assumed that during periods of low ocean survival, coho freshwater productivity above replacement levels was limited to areas of the highest habitat quality. Their analysis concluded life stage survival rates, particularly egg to smolt, are key indicators of habitat quality. Changes in the quality of these habitats directly affect life stage-specific survival that carries through the remainder of the life cycle, affecting overall productivity. They contended the critical impact of habitat capacity on coho productivity was most clearly expressed during periods of low ocean survival. ODFW concluded: “holding marine survival constant, the amount of high quality habitat is likely the primary driver of population productivity” at the ESU-scale. This finding appears consistent with preliminary analyses conducted by the TRT that showed those populations with the lowest levels of high quality freshwater habitat had lower probabilities of persisting over the next 100-years using the Nickelson-Lawson model. Therefore, the availability of high quality freshwater rearing habitat is directly related to productivity at the population scale. The contention that restoration of overwintering habitats will result in increased smolt survival is supported by the above analysis that concludes habitat quality is directly related to survival.

The State’s argument that winter carrying capacity can be increased by restoring pools, LWD and floodplain connectivity (i.e., features that provide slow-water refugia) is based on current knowledge of existing winter habitat conditions, winter habitat conditions needed for optimal coho rearing, habitat modeling, and monitoring of successful habitat restoration efforts completed in the subbasin and elsewhere.

The statement that improvement in water temperature would increase the abundance of summer parr and increase the population above the desired status level once depleted slow-water refugia are restored is supported by research and modeling conducted by the State (CCA (2005). The contention that efforts to improve water temperature would help restore the ecological processes necessary for creating and maintaining slow-water refugia over time is based on past experience where riparian silviculture and re-connecting cold water sources has increase riparian plant development; recruitment and retention of woody debris; floodplain connectivity; and channel migration – many of the same processes responsible to creating and maintaining slow-water refugia within overwintering habitats.

The contention that efforts to reduce fishing-related mortality of wild fish would likely not significantly increase abundance, but that efforts to better define and achieve the appropriate level of harvest are needed in the long-term is based on information described in Sections 4.5.2 and 6.5.1.

The statement that efforts to reduce juvenile depredation by exotic fish would likely not significantly increase abundance, although more study is needed, is supported by information described in Sections 3.1.3, 4.5.2 and 6.5.1.

4.6.3 Data Gaps

While the analysis described above may accurately portray the ecological conditions affecting population viability, more information is needed. Section 6.5 describes the research, monitoring, and evaluation needed to test the working hypothesis and implement the Subbasin Plan.

4.7 Restoration Opportunities

This section identifies where efforts to restore slow-water refugia and water temperature would be most effective. Potential project sites are provided. However, not all of these potential restoration sites are in the same ecological condition and trend, nor must all be restored to achieve the desired status. Further, many of the listed sites are not homogeneous as to land ownership or other important characteristic. Therefore, guidance for selecting sites to achieve specific objectives is provided in Section 6.3.7.

4.7.1 Restoration Potential

Both slow-water refugia and water temperature can be improved, given adequate funding, time, and landowner cooperation. Historic records of coho abundance and current surveys of stream habitat conditions clearly show great restoration potential. Many historically important summer and winter rearing habitats are currently degraded, but continue to retain many of the key habitat components needed to support recovery (see Appendix A.2). The river and stream channels within the Coquille River Valley, which comprise a large portion of coho overwintering habitat, have been simplified through land use, yet many maintain connections to their floodplain. Restoring wetland and riparian vegetation within these functioning floodplains would likely yield immediate and substantial improvements to coho overwintering survival. Much restoration work on agricultural lands has been accomplished by willing landowners through the cooperative efforts with the Coquille Watershed Association, Natural Resources Conservation Service, Bandon Biota, Ducks Unlimited, ODFW, United States Fish and Wildlife Service (USFWS) and others. Studies indicate the lower reaches of the North Fork, East Fork and Middle Forks of the Coquille River, previously down-cut by splash damming, are beginning to aggrade.

Both active and passive restoration approaches are appropriate, depending upon objective. The technology and equipment are available to reconstruct streambanks, side-channels and alcoves and to install boulders and LWD. More natural techniques are also available, and are often more cost effective in the long-term.

Pollock et al. (2004) found that "Although LWD placement is often a worthwhile activity, promotion of beaver dam building in suitable areas is often the most cost-effective and appropriate restoration technique for watersheds where coho salmon production is limited by the lack of pool habitat". Specifically, Polleck et al. (2004) determined: 1) the coho smolt production potential per beaver dam ranged from 527 to 1,174 fish, compared to about 6 to 15 individuals from a pool formed by instream LWD; and 2) the cost of LWD restoration activities can be quite expensive in contrast to the cost of translocating the beaver and adopting a no-trapping policy to encourage expansion of existing populations. While reintroducing beaver into suitable habitats is clearly the most cost effective approach to improving overwintering habitat, it has met with strong social opposition from many private landowners involved in agriculture, forestry, and road maintenance. As a result, the CCP (2007) includes an objective to improve beaver management. This includes working with ODA and others to identify suitable relocation sites and to deal with conflicts as they arise.

Riparian fencing can allow establishment and recovery of riparian vegetation and recovery of stream channel function. Riparian silviculture can be used to culture desirable conditions of riparian vegetation composition and structure which, over time, will help restore water temperature, pools, and LWD to stream channels.

Information on the spatial distribution of habitat-related limiting factors was determined using existing data sources. The level of slow-water refugia was obtained by reviewing stream survey data conducted by ODFW, BLM and FS. The spatial distribution of elevated water temperature was determined through a review of ODEQ, BLM and FS data bases. Analysis of much of this data can be found in Appendix A.3.

Not all watersheds within the subbasin have been affected equally nor do they possess the inherent potential to contribute equally to the restoration effort. Table 4-4 shows the general restoration potential and likelihood of success for restoring habitat-related limiting factors in each watershed.

Table 4-4. Estimated restoration potential and likelihood of success of restoring slow-water refugia and water temperature by watershed.

Limiting Factor	Restoration Potential / Likelihood of Success 1]				
	Lower Coquille	North Fork	South Fork	East Fork	Middle Fork
Depleted slow-water refugia	High/High	Med./Med	Med/low	Med./Med	Low./Low
Elevated water temperature	High/low	High./high	High/med	Med./med	Med./med

1] "Restoration Potential" refers to amount of difference between existing and optimal conditions for the assessed limiting factor. It is expressed, in relative terms, as high, medium or low. "Likelihood of success" refers to level of restoration that can reasonably be expected given the habitat potential, economic and social considerations, and availability of science to support a successful improvement. It is expressed, in relative terms, as high, medium or low.

4.7.2 Sites where Slow-water Refugia can be Restored

A Subbasin Plan work group assessed coho overwintering habitat across the subbasin and made the following findings:

- Typical high quality habitat occurs in low gradient (i.e., $\leq$2% gradient) channels which have access to a well vegetated and structurally diverse floodplain. This includes much of the mainstem Coquille River where the entire floodplain, nearly two miles wide in places, is transformed into what is locally referred to as the "winter lake" at flood stage.
- Flow volume is not a reliable indicator of high quality habitat, although refuge from high velocity flow is essential. This condition is often met in third-order and larger streams.
- Channels supporting high quality overwintering habitat have slow-water refugia afforded by abundant woody debris, boulders, or similar in-stream structure; deep pools and glides; well vegetated side-channels; or connections to wetland pools and ponds, although some tidal and estuarine reaches also qualify.
- ODFW's Coho Winter High Intrinsic Potential (CWHIP) model outputs could be easily modified to fit a specific need of the Subbasin Plan- to identify sites which were suitable for restoration at this time. For example, some mainstem river reaches have deeply down-cut channels resulting from historic splash damming and other management activities and

are not suitable sites for restoration at this time. Rather, restoration of their associated tributary stream reaches would be a prerequisite.
- ODSL's Tidal Wetland Assessment map supports the findings of the CWHIP model.

The work group used professional judgment and on-the-ground knowledge to modify the CWHIP model outputs and create a new map showing potential sites for restoring slow-water refugia (see Appendix A.6, Map A.6-1). From this map, a list of the stream reaches were described and presented by watershed and stream reach (see Appendix A.6, Tables A.6-1 through A.6-6). The assumptions under which HIP sites were selected include: 1) the quality and quantity of the existing data sets were adequate to complete the task; 2) all habitats accessible to overwintering coho, even if not currently occupied, were included; 3) only sites which are currently suitable for restoration were included; and 4) ground-truthing would be required prior to final site selection.

Nearly 260 miles of overwintering HIP habitat was identified by the team. This is considerably less than the amount modeled in Appendix 2, Table 7 of the CCP (2007), because the working group excluded many of the down-cut mainstem river reaches included in the original CWHIP model run. The list of HIP habitat does not differentiate sites as to their current condition, land ownership, or other important factors. Therefore, the final selection of individual restoration sites will take into account many social, economic and other ecological factors. These considerations are discussed in detail in Section 6.3.5.

4.7.3 Sites where Elevated Water Temperature can be Restored

A Subbasin Plan work group reviewed all existing data and selected the best candidate sites for restoring water temperature. Various ODEQ, BLM, FS, and Coquille Watershed Association water temperature data were available in several formats, including point data, 7-day maximum average, 7-day minimum average, and delta-T (i.e., difference between the daily high and low temperatures). A riparian shade analysis (Follansbee 2002), recently completed by the Coquille Watershed Association through a grant with ODEQ, contained data useful in site selection. This riparian shade analysis listed the current level of shade and predicted the potential amount of stream area that could be shaded based upon site potential vegetative communities (see Appendix A.3, Tables A.3-1 through A.3-5).

The assumptions used included: 1) the quality and quantity of the existing data sets were adequate to complete the task; 2) stream reaches above artificial barriers were included; 3) unoccupied stream reaches which feed occupied summer rearing stream reaches were included; 4) sites at ≥80% of potential stream shaded were generally in a desirable condition (i.e., for shade) and attempts to improve them further would not be the most efficient use of restoration funds; and 5) on-the-ground knowledge of individual sites would be necessary for final selection.

The work group findings were as follows:

- All streams contribute directly or indirectly to the overall quantity and quality of available summer rearing habitat. Although most of the perennial headwater streams are too small and steep to be occupied by rearing coho, each contributes to the woody debris, nutrient, base flow, sediment, and temperature budgets of downstream occupied habitats. Therefore, potential restoration sites should be viewed as cold water contribution areas- small stream networks made up of multiple tributary streams. Maintaining and restoring connectivity with these cold water sources is an important consideration in site selection.

- Many medium and large stream reaches, when viewed independently, had greatly elevated temperatures yet relatively low potentials to increase on-site shade. However, when the entire contribution area was evaluated, the elevated temperatures may be due to tributary warming and the low potential to increase on-site shading may be due to stream aspect, channel width, or other factors. Typically, tributaries have a relatively high potential to restore shade. Therefore, as a general rule, restoration work should proceed from the upper drainages, downward.
- Individual stream reaches varied greatly in their inherent ability to provide suitable water temperatures for salmonid rearing. Not all reaches had the same potential for stream shading and retention of ground water. This was due to physical limitations such as geology, potential riparian plant association, stream aspect, entrenchment ratio, width/depth ratio, and base flow. For example, a stream reach with a large width/depth ratio that flows south and has a potential riparian plant community comprised of willow and sedges, has a relatively low inherent potential to provide a high level of stream shade. Shading of streams with a north-south aspect is driven by overhanging riparian vegetation. Wide stream channels at this aspect are typically limited in their shade potential. Shading of streams with east-west aspects is driven primarily by shade from the south bank, and large trees can also provide significant shade even in relatively wide stream channels. Conversely, a stream reach with a narrow, deeply entrenched channel receives much more shade at any aspect because the overhang potential is high. They also noted that stream reaches flowing through certain types of geology have less ground water storage capacity than streams flowing through other types. Because water temperature is affected by flow volume and because ground water inflow is typically colder than stream flow, it follows that drainages within geological types with high groundwater storage capacity have inherently colder late summer water temperatures. Therefore, it is essential to use existing water temperature data in conjunction with riparian shade analysis data to get a more accurate determination of the overall potential of the site to produce water temperatures suitable for salmonid rearing.
- In conclusion, the best sites for focusing the restoration effort are those stream reaches that currently have suitable water temperatures coupled with the inherent ability to produce even colder water temperatures through a change in management. Overall, these sites represent the highest quality, most diverse, intact, and occupied sites within the subbasin. As such, they serve as both cold water contribution areas and population source areas for expansion of summer parr into adjacent areas. Sites currently in good condition with little inherent potential for significant improvement should simply be protected and maintained as such. Conversely, stream reaches in poor condition, and those with little inherent potential for recovery, should be considered for restoration at this time.
- Approximately 33 miles of first priority restoration sites occur throughout the subbasin (see listing, by watershed, in Appendix A.7, Tables A.7-1 through A.7-4). The North Fork Coquille Watershed, the most productive in terms of coho spawning and summer rearing, has the greatest potential to improve water temperature, with nearly 21 miles qualifying.

- When selecting individual sites for restoration work, other ecological factors, such as delta-T, connectivity to contribution and source areas, and the existing level of stream complexity, should be considered, along with various social and economic factors as described in Section 6.3.5.

The work group identified the appropriate restoration action for each stream reach, using a matrix of temperature and shade criteria which they developed. The first step categorized all stream reaches, based on existing water temperature, into either a "good", "fair" or "poor" water temperature category. The "good" category required a 7-day maximum average of ≤64°F, a temperature range generally regarded in the scientific literature as suitable for salmonid rearing (see Section 4.2.1). The "fair" category rating required a 7-day minimum average ≤64°F and a 7-day maximum average >64°F. The "poor" category was a 7-day minimum average >64°F.

The second step looked at the potential of each site to further increase stream shading (i.e., produce even colder water temperatures). Stream reaches from the "good" and "fair" water quality categories were then separated as to their potential to increase stream shade by >20%.

Sites in the "good" water temperature category that had ≤20% potential to further increase shade were already in a desirable condition. Therefore, the appropriate restoration action for these sites is to protect and maintain their ecological condition. The remaining sites in the "good" water temperature category have the potential to increase stream shade by >20%. Therefore, they are the first priority for restoration investment. Sites in the "fair" category with the potential to increase shade by >20% are the second priority for restoration. The remaining sites in the "fair" and "poor" categories are not good restoration investments at this time. The matrix is shown as Table 4-5. The stream reach category with the highest restoration potential is highlighted.

Table 4-5. Matrix of temperature and shade criteria for use in selecting the appropriate action when restoring water temperature on individual stream reaches.

Water Temperature Category and Criteria	Potential Increase in Stream Shade (%)	Recommended Restoration Action
Good: 7-day maximum average ≤64°F.	≤20	Protect and maintain
	>20	Restore (first priority)
Fair:7-day minimum average ≤64°F and a 7-day maximum average >64°F.	≤20	Do not invest at this time
	>20	Restore (second priority)
Poor: 7-day minimum average >64°F.	NA	Do not invest at this time

4.7.4 Opportunities to Achieve Synergistic Effects

There are opportunities to achieve synergistic effects by simultaneously improving both slow-water refugia and water temperature. Whenever riparian vegetation is restored, important ecological processes are put in place which create and maintain conditions favorable to both improved water temperature and slow-water refugia. In some cases, riparian vegetation restoration can render some stream reaches suitable to both summer and winter parr. In other situations, riparian vegetation restoration in summer rearing habitat may transmit LWD, clean water, and other desirable attributes to downstream overwintering habitats.

There are opportunities to benefit multiple species. Restoration of water temperature and slow-water refugia within the estuary and tidally influenced stream reaches benefits not only coho, but also fall-run chinook, cutthroat, and various other native fish and riparian-dependant wildlife species. The re-introduction of beaver into suitable overwintering sites to increase coho pool habitat can also improve floodplain function, water storage capacity, water temperature, and off-channel refugia important to lamprey, other native fish, waterfowl, shorebirds and other wildlife.

Many new agricultural practices, such as changes in tide gate management, benefit both fish and farmer. "Fish friendly" tide gates have been developed which allow passage by juvenile coho. Many tide gates can be operated to improve floodplain function, coho use of tidal areas, and irrigation efficiency.

There are opportunities to use a local workforce made up of displaced workers, such as loggers and commercial salmon fishermen, to complete restoration work and monitoring. This would not only help to diversify and stabilize the area's workforce, but could also increase local understanding and ownership in the restoration effort.

5. Inventory of Existing Activities

This chapter reviews the various fish and fish habitat protection, restoration, and artificial production activities and programs that are on-going, have occurred in the last five years or are about to be implemented. It provides an understanding of how, and to what degree, aquatic, riparian, and fisheries resources are protected and which agency is responsible for their management.

During development of the CCP (2007), there was much public debate over the effectiveness of the State's existing protections, programs and plans to restore and conserve the coho population. The State responded in the Introduction of the CCP (2007) with the following statement:

> *"This Conservation Plan does not propose new land-use regulations, maintains existing regulatory programs, and enhances support for non-regulatory cooperative conservation. A key element of this Plan is to provide a higher and more effective level of support to local conservation groups and private landowners (e.g., Soil and Water Conservation Districts, watershed councils, industrial forestland owners, Salmon and Trout Enhancement Program volunteers, and other individuals and groups). These community-based organizations have demonstrated an impressive record of planning, prioritizing, and implementing habitat improvement projects through their participation in the Oregon Plan*".

Because the Subbasin Plan tiers off of the CCP (2007), it generally defers discussion of this topic to the findings of the State. A summary of the State's findings will be included in the Subbasin Plan Annual Report for the year the findings are published and will be included in any revision of the Subbasin Plan.

5.1 Existing Legal Protections

Following is a brief description of the primary laws and regulations currently affecting the management of aquatic, riparian, and fisheries resources in the subbasin.

5.1.1 Fisheries Resources

For the most part, the State has the lead responsibility for protection the fisheries resources. It shares this responsibility with others in managing ocean harvest of anadromous fish originating in the State.

Coho Conservation Plan

The CCP (2007) is not a legal protection, but is discussed here because it relates to the State's overall approach to its legal protections relating to coho management. The CCP (2007) states an increased, more effective, level of voluntary habitat protection and restoration will be necessary to achieve the desired status, or goal, of the plan. The State contends this can be accomplished through its current regulatory programs and, therefore, no new legal protections are needed as an outcome of the CCP (2007), nor does the CCP (2007) represent a legal requirement to establish future changes to land-use or other regulatory programs. This management philosophy is articulated in the CCP (2007) as follows: "One key principle of the Oregon Plan is that Oregonians will strive to obey existing laws that protect water quality, watershed health, and salmon. This commitment was noted in Executive Order 99-01:

"agencies with regulatory programs that are included in the Oregon Plan will determine levels of compliance with regulatory standards and identify and act on opportunities to improve compliance levels." Oregon agencies remain committed to evaluate compliance with environmental protection laws and seek constructive means of improving compliance with these laws as may be warranted.

Oregon's existing regulatory structure was not designed to support achieving the desired status goal for this ESU. Oregon's management philosophy regarding regulation and enforcement of laws on private lands is clear: that, given Oregon's extensive natural-resources regulatory programs, additional cooperative conservation stewardship action on private lands will be most effectively achieved by willing participation of private landowners in non-regulatory settings. This management philosophy is a conscious decision by executive leadership, based on the current realities of public values, state agency board and commission actions, legislative direction, and funding priorities.

Oregon is relying therefore on a combination of Oregon's current regulatory programs plus long-term participation in non-regulatory cooperative conservation work to achieve the desired status goal for the Coast coho ESU. The Oregon Plan habitat strategy is designed to support effective work by the existing conservation network across the ESU. This effort is expected to increase participation in non-regulatory cooperative conservation work by private landowners, especially landowners in areas with the greatest potential to create high quality coho habitat and support achievement of the desired status goal for the ESU. A partnership of private forest and agricultural landowners represents a powerful means of increasing the level of investment in effective voluntary habitat-improvement."

Oregon Native Fish Conservation Policy

Oregon developed the NFCP to provide direction for managing hatcheries, fisheries, habitat, predators, competitors and pathogens in balance with sustainable natural fish production. This policy was last adopted in 2002 when interim criteria were added. The NFCP is implemented through conservation plans tailored to the needs, opportunities and constraints of each group of fish populations. Interim criteria defined in the NFCP are used to provide interim guidance to native fish management prior to completion of conservation plans. The criteria help identify priorities for fish management actions and conservation plan completion. Once a conservation plan is approved, interim criteria are superseded by a broader set of measurable primary and secondary criteria. Preliminary risk assessments have been completed for some populations of native salmon, steelhead, trout and selected sensitive species using the NFCP interim criteria. Risk refers to the threat to the sustainability of a unique group of populations in the near-term (i.e., 5-10 years). NFCP goals are to: 1) "prevent the serious depletion of any native fish species by protecting natural ecological communities, conserving genetic resources, managing consumptive and nonconsumptive fisheries and using hatcheries responsibly so that naturally produced native fish are sustainable; 2) maintain and restore naturally produced native fish species, taking full advantage of the productive capacity of natural habitats in order to provide substantial ecological, economic, and cultural benefits to the citizens of Oregon; and 3) foster and sustain opportunities for sport, commercial, and tribal fishers consistent with the conservation of naturally produced native fish and responsible use of hatcheries" (OAR 635-007-0507).

This policy provided the direction and authority ODFW used to conduct the CCA (2005) and the CCP (2007). The findings and recommendations found in these documents provide the basis for smaller scale conservation efforts, such as is proposed in this document. The NFCP attempts to conserve and restore the key biological and physical processes that create healthy watersheds and diverse fish habitats. Because the legal protections of the NFCP are rather limited, its effectiveness lays primarily in the implementation of on the ground restoration plans.

Harvest

ODFW sets freshwater harvest levels for all salmonids. Excessive ocean harvest caused a decline in the coho population beginning in the 1950's and remained high through the 1970s. In 1982, harvest rates were reduced as a result of the adoption of the Oregon Coho Management Plan. Due to depleted numbers, ODFW halted freshwater harvest of coho. Today, the level of permitted harvest of both wild and hatchery-reared coho is dependent upon marine survival rates (see Table 6-1) and is intended to achieve the desired status level identified in the CCP (2007). ODFW operates through the federal Pacific Fishery Management Council to set and implement ocean harvest levels beyond the three-mile limit. Ocean harvest is regulated, under Amendment 13, to target hatchery coho while protecting a sufficient number of naturally produced coho. Harvest rates on naturally-produced coho also consider the incidental mortality associated with harvest of hatchery-produced coho and various chinook stocks. The model used to set sport and commercial harvest rates is periodically evaluated and improved, but more data are needed. Therefore, this legal protection has the capability to support salmon recovery in the subbasin.

Fish Screening

ODFW requires fish screens be placed at all points of water diversion where anadromous fish are present. There are only a dozen fish screens in the subbasin. There are no known conflicts where the lack of a serviceable fish screen is blocking access of migrating adult salmon or reducing survival of migrating juveniles. Therefore, this legal protection is effective and supports salmon recovery in the subbasin.

Fish Passage

The State has statutory authority for protection of passage of fish and aquatic organisms through potential barriers such as road culverts. They require culverts be sized to pass a 50-year flow event.

The FS, BLM and Coquille Indian Tribe have a much stronger policy. They require that all culverts pass all aquatic organisms and a 100-year flow event. This larger size requirement improves passage of woody debris, extends the replacement interval, and provides a higher level of protection against culvert blockage and roadfill wash-out.

Many culverts on private and public lands within the subbasin have been replaced or retrofitted to allow for fish passage and increased flows. There are very few barriers to fish passage remaining. Problem culverts have been identified and are addressed as funds become available.

5.1.2 Water Resources

The ODFW has water rights for instream flows needed for channel maintenance and fish habitat. However, two problems impact fish populations. First, ODFW's water rights for instream flows are junior to those issued earlier. In many systems, senior water rights account for such a high proportion of the stream flow that not enough water remains for channel maintenance or fish habitat. Secondly, some stream flows have been over-allocated by the Oregon Department of Water Resources. Systems where instream flows are inadequate to provide for channel maintenance and fish habitat include: North Fork Coquille River (lower half), South Fork Coquille River (lower half), Middle Fork Coquille River (Camas Valley), East Fork Coquille River (Dora to Sitkum), Cherry Creek, Bear Creek, and Dement Creek. According to the Oregon Water Resources Department website, for the summer high water demand period (i.e., August 1st), 170 cfs is appropriated out of the Coquille basin for multiple uses both in surface and groundwater diversions. This website also contains a map of the subbasin showing water right locations.

ODEQ is responsible for management of water quality under the Clean Water Act. Water quality standards have two aspects: 1) protection of beneficial uses, including anadromous fish passage, salmonid rearing, salmonid spawning, and resident fish and aquatic life; and 2) established water quality standards necessary to support the beneficial uses. Water quality criteria have been established for DO, oil and toxins, sediment/turbidity, and temperature. Under Sec 303(d) of the Clean Water Act, ODEQ listed 37 streams or stream segments that do not meet water quality standards or need further study (see Appendix A.1). The most common parameter not meeting the water quality standard is water temperature, a factor limiting survival of summer parr (see Section 4.5.2). ODEQ also manages a grant program which funds monitoring and restoration work to improve water quality, providing the activity is contained in watershed restoration plans supported by watershed assessments. Effective monitoring, public education, cooperation, and violation enforcement are essential to improving fish habitats.

The Oregon Department of State Lands (ODSL) regulates the use of waterways and wetlands through administration of Oregon's Removal-Fill Law, enacted in 1967. This law requires most activities that affect more than 50 cubic yards of material in streams, lakes, estuaries and wetlands to have a permit from ODSL. Regardless of size, almost all activities in streams designated essential salmon habitat require a permit from ODSL. They are responsible for setting the environmental protection standards and issuing permits for dredge and fill activities affecting waterbodies. Many permits are issued for in-stream gravel mining. ODSL does not regulate or permit removal of in-stream wood, a critical habitat component which helps create and sustain slow-water-refugia, the key limiting factor.

The permit review process involves coordination with the applicant, adjacent land owners, natural resource agencies and local governments. The program's purpose is to: 1) protect, conserve and make best use of water resources; 2) protect public navigation, fishery and recreational uses; 3) ensure that activities of one landowner don't adversely affect another landowner; and 4) minimize flooding, improve water quality, and provide fish and wildlife habitat.

Wetlands and Waterways Conservation Division members issue permits and carry out enforcement actions for removal-fill activities on public and private waterways, wetlands, the Pacific Ocean, and other waters of the state.

Oregon Department of Forestry (ODF) does not own lands within the subbasin, but is responsible for protecting water quality during State and private forest management activities. The legal authority under which they operate is the Oregon Forest Practices Act. While ODF prefers to rely on voluntary measures to meet water quality standards, it will legally enforce known violations (see Section 5.1.3).

5.1.3 Forest Resources

Approximately 72% of the subbasin is private agricultural and timber land and 27% is BLM, FS and Coquille Forest lands. All of the federal lands are forested.

State and Private Timber Lands

Use of Oregon's state and private commercial timber lands is managed by ODF under the Forest Practices Act. Approximately 40% of the subbasin is private industrial forest land and less than 100 acres is State land (i.e., ODSL). Prior to 1963, riparian buffers along streams were not required. In 1963, a narrow riparian buffer was required on one side of the stream in state-owned timber harvest areas. Five years later, buffer strips were required on both sides of fish-bearing streams in some state-owned timber sales. In 1972, limited buffers along streams on private forestlands with "significant" fish use were required. It was not until 1994 that ODF required a buffer on perennial streams on private land. ODF does not regulate the cutting of riparian trees or instream wood on private lands for non-commercial purposes such as for fire wood or to clear land for other uses. Revisions in the Forest Practices Act Rules in 1994 required riparian buffers and conifer retention to prevent conversion of conifer stands to hardwoods and required buffers for all fish-bearing and some non fish-bearing streams. However, ODF riparian buffer widths remain much narrower than those used on Coquille Indian Tribe, BLM and FS administered lands which are managed under the Northwest Forest Plan. The Oregon Forest Practices Act requires road culvert sizes be large enough to pass a 50-flow event, while the Coquille Indian Tribe, BLM and FS require culverts pass a 100-year flow event and also pass all life stages of fish under all flows when the species are present. The use of larger culverts by the Coquille Tribe, BLM and FS allows woody debris to pass. Therefore, less woody debris is removed from stream reaches on federal lands (see Section 5.1.1).

In conjunction with the CCA (2005) planning process, the IMST reviewed the Forest Practices Act for conformity with the Oregon Plan and provided 19 specific recommendations regarding improvements in: policy, riparian and floodplain protection; studies and monitoring; protection of anadromous fish "core areas"; road construction and use; and watershed protection to make the Forest Practices Act more congruent with the Oregon Plan (CCA 2005). ODF has acted some, but not all of the IMST recommendations. The Environmental Protection Agency (EPA) testified to the Oregon Board of Forestry, that the existing rules and best management practices (BMPs) do not consistently meet water quality standards or fully provide riparian functions important to water quality, public water supplies and fish (Powers 2005). The Oregon Board of Forestry is considering these and other proposals affecting forest practice rules relating to riparian protection. Implementation of changes to retain an adequate level of large riparian trees along all stream types would benefit watershed function and the conservation of native fish within the subbasin.

Coos County Forest Lands

Coos County manages 15,000 acres of land as County Forest with the purpose of producing revenue for the County General Fund. The primary source of income is from the sale of timber on a sustained yield basis. The County Forest also derives monies from the sale of special forest products and mineral leases. These lands are scattered within the northern portions of the Lower Coquille and North Fork Coquille Watersheds. Timber is harvested under the Forest Practices Act (see Section 5.2.6).

Federal Forest Lands

Forestry activities conducted on federal lands are legally regulated under a variety of acts including the Clean Water Act and the agencies' Organic Acts. Compliance to these acts and other regulations is achieved through standards and guidelines outlined in the Northwest Forest Plan (see Section 5.2.7). They provide a very high level of protection to watershed function and water quality. Because most of the federal ownership is at the mid and high elevations, the greatest benefit occurs in summer rearing habitats. A premise of the CCA (2005), is that the high level of protection afforded to large riparian conifers on federal lands will off-set the negative effects of elevated stream temperature and reduced LWD occurring on State and private forest lands and result in improved overall conditions in the long-term. However, this proposition is not supported by long-term monitoring studies conducted on federal lands (see 5.2.7).

5.1.4 Agriculture

Agricultural lands are managed under a variety of laws and regulations affecting pesticide use, invasive plants and weeds, animal waste management, water quality and soil erosion. ODA is responsible for the management of these programs. ODA works with ODEQ to resolve water quality issues. State management regulating point source pollution and soil erosion has been relatively successful. State law requires agricultural activities allow growth of riparian vegetation to control water pollution. Oregon Administrative Rules require ODA work with agricultural landowners to seek voluntary compliance and to pursue enforcement actions only after reasonable attempts at voluntary solutions have failed (locally referred to as SB 1010 after the State law).

5.1.5 Land Use Planning

Oregon's management emphasis on conserving or establishing riparian buffers along streams in agricultural and urban settings dates only to the mid-1990s. The Land Conservation and Development Commission establish the state's planning goals and regulates land use planning. The planning goals are intended to help manage development on agricultural and forest lands in a manner that provides a level of protection to natural resources. Local jurisdictions must then develop their own land use plans that are consistent with these planning goals.

On 12/2/04, Oregonian's passed Ballot Measure 37- Compensation for loss of value due to land use regulation (ORS 197.352). On January 25, 2007, the Oregon Land Conservation and Development Commission adopted new administrative rules regarding Measure 37 claims. The new rules (OAR 660-041) will: 1) make permanent the temporary Measure 37 rules that the Land Conservation and Development Commission adopted in November, 2006 and clarify requirements; 2) require local governments to notify the Land Conservation and Development Commission of pending and adopted permits or other authorizations to allow a use based on a Measure 37 waiver; and 3) clarify that both the local government and the state must modify, remove, or not apply ("waive") applicable local and state land use regulations before a land owner may lawfully obtain a local permit or other authorization to proceed with a use authorized under a Measure 37 waiver, for claims based on existing statewide land use planning statutes, goals and rules. Measure 37 greatly weakened the level of land protection applied through previous zoning and land development regulations and, if fully implemented, has the potential to degrade watershed and aquatic habitats within the subbasin. According to Portland State University's Institute for Portland Metropolitan Studies' Measure 37 Database, as of March, 2007, more than 7,500 Measure 37 claims were filed with the state requesting over 12 billion dollars in compensation for over 750,000 acres of land. In Coos County, 230 claims have been filed covering 38,000 acres of land. Seven of these claims have been approved by both Coos County and the state. They involve 426 acres and seek compensation of $4,929,011.

The Coos County Planning Department ordinances require protection of a 50 foot riparian vegetation buffer adjacent to wetlands, streams, lakes and rivers, as identified on the Coastal Shoreland and Fish and Wildlife Habitat Inventory maps (92-05-009PL). Their development standard (Section 4.9.700) allows for exceptions to accommodate infrastructure, safety and usual farming practices.

An increase in urban and residential development is a potential future threat to coho conservation in the subbasin. The IMST (2004), in their review of Oregon's water temperature standards, recommended "…the Governor's Natural Resource Office and the Oregon Legislature complete and implement a statewide program of riparian protection and restoration".

5.2 Existing Management Plans

Following is a description of the major management plans affecting fish and fish habitat restoration in the subbasin.

5.2.1 Coquille Watershed Action Plan

The Coquille Watershed Association completed the Coquille Watershed Action Plan (CWAP) in 1997 which provides valuable habitat data, much of which is included in this document. This plan has been very effective in restoring fish habitats on an opportunity basis. However, the Coquille Watershed Association intends to revise it to include the findings and recommendations of this document (see Sections 5.3.7 and 5.4).

5.2.2 Coos and Coquille Agricultural Water Quality Management Area Plan

The Coos and Coquille Agricultural Water Quality Management Area Plan was developed as a result of the 1993 Senate Bill 1010. It identifies strategies to reduce water pollution from agricultural lands through a combination of educational programs, suggested land treatments, management activities and monitoring. The plan was adopted by the Board of Agriculture in 2002 and the rules became effective in 2005. The legal requirements under which the plan was written were established by ODA as Oregon Administrative Rules.

5.2.3 Water Quality Management Plans

The majority of the subbasin's rivers and streams, including the tidal reach and estuary, have been identified as water quality limited under Section 303(d) (1) of the of the Clean Water Act (see Appendix A.1). ODEQ's Strategic Plan strives to protect and improve water quality to support human health and fish habitat. Temperature, dissolved oxygen, and fine sediment are the primary concerns relating to salmonid reproduction and survival. ODEQ works with Coquille Watershed Association, BLM and FS and other cooperators to develop and implement Water Quality Management Plans that address TMDLs for these parameters. A Water Quality Management Plan was drafted for the Upper South Fork Coquille River watershed in 2000. A Water Quality Restoration Plan for the East Fork Coquille River was completed in 2001 by the Coos Bay District of the BLM and the Coos Bay Office of ODEQ.

For 2007-2008, ODEQ is continuing development of TMDLs for dissolved oxygen and bacteria loading within the subbasin. They are currently collecting riparian condition and water temperature data on the lower mainstem of the South Fork Coquille River and water temperature and dissolved oxygen data in the Middle Fork and North Fork Coquille Watersheds.

5.2.4 Oregon Plan

Oregon chartered the Oregon Coastal Salmon Restoration Initiative in 1997 in an attempt to restore coastal salmon populations to sustainable and harvestable levels. This effort used a three-prong approach in its recovery efforts: 1) adjust fish harvest and hatchery management within the jurisdiction of the ODFW; 2) rely on and enforce existing legislation and build partnerships with federal and other agencies and entities to improve habitat management; and 3) support voluntary restoration efforts through watershed councils and other groups. In 1998, the state broadened its fish recovery efforts to include steelhead runs in coastal basins, the Lower Columbia and Snake Rivers, Klamath Mountain regions and the Upper Willamette River Basin, transforming the Oregon Coastal Salmon Restoration Initiative to the Oregon Plan. In 1999, former Governor Kitzhaber expanded the Oregon Plan efforts to include all at-risk salmonids, through Executive Order 99-01, across the state and reemphasized recovery efforts that rely heavily on cooperative efforts among state, local, federal, tribal and private organizations. The plan also has provisions for scientific oversight by the IMST and regional monitoring of salmonid habitats.

Since its inception, additional legislation has been enacted that further strengthens the State's commitment and ability to restore salmon populations and watersheds. In 2003, the State and NOAA Fisheries began a collaborative planning effort to address the conservation of OC coho. Even though NOAA Fisheries later found the ESU not warranted for listing under the ESA, the planning commitment continued with an adjustment made to develop the CCP (2007) (see Section 5.

5.2.5 Oregon Coast Coho Conservation Plan

The CCP (2007) was completed by the State to provide goals and recommendations to conserve the OC coho. The plan meets State requirements under the NFCP (see Section 5.1.1), but is not an ESA Recovery Plan. The plan applies the best available science, data and the NFCP guidelines to describe a desired status of the ESU and a strategy for achieving the desired status. Overall, it provides a useful framework needed for future local planning efforts, such as this Subbasin Plan.

5.2.6 Coos County Forest Management Plan

The management of the Coos County Forest lands is directed at re-establishing a forest canopy on lands that were previously settled. Much of these lands were grazed and had little forest canopy. Today, they are tree farms. Coos County has replaced several culverts on their forest lands which were barriers to juvenile salmonids. Their policy is to manage within the presence of beaver (see Section 5.1.3).

5.2.7 Northwest Forest Plan

All BLM, FS and Coquille Forest lands are currently managed under the Northwest Forest Plan. The plan, in affect since 1994, serves as a recovery plan for at-risk stocks of salmon and steelhead within the range of Pacific Ocean anadromy. An important element of this plan was the Aquatic Conservation Strategy developed to help restore and maintain the ecological health of watersheds and associated aquatic systems on public lands. The Aquatic Conservation Strategy requires that: 1) riparian areas are fully protected; 2) Key Watersheds are designated for protection and improvement of anadromous fish habitat; 3) watershed assessments are conducted prior to timber harvest; and 4) watershed restoration funds are directed at restoring anadromous fish habitats.

The Northwest Forest Plan includes a comprehensive, long-term program to restore watershed health and aquatic systems, particularly those in Key Watersheds. This plan provides broad scale direction that is consistent with the subbasin assessment. It has been quite effective in arresting historic degradation and improving water quality and habitat conditions for coho on public lands. However, public lands tend to be higher in the landscape and, thus, support primarily salmonid spawning and summer rearing habitat and only a small proportion of the winter rearing habitat. Most of the winter rearing habitat is on private lands and is in a degraded condition with a stable trend. Therefore, implementation of the Forest Plan alone has not resulted in increased adult abundance of salmon and steelhead.

Past and on-going implementation monitoring indicates the compliance level with the standards and guidelines for management of Riparian Reserves is high. On-going monitoring results validate the assumption that Riparian Reserve buffer widths fully protect aquatic and riparian habitats. Because BLM, FS and Tribal administered lands comprise 25%, 1% and 1% respectively, of the subbasin, full riparian buffers exist across 27% of the subbasin. Note that BLM is undergoing a revision of this plan, as it applies to management on their Oregon and California lands, which may decrease the environmental protections currently applied to riparian areas.

5.3 Existing Management Programs

Several county, state, federal and private programs affect the conservation of native fish within the subbasin. A brief description is provided for each.

5.3.1 Water Quality

State and federal agencies have the responsibility and authority, under the Clean Water Act, to regulate activities that affect water quality and wetlands. ODEQ is responsible for protection of water quality and for restoring polluted waters. They set water quality standards to protect beneficial uses including irrigation, domestic use, recreation, and aquatic life. In salmonid producing streams, the temperature standard is established to protect salmonid spawning, rearing and migration. ODEQ is responsible for setting limits for the discharge of pollutants from point sources and enforcing violations. They require permits for septic systems and for the application of wastewater to land. ODEQ provides technical assistance and funds to reduce nonpoint source pollution. They monitor water quality on large rivers and small streams throughout the state and report on the status of monitored water bodies. They use this data and additional data collected from various studies to develop TMDL's and issue permits.

ODEQ implements a Watershed Monitoring Program that: 1) collects water quality data through physical, chemical, and biological sampling and assessment; 2) ensures the availability of accurate and complete data; and 3) interprets data to identify water quality conditions, threats, trends, and consequences of proposed actions. It also oversees a Volunteer Monitoring Program that helps watershed councils, soil and water conservation districts, schools, and other volunteer groups collect consistent water quality measurements that fulfill volunteer monitoring goals and satisfy ODEQ quality requirements.

The IMST (2004) conducted a review of Oregon's temperature standards for salmonids and reached the following conclusions: 1) the scientific basis for the temperature standard is credible; 2) the seven day moving average of daily maximum temperatures is an appropriate unit of measurement; 3) ODEQ's temperature model is scientifically sound; and 4) Oregon's TMDL process and Water Quality Management Plans are appropriate for implementation at a landscape scale. They also provided the following recommendations: 1) ODEQ should continue systematic evaluation of their temperature model; 2) OWEB and ODEQ should jointly monitor effectiveness of stream temperature protection and restoration activities; and 3) OWEB and ODEQ should coordinate with ODA, ODF and ODFW on issues involving water temperature.

Oregon Department of Transportation has revised their manual guidance for road construction and maintenance to better mitigates the effects to stream processes and water quality. Overall, much improvement has taken place. Additional improvements would be expected if additional funding were available.

5.3.2 Agriculture

The ODA, NRCS, USDA Farm Service Agency, Coos County SWCD and Oregon State University Extension Service are agencies which share a key role in the effort to restore coho overwintering habitat on private land. This will require greater coordination and a shared vision.

ODA manages several programs aimed at limiting the amount of water pollution originates from agricultural land activities. These include the Agriculture Water Quality Management Program (SB 1010), CAFO Program, Pesticides Program, Noxious Weeds and Invasive Species Program, and Conservation Reserve Enhancement Program. Implementation of these programs occurs through partnerships with local agricultural land owners, NRCS and the Coos SWCD (see Section 5.5.2).

ODA works with confined animal feeding operators to design wastewater treatment and/or disposal facilities. ODA has permitted approximately 20 CAFO's within the subbasin under the National Pollutant Discharge Elimination System program. The CAFO program was developed to assist operators and producers with managing their animal waste so as not to contaminate ground or surface water. The program allows properly maintained operations to dispose of wastes in a number of ways that protect water quality. Therefore, a properly maintained CAFO effectively protects ground and surface water.

ODA has a Memorandum of Agreement with EPA to regulate all pesticide use in Oregon.

Several financial assistance programs, administered by the NRCS or the Farm Service Agency, are available to address environmental problems, maintain desirable environmental conditions, or improve agricultural management. Participation in them is entirely voluntary. The Farm Security and Rural Investment Act of 2002 (Farm Bill) provides federal funding assistance to farmers and ranchers who wish to resolve environmental challenges on their land. NRCS and ODA work with many cooperating agencies to implement the following programs that relate to the Subbasin Plan:

Environmental Quality Incentives Program – This program provides technical, educational and financial assistance to farmers and ranchers to address soil, water and related natural resource concerns. It is the most widely used program in the subbasin.

Resource Conservation and Development Program - This program encourages civic leaders to plan and implement activities that contribute to sustainable communities, prudent land use, and sound conservation and management of natural resources. This program has not been used much.

Wetlands Reserve Program – This program provides technical and financial support to landowners who wish to address wetland and related natural resource concerns in an environmentally beneficial and cost-effective manner. Participating landowners can establish conservation easements of either permanent or 30-year duration, or can enter restoration cost-share agreements without an easement. This is a very popular program nationally and would have great utility if implemented within the subbasin. However, there are currently only two conservation easements (i.e., permanent) in the subbasin.

Wildlife Habitat Incentives Program - This program provides technical and financial support to enhance upland, wetland, riparian and aquatic habitat for wildlife populations of National, State, Tribal and local significance. In some cases, marginal farmlands are converted back to productive wetlands benefiting fish and wildlife. This program, while seemingly worthwhile, does not receive much use in the subbasin.

Conservation Reserve Enhanced Program – This is a Farm Service Agency program that also receives technical assistance from the NRCS and partners with ODA and OWEB. Its purpose is to enhance riparian habitat and protect surface water quality on agricultural lands. Federal and state dollars are combined to provide an enhanced financial incentive over that which may be offered under a regular Conservation Reserve Program agreement. Participants receive rental payments and cost shares to create conservation buffers on cropland or marginal pastureland under a 10- or 15-year contract. This program has been especially successful on lands which are marginal for agricultural production. There are 30 active contracts in Coos County and more are being processed. These contracts cover 295 acres of riparian habitat, protect over 20 miles of stream, and provide over $21,500 in annual rental payments to farmers and ranchers. In fiscal year 2006, the Farm Service Agency and OWEB paid Coos County landowners $57,610 in cost-shares to protect and restore riparian forest buffers. The total federal dollars to Oregon landowners since program inception is $46,324,527 (NRCS 2006).

5.3.3 Water Use

Oregon Department of Water Resources issues and adjudicates water rights and manages small dams and diversions. In 1987, the Instream Water Rights Act passed which allowed agencies to apply for instream water rights to protect recreation, water quality, and habitat for fish and wildlife. While the amount of water use is a concern within some stream reaches, water quantity was found to not be a limiting factor at the subbasin scale. However water quality (i.e., temperature) is a factor which reduces abundance of summer parr and is exacerbated when summer stream flows are significantly depleted due to water use (see Section 4.5.2).

The department conducts regulatory and restorative programs to protect existing flows in streams that provide significant salmon habitat. There are also numerous voluntary conservation efforts aimed at providing instream flows for aquatic life. The Allocation of Conserved Water Program allows a water user who conserves water to use a portion of the conserved water on additional lands, lease or sell the water, or dedicate the water to instream use. Under this program, *conservation* is defined as "the reduction of the amount of water diverted to satisfy an existing beneficial use achieved either by improving the technology or method for diverting, transporting, applying or recovering the water or by implementing other approved conservation measures." Further, “water users who make the necessary investments to improve their water use *efficiency* are not allowed to use the conserved water to meet new needs; instead any unused water remains in the stream where it is available for the next appropriator. In exchange for granting the user the right to spread a portion of the conserved water to new uses, the law requires allocation of a portion to the state for instream use.” State-wide, this voluntary program, in effect since 1988, has processed approximately 40 applications submitted to either expand supplies or support instream flows.

The department manages an instream leasing program that provides water users with options that protect their water rights while leasing water for instream benefits. Water users who are at risk of forfeiture of their water rights due to non-use may lease their water rights for flows that benefit fish and wildlife, scenic values, and improved water quality. They also manage programs for the re-use of water. Municipal effluent may be used for irrigation or for other beneficial uses without a water right. In addition, appropriated ground water used under a permit or certificate for industrial purposes or for concentrated animal feeding purposes may be reused for irrigation without an additional water right for the irrigation.

5.3.4 Fish Management

The State manages research, monitoring, hatchery, harvest, and restoration programs affecting fisheries.

Research and Monitoring

ODFW conducts long-term coho spawning surveys to assess population status and trends in coastal basins of the Columbia River to Cape Blanco. They annually conduct spawning surveys on approximately six stream miles within the subbasin. These standard and random surveys have been instrumental in identifying coho population size and trend; spawning timing; the abundance and distribution of hatchery-reared fish; and the distribution and use of spawning habitats (see Section 6.5.1).

Harvest

Historically, programs to manage a sustainable coho harvest were unsuccessful. For a time, hatcheries were used in an attempt to maintain an unsustainable harvest level. Today, ODFW regulates fish harvest within the waters of the State and operates through the federal Pacific Fishery Management Council to set and implement ocean harvest levels beyond the three-mile limit (see Section 5.1.1).

Hatcheries

In the decades up to the 1990s, ODFW planted high numbers of hatchery coho that adversely affected the genetic integrity of several populations within the ESU. The Coquille River subbasin was not spared. A total of 6.5 million fry from Columbia River stock were planted from 1908 to 1958. An ODFW hatchery was constructed at Bandon and began operations in 1979. Since 1980, 50,000-120,000 smolts of unspecified stock were planted. From 1980 to 1991, approximately 10,000-960,000 hatch-box fry were produced in the subbasin. Also, from 1980 to 1981 over 400,000 fry from Rogue River stock were planted in the subbasin. In the 1980's, the direction toward using only localized brood stock was implemented under the former Wild Fish Management Policy, since replaced by the NFCP.

In 2003, ODFW adopted the Fish Hatchery Management Policy which acknowledged that interactions between hatchery and naturally produced salmonids can occur at broad scales and that these interactions may have adverse effects on coho population viability. The new policy defined how hatcheries would be used to ensure conservation of both naturally spawned and hatchery spawned native fish. To help facilitate this effort, they joined forces with Oregon State University and in 2005 constructed the Oregon Hatchery Research Center, a new research hatchery and education center on Fall Creek, a tributary to the Alsea River in the

Alsea Subbasin. They also submit their hatchery management plans affecting OC coho to NOAA Fisheries for review.

In recent years, the Bandon Hatchery used re-founded hatchery and unmarked adults from within the subbasin as brood stock. The current direction is to use a minimum of 30% unmarked adults per year. As of 2004, approximately 50,000 coho smolts were released annually in the lower one-third of tidewater to reduce potential interactions with wild fish. Returning adults are fewer than 6% of the total spawning population within the subbasin. Based on limited studies, the Bandon Hatchery produces about 2% of the strays found in Oregon streams. Stocking of coho smolts into the Coquille system resulted in low survival and did not significantly contribute to the fisheries. Therefore, stocking of coho smolts will be discontinued after the 2006 yearling release. No broodstock to produce smolts were collected in the winter of 2005-2006. ODFW has no plans to stock coho in the Coquille subbasin in the future. Overall, past hatchery management has likely had a small but negative effect on the viability (e.g., diversity) of wild coho within the subbasin. Discontinuation of the coho hatchery supplementation program in the subbasin will: 1) eliminate competition between hatchery and naturally spawned coho smolts in the estuary; 2) eliminate the impacts of hatchery fish mixing with wild fish on the spawning grounds; and 3) provide for natural development of adapted traits.

5.3.5 Dredge, Fill and In-water Construction

ODSL recognized that loss of estuary and adjacent wetland habitat was significant prior to 1970s. In an effort to assess the overall condition and location of existing wetlands, they recently completed the mapping of tidal wetlands along the Oregon coast. This effort is critical to understanding the overall distribution and condition of coho winter rearing habitat and to identify potential opportunities for restoration (see Section 4.7.2). It also supports an ODSL program for the voluntary restoration of wetlands.

Dredge, fill and in-water construction activities are managed under the state's Removal-Fill Program and the Wetland Management and Planning Program. ODSL regulates fill and removal activities in the waters and of the state, including wetlands. They are responsible for protecting water quality and ensuring permitted activities do not injure or interfere with public navigation, fish or recreational uses. ODEQ and ODFW have the opportunity to provide comments on these permits, but can not regulate use. Certain activities also require a permit from the USACE. Obtaining removal or fill permits from ODSL or the USACE for restoration work within the subbasin is in the process of being streamlined.

Based on an IMST review (2004), management of wetlands, water quality and fish habitat would be improved if ODSL actively enforced violations of their permits and implemented programs to restore wetlands for use as natural water storage systems.

5.3.6 Urban Growth Management

Urban growth is managed under the Statewide Planning Program and the Statewide Planning Goals for Agricultural Lands, Urbanization, Natural Resources and Estuarine Resources.

5.3.7 Stream and Watershed Restoration

Watershed-scale planning and restoration began in Oregon in the 1990's with the advent of the Oregon Plan and the Northwest Forest Plan (see Sections 5.2.4 and 5.2.7). Many resource management agencies and interested publics became involved with planning and restoration. Watershed councils were formed and important fish habitats were given special designations.

The state has a Riparian Property Tax Incentives Program administered by the ODFW which provides a financial incentive to landowners involved in restoring riparian areas on their property.

Coquille Watershed Association

The Coquille Watershed Association, formed in 1994, is a nonprofit organization comprised of a broad spectrum of over 250 active participants within the subbasin. For nearly ten years, they have promoted watershed stewardship through public involvement and environmental education; coordinated the multi-agency permitting process; worked quickly and demonstrated success. They are currently implementing their CWAP by inventorying watershed conditions, monitoring, and restoring degraded habitats. They have worked with more than 210 private landowners to complete over 130 miles of riparian fencing and planting; 23 culvert replacements or retrofits; and 180 in-stream habitat improvement structures. The Coquille Watershed Association has earned several awards for their efforts in the subbasin. This is a very effective organization and a key partner in development of the Subbasin Plan.

Subbasin Planning

In 1991, the Northwest Power Planning Council created the subbasin planning program under their Fish and Wildlife Program. It began initial efforts to assess current watershed conditions against those needed to restore anadromous fish runs. The requirements for subbasin plans increased as scientific information became more available. Today, subbasin plans must meet standards relating to scientific content, monitoring and consistency with ESA, the Clean Water Act, and federal treaty and trust responsibilities to Native American Tribes. This document, undertaken by the Coquille Indian Tribe, marks the completion of a subbasin plan (see Section 2.1).

Western Oregon Stream Restoration Program

ODFW's Western Oregon Stream Restoration Program is focused on restoring high priority coho rearing habitat on private timber and agricultural lands. ODFW has assigned fish biologists to implement this program since the 1990's. It has developed restoration projects that plant conifers, install woody debris and encourage re-introduction of beaver into appropriate locations. The Department received a waiver of the USACE permit normally required to place woody debris in streams when completed in conjunction with timber sales. This program has streamlined restoration activities.

Special Designations

Several conservation designations have been established to identify crucial coho habitats for protection and restoration. These designations are intended as a planning aid rather than a regulatory mechanism. Conservation designations important to the subbasin include ODFW Core Areas, ODFW Source Watersheds, ODSL Essential Salmonid Habitats, American Fisheries Society Aquatic Diversity Areas and federal land Key Watersheds.

The Oregon Plan identified over 200 stream miles of Core Area habitats for anadromous fish, including 126 stream miles of coho Core Area habitat. More than half the Core Area miles were designated for coho protection and recovery.

The Northwest Forest Plan identified watersheds important to the recovery of anadromous salmonids. Six Key Watersheds (i.e., Roland Creek, Baker Creek, Salmon Creek, Upper South Fork Coquille River, Cherry Creek to headwaters, and North Fork Coquille River) were designated within the subbasin and receive special management.

Salmon Plates

Salmon plates are a program of the Oregon Plan. When passenger car or light truck owners pay an additional $30 for their two-year license plate, $15 is granted by OWEB directly to projects that address road-related impacts to salmon and trout streams. The remaining $15 goes to the Oregon Parks and Recreation Department to promote the Oregon Plan and support fish habitat restoration in state parks. Since the beginning of the salmon license plate program in 1998, OWEB and Oregon Parks and Recreation Department have each received nearly two million dollars. In the 2006 fiscal year, salmon license plate purchases reached $648,000.

Watershed Analysis

The BLM and FS are required, under the Northwest Forest Plan, to complete watershed analysis for those watersheds where future timber sales, road construction and/or road obliteration are planned. Watershed analysis includes a description of the geologic, social, economic, biological and climatic conditions; specific resource objectives; and recommended actions for achieving desired resource conditions. Watershed analysis has proven effective in reducing adverse effects of federal actions. The following Watershed Analyses have been completed within the subbasin:

- Middle Main Coquille River (USDI 1997)
- Middle Fork Coquille River (USDI 1994)
- North Fork Coquille River (USDI 2001)
- Lower South Fork Coquille River (USDI 1996)
- Upper South Fork Coquille River (USDA 1995)

Inter- and Intra-agency Coordination

The Coquille Watershed Association, Coos SWCD, Coquille Indian Tribe, BLM and FS are involved in restoration activities that focus on crucial coho habitats. Funding at the state level is administered by OWEB and ODFW. Federal funding sources include BLM, FS, EPA, NOAA Fisheries, USFWS and NRCS. Ducks Unlimited and many other private entities also contribute time, expertise and funding to improving streams and wetlands. Between 1995 and 2004, the Coos Bay and Roseburg BLM Districts spent $9,000,000 and $10,300,000, respectively on watershed restoration (USDI and BLM 2004). The bulk of this money was spent on resurfacing roads to reduced sediment delivery to streams and replacing culverts to improve fish passage. The Coos Bay BLM District has replaced more than 70 culverts which were barriers to adult or juvenile salmonids. A few culverts remain which are barriers to adult or juvenile salmonids, but they will be addressed as funds become available. The Coos Bay District has completed instream improvements, mostly LWD placement, on 25 (11%) miles of the anadromous fish habitat.

ODFW is involved in many aspects of fish habitat restoration. The Salmon and Trout Enhancement Program involves volunteers in fish habitat restoration. This program is integrated with their fish hatchery and environmental education programs. ODFW works with the Oregon Water Resources Department to identify streams where instream flows are not sufficient to support important fisheries. Efforts to increase instream flows have restored over 25 cfs within the ESU. However, instream flows remain low in many streams. ODFW also assists private landowners and the Coquille Watershed Association in planning and implementing stream restoration work.

Other watershed restoration efforts are underway throughout the subbasin by state, federal and private entities. They have been successful in restoring degraded sites and as educational experiences for those involved. Restoration activities typically require assessments, permits and other authorizations prior to initiation. Because this greatly increases the cost and time required to complete the work, it has discouraged the participation of some otherwise willing landowners.

OWEB is in the process of developing subbasin scale priorities for restoration actions funded under Measure 66, a long-term funding source for habitat restoration and protection as well as support to watershed councils and technical assistance in development of restoration projects. Projects specifically designed to improve coho overwintering habitat will receive high priority for funding. In the IMST's review of water quality, they recommended OWEB and ODEQ jointly monitor effectiveness of stream temperature protection and restoration activities and coordinate with ODA, ODF and ODFW on issues involving elevated water temperature.

The Oregon Department of Transportation has replaced 22 barrier culverts with larger culverts or bridges and retrofitted 40 other culverts to improve salmonid passage within the ESU. All of their high priority culverts for salmonid passage in the subbasin have been addressed.

5.4 Existing Restoration and Conservation Projects

Following is a description of the past, current and planned restoration projects. On-the-ground restoration and conservation activities have occurred on both public and private lands over the last ten years. The majority of this work has occurred on farms, ranches and private timberlands under the various financial assistance conservation programs made available under the Farm Bills and OWEB. Table 5-1 provides a brief summary of projects that were reported to OWEB. However, some farmers and ranchers have voluntarily implemented best management practices and completed conservation work on their lands outside of the various existing management programs reported to OWEB. Therefore, Table 5-1 understates the on-going conservation effort within the subbasin.

Table 5-1. Restoration projects completed from 1995 to 2005 by activity type, number, unit and cost.

Project Activity	**Number, Unit** 1]	**Cost (1995-2005)** 2]
Improve or restore fish passage (all species)	93 culverts	$2,036,149
Instream work to restore channel diversity and structure	26 miles	$1,130,344
Riparian silviculture (planting, fencing, thinning)	304 miles 2]	$1,213,069
Wetland Restoration	344 acres	$1,071,769

1] In some situations, more than one project activity may occur on the same acre of wetland or mile of stream.
2] Total includes the miles involved in all silviculture activities, so some overlap (double-counting) occurs within this project activity category. From OWEB database

Many restoration and conservation projects are proposed in the subbasin. The Coquille Watershed Action Plan lists more than 20 proposed restoration activities as shown in Table 5-2 of their Action Plan. All of these projects involve willing landowners and there is a waiting list of others who want to be involved. Many landowners share in the cost of project work. The Action Plan provides specific objectives for each proposed restoration activity based on an evaluation of an identified habitat deficiency and the capability of the stream to provide improved habitat.

Project work also occurs on federal lands. The five Watershed Analyses listed in the section above propose an assortment of project work including riparian silviculture to restore plant composition and structure, stream shade and woody debris; instream structures to restore stream processes, including floodplain connectivity; modification of water withdrawal systems to improve efficiency; monitoring and enforcement of water use to maintain minimum flows for salmonids; education of water users to improve effective use and conservation; upland sediment abatement to restore sediment regime; securing early priority consumptive water rights for instream water rights to restore summer flows; and monitoring to track changes in habitat conditions over time, document if project work was completed as designed, and to measure the effectiveness of completed project work. The Coquille Indian Tribe, BLM and FS typically incorporate riparian silviculture into their timber management plans. This allows for improvement of riparian habitat conditions while providing a timber product.

6. Management Plan

This chapter identifies the conservation actions needed to address the limiting factors and threats affecting coho viability; the interim actions needed to assess and conserve viability of Pacific lamprey, brook lamprey and spring-run Chinook; and the monitoring and evaluation necessary for adaptive management. The conservation principles which guided development of the habitat restoration effort are provided. A vision of the subbasin provides a view for all native fish, while desired future conditions are described specifically for coho. The priority and sequence of the planned actions is included as guidance. And, finally, a consistency check with related laws, regulations and agency processes is provided.

6.1 Guiding Conservation Principles

Restoring the native fish populations of the subbasin is a complex endeavor that requires a blend of applied science, local involvement, and adaptive management. The conservation principles that help form the foundation of the Subbasin Plan were adapted from Roni et al. (2002), Spence et al. (1996) and Williams (2004) and are described below.

6.1.1 Remove or Reduce the Threats and Factors Limiting Population Viability

Identify the threats and limiting factors, based on a population viability assessment. Design actions which remove or adequately reduce the impacts of limiting factors on population viability.

6.1.2 Maintain and Restore Habitat Connectivity for all Life Stages

Provide a subbasin-wide network of high quality habitat patches needed during each life stage and ensure connectivity between these patches during all times they are used.

6.1.3 Focus Investments in Areas that Yield the Greatest Benefit

Conserve and restore the best areas first - those habitat patches which are the largest, highest quality, most diverse, intact, and occupied. Treat the causes of degradation. Provide long-term solutions which have minimal chance of failure or unforeseen consequences. Invest in streams where existing and expected future human disturbances are not significantly degrading ecological processes and where the condition of the entire watershed is likely to be maintained or improved over time.

6.1.4 Conserve and Restore Important Ecological Processes

To the extent feasible, maintain and restore the ecological processes that create and sustain healthy fish habitats.

6.1.5 Be Spatially and Temporally Explicit

Spatially organize restoration work to achieve ecological objectives at the subbasin, watershed, and stream reach scales. Focus work in areas that will provide multiple benefits. Consider the short- and long-term effects of restoration work. Sequence the completion of habitat restoration work to increase efficiencies and effectiveness. Capitalize on time-sensitive opportunities (e.g., willing landowners, time-association with land-use action, etc.).

6.1.6 Protect and Restore Genetic Integrity

Avoid hatchery impacts to populations which are currently self-sustaining. Ensure fishing protects all life history forms related to run-timing, body size, etc.

6.1.7 Involve the Local Community

It is essential the private landowners and local conservation entities understand, support and participate in the restoration effort. To the extent practical, involve the local community in population and habitat inventory and restoration planning, implementation and monitoring.

6.1.8 Monitor Results and Adapt Accordingly

Periodic review, incorporation of new information, and reassessment are critical steps to achieving long-term restoration.

6.2 Vision of the Subbasin

Information from Chapters 3 through 5 is combined in this section to develop a timeless vision for the subbasin which will guide development of the actions needed to improve viability and establish priorities for the restoration effort. The vision describes the desired biological, physical and social/economic conditions in the future, given the ecological realities within the subbasin. Many desired future conditions are similar to existing conditions and simply require maintenance of the status quo, while others represent significant improvements over existing conditions and require considerable effort, funding, and time to achieve.

6.2.1 Vision

The vision is consistent with the goals of the Oregon Plan, the desired status goal for coho found in the CCP (2007), and the objectives of the NFCP. The vision for the subbasin is as follows:

> *The Coquille River subbasin is well known for its healthy rivers and streams and the diversity of fish and wildlife they support. Community and industrial growth is well planned to support thriving communities, healthy watersheds, and a wide variety of traditional land use activities including forestry, agriculture, fishing, industry and recreation.*
>
> *All native fish populations are self-sustaining and comprised of naturally-produced individuals that are abundant, productive, and diverse (in terms of life histories and geographic distribution). Native fish populations are viable and can survive prolonged periods of habitat, oceanic, climatic and environmental conditions that can be detrimental to a population and have habitat of sufficient quality and quantity that provides survival rates adequate to maintain associated ecological, cultural and economic benefits. The Pacific and brook lamprey support subsistence fisheries to Indian tribes. Steelhead and coastal cutthroat trout provide recreational harvest. Coho and chinook provide recreational, commercial and cultural harvest and nutrient enrichment to spawning watersheds during all years. Introduced fish, such as striped bass and largemouth bass, do not threaten the viability of native fish populations.*
>
> *Research and monitoring of native fish and their habitat requirements are on-going and provide a basis for directing improved management. ODFW's hatchery*

program produces native fish to support consumptive fisheries in a manner that supports the viability of all native fish. Population and habitat objectives for native fish are achieved through the informed and adaptive management of all stakeholders. Management of the commercial and recreational fisheries continues to closely regulate harvest and harvest-related mortality to support achievement of abundance goals.

Native riparian vegetation and woody debris are abundant. Riparian zones and upland recruitment areas have the plant composition and structure necessary to shade streams, supply nutrients and woody debris to all stream channels, build banks during high flows, and provide abundant food and shelter for beaver and other riparian- and aquatic-dependant species.

Channel forming processes are fully functional. Stream channels are unobstructed by man-made barriers, diverse, and well connected to upstream and downstream reaches, floodplains, beaver ponds, wetlands, and thermal and velocity refugia. Stream hydrographs are similar to historic conditions of peak and low flows. The frequency and intensity of floods, landslides and debris torrents are similar to those that operated historically. Stream substrates provide adequate spawning, embryological development, and juvenile cover for native fish and provide habitat for aquatic insects.

The biological and physical processes (e.g. landslides, stream channel migration, forest vegetation development) that form and sustain aquatic habitats are well understood and conserved through the combined efforts of the Coquille Watershed Association, natural resource agencies, municipalities, conservation groups and private landowners. Tributary, mainstem, estuarine, and wetland reaches provide high quality habitats to rearing and ocean-bound anadromous fishes. Water of streams and wetlands meets water quality standards. All streams meet instream flow requirements for beneficial uses. The levels of riparian vegetation and LWD needed to sustain the biological, chemical and physical processes that sustain healthy watersheds are protected on State and private timber lands; on agricultural lands; and on tribal and federal public lands. ODFW has been successful in restoring beaver to suitable sites throughout the subbasin. Agricultural lands incorporate riparian stream buffers and wetlands to stabilize streambanks and control runoff. Funds, planning, and technical assistance for restoration work are available through the combined efforts of the Coquille Watershed Association, State, Coquille Indian Tribe, BLM, FS, NRCS, Coos County SWCD and others. Economic and other incentives are readily also available to landowners willing to manage for the long-term sustainability of the area's rivers and streams.

6.2.2 Desired Future Conditions Related to Coho Viability

The desired future conditions are described below for each of the five VSP parameters discussed in Section 4.4.

Abundance

Abundance was found to be currently depressed. The desired future conditions relating to abundance are:

1. Adult abundance is ≥8,400 – 67,900 naturally produced spawners, depending upon the marine survival and allowable harvest rates for that year as shown in Table 6-1. In *addition, the observed spawner abundance is ≥ the marine survival-specific escapement target at least six times in the most recent 12-year period, but not below the target for any three consecutive years.*

2. The ecological processes which create and maintain slow-water refugia over time (e.g., riparian vegetation development, recruitment and retention of woody debris, floodplain connectivity, delivery and transport of sediments and nutrients, and channel migration) are restored and result in a subbasin-wide smolt production increase of 467,600 individuals.

3. Beaver occupy all suitable sites. They create and maintain HIP slow-water refugia used by winter parr.

4. Tide gates, road culverts and dikes allow fish access to habitats needed by all life stages.

5. Changes in the structure and composition of riparian vegetation have lowered water temperatures, increased in-stream woody debris, increased pool frequency and quality, and improved floodplain connectivity and cover.

6. Woody debris is managed as an important component of healthy streams. It is recruited to mountain streams and transported, over time, to lower stream reaches. Where woody debris creates conflicts with existing infra-structure, efforts are made to relocate, rather than remove, it from stream channels and floodplains.

7. The management of State and private forest lands provides a higher level of protection to water quality, riparian vegetation, and stream channels. Federal forest lands continue to be managed to maintain and restore stream and riparian processes.

8. The commercial and recreational coho fisheries do not prevent or retard attainment of the desired status.

9. The management of introduced fishes does not prevent or retard attainment of the desired status.

Table 6-1. Desired status of the Coquille coho population under various marine survival rates.

Smolt to Adult Marine Survival 1]		**Recruits**	**Maximum Allowable Harvest** 2]		**Spawners** 3]
Category	**Average Rate**		**Rate**	**Number**	
Extremely Low	1.1%	8,988	7%	588	8,400
Low	4.4%	35,535	15%	4,635	30,900
Medium	10.3%	77,350	30%	17,850	59,500
High	15.0%	98,455	45%	30,555	67,900

1] For wild fish as indexed at ODFW Life Cycle Monitoring Sites.
2] Based on Amendment 13.
3] Refers to naturally produced individuals.
From CCP (2007).

Productivity

This VSP parameter currently passes the evaluation threshold metric described in the CCP (2007). However, it is somewhat reduced. The level of productivity is expected to fluctuate over the life of the Subbasin Plan in response to improvements in overwintering habitat carrying capacity, natural changes in ocean survival, and abundance. Because the population size is currently low, the goal is to increase productivity, at least initially, above the existing level (see Section 4.4.2). Therefore, the desired future condition is:

The recruit/spawner ratio is ≥1.17.

Distribution

This VSP parameter was evaluated in the CCA (2005) using the spatial pattern of adult spawners. The distribution of adult spawners was found to not be reducing the viability of the Coquille population. The Subbasin Plan also looked at the distribution of summer and winter parr and found their distribution, at the HUC-6 scale, was not reduced (see Section 4.4.2). Therefore, the desired future condition is:

All life stages continue to occupy ≥83% of the 6th field HUC subwatersheds.

Diversity

Based on the findings of the CCA (2005), diversity has not been measurably reduced. Therefore, the desired future conditions reflect a maintenance or slight improvement in the status quo as follows:

1. The average of the100-year harmonic means of spawner abundance as forecast from a population viability model continues to be ≥12,439.

2. The population continues to not require hatchery supplementation to achieve its desired abundance goal.

3. Hatchery strays from outside the subbasin continue to comprise ≤5% of the spawning adults in the subbasin.

Persistence

Based on the findings of the CCP (2007), this VSP parameter passed the viability threshold by a significant margin. The status of this VSP parameter indicates there are no factors limiting the persistence of the population. Therefore, the desired future condition reflects maintenance of the status as follows:

The population maintains a probability of extinction value of 0.000.

6.3 Strategies

Strategies are sets of actions which address each of the limiting factors identified in Section 4.5.2 and contribute to achievement of desired future conditions identified in Section 6.2.2. Each strategy and action has a unique number. The strategy number is related to its overall priority. Hence, Strategy 1 is the highest priority and Strategy 4 is the lowest. Each action is numbered based on its strategy number and the recommended sequence in which it should be implemented. For example, Conservation Action 2.1 is a component of Strategy 2 and should be implemented prior to Conservation Action 2.2.

Strict adherence to the listed sequences is not required. Rather, many of the conservation actions or interim conservation measures could well be implemented concurrently. Because much of the restoration work will occur on private land, it will often be implemented on an opportunity basis. Other considerations which should influence the sequence of conservation actions include:1) opportunities to benefit multiple native fish and wildlife species; 2) opportunities to contribute to achievement of multiple strategies; 3) opportunities to provide information needed for adaptive management; 4) opportunities to acquire funding; and 5) anticipated effectiveness and efficiency of restoration work.

6.3.1 Strategy 1: Restore Slow-water Refugia for Winter Parr

This strategy calls for increasing slow-water refugia to increase abundance of winter parr. Based on the findings presented in Sections 4.4 and 4.6, this is the only key limiting factor – it alone prevents the population from reaching the desired status. Therefore, to the extent practical, restoration work should be focused on achieving this strategy first. Conservation actions are:

1.1. Contact landowners of potential restoration sites and provide them with: a) purpose and need for restoration within their watershed; b) potential restoration activities and expected results over time; c) disclosure of any financial and liability obligations; d) benefits to them, other than restoration; e) financial and technical assistance available to them; f) other potential options of participating such as conservation easements or long-term leases.

1.2. Annually, restore slow-water refugia on ≥ 6.7 miles (167 miles over 25-years) on degraded HIP overwintering habitat. Focus work on restoring the ecological processes which create and maintain slow-water refugia (e.g. development of riparian vegetation, recruitment and retention of woody debris, channel migration, and floodplain connectivity). Project work, in order of priority, includes: 1) re-establishing beaver and their food sources into sites where the landowner is supportive and potential associated impacts can be managed; 2) re-connecting side-channels, wetlands and floodplains; 3) placing boulders and woody debris within the channel or active floodplain to create pools; 4) conducting riparian silviculture; and 5) removing or modifying barriers to desirable habitats. Select work sites from those identified in Tables A.6-1 to A.6-5 of Appendix A.6.

6.3.2 Strategy 2: Restore Water Temperature for Summer Parr

The objective of this strategy is to improve water temperature to increase the abundance of summer parr. Based on the findings presented in Sections 4.4 and 4.6, the second highest priority is to restore water temperature to increase survival of summer parr. Completion of this strategy is not required for population recovery, but its completion would: 1) result in a population size in excess of the desired status, once Strategy is implemented; and 2) help to achieve Strategy 1 by restoring the ecological processes responsible for creating and maintaining slow-water refugia over time. Conservation actions are:

2.1. During the period 2008-2032, initiate work to restore water temperature on 120 miles of summer parr habitat by conducting riparian silviculture; re-connecting wetlands and other cold-water refugia; and placing boulders and woody debris within the channel or active flood plain. Select work sites from those identified in Tables A.7-1 to A.7-4 of Appendix A.7.

2.2. Outreach to landowners the need and benefits of restoring and maintaining the processes which maintain cool water temperatures, including water conservation measures, leaving water instream, or donating water rights to benefit fish.

6.3.3 Strategy 3: Improve Fishing Management

This strategy strives to improve the management of fishing-related mortality. Implementation of this strategy is not required to achieve the desired status. The planned action is:

3.1. Support research which maintains or improves the ability of managers to identify and control the appropriate level of fishing-related mortality so that it does not prevent or retard attainment of the desired status.

6.3.4 Strategy 4: Improve Management of Coho Depredation

This strategy addresses the predation of coho by introduced fishes and native birds, pinnipeds, and other mammals. Implementation of this strategy is likely not required to achieve the desired status. Planned actions are:

4.1. Support research which maintains or improves the ability of managers to identify and control the appropriate level of depredation so that it does not prevent or retard attainment of the desired status.

4.2. Outreach to fishermen and landowners the potential pitfalls of accidentally or intentionally introducing exotic fishes.

6.3.5 Selecting Restoration Sites for Implementing Strategies 1 and 2

Proper selection of restoration sites is critical to achieving strategy objectives. Guidance for where Strategies 1 and 2 should be implemented across the subbasin was developed at two spatial scales: between (i.e., inter-) watersheds and within (i.e., intra-) watersheds, using the conservation principles described in Section 6.1. Sites should be selected using first the interwatershed priorities, followed by the intrawatershed priorities. It is desirable, but not necessary, to complete all restoration work in the highest priority watersheds, prior to staring work in lower priority watersheds. Thus, these priorities are intended as guidance.

Interwatershed Priorities

The overall objective is to provide a subbasin-wide network of high quality habitats which, to the extent practical, represent historic conditions; provide for the needs of all life stages; and have a high level of connectivity during the times they are used.

The following priorities consider the habitat restoration contribution of each watershed relative to its ability to address the limiting factor. The priority ranking, from highest to lowest, for implementing Strategy 1 is: Lower Coquille, North Fork Coquille, East Fork

Coquille, South Fork Coquille and Middle Fork Coquille. The ranking for implementing Strategy 2 is: North Fork Coquille, East Fork Coquille, Middle Fork Coquille, South Fork Coquille and Lower Coquille (see Section 4.7).

Intrawatershed Priorities

Once the appropriate watershed has been selected, individual project sites should be selected from those listed in Tables A.6-1 to A.6-5 of Appendix A.6 and Tables A.7-1 to A.7-4 of Appendix A.7. The selection of work sites must consider an array of factors including the social, economic and ecological benefits and limitations to restoration. The intent is to select restoration sites which best restore the limiting factor and can be implemented in a manner that respects the rights of landowners, maintains or improves existing lifestyles, meets legal requirements, and are economically and ecologically effective and efficient. Below is a list of criteria that should be used in the final selection of work sites. The criteria, which are intended to be considered in the order they are listed, are:

- site is one of the best occupied habitats, in terms of diversity, patch size, overall quality, and intrinsic potential;
- condition and trend of the site is suitable for restoration at this time;
- restoration would be cost effective;
- restoration would produce a beneficial or neutral impact to adjacent landowners;
- existing infrastructure (e.g. major highways, drainage districts, etc.) does not prevent recovery of the site;
- current and future access to the site by the featured species is likely;
- potential present and anticipated future impacts from surrounding landscape are acceptable;
- potential impacts to other species such as beaver, lamprey and cutthroat trout are acceptable;
- the landowner is willing;
- restoration would achieve multiple strategies;
- the current or expected future seeding level is adequate to fully occupy the site;
- restoration would produce synergistic effects from other past, future or upstream restoration work; and
- work has potential to provide important scientific or educational information.

6.3.6 Strategy Summary

Of the four strategies, only Strategy 1 must be fully implemented to achieve the desired status. Implementation of this strategy should begin immediately and be focused primarily in the Lower Coquille Watershed.

Implementation of Strategy 2 is not required to reach the desired status. However, it would likely increase the rate of population recovery once implementation of Strategy 1 is completed. Implementation should focus on the North Fork Watershed. A summary of the limiting factors, life stages affected, strategies, and planned actions is provided in Table 6-2.

Table 6-2. Summary of limiting factors, affected life stage, strategy and conservation action.

Limiting Factor	Life Stage Affected	Strategy	Conservation Action
Depleted slow-water refugia	Winter parr	1. Increase the abundance of winter parr by restoring the ecological processes which create and maintain slow-water refugia and halting or reducing the rate at which existing slow-water refugia are lost. Focus on overwintering areas identified as HIP habitat.	1.1 Contact landowners of potential restoration sites and providing them with: a) purpose and need for restoration within their watershed; b) potential restoration activities and expected results over time; c) disclosure of any financial and liability obligations; d) benefits to them, other than restoration; e) financial and technical assistance available to them; f) other potential options of participating such as conservation easements or long-term leases. 1.2. Annually, restore slow-water refugia on > 6.7 miles (167 miles over 25-years) on degraded HIP overwintering habitat. Focus work on restoring the ecological processes which create and maintain slow-water refugia (e.g. development of riparian vegetation, recruitment and retention of woody debris, channel migration, and floodplain connectivity). Project work, in order of priority, includes: 1) re-establishing beaver and their food sources into sites where the landowner is supportive and potential associated impacts can be managed; 2) re-connecting side-channels, wetlands and floodplains; 3) placing boulders and woody debris within the channel or active floodplain to create pools; 4) conducting riparian silviculture; and 5) removing or modifying barriers to desirable habitats. Select work sites from those identified in Tables A.6-1 to A.6-5 of Appendix A.6.
Elevated water temperature	Summer parr	2. Increase the abundance of summer parr by restoring the ecological processes which create and maintain cool water temperature. Reconnect cold water refugia. Focus restoration work on summer rearing areas identified as having highest potential. To the extent practical, complete work in areas where summer and winter parr habitat overlap.	2.1. During the period 2008-2032, initiate work to restore water temperature on 120 miles of summer parr habitat by conducting riparian silviculture; re-connecting wetlands and other cold-water refugia; and placing boulders and woody debris within the channel or active flood plain. Select work sites from those identified in Tables A.7-1 to A.7-4 of Appendix A.7. 2.2. Outreach to landowners the need and benefits of restoring and maintaining the processes which maintain cool water temperatures.

Fishing-related mortality	Marine rearing and spawning migration	3. Maintain or improve the ability to identify and control the appropriate level of fishing-related mortality so that it does not prevent or retard attainment of the desired status.	3.1. Support research which maintains or improves the ability of managers to identify and control the appropriate level of fishing-related mortality so that it does not prevent or retard attainment of the desired status.
Increased depredation	Summer parr, winter parr, smolts,	4. Manage predation by introduced fishes and native birds, pinnipeds and other mammals.	4.1. Support research which maintains or improves the ability of managers to identify and control the appropriate level of depredation so that it does not prevent or retard attainment of the desired status. 4.2. Outreach to fishermen and landowners the potential pitfalls of accidentally or intentionally introducing exotic fishes.

6.3.7 Implementation Responsibilities

The responsibility of ensuring implementation of planned actions and of reporting accomplishments was assigned to those involved in development of the Subbasin Plan. The agency or group which assumes lead responsibility for completing the planned actions, including securing the necessary staff, permits, planning, funding, and reporting accomplishments is termed the “responsible party”. While it is recognized that an agency or organization’s priorities, funding and staff varies over time, the responsible party is expected to formally request the necessary funding to fully accomplish the planned action. In the event adequate agency funding is not available, the responsible party is required to document the deficiency in the Subbasin Plan Annual Report (see Section 6.5.2) and take remedial action. Table 6-3 provides a summary of the responsible party and timeframe required to implement each strategy and planned action.

Table 6-3. Summary of strategies, planned actions, responsible parties and timeframes.

Strategy	Conservation Action	Responsible Party 1]	Timeframe 2]
1	1.1	CWA	2007-2017
	1.2	CWA	2007-2032
2	2.1	Private lands: CWA State lands: ODFW BLM lands: BLM FS lands: FS	2008-2032
	2.2	CWA	2007-2017
3	3.1	ODFW	2007-2032
4	4.1	ODFW	2007-2032
	4.2	ODFW	2010-2032

1] CWA refers to the Coquille Watershed Association
2] Some planned activities would be completed annually over a period of several years.

6.4 Interim Conservation Measures for Lamprey and Spring-run Chinook

Conserving native fish populations is integral to the Subbasin Plan. Assessing, restoring and maintaining the viability of the subbasin's native fish populations is essential to their long-term sustainability. Of particular concern are Pacific lamprey, brook lamprey and spring-run chinook. While they are ecologically and culturally important species within the subbasin, there is a lack of information regarding their distribution, life history needs, and population viability.

Following are interim conservation measures - short-term actions needed to assess and protect the viability of species where a viability assessment has not been completed. Once population viability assessments are completed, specific actions should be developed to replace these interim measures, where appropriate. Interim conservation measures directed at Pacific and brook lamprey have an "L" prefix, and those directed at spring-run chinook have "C". To the extent practical, interim conservation measures should be implemented in areas which also achieve Strategies 1, and 2. They are summarized in Table 6-4.

6.4.1 Pacific and Brook Lamprey

Any conservation effort should start with an assessment of the viability of the population at the subbasin and larger scales. The interim conservation measures are:

L-1. By 2011, complete a NFCP viability assessment on the subbasin's Pacific lamprey population. Once completed, take measures to correct viability concerns and provide conservation recommendations to the Coquille Watershed Association and others involved in activities affecting this species.

L-2. By 2012, complete a NFCP viability assessment on the subbasin's brook lamprey population. Once completed, take measures to correct viability concerns and provide conservation recommendations to the Coquille Watershed Association and others involved in activities affecting this species.

All native fish require unobstructed access to historic habitats. Much has been done to restore passage for salmonids, although little is known of the specific passage requirements of Pacific and brook lamprey. The following interim conservation measures address this concern:

L-3. By 2009, determine the passage requirements of Pacific and brook lamprey through road culverts and other man-made obstructions found within the subbasin and share this information with others, including Coos County Road Department, FS, BLM, ODF, ODOT and the public.

L-4. By 2010, determine which road culverts and similar man-made obstructions are barriers.

L-5. By 2010, prioritize all man-made barriers for retrofitting or replacement using OWEB's suggested protocol for site selection.

L-6. From 2010 – 2032, restore passage through all high priority man-made barriers.

Striped bass and largemouth bass are exotic fish which prey upon native fish, including lamprey. The impact of this on Pacific and brook lamprey population viability has not been studied. Changes in the management of striped bass and largemouth bass may prove socially and ecologically challenging without a thorough scientific understanding. This information need is addressed in Section 6.5.

6.4.2 Spring-run Chinook

There is a need to assess the viability of this species within the ESU and the subbasin. The interim conservation action which addresses this need is:

C-1. By 2009, complete a NFCP viability assessment on the subbasin's spring-run chinook population. When completed, take measures to correct viability concerns and provide conservation recommendations to the Coquille Watershed Association and others involved in activities affecting this species.

During the summer months, spring-run chinook rest in deep pools within the North and South Forks of the Coquille River. These holding pools provide relatively scarce habitat characteristics used by a variety of native fish and wildlife species. Many of these deep pools no longer support the diversity or abundance of fish they did historically due to the loss of LWD, boulders, overhanging tree canopy, or connectivity to cold water refugia such as off-channel springs or cold water tributaries. A description of desirable holding pool habitat is taken from the Washington State Department of Ecology (1998). They describe a first-class summer holding pool as large and deep. Pool depth and area are sufficient to provide a low velocity resting area for several adult chinook. More than 30% of the bottom is obscure due to turbulence, turbidity, or the presence of structures such as logs, boulders, or overhanging objects. Or, the greatest pool depth is >1.5 m (i.e., 4.9 feet) in streams <5 m (i.e., 16.4 feet) or >2 m (i.e., 6.6 feet) in streams >5 m wide. The 7-day minimum average temperature at the location adults are holding should be $\leq 64^{o}$F. The following interim action addresses this conservation need:

C-2. By 2009, determine the distribution, use, condition and restoration potential of all spring-run Chinook summer holding pools within the subbasin. Collect the summer 7-day maximum and minimum average water temperature within each holding pool and its connected tributaries.

C-3. By 2011, establish the restoration priority of these summer holding pools.

C-4. By 2011, begin restoration of at least one high priority summer holding pool and complete the remaining high priority sites by 2032.

Table 6-4. Summary of interim conservation measures by species benefited, priority, responsible party and timeframe.

Species Benefited	Interim Conservation Action	Priority	Responsible Party 1]	Timeframe 2]
Pacific lamprey and brook lamprey	L-1	High	ODFW	2007-2011
	L-2	High	ODFW	2007-2012
	L-3	Medium	Coquille Indian Tribe	2007-2009
	L-4	Medium	CWA	2009-2010
	L-5	Medium	CWA	2010
	L-6	Medium	Private lands: CWA BLM lands: BLM FS lands: FS State lands: ODFW	2010-2032
Spring-run chinook	C-1	High	ODFW	2008-2009
	C-2	Medium	North Fork: BLM South Fork: FS	2007-2009
	C-3	Medium	ODFW	2011
	C-4	Medium	North Fork: BLM South Fork: FS	2011-2032

1] CWA refers to the Coquille Watershed Association.
2] Some activities would be completed annually over a period of several years.

6.5 Research, Monitoring and Evaluation

The Subbasin Plan will be implemented using an adaptive management approach that relies heavily on the findings of research, monitoring and evaluation. Much research, monitoring and evaluation is already taking place under the CCP (2007), Oregon Plan, Coquille Watershed Association Action Plan, Northwest Forest Plan and elsewhere. Relevant findings will be incorporated into the Subbasin Plan and will serve to both monitor progress toward achieving the Strategies and Interim Conservation Measures and to alter course if necessary.

6.5.1 Existing Research, Monitoring and Evaluation Programs

Coquille Watershed Association

The Coquille Watershed Association conducts monitoring and evaluation of their project activities and of resource conditions throughout the subbasin. Their program is well coordinated with others involved in natural resource management issues. For example, they work with ODEQ to provide input on sampling plan design, make use of acquired data, and provide a coordination role for information storage and distribution. They completed a riparian shade analysis of the subbasin through a grant with ODEQ. That data was used in the Subbasin Plan to aide in the selection of individual stream reaches for implementing Strategy 2 (see Section 4.7.3).

They routinely conduct implementation monitoring of their activities to satisfy grant and contract obligations and to provide a foundation for effectiveness monitoring. Effectiveness monitoring is conducted on nearly all habitat restoration projects as an integral part of the project. All monitoring plans are reviewed and approved by their Executive Council and Technical Advisory Group when new projects are proposed. These data also provide information on the cumulative impact of implementing multiple projects over time. This monitoring is coordinated with other organizations and agencies presently conducting baseline monitoring. As new information becomes available, it is analyzed by the Technical Advisory Group who works with the Executive Council to incorporate relevant new data into future updates of their Action Plan. A complete list of implementation and effectiveness monitoring records is summarized in their Action Plan.

State of Oregon

The Oregon Plan provides the foundation for research, monitoring and evaluation efforts aimed at restoring fish populations and watersheds state-wide. This effort collects and analyzes data collected at regional, watershed and site scales. The OWEB Oregon Plan Monitoring Team works closely with NOAA Fisheries, state agencies and others to coordinate a program which provides a shared database for fish abundance, distribution and density which is useful to all entities. Individual state agency monitoring efforts are described in Appendix II and Chapter 17B of the Oregon Plan. More detailed information on state-level monitoring can be found in Chapter 16 of the Oregon Plan.

ODFW's Oregon Plan Monitoring for Coastal Basins Program includes a number of efforts which generate basic information on salmon populations and conditions across large geographic areas of the coast. Activities include juvenile salmon population census, stream habitat assessment, salmonid life cycle monitoring, stream health monitoring and adult salmon spawning surveys. ODEQ is working with partners to monitor water quality on additional streams, including many which provide coho habitat. TMDL monitoring is occurring on the South Fork Coquille Watershed. The multi-agency Coastal Landscape Analysis and Modeling Study project has developed a model which predicts intrinsic potential of coho habitat and prioritizes sites for restoration. StreamNet, an online multi-agency fisheries and watershed data base accessible to the field level user, has modeled salmonid habitats across most Oregon basins (www.streamnet.org). All of these existing monitoring and modeling efforts can be used for monitoring and evaluation of the Subbasin Plan.

New efforts are being designed to monitor or verify assumptions used in the CCP (2007). Under the CCP (2007), the State commits to: 1) monitor the status and trend of coho populations and their habitat; 2) validate key assumptions and clarify critical uncertainties associated with the identification of primary limiting factors; and 3) evaluate the effectiveness of key habitat protection, management, and conservation actions. The results of this research, monitoring and evaluation effort will be summarized in the Subbasin Plan Annual Reports.

Based on the CCP (2007), Oregon funds five long-term programs that monitor the status and trend of coastal coho populations and their habitat. These programs are: 1) ODFW spawner surveys that provide annual estimates of the spatial distribution and abundance of wild and hatchery coho; 2) ODFW habitat surveys that provide estimates of a broad array of instream physical habitat and riparian conditions. The surveys annually assess the condition of coho habitat in wadeable streams within the subbasin. These surveys include: a) ODFW Juvenile Surveys that provide annual estimates of the summer distribution, density, and habitat occupancy rate of juvenile coho within the subbasin; b) ODFW Life Cycle Monitoring that annually estimates freshwater and marine survival of coho from seven coastal streams.

This information is used to determine the marine survival category to which observed spawner abundances will be assigned; c) ODFW and ODEQ Water Quality Monitoring that is designed to provide information on the spatial pattern of water temperature, fine sediment, and other water quality conditions in wadeable streams. Every five years, these data will be analyzed to provide information on the status and trend of water quality in wadeable streams within the subbasin. In addition to this program, ODEQ has established a series of long-term water quality monitoring stations as part of its TMDL program. Recently, this program was upgraded to insure that at least one water quality monitoring station is located in the subbasin. Relevant information from these surveys will be included in the Subbasin Plan Annual Reports and will serve as a basis for adaptive management.

Research is essential to answering technical questions relating to the biological performance of the coho population, and in validating the key assumptions of the CCP (2007). The CCP (2007) identified the need to fund eight topics for research and evaluation, but did not commit to doing so. These include:

1. research on the mechanisms that cause poor ocean survival of coho and methods to predict ocean survival conditions;
2. research on the relative importance of potential limiting factors throughout the entire freshwater and estuarine residence of coho;
3. evaluation of the contribution that habitat protection, management, and restoration programs have toward achieving desired status goals;
4. validation and refinement of the CWHIP model;
5. evaluation of methods to maintain, enhance, or promote beaver dams in areas where they can create or maintain high quality coho rearing habitat;
6. evaluation of the causes and impacts of marine mammal, avian and exotic fish predation on coho;
7. evaluation of the re-establishment of a self-sustaining population of coho in Salmon River; and
8. development of tools to identify and prioritize habitat restoration projects at local watershed and stream-reach scales.

All research and evaluation topics would provide valuable information useful for adaptive management within the subbasin. Enough information exists today to begin a successful restoration effort in the ESU, but more information is needed to increase efficiency and effectiveness and to provide needed information to others involved in similar efforts elsewhere in the ESU.

Federal

The BLM and FS conduct stream surveys on many streams throughout the subbasin and state-wide. These surveys provide information on baseline environmental conditions and, when repeated over time, provide trend information. These data are shared with ODFW, the Coquille Watershed Association, and others. These agencies also collect data on watershed conditions throughout the subbasin, usually to provide baseline information where future management activities (e.g., timber harvest, road construction or obliteration) are proposed.

Both agencies also conduct implementation and effectiveness monitoring of projects as a requirement under the Northwest Forest Plan. Also, research is conducted to either address critical resource issues or to validate the assumptions of the Northwest Forest Plan. Research results are made available to interested entities through formal publication.

NOAA Fisheries provides guidance to the Oregon Plan Monitoring Team for monitoring the status of a fish population's viability attributes and the status of the population's primary limiting factors.

6.5.2 Research, Monitoring and Evaluation Plan

The Research, Monitoring and Evaluation Plan is intended to help resolve uncertainties concerning the desired status, the identification of limiting factors, and the cause-and-effect relationships described in the working hypothesis. This is not to say that implementation of the Subbasin Plan can not begin without this information, only that the approach must account for these uncertainties. Research, monitoring and evaluation conducted under the Subbasin Plan collects information which responds to the State's research and evaluation topics 3 and 5 described in Section 6.5.1.

Research Needs

Research is the scientific investigation and analysis of specific information for the purpose of answering a question. It is typically presented in scientific literature that is peer reviewed. The Subbasin Plan endorses the eight research topics described in the CCP (2007) as relevant, but places greatest emphasis on topics 2-6 and 8. Findings from this research will be tracked in the Subbasin Plan, as described in Section 6.5.3. Of the eight research topics identified in the CCP (2007), topic 2 is of highest priority because the outcome of this research has the greatest potential to affect implementation of the Subbasin Plan.

Three research needs have been identified and are listed in priority order as follows:

1. More information is needed to identify and measure the specific habitat components which most affect survivorship of the winter parr and smolt life stages. The CCA (2005) identified the limiting factor responsible for poor survivorship of winter parr and smolts to be the "loss of stream complexity". The State defines "stream complexity" as a multi-variant set of habitat conditions including components of stream structure and function, but fails to provide a means by which it can be quantitatively measured or evaluated. This research would determine the appropriate metric by which overwintering habitat conditions could be measured and evaluated. This research need relates to the State's research topics 3, 4, and 8.

2. More information is needed on the amount of high quality overwintering habitat which currently exists in the subbasin and the number of smolts produced per mile of the 30-mile reach of the Coquille River referred to as the "winter lake". This information would greatly improve the accuracy of the estimated number of miles of restoration required to achieve the desired status. This relates to the State's research topic 3.

3. We need to know the amount of use tidal and estuarine areas receive by rearing coho, particularly winter parr, and the restoration potential of these areas. Much of the historic coho winter rearing habitat is now managed as agricultural land through the installation and operation of tide gates. Where willing landowners want to participate in restoration, potential exists to remove or alter operations of some tide gates. However, this action requires further knowledge of the positive and negative effects to coho and other native fish populations, adjacent private lands, public safety, flood control, navigation, and other factors. This expands upon the State's research topics 2 and 3.

Monitoring Program

Monitoring is the long-term systematic collection of data for the purpose of detecting change. Two types of monitoring will be conducted – implementation and effectiveness. Monitoring and evaluation items are summarized in Table 6-5.

Implementation monitoring - Implementation monitoring involves documenting whether the strategies and interim conservation measures were completed as designed and on schedule. Implementation monitoring items have an "IM" prefix followed by the number of the strategy action or interim conservation measure they address. For example IM-1.1 refers to the implementation monitoring item which addresses strategy action 1.1 and IM-L-1 addresses interim conservation measure L-1. They are listed as follows:

IM-1.1: Annually record the % of total landowners contacted.

IM-1.2: Annually record the number of miles where work to restore slow-water refugia for winter parr was completed.

IM-2.1: Annually record the number of miles where work to restore water temperature for summer parr was completed.

IM-2.2: Annually record the % of total landowners contacted.

IM-3.1: Record how much research and management was supported.

IM-4.1: Record how much support was provided for research and management.

IM -4.2: Record whether and how specified outreach to fishermen and landowners was provided.

IM-L-1: In 2011, record whether: 1) a NFCP viability assessment on the subbasin's Pacific lamprey population was completed; 2) measures were taken to correct viability concerns; and 3) conservation recommendations were provided to the Coquille Watershed Association and others involved in activities affecting this species.

IM-L-2: In 2012, record whether: 1) a NFCP viability assessment on the subbasin's brook lamprey population was completed; 2) measures were taken to correct viability concerns; and 3) interim conservation recommendations were provided to the Coquille Watershed Association and others involved in activities affecting this species.

IM-L-3: In 2009, record whether: 1) specified lamprey passage requirements were determined; and 2) this information was shared with Coos County Road Department, FS, BLM, ODF, ODOT and the public.

IM-L-4: In 2010, record whether lamprey barriers were identified.

IM-L-5: In 2010, record whether all man-made barriers were prioritized for retrofitting or replacement using OWEB's suggested protocol for site selection.

IM-L-6: In 2032, record whether passage through all high priority man-made barriers was restored.

IM-C-1: In 2009, record whether: 1) a NFCP viability assessment on the subbasin's spring-run chinook population was completed; 2) conservation measures were taken to correct viability concerns; and 3) conservation recommendations were provided to the Coquille Watershed Association and others involved in activities affecting this species.

IM-C-2: In 2009, record whether: 1) the distribution, use, condition and restoration potential of all summer holding pools within the subbasin was determined; and 2) the summer 7-day maximum and minimum average water temperature within each summer holding pool and its connected tributaries was collected.

IM-C-3: In 2011, record whether a restoration priority of all summer holding pools within the subbasin was established.

IM-C-4: At the end of 2011, record whether restoration of at least one high priority summer holding pool habitat was started and record when the remaining high priority sites were completed.

Effectiveness monitoring - Effectiveness monitoring involves determining whether conservation actions and interim conservation measures produced the intended results. This will be accomplished using a combination of project-level monitoring within the Subbasin Plan and broad-scale effectiveness monitoring conducted under the various State programs described in Section 6.5.1. Three effectiveness monitoring topics will be addressed: 1) beaver management; 2) water temperature; and 3) spring-run chinook holding pools. Effectiveness monitoring items have an "EM" prefix. They are listed as follows:

EM-1: Determine the success of beaver re-introductions by evaluating the results of annual follow-up surveys conducted on all re-introduction attempts that document the following: 1) whether re-introduced beaver occupied the intended site; 2) whether their food supply was sustainable; 3) whether beaver created pools used by winter parr; 4) conflicts with land use activities; and 5) recommendations from landowners on how to best mange for beaver. This item relates to the State's research topic 5.

EM-2: Determine the percent stream area shaded and the 7-day minimum and maximum water temperature on all coho summer rearing sites where restoration was completed 12-years prior. Compare data from treated stream reaches to untreated reaches with similar characteristics of elevation, aspect, orientation, width, etc. to: 1) record whether restoration work increased stream shade and lowered water temperature; 2) determine which restoration techniques were most effective in reducing water temperature; 3) document unexpected outcomes; and 4) predict a timeline for achieving the desired temperature. Record this data in 2019 and 2031.

EM-3: Record the 7-day minimum and maximum average temperatures and level of spring-run chinook use of all treated and untreated summer holding pools and compare this data with pre-treatment data to determine if restoration work increased use.

Table 6-5. Summary of Monitoring Plan showing the description of monitoring item and responsible party.

Item No.	Description 1]	Responsible Party 1]
IM-1.1	Annually record the % of total landowners contacted.	CWA
IM-1.2	Annually record the number of miles where work to restore slow-water refugia for winter parr was completed.	CWA
IM-2.1	Annually record the number of miles where work to restore water temperature for summer parr was completed.	CWA
IM-2.2	Annually record the % of total landowners contacted.	CWA
IM-3.1	Record how much research and management was supported.	ODFW
IM-4.1	Record how much support was provided for research and management.	ODFW
IM-4.2	Record how specified outreach to fishermen and landowners was provided.	ODFW
IM-L-1	IM-L-1: In 2011, record whether: 1) a NFCP viability assessment on the Coquille subbasin's Pacific lamprey population was completed; 2) measures were taken to correct viability concerns; and 3) conservation recommendations were provided to the CWA and others involved in activities affecting this species.	ODFW
IM-L-2	IM-L-2: In 2012, record whether: 1) a NFCP viability assessment on the subbasin's brook lamprey population was completed; 2) measures were taken to correct viability concerns; and 3) interim conservation recommendations were provided to the CWA and others involved in activities affecting this species.	ODFW
IM-L-3	IM-L-3: In 2009, record whether: 1) specified lamprey passage requirements were determined; and 2) this information was shared with Coos County Road Department, FS, BLM, ODF, ODOT and the public.	Coquille Tribe
IM-L-4	In 2010, record whether lamprey barriers were identified.	Coquille Tribe
IM-L-5	In 2010, record whether all man-made barriers were prioritized for retrofitting or replacement using OWEB's suggested protocol for site selection.	Coquille Tribe
IM-L-6	In 2032, record whether passage through all high priority man-made barriers was restored.	Coquille Tribe
IM-C-1	IM-C-1: In 2009, record whether: 1) a NFCP viability assessment on the subbasin's spring-run chinook population was completed; 2) conservation measures were taken to correct viability concerns; and 3) conservation recommendations were provided to the CWA and others involved in	ODFW

	activities affecting this species.	
IM-C-2	In 2009, record: 1) whether the distribution, use, condition and restoration potential of all holding pools within the subbasin was determined; and 2) record whether the summer 7-day maximum and minimum average water temperature within each holding pool and its connected tributaries was collected.	FS
IM-C-3	In 2011, record whether the restoration priority of all holding pools within the subbasin was established.	ODFW
IM-C-4	At the end of 2011, record whether restoration of at least one high priority holding pool habitat was started and record when the remaining high priority sites were completed.	FS
EM-1	EM-1: Determine the success of beaver re-introductions by evaluating the results of annual follow-up surveys conducted on all re-introduction attempts that document the following: 1) whether re-introduced beaver occupied the intended site; 2) whether their food supply was sustainable; 3) whether beaver created pools used by winter parr; 4) conflicts with land use activities; and 5) recommendations from landowners on how to best mange for beaver. This item relates to the State's research topic 5.	ODFW
EM-2	EM-2: Determine the percent stream area shaded and the 7-day minimum and maximum water temperature on all coho summer rearing sites where restoration was completed 12-years prior. Compare data from treated sites to untreated sites with similar characteristics of elevation, aspect, orientation, width, etc. to: 1) record whether restoration work increased stream shade and lowered water temperature; 2) determine which restoration techniques were most effective in reducing water temperature; 3) document unexpected outcomes; and 4) predict a timeline for achieving the desired temperature. Record this data in 2019 and 2031.	CWA
EM-3	EM-3: Record the 7-day minimum and maximum average temperatures and level of spring-run chinook use of all treated and untreated summer holding pools and compare this data with pre-treatment data to determine if restoration work increased use.	FS

1] CWA refers to the Coquille Watershed Association.

6.5.3 Adaptive Management Plan

Adaptive management is the process of routinely analyzing specific research and monitoring information for the purpose of determining if changes in management are warranted and how to best proceed. The primary means by which relevant data will be tracked and evaluated is through the use of the Annual, six-, 12-, 18- and 24-year Reports. Some of the data tracked in these reports will be compiled under the CCP (2007), OWEB or other programs. In other cases, data will be generated under the Subbasin Plan.

Annual Reports

Annual Reports are to be completed to provide a record of the current situation for the purpose of making incremental improvements in plan efficiency over time. Each Annual Report will include four parts as follows:

1. Summary of the State's Findings – This part includes: 1) a copy of the current CCP (2007) Annual Report; 2) highlights of relevant hatchery or fishery management changes; 3) a summary of relevant research and monitoring findings; and 4) a summary of findings related to State agency effectiveness in implementing the CCP (2007).

2. Summary of Subbasin Plan's Findings – This section has five functions: 1) records the progress toward implementing each of the strategy actions listed in Section 6.3, including actual costs and accomplishing party; 2) provides a rationale and list of remedial actions taken to address strategy actions that were not completed on schedule or within budget; 3) tracks the results of each year with the cumulative effort of previous years; 4) assesses whether recommendations provided in previous years were effective in addressing the identified problems; and 5) includes a summary of the completed monitoring items listed in Table 6-5.

3. Relevant Environmental or Social Changes – This part notes important environmental and social changes which occur in the subbasin. These include changes in the biological or management status of species (e.g., listing under ESA), significant changes in land ownership or land use regulation, newly identified threats or limiting factors, and major disturbances (e.g., floods, large wildfires).

Six-, 12-, 18- and 24-year Reports

These reports will be used to compile specific information from the Annual Reports and provide a check point for summarizing and evaluating the progress of the Subbasin Plan, incorporating new information, and recommending a course of action for the future. They will be organized in three parts as follows:

1. Research, Monitoring and Evaluation - This part will summarize the findings from the previous Annual Reports, evaluate them in total, and provide recommendations as needed. Whether implementation of monitoring items occurred on schedule and within budget will be documented. If major problems occurred in the proposed schedule or budget, recommendations to rectify the problems will be provided. If the problems can not be rectified, the Subbasin Plan will be revised.

2. Habitat Restoration – This part will summarize the findings from previous Annual Reports, evaluate them in total, and provide recommendations as needed. Whether restoration was accomplished on schedule and within budget will be documented. If major problems occurred in the proposed schedule or budget, recommendations to rectify the problems will be provided. If the problems can not be rectified, the Subbasin Plan will be revised.

3. Biological Performance – This part will record the ODFW estimates of adult abundance, compare them with the desired status goal levels depicted in Table 6-6, and provide a recommendation for the future. In the event the adult abundance values meet or exceed those shown in Table 6-6, implementation of the Subbasin Plan should continue without major change. However, if adult abundance is significantly less than the goal level, the Subbasin Plan should be revised. The revision will include a critical review of the working hypothesis, the desired status, and proposed rate of implementation.

Table 6-6. Twelve-, 24-, and 30-year coho adult abundance goals under various marine survival rate categories.

Smolt to Adult Marine Survival 1]		Adult Abundance 2]		
Category	**Average Rate**	**12-year Goal**	**24-year Goal**	**30-Year Goal**
Extremely Low	1.1%	3,595	7,190	8,988
Low	4.4%	14,214	28,428	35,535
Medium	10.3%	30,940	61,880	77,350
High	15.0%	39,382	78,764	98,455

1] For wild fish as indexed at ODFW Life Cycle Monitoring Sites.
2] Values include only naturally-produced adult recruits (harvest quota + spawners). Assumptions for development of the 12- and 24-year goals include: a) all restoration work is successful; b) un-restored habitat does not degrade; c) a direct, straight line relationship exists between restoration effort and abundance; and d) biological response to restoration effort is immediate (i.e., no lag time). For example, the relationships for the 12- and 24-year abundance goals are 12/30 or 0.4 and 24/30 or 0.8, respectively. The 30-year goal is the same as the 50-year goal described in the CCP (2007).

6.6 Consistency with Related Mandates and Processes

A key goal of subbasin planning is to maintain consistency with federal, state and tribal entities. This Subbasin Plan complies with the mandates and processes discussed below.

6.6.1 Subbasin Planning

The Subbasin Plan was developed using the guidance found in the Technical Guide for Subbasin Planners (Northwest Power Planning Council Document 2001-20) and the Oregon Specific Guidance (Oregon Subbasin Planning Coordination Group. 2002).

6.6.2 Endangered Species Act

The focal species, OC coho salmon, was federally listed as Threatened under the ESA at the time the Subbasin Plan was being developed. However, it is no longer listed under the ESA.

Many components of the Subbasin Plan tier off of the CCP (2007). While the CCP (2007) does not include all of the components required of an ESA Recovery Plan, it can be modified to serve as a recovery plan in the event OC coho is listed in the future. Because the Subbasin Plan is intended to conserve coho at the population scale, it will improve the overall viability of the OC coho ESU.

6.6.3 Clean Water Act

ODEQ worked with the Siskiyou National Forest and Georgia-Pacific West Inc. to develop the South Fork Coquille Water Quality Management Plan (2000) as part of the TMDL process. The plan was approved by the EPA in 2001. The 303(d) listed parameters are temperature and habitat modification. The Subbasin Plan supports the goals and objectives of this plan.

The Coquille Watershed Association, under a grant with ODEQ, completed a riparian shade analysis of the subbasin. These data were used to select the best sites for restoring water temperature, a limiting factor reducing abundance of summer parr. Implementation of the Subbasin Plan will help achieve TMDL goals for water temperature throughout the subbasin.

6.6.4 Tribal Responsibilities

The Coquille Indian Tribe is the Bureau of Indian Affairs recognized Native American tribal entity of the Coquille people, who have traditionally lived on the southern Oregon Coast. They are members of the Confederated Tribes of Siletz, based in Siletz, Oregon and own 6,512 acres of non-contiguous reservation lands in southern Coos County. Their Tribal office is in Coos Bay, Oregon. They were the lead entity in development of the Subbasin Plan. As such, it is consistent with their policies.

6.6.5 Federal Land Management Planning

Both the BLM and FS were involved in development of the Subbasin Plan. Because the Subbasin Plan is consistent with their land use plans, opportunities exist to achieve mutual goals through sharing of restoration resources, technical expertise, data, and funds.

6.6.6 State Planning

The Subbasin Plan is fully consistent with, and supportive of, the Oregon Plan, NFCP, Fish Hatchery Management Policy, Amendment 13 (i.e., relating to the Pacific Fishery Management Council) and the CCP (2007). Many of the findings of the CCA (2005), developed under the NFCP, and the CCP (2007) were incorporated into the Subbasin Plan. The Subbasin Plan includes actions to improve habitat conditions for all native fish species present in the subbasin including spring-run chinook, Pacific lamprey, and brook lamprey. Monitoring will meet protocol developed by OWEB so that data can be shared by all entities involved in watershed restoration throughout the state.

Appendix: Information Sources

A.1 Water Quality Status of Subbasin Streams

The following data was taken directly from the Limiting Factors Report (2005).

A.1.1 Water Quality Limited Streams

Following is a list of Water Quality Limited Streams and their affected parameter (see Table A.1-1).

Table A.1-1 Water Quality Limited Streams and their affected parameters.

Name	Description	Parameter 1]						
		DO	Fe	FC	CA	HM	FM	T
Alder Creek	Mouth to headwaters							X
Baker Creek	Mouth to headwaters							X
Battle Creek	Mouth to headwaters							X^
Bear Creek	Mouth to headwaters	X		X			X	
Belieu Creek	Mouth to headwaters							X
Bingham Creek	Mouth to headwaters							X
Boulder Creek	Mouth to headwaters							X
Coquille River	RM 4.2-35.6			X	X			
Coquille River	RM 0-35.6	X		X				
Coquille River	RM 21-35.3			X*				X
Cunningham Creek	Mouth to headwaters	X++		X**		X	X	
Dement Creek	Mouth to headwaters					X	X	X
E F Coquille River	Mouth to headwaters					X		X
Elk Creek	Mouth to headwaters						X	X
Fat Elk Creek	RM 0-2.2					X	X	
Ferry Creek	RM 0-3.6			X				
Fishtrap Creek	Mouth to headwaters		X					
Foggy Creek	RM 0-3.6					X		
Hall Creek	RM 0-9					X	X	
Middle Creek	Mouth to headwaters							X
M F Coquille River	Mouth to RM 39.6	X+				X		X^^
Moon Creek	RM 0-4.7					X		X
Myrtle Creek	RM 0-17					X		
N F Coquille River	RM 0-27.9	X+						X
N F Coquille River	RM 0-19					X	X	
N F Coquille River	RM 19-52.3					X		
N F Coquille River	RM 27-52.3							X
Panther Creek	RM 0-2.1					X		
Pulaski Creek	RM 0-2.5					X	X	
Rock Creek (-9883)	RM0-11.5					X		X
Rock Creek (-9735)	RM 0-14.8					X		
Rock Creek (-7212)	RM 0-3					X		
Rowland Creek	Mouth to headwaters							X
Sandy Creek	RM 0-5.2					X		
Salmon Creek	Mouth to headwaters							X
S F Coquille River	RM 0-18.1	X						
S F Coquille River	RM 0-18.9					X	X	

S F Coquille River	RM 19.3-42.2					X	X	
S F Coquille River	RM 18.1-62							X
Twelvemile Creek	Mouth to headwaters							X
Unnamed 1 (-9955)	Mouth to headwaters							X
Wooden Rock Creek	RM 0-7.9					X		
Woodward Creek	Mouth to headwaters							X

Source – ODEQ Oregon's 2004/2006 Integrated Report. Data in the above table compiled from ODEQ website on 11/17/06.
1] Includes pollutant and non-pollutant parameters.
CA = Chlorophyll A – Summer
HM = Habitat Modification
T = Temperature – Summer
Fe = Iron
DO = Dissolved oxygen – salmonid spawning: October – April.
FM = flow modification
FC = Water Contact Recreation (Fecal Coliform): Fall – Spring
+ = Dissolved Oxygen – Cold Water Aquatic Life: May – September
* = Fecal Coliform – Shellfish Growing Waters – Annual
++ = Dissolved Oxygen – Annual
** = Water Contact Recreation (Fecal Coliform) – Fall – Spring and Summer
^ = Temperature – 10/1 through 5/31
^^ = Temperature - annual

A.1.2 Streams with a "Needs Data" status

Following is a list of streams with a "needs data" status (see Table A.1-2).

Table A.1-2. Streams with a "Needs Data" status.

Name	Description	Parameter
Baker Creek	Mouth to headwaters	Sediment
Beaver Creek	Mouth to headwaters	Algae Dissolved Oxygen Nutrients Sediments
Bill Creek	Mouth to headwaters	Temperature
Elk Creek	Mouth to headwaters	Sediment
Foggy Creek	Mouth to headwaters	Sediment Temperature
Hall Creek	Mouth to headwaters	Sediment
Middle Fork Coquille River	Upper Rock Creek to headwaters	Sediment Temperature
Panther Creek	Mouth to headwaters	Temperature
Rock Cr (Myrtle Cr Drainage)	Mouth to headwaters	Sediment
Twelvemile Creek	Mouth to headwaters	Sediment
Wooden Rock Creek (M F)	Mouth to headwaters	Habitat Modification

A.2 Aquatic Habitat Inventory Analysis

This section was taken from the Limiting Factors Report (2005). Since the Limiting Factors Report was written, the USGS changed the delineation and names of some of the watersheds. For example, what was previously called the Mainstem Coquille Subbasin is now referred to as the Lower Coquille Watershed. These changes have been made in this section. Also, note the definition of *limiting factor* used in this analysis varies from the NOAA Fisheries definition used in the body of the Subbasin Plan (see section 4.5.1).

A.2.1 Introduction

Habitat conditions were identified using ODFW habitat benchmarks and associated threshold values. Over the course of several years, ODFW conducted an Aquatic Habitat Inventory (AHI) project which entailed extensive field surveys of Oregon streams. In the subbasin, 132 out of 241 (55%) streams were surveyed by ODFW between 1994 and 2002. This analysis provides detailed information, by reach, of 20 habitat features, ranging from the width of the active stream channel to the number of large riparian conifers present. Instead of using the full 20 habitat assessment criteria presented in the AHI, six key factors contributing to stream health were selected, as demonstrated in Flitcroft et al. 2002. The full habitat assessment data set (i.e. reach summaries) is presented below.

As suggested by Foster et al. (2001), benchmarks provide a method for comparing values of key components and allow an estimate of whether a component is high or low in a reach. However, the natural history of the reach must be taken into account as well (i.e. climate, geology, vegetation, disturbance history). The amount of large wood debris is often used to gauge the condition of the habitat and to evaluate its influence on the life history of fishes. This, and the following information, is presented by Foster et al. (2001) as a caveat to AHI use:

> *"For example, 8 pieces of large wood debris/100m may be very low for a stream in the Cascade Mountains, but extremely high for a stream in the high desert of Southeastern Oregon. . . Similarly, a reach in the Cascade Mountains may have 8 pieces of large wood debris/100m, but neighboring reaches may have 25 pieces per 100m. Variability within a watershed reflects normal disturbance and hydrologic cycles as well as management history. Again, the natural regime of a stream is as important as the range of values within a watershed. . . The components and values in the [AHI] table provide a starting point for comparing the distribution of habitat within a watershed and their importance to fish. They are only useful when place in the natural context of the streams in a watershed and the life history diversity of fishes."*

The following analysis is an attempt to examine ODFW benchmark criteria and compare them with the available AHI data for each reach within each watershed of the Coquille subbasin. In each case, the life history requirements of OC Coho salmon were taken into account, as was the natural history of each drainage under consideration. The section is organized by watershed.

It should be noted, however, that survey data may not reflect actual conditions as they exist today. Habitat conditions have changed on some stream reaches over time due to changes in riparian vegetation, management, or bank full flow events. Also, stream survey protocol does not require a measurement of gravel depth. Therefore, gravel too shallow to serve as spawning gravel would not be differentiated from suitable spawning gravel.

A summary of the fish habitat conditions is presented in this section. Detailed reach-by-reach analyses are provided below.

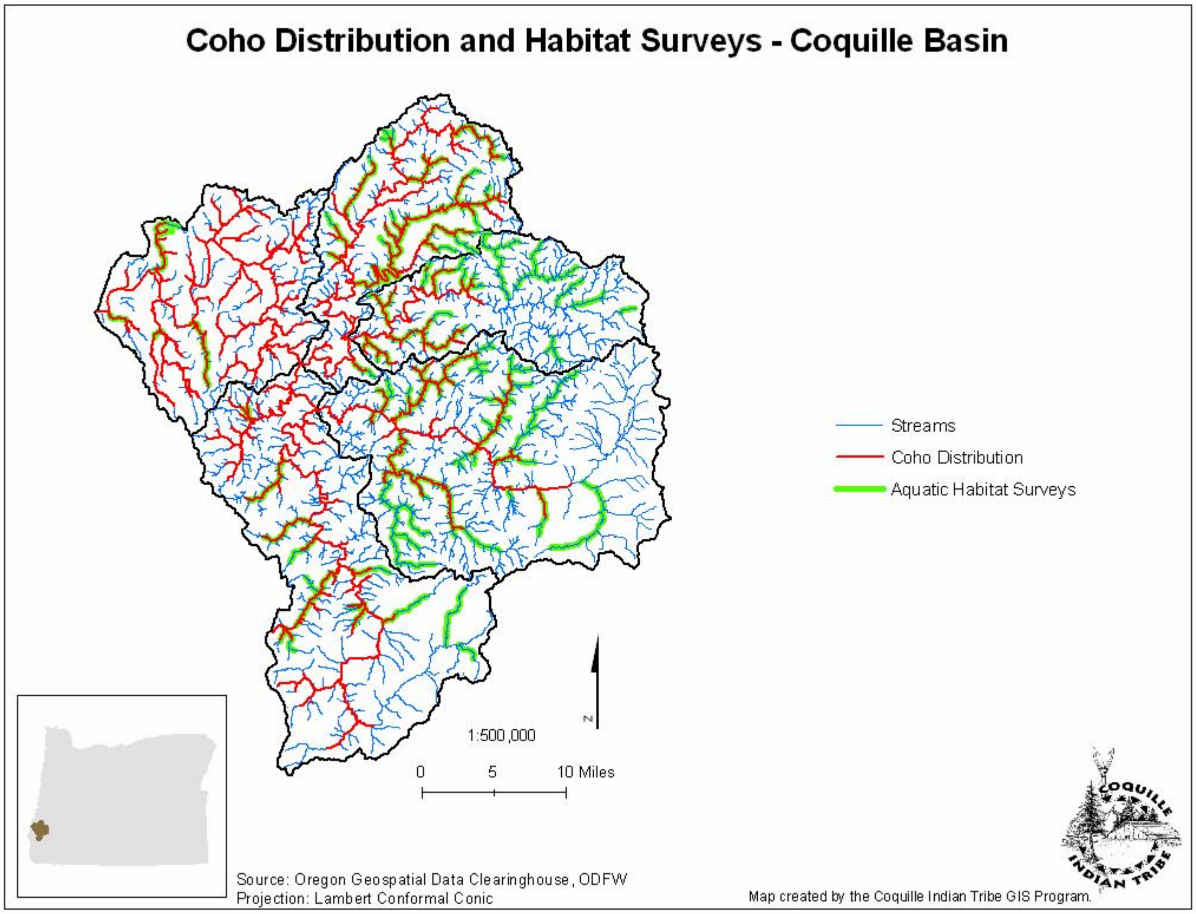


Figure A.2-1. Coho distribution and Aquatic Habitat Inventories survey locations in the Coquille Subbasin.

A.2.2 East Fork Coquille Watershed

Summary

Twenty-three streams (or stream groups, in the case of tributaries) were identified and analyzed to determine limiting factors in habitat for OC Coho Salmon. ODFW Aquatic Habitat Inventory stream report data was used to conduct this analysis. Low order streams were the focus of these surveys. As a result, there is no habitat inventory data for the higher order mainstem of the East Fork Coquille River.

Within each stream analysis, this report presents two habitat inventory summary tables. The first table provides the actual percentages of six broad habitat benchmark criteria, as averaged for each reach. These six criteria were selected for use as described in the Oregon Plan 2002 Western Stream Report (Flitcroft et al. 2002):

1. Pool area greater than 35% of total habitat area
2. Fine sediments (<4mm diameter) in riffle units less than 12% of all sediments
3. Gravel (4-64m diameter) in riffle units greater than or equal to 35% of all sediments
4. Volume of large woody debris greater than $20m^3$ wood/100m stream length
5. Shade greater than 70%
6. Large riparian conifers (>0.5m dbh) more than 150 trees per 305m stream length

These six benchmarks were further broken down and analyzed according to ODFW habitat benchmark thresholds on a sliding scale (*Desirable – Moderate –Undesirable*) as defined in (Foster et al. 2001). Throughout the analysis, attention was given to the natural regime of the stream in order to present the most accurate representation of potential limiting factors in the East Fork Coquille River system.

To summarize, twenty-three analyses were conducted on this subwatershed. The majority of the reaches surveyed were limiting in large riparian conifers. Various reaches were limited by the remaining six habitat components as well, but none to the extent of large riparian conifers.

Habitat Component	Number of Streams Limiting	Total Number of Streams	Percentage of Streams Limited
Riparian conifers	22	23	96%
Fines	13	23	57%
LWD	11	23	48%
Gravel	9	23	39%
Pools	7	23	30%
Shade	1	23	4%

Two streams in the North Fork Coquille Watershed have been identified by ODEQ as being water quality limited:

Stream	River Mile	Parameter	Season	List Date
East Fork Coquille River	0 to 26.2	Temperature	Summer	1998
Elk Creek	0 to 5.7	Temperature	Summer	1998

Individual Stream Reports

Bills Creek - One reach was surveyed on Bills Creek. Primary land use is timber production, with stands consisting of second growth timber. Bills Creek is a high gradient (14.2%) stream that is constrained by hillslopes.

A small concrete dam has been constructed by a private landowner on the reach. A 2.9 meter high step-over-boulders at unit 71 (1840 meters) appears to be an upstream barrier.

Reach	Length (m)	Year	%Open Sky	% Fines	% Gravel	% Pools	LWD	Riparian conifers
1	2561	1997	1	10	23	4	28	61

Limiting Factors:

1. Riparian Conifers
2. Pool Area and Frequency
3. Gravel

Reach	Pools			Riffles		Shade	LWD		Riparian Conifers	
	% Area	Freq.	Depth	Gravel	Fines		No.	Vol.	>20"dbh	>35"dbh
1	U	U	M	M	M	D	M	M	U	U

A small number of large riparian conifers are present along the surveyed reach of Bills Creek, but the number is not large enough to meet ODFW habitat benchmark criteria for this watershed. Pool habitat characteristics are undesirable to moderate for juvenile rearing and overwintering; this is probably a function of the stream's high gradient natural history. Spawning habitat is moderate, with lower-than-desirable amounts of gravel, and higher-than-desirable amounts of fine sediments present in riffles.

Camas Creek - Four reaches were surveyed on Camas Creek. Primary land use is timber production, with stands consisting of second growth timber. Camas Creek is a low to moderate gradient stream, with its channel constrained by hillslopes. High numbers of large boulders were documented in reaches 1 and 2. There is very little area in side channel habitat.

Two large bedrock falls appear to be passage barriers. The falls at survey end (represented on 7.5' topographic map) has a height of 17 meters. Numerous bridge failures were observed on Camas Creek Road.

Reach	Length (m)	Year	%Open Sky	% Fines	% Gravel	% Pools	LWD	Riparian conifers
1	2789	1997	7	6	16	24	5.2	
2	3355	1997	2	8	12	8.7	5.9	41
3	3629	1997	4	2	40	39.7	15.3	
4	1574	1997	1	20	80	33.3	46.2	122

Limiting Factors:

1. Riparian Conifers
2. LWD
3. Gravel
4. Pools

Reach	Pools			Riffles		Shade	LWD		Riparian Conifers	
	% Area	Frequency	Depth	Gravel	Fines		Number	Volume	>20"dbh	>35"dbh
1	M	M	D	M	D	D	U	U	No Data	
2	U	U	D	U	D	D	U	U	U	U
3	D	D	D	D	D	D	U	U	No Data	
4	D	M	M	D	M	D	D	D	U	U

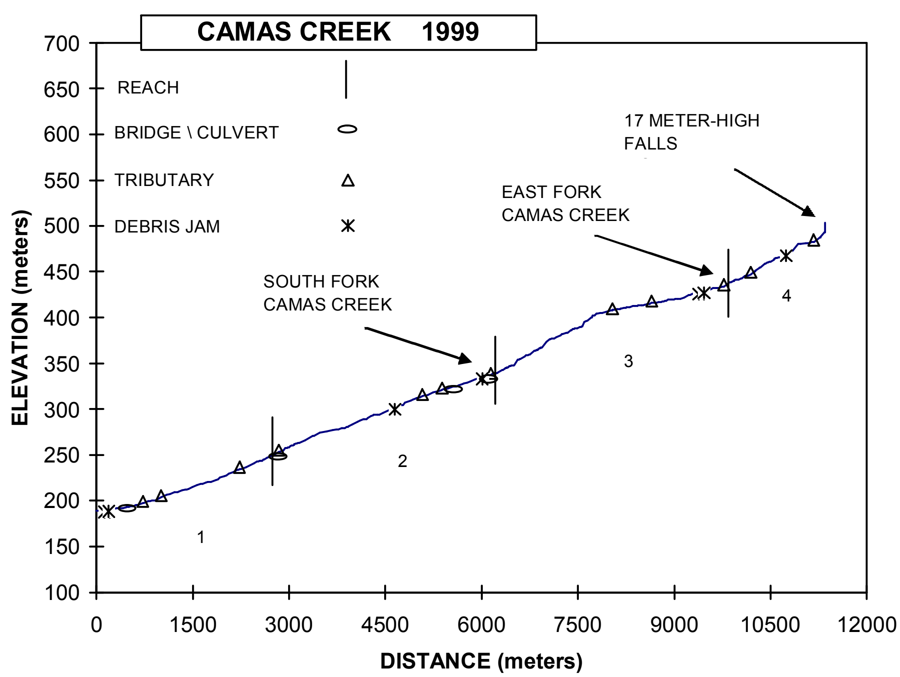
Although large riparian conifers are present in reaches 2 and 4, their numbers are still too low to be considered even moderately achieving habitat benchmark criteria. Riparian communities largely dominated by hardwoods provide desirable levels of shade to the stream.

With the exception of reach 2, pool characteristics are moderate to desirable, on average. Reach 2 is limiting in the area and frequency of pool habitat. In addition, gravel is a limiting factor in reach 2 as well, as is LWD.

LWD is limiting in all reaches except reach 4. The undesirable level of LWD in the first three reaches indicates low levels of habitat complexity are available to juvenile and overwintering coho.

The amount of gravel is not limiting in this system, with the exception, as already mentioned, of reach 2. The remaining reaches appear to contain high to moderate quality spawning habitat. While a number of bridge failures were noted during the survey, barriers to fish passage were not evident, until the 17 meter falls at the end of the survey.

Stream Profile Graph: Camas Creek



Camas Creek Section 13 Tributary - One reach was identified on the Section 13 Tributary to Camas Creek. Primary land use on this stream is timber production, with stands consisting of second growth timber. The Section 13 Tributary to Camas Creek is a high gradient stream, with a low degree of bank erosion and little available off-channel habitat. Numerous natural barriers to fish migration were documented throughout the survey, including a natural falls 307 meters upstream from the confluence with Camas Creek. Numerous natural fish barriers are present, including a 30 meter-high falls at unit17 (307 meters from the survey start).

Reach	Length (m)	Year	%Open Sky	% Fines	% Gravel	% Pools	LWD	Riparian conifers
1	2140	1997	12	27	61	33.3	60.8	No data

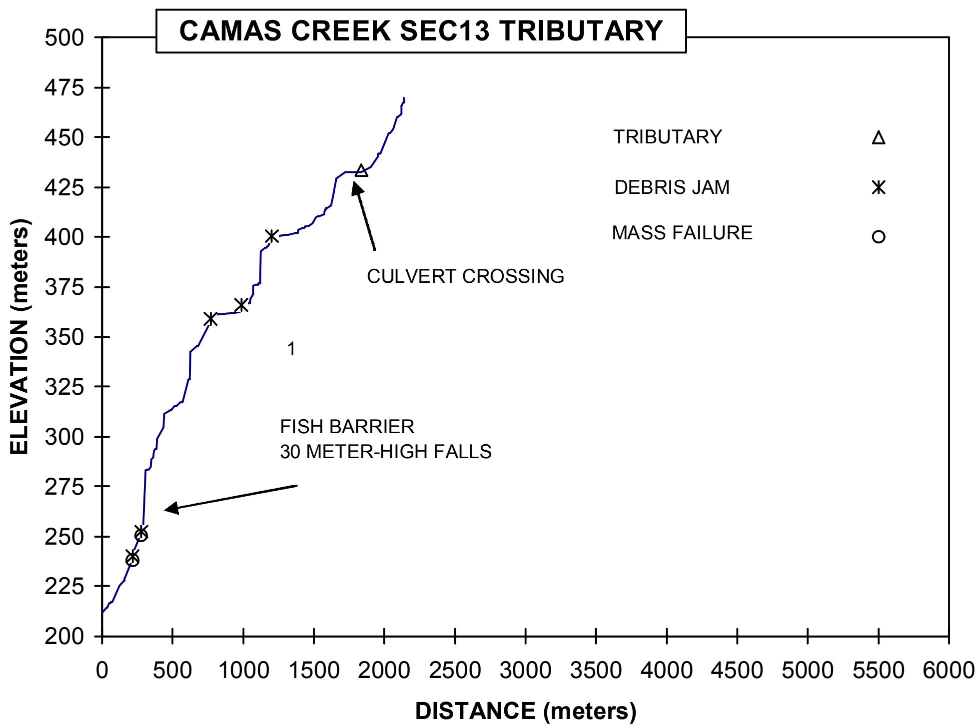
Limiting Factor:

1. Fines

Reach	Pools			Riffles		Shade	LWD		Riparian Conifers	
	% Area	Frequency	Depth	Gravel	Fines		Number	Volume	>20"dbh	>35"dbh
1	M	D	D	D	U	D	D	D	No data	

The only factor limiting in this stream is the percentage of fines in riffles, which may compromise spawning efforts. There is no data regarding the number of large riparian conifers, but the surveyors documented that the riparian community was dominated by hardwoods. This indicates that large riparian conifers are also limiting in this system.

Stream Profile Graph: Section 13 Tributary to Camas Creek



China Creek - Two reaches were identified along China Creek. Primary land use is timber production, with stands consisting of second growth and large timber. China Creek is a moderately high gradient stream, with its channel constrained by hillslopes. A relatively high percentage of reach 2 is available as side-channel habitat. A small concrete fish weir has been built near the mouth of China Creek as an egg-taking station for steelhead. Two natural boulder steps at 1922 and 2020 meters present potential barriers to fish migration. A 3 meter high boulder step at unit 104 (1922 m) and a 4 meter high boulder step at unit 108 (2020 m) appear to barriers to upstream fish migration.

Reach	Length (m)	Year	%Open Sky	% Fines	% Gravel	% Pools	LWD	Riparian conifers
1	754	1997	7	3	12	32	38	no data
2	1709	1997	5	2	12	17	91	20

Limiting Factors:

1. Riparian Conifers
2. Gravel

Reach	Pools			Riffles		Shade	LWD		Riparian Conifers	
	% Area	Frequency	Depth	Gravel	Fines		Number	Volume	>20"dbh	>35"dbh
1	M	D	M	U	D	D	M	D	No data	
2	M	U	D	U	D	D	D	D	U	U

The number of large riparian conifers is limiting in reach 2 of China Creek. No data is available for reach 1; however, in the written report for China Creek, the riparian community is documented as being dominated by hardwoods. Pool characteristics are moderate to desirable, on average, and the level of fines in riffles is at desirable levels. However, there is an extreme deficit in the amount of gravel available, which limits this stream's ability to provide adequate spawning habitat.

China Creek Tributary A - One reach was surveyed on Tributary A to China Creek. Primary land use is timber production, with stands consisting of second growth timber. Tributary A is a high gradient stream, with negligible bank erosion, little area in side channels, and is constrained by hillslopes.

Reach	Length (m)	Year	%Open Sky	% Fines	% Gravel	% Pools	LWD	Riparian conifers
1	1182	1997	7	9	20	15	37	20

Limited Factors:

1. Riparian Conifers
2. Pool Frequency

Reach	Pools			Riffles		Shade	LWD		Riparian Conifers	
	% Area	Freq.	Depth	Gravel	Fines		No.	Vol.	>20"dbh	>35"dbh
1	M	U	M	M	D	D	M	D	U	U

The number of large conifers in the riparian community is limiting as a potential LWD source. The amount of shade provided the stream by the hardwood-dominated riparian community is desirable. Pool characteristics are moderate to undesirable; thus, this stream provides limited rearing and overwintering habitat for juvenile coho. Spawning habitat is adequate, but could be improved with larger percentages of gravel in riffle environments.

Dead Horse Creek - Three reaches were identified on Dead Horse Creek. Primary land use is timber production, with stands consisting of second growth and large timber. Dead Horse Creek is a high gradient stream, with moderate bank erosion, whose channel is constrained by hillslopes and terraces.

Three natural barriers (boulder and bedrock steps) present potential barriers to fish migration. The survey crew recommended examining the culvert drop at 3205 meters as a potential upstream migration barrier. The crew reported numerous landslides and large debris jams throughout the survey. The roadbed is eroding into the creek at unit 46 (740 m).

Reach	Length (m)	Year	%Open Sky	% Fines	% Gravel	% Pools	LWD	Riparian conifers
1	2742	1997	2	41	34	26	32	24
2	477	1997	4	21	33	3	20	0
3	1020	1997	0	30	60	23	80	0

Limiting Factors:

1. Riparian Conifers
2. Fines
3. Pool Area – reach 2

Reach	Pools			Riffles		Shade	LWD		Riparian Conifers	
	% Area	Freq.	Depth	Gravel	Fines		No.	Vol.	>20"dbh	>35"dbh
1	M	D	M	M	U	D	M	D	U	U
2	U	U	M	M	U	D	M	M	U	U
3	M	U	M	D	U	D	D	D	U	U

Large conifers are deficient in the riparian community. Pool characteristics are moderate to undesirable. Pool frequency is limiting in reaches 2 and 3; in addition, the percentage of the stream composed of pools (pool area) is limiting in reach 2. The high levels of LWD in the stream may mitigate the less than desirable pool characteristics. Spawning habitat is limited by high percentages of fines in riffles, presumably from documented mass failures along the stream and the fact that the road bed is eroding into the stream as well.

East Fork Brummit Creek - Six reaches were surveyed on the East Fork of Brummit Creek. Primary land use is timber production, with stands consisting of second growth, mature, and old growth timber. East Fork Brummit Creek is a moderately high gradient stream, with low levels of bank erosion, high numbers of instream boulders, and very little off-channel habitat. The channel is constrained by hillslopes and terraces.

Reach	Length (m)	Year	%Open Sky	% Fines	% Gravel	% Pools	LWD	Riparian conifers
1	1608	1998	16	11	15	26.7	38	0
2	1403	1998	17	12	26	31	30.8	0
3	1402	1998	12	25	54	37.8	132.8	61
4	993	1998	17	16	43	61.2	35.7	152
5	650	1998	4	13	17	16.2	12.2	no data
6	2297	1998	1	37	31	32.4	47.4	0

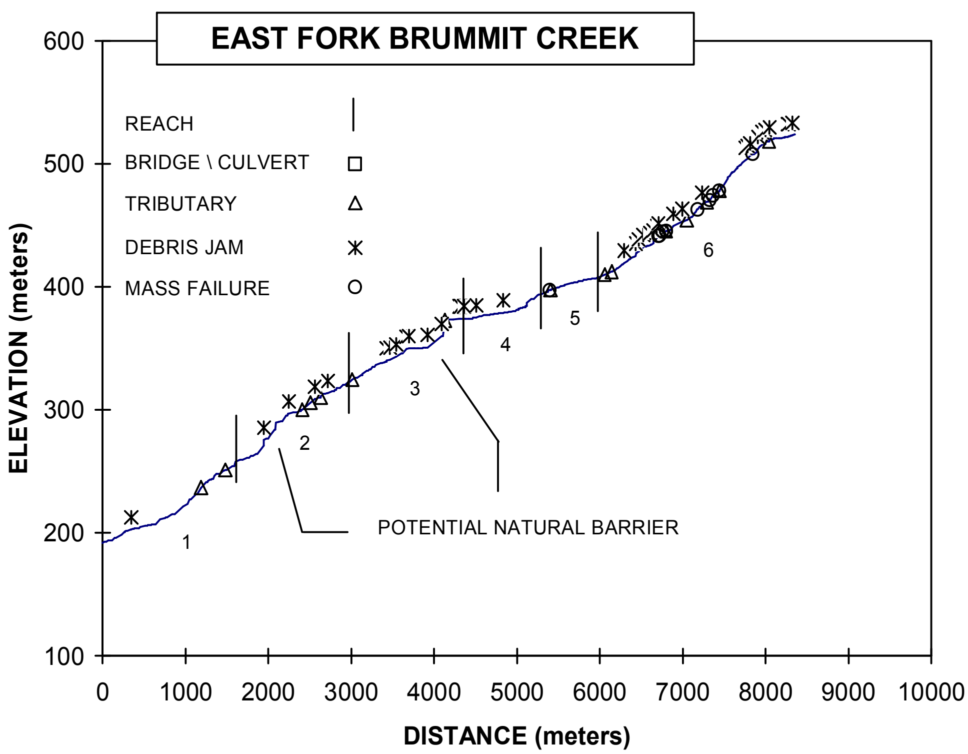
Limiting Factors:

1. Riparian Conifers
2. Fines – reaches 3 and 6
3. LWD – reach 4

Reach	Pools			Riffles		Shade	LWD		Riparian Conifers	
	% Area	Freq.	Depth	Gravel	Fines		No.	Vol.	>20"dbh	>35"dbh
1	M	M	M	M	M	D	M	D	U	U
2	M	M	M	M	M	D	M	D	U	U
3	D	D	D	D	U	D	D	D	U	U
4	D	M	D	D	M	D	D	D	M	U
5	M	M	U	M	M	D	U	U	No data	
6	D	M	M	D	U	D	D	D	U	U

Large riparian conifers are limiting in all reaches except reach 4. Reach 4 is limited in LWD, and depth of pools aw well. The percentage of fine sediments limits the potential for salmon spawning potential in reaches 3 and 6, but the remainder of the reaches surveyed appears to provide high quality spawning habitat. Pool habitat, on average, is moderate to desirable, indicating that East Fork Brummit Creek provides quality habitat for juvenile coho rearing and overwintering.

Stream Profile Graph: East Fork Brummit Creek



East Fork Camas Creek - Six reaches were identified on the East Fork of Camas Creek, and five were surveyed. Primary land use is timber production, with stands consisting of second growth and old growth timber. East Fork Camas Creek is a low to moderate gradient stream, the majority of which is constrained by hillslopes and terraces. Reach 6, however, is documented as an unconstrained single channel.

Several bedrock steps were identified throughout the survey. One, an 8 meter bedrock waterfall, presents a potential barrier to fish migration. A culvert crossing in reach 4 with a 20 cm step-up may present difficulties to migrating fish.

Reach	Length (m)	Year	%Open Sky	% Fines	% Gravel	% Pools	LWD	Riparian conifers
1	1758	2000	8	13	23	33.6	17.3	0
2	1001	2000	3	8	3	9.6	28.8	0
3	872	2000	No access					
4	802	2000	15	23	44	38.2	41.7	0
5	589	2000	15	30	48	43.2	84.9	183
6	453	2000	11	37	40	15.3	53.4	0

Limiting Factors:

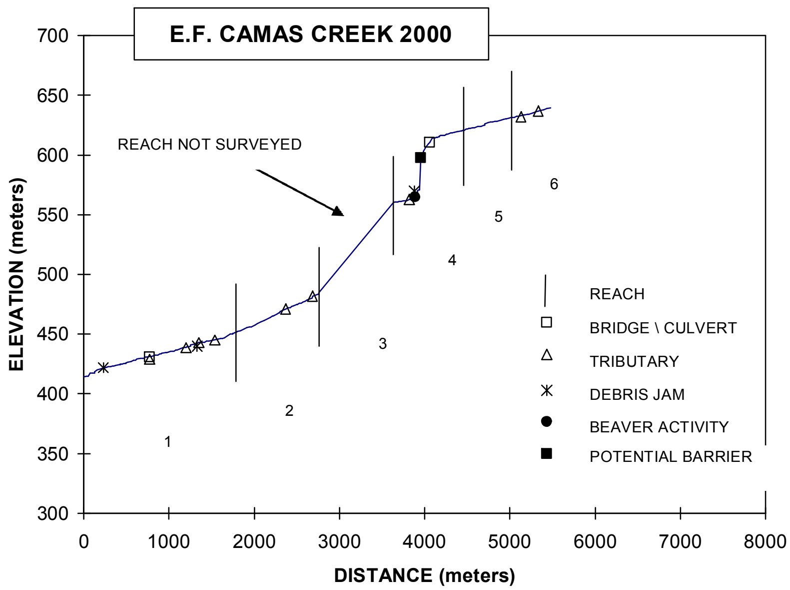
1. Riparian Conifers
2. LWD – reach 1
3. Fines – reaches 4-6
4. Gravel – reach 2
5. Pool Area – reach 2
6. Pool Frequency – reaches 2 and 6

Reach	Pools			Riffles		Shade	LWD		Riparian Conifers	
	% Area	Freq.	Depth	Gravel	Fines		No.	Vol.	>20"dbh	>35"dbh
1	M	M	D	M	M	D	D	U	U	U
2	U	U	D	U	D	D	D	M	U	U
3	No Access									
4	D	M	D	D	U	D	D	D	U	U
5	D	M	M	D	U	D	D	D	M	U
6	M	U	M	D	U	D	M	D	U	U

With the exception of reach 5, large riparian conifers are limiting along East Fork Camas Creek. Written survey reports for reaches 2, 4, 5, and 6 indicated that the riparian community hosts small (3-15cm diameter) conifers, indicating that, with time, the large riparian conifer benchmark criterion will be met. However, riparian transects in reach 1 did not indicate the presence of small riparian conifers, and while the hardwood community provides adequate shade to the stream, the potential for coniferous LWD contribution in this reach is limiting.

Pool characteristics are moderate to desirable, on average, and coupled with typically moderate to desirable instream LWD, habitat complexity appears to be high quality for rearing and overwintering juvenile coho. Spawning habitat is moderate, at best, limited by either inadequate amounts of gravel, or high percentages of fine sediments in riffles.

<u>Stream Profile Graph</u>: East Fork Camas Creek



<u>East Fork Coquille River</u> - Twelve reaches were identified, and eight were surveyed on East Fork Coquille River. Primary land use is timber production, with stands consisting of second growth and large timber. Timber harvest occurred recently on reach 10. The reaches surveyed along the East Fork Coquille River are low to moderate gradient reaches, typically constrained by hillslopes and terraces.

There are two potential barriers to upstream fish migration in the surveyed length. The first potential barrier is at unit 99 (5,203 meters). It is a bedrock cascade approximately five meters high. The second potential barrier is at unit 242 (10,799 meters). This unit is a bedrock cascade with a 22 percent slope. The crew noted landslides in reach 1, reach 2, reach and reach 9. Bridge crossings occur at unit 103 (5,354 meters), unit 136 (6,201 meters), unit 172 (6,900 meters), unit 443 (14,516 meters) and unit 468 (14,913 meters). There is a culvert crossing at unit 327 (12,349 meters). There is a 0.5 meter step associated with the culvert. Debris jams are present in units 256 (11,201 meters) and unit 368 (13,212 meters).

Reach	Length (m)	Year	%Open Sky	% Fines	% Gravel	% Pools	LWD	Riparian conifers
1	275	2000	No Access					
2	2259	2000	15	11	51	50.4	8	61
3	2380	2000	No Access					
4	1160	2000	19	10	14	24	2	0
5	972	2000	9	13	38	19	4.7	No data
6	1680	2000	No Access					
7	736	2000	6	12	22	24	26.4	No data
8	1260	2000	No Access					
9	543	2000	9	13	18	17	8.6	152
10	1199	2000	10	9	48	45	14.9	No data
11	1350	2000	5	14	37	22.5	12	No data
12	968	2000	11	13	43	21	5.7	30

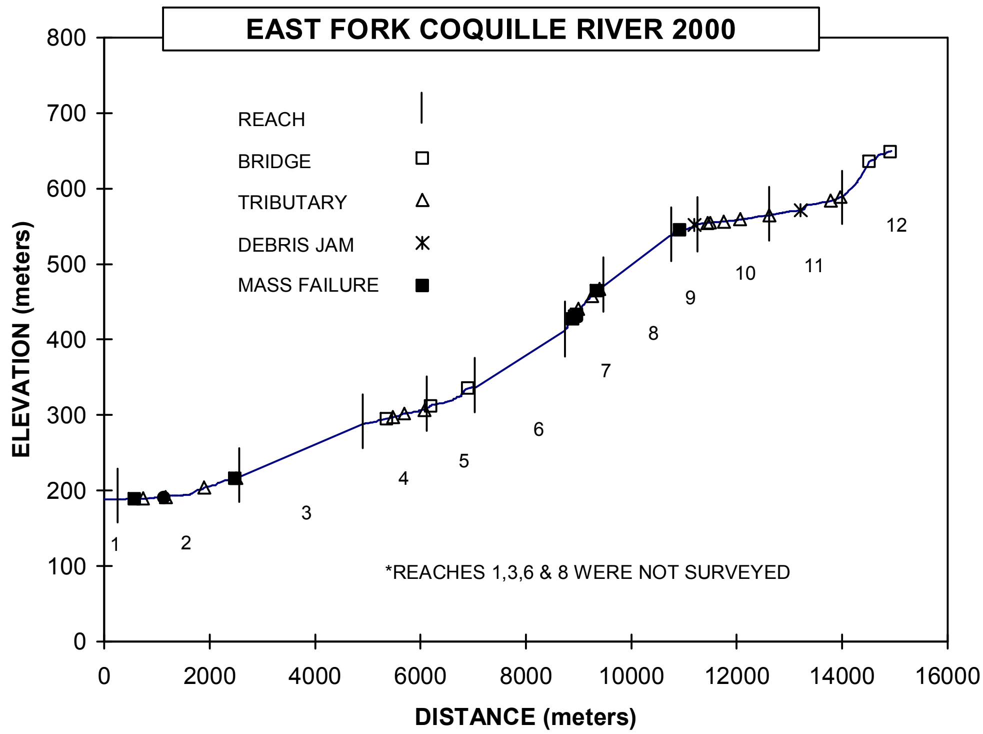
Limiting Factors:

1. Riparian Conifers
2. LWD
3. Gravel - reach 4
4. Temperature (DEQ 303(d) list)

Reach	Pools			Riffles		Shade	LWD		Riparian Conifers	
	% Area	Frequency	Depth	Gravel	Fines		No.	Vol.	>20"dbh	>35"dbh
1	No Access									
2	D	M	D	D	M	D	U	U	U	U
3	No Access									
4	M	D	M	U	M	D	U	U	U	U
5	M	M	D	D	M	D	M	U	No data	
6	No Access									
7	M	D	D	M	M	D	M	M	No data	
8	No Access									
9	M	M	D	M	M	D	D	U	M	M
10	D	D	D	D	D	D	M	U	No data	
11	M	M	M	D	M	D	M	U	No data	
12	M	M	M	D	M	D	U	U	U	U

Large riparian conifers are limiting in all reaches surveyed except reach 9, where their numbers are moderate. Levels of instream LWD are typically moderate to undesirable. Pool habitat is moderate to desirable, indicating that the East Fork Coquille River provides quality rearing and overwintering habitat for juvenile salmonids. Increasing LWD inputs would only enhance this aspect. Spawning habitat is of moderate to desirable quality as well. Gravel is limiting in reach 4, but the remainder of reaches has either moderate or desirable percentages of gravel.

Stream Profile Graph: East Fork Coquille River



Elk Creek - Five reaches were identified on Elk Creek and one on the Section 33 Tributary of Elk Creek. Primary land use is agriculture and second growth timber on Elk Creek, and old growth timber on the tributary. Elk Creek is a low gradient stream, with the exceptions of reach 5, where the gradient increases to 13.1%, and the tributary, where the average gradient is 11.5%. Bank erosion is moderate on average, but high in reach 1. A low percentage of the total stream area is in side channels, and the channel itself is constrained by terraces and hillslopes.

Logging activity was documented in the riparian transects in reach 3. Willows have been planted in sections of reach 1. A number of unspecified habitat restoration projects exist in reach 2.

Reach	Length (m)	Year	%Open Sky	% Fines	% Gravel	% Pools	LWD	Riparian conifers
1	1453	1997	30	23	65	74	5	0
2	3080	1997	3	19	29	66	2	30
3	1860	1997	4	14	24	59	30	49
4	834	1997	6	19	39	61	49	0
5	1721	1997	1	4	15	24	26	15
Sec33-1	2044	1997	2	0	87	36.2	75.9	30

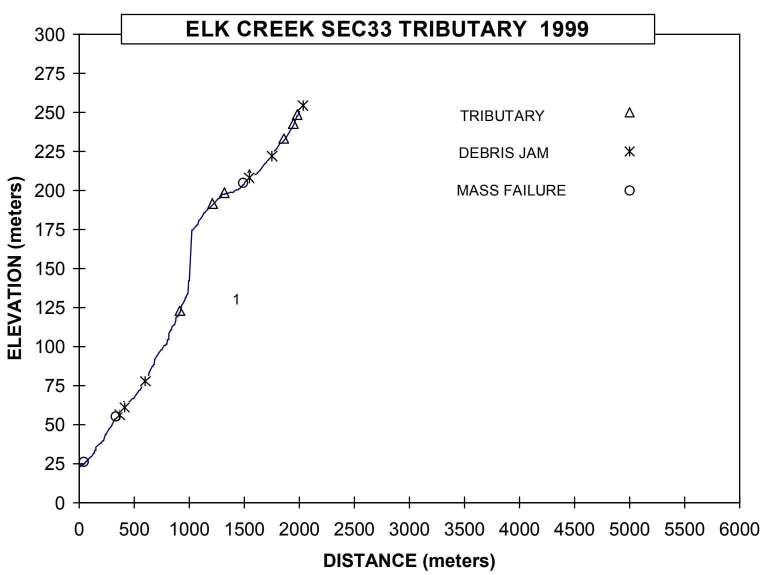
Limiting Factors:
1. Riparian Conifers
2. Fines
3. LWD – reaches 1 and 2
4. Temperature (DEQ 303(d) list)

Reach	Pools			Riffles		Shade	LWD		Riparian Conifers	
	% Area	Frequency	Depth	Gravel	Fines		No.	Vol.	>20"dbh	>35"dbh
1	D	M	M	D	U	D	U	U	U	U
2	D	D	D	M	M	D	U	U	U	U
3	D	M	M	M	M	D	M	D	U	U
4	D	M	M	D	M	D	D	D	U	U
5	M	M	M	M	D	D	M	M	U	U
Trib	D	D	M	D	D	D	D	D	U	U

Large riparian conifers are limiting in all reaches. Reach 3 of Elk Creek has the only riparian community in which small conifers were documented in the surveyors' written report. The Section 33 Tributary to Elk Creek has small conifers present in the riparian community as well. In the mainstem of Elk Creek, LWD is limiting in reaches 1 and 2, but is moderate to desirable in reaches 3-5.

Pool habitat is moderate to desirable, indicating that Elk Creek has the potential to provide quality rearing and overwintering habitat for juvenile coho. In addition, the percentage of gravel and fines generally falls within habitat benchmark criteria standards for either moderate or desirable levels. Other than reach 1, which exceeds the allowable percentage of fines in riffle habitat, Elk Creek provides quality spawning habitat as well. The Section 33 Tributary to Elk Creek exhibits habitats that should provide exemplary habitat for juvenile and adult coho salmon.

Stream Profile Graph: Section 33 Tributary to Elk Creek



Hantz Creek - Three reaches were identified on Hantz Creek. Primary land use is timber production, with stands consisting of second growth timber. Hantz Creek is a low gradient stream in the first two reaches, but transitions to a high gradient (11.7%) in reach 3. Backwater and pool areas comprised a significant portion of the overall stream area due to the presence of a large pond on the surveyed reach. A fish ladder allows passage above the Myrtle Point-Sitkum Road.

Reach	Length (m)	Year	%Open Sky	% Fines	% Gravel	% Pools	LWD	Riparian conifers
1	505	1997	10	30	70	88	2	no data
2	2184	1997	1	20	72	22	14	49
3	393	1997	0	0	30	6	9	0

Limiting Factors:
1. Riparian Conifers
2. LWD
3. Fines

Reach	Pools			Riffles		Shade	LWD		Riparian Conifers	
	% Area	Frequency	Depth	Gravel	Fines		No.	Vol.	>20"dbh	>35"dbh
1	D	M	M	D	U	D	U	U	No data	
2	D	M	M	D	U	D	D	U	U	U
3	D	U	M	M	D	D	M	U	U	U

Large conifers are limiting in the riparian community of Hantz Creek, although smaller conifers compose a proportion of those communities, indicating that, in time, large conifers will be present as a LWD source. Pool habitat is, on average, moderate to desirable, indicating that juvenile rearing and overwintering habitat is available. The percentage of fines in riffles is high and may limit the productivity of an otherwise healthy spawning environment.

Karl Creek - Five reaches were surveyed on Karl Creek. Primary land use is timber production, with stands consisting of a variety of age classes: young, second growth, mature, and large timber. Karl Creek is a moderate to high gradient stream, with moderate instream structure from boulders. Twenty-six percent of reach 4 consists of side channel habitat; increased levels of beaver activity were observed in reach 3. The stream channel is constrained by hillslopes. No barriers to fish migration were observed.

Reach	Length (m)	Year	%Open Sky	% Fines	% Gravel	% Pools	LWD	Riparian conifers
722	1998	1	6	12	42	42.5	99.4	30
656	1998	2	21	13	55	36.8	194	183
894	1998	3	12	38	30	68.2	138.8	274
224	1998	4	15	27	73	69.5	120.7	0
730	1998	5	11	20	60	29.2	58.5	no data

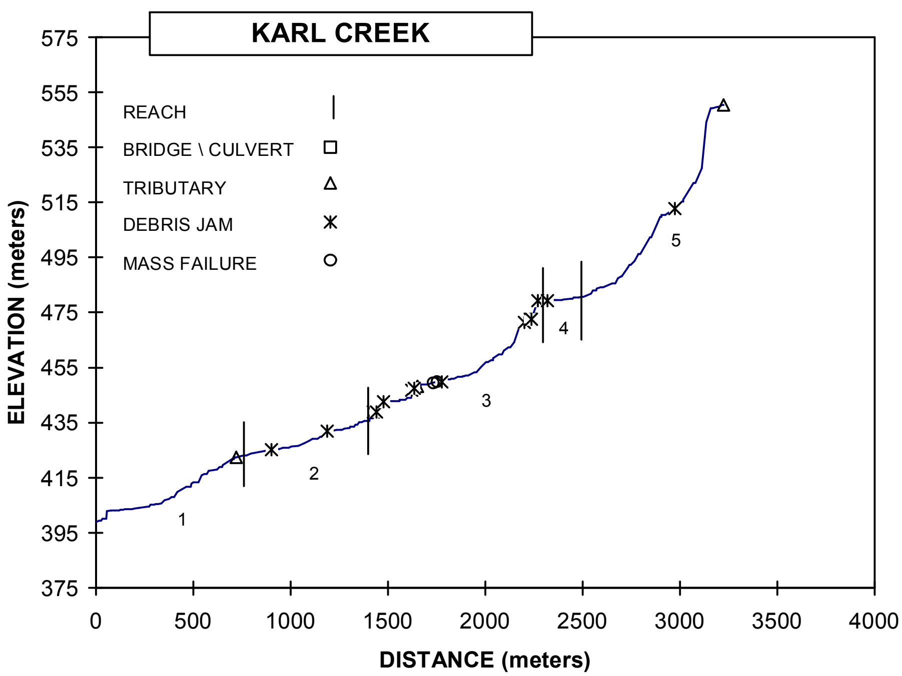
Limiting Factors:

1. Riparian Conifers – reaches 1 and 5
2. Fines – reaches 3-5

Reach	Pools			Riffles		Shade	LWD		Riparian Conifers	
	% Area	Frequency	Depth	Gravel	Fines		No.	Vol.	>20"dbh	>35"dbh
1	D	M	M	D	M	D	D	D	U	U
2	D	D	M	D	M	D	D	D	M	M
3	D	D	D	M	U	D	D	D	M	M
4	D	M	D	D	U	D	D	D	U	U
5	M	M	M	D	U	D	D	D	No data	

Riparian conifers are limiting in reaches 1 and 4, but the amount of shade and LWD provided to the stream is at desirable levels, and does not appear to be limited by the composition of the riparian community. Pool habitat is moderate to desirable, indicating quality rearing and overwintering habitat is available for juvenile coho. In addition, reaches 1 and 2 possess adequate spawning habitat. The levels of fines in reaches 3-5 may decrease the effectiveness of spawning efforts in these reaches.

Stream Profile Graph: Karl Creek



Knapper Creek - Two reaches were identified on Knapper Creek. Primary land use is timber production, with stands consisting of second growth timber. Knapper Creek is a moderate to high gradient stream, with little area in side channels, whose channel is constrained by hillslopes and terraces.

A 4 meter high step-over-bedrock at unit 52 (857 m) presents a potential fish passage barrier. Several steep cascades above the falls are also potential barriers. A single beaver dam was encountered at unit 72 (1238 m) but beaver activity did not appear recent.

Reach	Length (m)	Year	%Open Sky	% Fines	% Gravel	% Pools	LWD	Riparian conifers
1	591	1997	12	77	23	56	73	0
2	1103	1997	0	48	43	36	19	0

Limiting Factors:

1. Riparian conifers
2. Fines

Reach	Pools			Riffles		Shade	LWD		Riparian Conifers	
	% Area	Frequency	Depth	Gravel	Fines		No.	Vol.	>20"dbh	>35"dbh
1	D	D	D	M	U	D	D	D	U	U
2	D	U	D	D	U	D	M	U	U	U

Large conifers are limiting in the riparian community, but riparian transect surveys indicate that small conifers are present in good proportions, and this limiting factor is temporary. Pool habitat is excellent in reach 1, indicating that quality rearing and overwintering habitat is available. Reach 2 is a high gradient reach, and the frequency of pools is limiting. Spawning habitat is limited by the very high percentage of fines in the stream.

Lausch Creek - Two reaches were identified on Lausch Creek, but only one was surveyed due to access limitations. Primary land use is timber production, with stands consisting of old growth and second growth timber. Reach 2 of Lausch Creek is a high gradient (14.1%) reach whose channel is constrained by hillslopes.

Two potential natural barriers, in the form of bedrock falls, exist along the surveyed reach. In addition, a culvert crossing with a 0.9 meter step was identified. Beaver activity was observed in reach 2.

Reach	Length (m)	Year	%Open Sky	% Fines	% Gravel	% Pools	LWD	Riparian conifers
1	419	2000	No Access					
2	957	2000	13	64	7	65.4	88.7	76

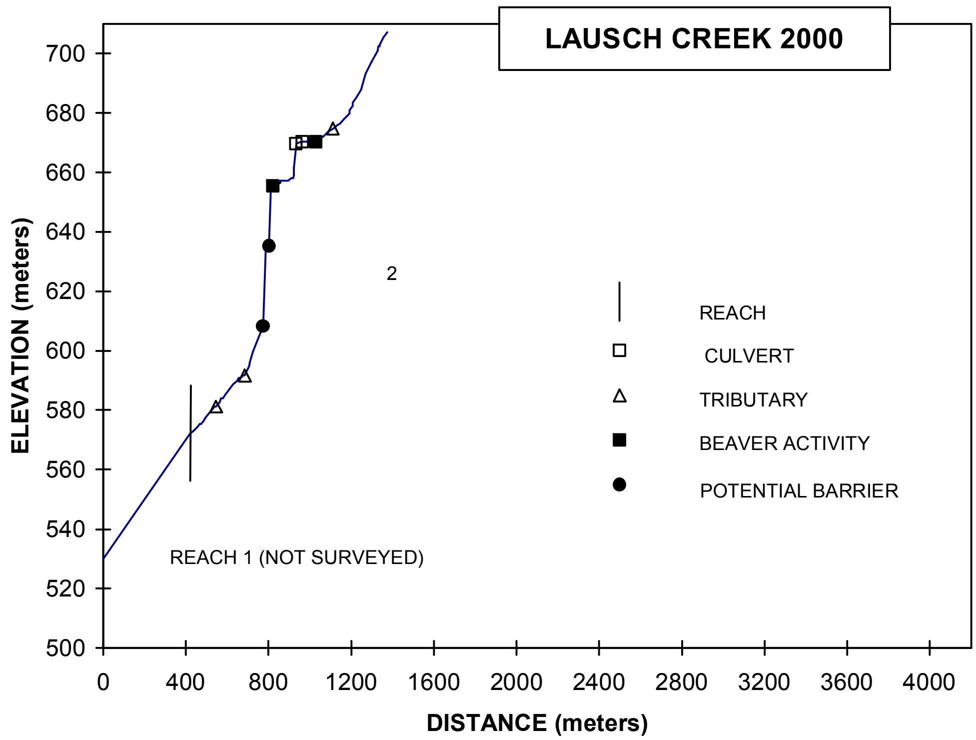
Limiting Factors:

1. Riparian Conifers
2. Gravel
3. Fines

Reach	Pools			Riffles		Shade	LWD		Riparian Conifers	
	% Area	Frequency	Depth	Gravel	Fines		No.	Vol.	>20"dbh	>35"dbh
1	No Access									
2	D	U	M	U	U	D	D	D	U	U

Large riparian conifers are limiting in reach 2, but riparian transect surveys indicate that small conifers are present in the riparian community, indicating that this limitation is temporary. Pool frequency is limiting, although this is most likely a function of the stream's high gradient. Beaver dams and instream LWD structure may provide some rearing or overwintering habitat. Spawning habitat is limiting in this stream, as well, with low percentages of gravel and high percentages of fines in riffles.

Stream Profile Graph: Lausch Creek



Middle Fork Brummit Creek - Four reaches were surveyed on the Middle Fork of Brummit Creek. Primary land use is timber production, with stands consisting of young and mature timber. Middle Fork Brummit Creek is a high gradient stream, with low percentages of total stream area available in side channels. The stream channel is constrained by hillslopes.

Four natural potential barriers to fish migration were identified: one 4 meter falls in reach 2, one 10-meter boulder cascade in reach 4, and two large bedrock falls in reach 4.

Reach	Length (m)	Year	%Open Sky	% Fines	% Gravel	% Pools	LWD	Riparian conifers
1	1110	1997	23	3	8	33	174	61
2	509	1997	13	0	70	48	425	183
3	1539	1997	16	24	63	37	258	0
4	798	1997	12	42	40	27	321	122

Limiting Factors:

1. Riparian Conifers
2. Fines –reaches 3 and 4
3. Gravel – reach 1

Reach	Pools			Riffles		Shade	LWD		Riparian Conifers	
	% Area	Frequency	Depth	Gravel	Fines		No.	Vol.	>20"dbh	>35"dbh
1	M	M	M	U	D	D	D	D	U	U
2	D	D	M	D	D	D	D	D	M	U
3	D	M	D	D	U	D	D	D	U	U
4	M	M	M	D	U	D	D	D	U	U

The deficiency in the number of large riparian conifers is temporary; riparian transect surveys indicate al large number of small riparian conifers present, indicating that this benchmark criterion will be achieved without intervention. Pool habitat is moderate to desirable, and the incredible amount of LWD present will facilitate and improve habitat complexity for rearing and overwintering juvenile coho. Spawning habitat is limited by a low percentage of gravel in reach 1 and a high percentage of fines in reaches 3 and 4. Reach 2 appears to provide desirable amounts of gravel and fine sediments for successful spawning efforts.

South Fork Elk Creek - Four reaches were surveyed on the South Fork of Elk Creek. Primary land use is timber production, with stands consisting of large timber. South Fork Elk Creek is a low to moderate gradient stream, with little of its area in side channels, and whose channel is either unconstrained (reaches 1 and 3) or constrained by hillslopes.

Beaver activity was observed in reaches 1-3. A culvert in the upstream portion of reach 4 presents a potential barrier to fish migration.

Reach	Length (m)	Year	%Open Sky	% Fines	% Gravel	% Pools	LWD	Riparian conifers
1	3848	1997	14	16	47	63	14	10
2	1395	1997	15	15	39	46	51	20
3	845	1997	27	16	27	57	11	0
4	1515	1997	9	11	26	14	64	152

Limiting Factors:

1. Riparian Conifers
2. LWD – reaches 1 and 3

Reach	Pools			Riffles		Shade	LWD		Riparian Conifers	
	% Area	Frequency	Depth	Gravel	Fines		No.	Vol.	>20"dbh	>35"dbh
1	D	M	M	D	M	D	M	U	U	U
2	D	D	M	D	M	D	M	D	U	U
3	D	M	D	M	M	D	U	U	U	U
4	M	M	M	M	M	D	D	D	M	M

Large riparian conifers are limiting in reaches 1-3, and riparian transect surveys indicate that small riparian conifers are limiting as well. Pool characteristics are moderate to desirable, and moderate to desirable levels of gravel and fine sediments indicate that South Fork Elk Creek provides the necessary habitat for the fulfillment of coho salmon life history requirements. Reaches 1 and 3 are deficient in LWD.

South Fork Elk Creek Tributaries - One reach of Tributary 2, and two reaches of Tributary 3 of the South Fork Elk Creek were surveyed. Primary land use is timber production, with stands consisting of second growth timber. These are low gradient reaches, with little area available in side channels. The stream channels are constrained by hillslopes.

Tributary 2: Beaver activity was observed throughout the survey. A culvert near the end of reach 2 presents a potential barrier to migration.

Reach	Length (m)	Year	%Open Sky	% Fines	% Gravel	% Pools	LWD	Riparian conifers
Trib2-1	634	1997	1	2	56	31.8	22.1	61
Trib2-2	1967	1997	19	13	82	35.1	26.6	
Trib3-1	971	1997	1	1	63	3.7	28.9	61

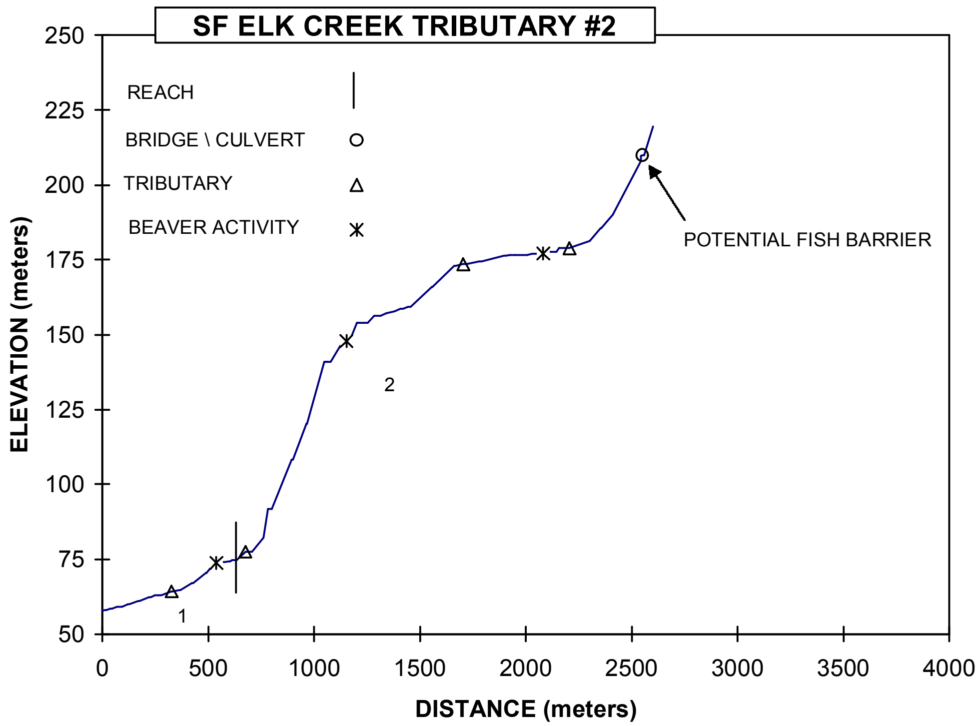
Limiting Factors:
1. Riparian Conifers
2. Pool Area – Tributary 3

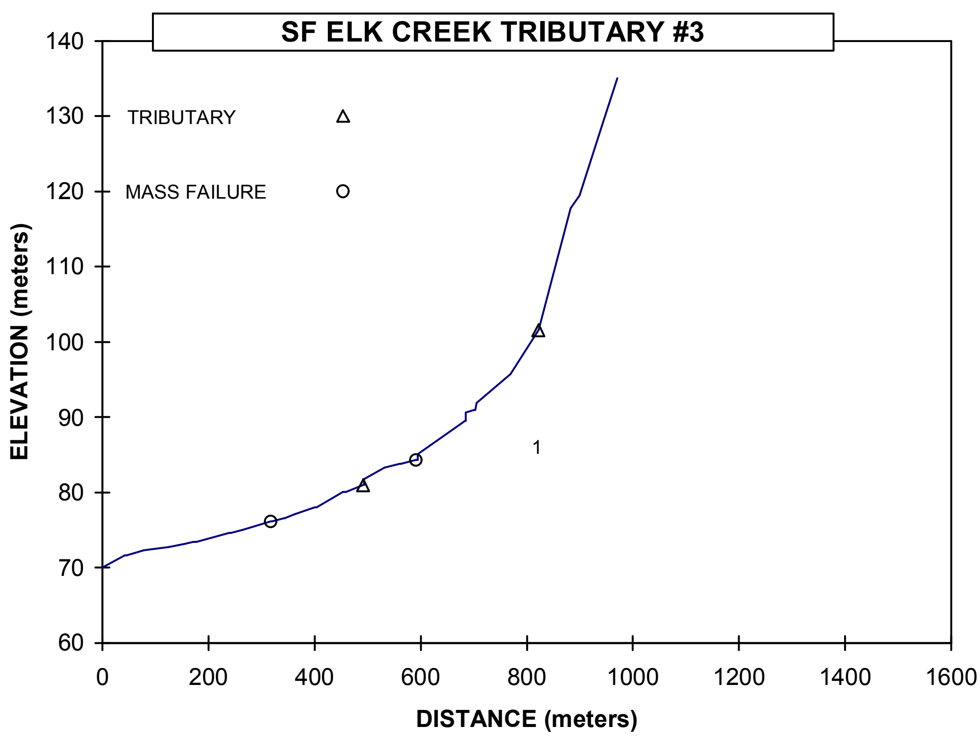
Reach	Pools			Riffles		Shade	LWD		Riparian Conifers	
	% Area	Freq.	Depth	Gravel	Fines		No.	Vol.	>20"dbh	>35"dbh
Trib2 -1	M	D	M	D	D	D	M	M	U	No data
Trib2-2	D	M	M	M	D	D	M	M	No data	
Trib3-1	U	U	U	D	D	D	M	M	U	U

Tributary 2. Large riparian conifers are limiting in reach 1 and temporarily limiting in reach 2 due to the number of small conifers present in the riparian community. Pool and spawning habitat is moderate to desirable, indicating that this stream provides adequate habitat for all life stages of coho salmon. LWD levels are moderate, and these levels should provide adequate instream structure.

Tributary 3. Large riparian conifers are temporarily limiting in this stream. Riparian transect surveys indicate that the community contains small conifers, which will, in time, fulfill the habitat benchmark criteria for large riparian conifers. Pool habitat is at undesirable levels for this stream, at all analyzed levels. LWD is present in moderate amounts.

Stream Profile Graphs: Tributaries 2 and 3 of South Fork Elk Creek





Steel Creek - Three reaches were surveyed on Steel Creek. Land is primarily designated as rural residential in reach 1, and is in timber production in reaches 2 and 3. Steel Creek is a low gradient stream in the lower reaches, but increases to 8.3% in reach three. In addition, the channel is unconstrained in reach 1, but becomes constrained with terraces and hillslopes in reaches 2 and 3. A low to moderate amount of the stream area contained in side channels.

A natural potential barrier to fish migration exists in reach 3. Several gabions and other habitat structures have been constructed in reach 1, although some are damaged.

Reach	Length (m)	Year	%Open Sky	% Fines	% Gravel	% Pools	LWD	Riparian conifers
1	1216	1997	11	12	56	48	18	91
2	2170	1997	12	6	22	45	22	61
3	3175	1997	9	10	85	19	69	52

Limiting Factors:
1. Riparian Conifers
2. LWD – reach 1

Reach	Pools			Riffles		Shade	LWD		Riparian Conifers	
	% Area	Frequency	Depth	Gravel	Fines		No.	Vol.	>20"dbh	>35"dbh
1	D	M	M	D	M	D	M	U	U	U
2	D	M	M	M	D	D	M	M	U	U
3	M	M	D	D	M	D	M	D	U	U

The number of large riparian conifers is limiting in Steel Creek. Riparian transect surveys indicate that small conifer trees are present in the riparian community, although not in numbers that would cause this habitat benchmark to be met in the future. Pool habitat is moderate to desirable, and combined with LWD levels that are, on average, moderate to desirable as well, there appears to be adequate rearing and overwintering habitat available to juvenile salmonids. The level of gravel and fine sediments in riffles is moderate to desirable as well, indicating that quality spawning habitat is available.

West Fork Brummit Creek - Nine reaches were surveyed along the West Fork of Brummit Creek. Primary land use is timber production, with stands consisting of a variety of age classes: young, second growth, mature, and old growth timber. The average reach gradient is low to moderate, with the exception of reach 8, whose average gradient is 16.8%. The majority of the channels are single channels constrained by hillslopes or terraces. Reach 3, however, consists of a braided channel.

Reach	Length (m)	Year	%Open Sky	% Fines	% Gravel	% Pools	LWD	Riparian conifers
1	2711	1998	23	67	32	62.3	20.4	0
2	726	1998	3	25	20	34.3	26.8	0
3	1361	1998	2	40	20	27.1	30.3	0
4	594	1998	1	41	20	30.2	76.6	0
5	1217	1998	6	36	51	46.6	46.5	0
6	872	1998	4	33	59	56.5	27.8	0
7	1249	1998	0	17	74	41.4	27.9	0
8	955	1998	5	50	50	57.3	173.4	61
9	888	1998	52	73	27	27.7	75.5	0

Limiting Factors:
1. Riparian Conifers
2. Fines
3. Shade – reach 9

Reach	Pools			Riffles		Shade	LWD		Riparian Conifers	
	% Area	Frequency	Depth	Gravel	Fines		No.	Vol.	>20"dbh	>35"dbh
1	D	M	D	M	U	D	D	M	U	U
2	M	D	D	M	U	D	M	M	U	U
3	M	M	M	M	U	D	M	D	U	U
4	M	M	M	M	U	D	D	D	U	U
5	D	M	D	D	U	D	D	D	U	U
6	D	M	D	D	U	D	M	M	U	U
7	D	D	D	D	M	D	M	M	U	U
8	D	M	D	D	U	D	D	D	U	U
9	M	U	D	M	U	U	D	D	U	U

Large conifers are limiting in the riparian community. The percentage of fine sediments is much higher than is considered desirable, or even moderate, by ODFW habitat benchmark standards, and indicates that although the amount of gravel available for spawning is moderate to desirable, spawning efforts will likely be compromised by the amount of fines present. Pool habitat is moderate to desirable, and the high levels of LWD present indicate that structural complexity is adequate for rearing and overwintering juvenile coho. Shade to the stream is limited in reach 9.

Weekly Creek - Six reaches were identified on Weekly Creek. Primary land use is timber production, with stands consisting of large and mature timber, although lands adjacent to reach 1 are primarily used for agricultural purposes. Weekly Creek is a low gradient stream in the lower reaches, but achieves average gradients of 7-9% in reaches 5 and 6. The single stream channel is constrained by hillslopes and terraces.

Reach	Length (m)	Year	%Open Sky	% Fines	% Gravel	% Pools	LWD	Riparian conifers
1	1207	1997	18	43	57	72	2	0
2	842	1997	2	22	50	60	17	244
3	684	1997	6	22	27	62	31	122
4	493	1997	5	8	11	51	15	61
5	1153	1997	1	15	20	29	17	30
6	745	1997	4	10	50	9	21	no data

Limiting Factors:
1. Riparian Conifers
2. Fines
3. Gravel – reach 4
4. Pool Area – reach 6
5. LWD – reach 1

Reach	Pools			Riffles		Shade	LWD		Riparian Conifers	
	% Area	Frequency	Depth	Gravel	Fines		No.	Vol.	>20"dbh	>35"dbh
1	D	M	D	D	U	D	U	U	U	U
2	D	D	D	D	U	D	D	U	M	U
3	D	D	M	M	U	D	D	D	U	U
4	D	D	M	U	D	D	M	U	U	U
5	M	M	D	M	M	D	M	U	U	U
6	U	M	D	D	M	D	M	M	No data	

Riparian conifers are limiting in all reaches, with the exception of reach 2, where the number of large riparian conifers is moderate. Pool characteristics are moderate to desirable, although there is an undesirable percentage of the total stream area comprised of pools in reach 9. However, there does appear to be adequate rearing and overwintering habitat for juvenile coho. Spawning habitat is limited by the high percentages of fine sediments in reaches 1-3, and the low percentage of gravel in reach 4. Reaches 5 and 6 contain adequate amounts of spawning gravel and fine sediments for quality spawning habitat to exist. The amount of LWD in the stream is limited in reaches 1, 2, 4 and 5.

Weekly Creek Tributaries - Two tributaries were surveyed on Weekly Creek. Primary land use on these streams is timber production, with stands consisting of large timber (Tributary A) and second growth timber (Tributary B). Both tributaries are moderate gradient, with their channels constrained by hillslopes and terraces.

Reach	Length (m)	Year	%Open Sky	% Fines	% Gravel	% Pools	LWD	Riparian conifers
Trib A	577	1997	4	21	25	25	11	0
Trib B	811	1997	0	95	5	18	14	0

Limiting Factors:
1. Riparian Conifers
2. LWD
3. Fines
4. Gravel – Tributary B

Reach	Pools			Riffles		Shade	LWD		Riparian Conifers	
	% Area	Frequency	Depth	Gravel	Fines		No.	Vol.	>20"dbh	>35"dbh
1	M	M	M	M	U	U	M	U	U	U
2	M	M	M	U	U	U	M	U	U	U

Large riparian conifers are limiting in both tributaries. Pool characteristics are moderate, and LWD content in the stream is at levels that are moderate to undesirable. This indicates that although rearing and overwintering habitat is available, it is of moderate quality. Spawning habitat is limiting both by low availability of gravel, and high percentages of fines.

Lost Creek - Two reaches were surveyed on Lost Creek. Primary land use is timber production, with stands consisting of second growth timber. The surveyed reaches are low gradient, with single channels constrained by hillslopes and terraces.

A barrier to fish migration exists at Lost Creek Falls, a 24-meter high falls, located in reach 1.

Reach	Length (m)	Year	%Open Sky	% Fines	% Gravel	% Pools	LWD	Riparian conifers
1	4031	1995	8	10	48	37.1	247.4	0
2	547	1995	0	17	21	43.4	16.1	0

Limiting Factors:
1. Riparian Conifers
2. LWD – reach 2

Reach	Pools			Riffles		Shade	LWD		Riparian Conifers	
	% Area	Frequency	Depth	Gravel	Fines		No.	Vol.	>20"dbh	>35"dbh
1	D	D	D	D	M	D	D	D	U	U
2	D	D	M	M	M	D	M	U	U	U

Large conifers are limiting in the riparian community, although transect surveys documented small riparian conifers comprising up to 24% of the surveyed communities. This indicates that the deficiency in large riparian conifers may be temporary. Pool habitat is at desirable levels, indicating that rearing and overwintering habitat exists for juvenile coho. LWD levels are moderate to desirable, with the exception of reach 2. However, this reach is not attainable by coho salmon, due to the natural barrier to fish passage presented by Lost Creek Falls.

Weekly Creek Section 31 Tributary - Three reaches were surveyed on the Section 31 Tributary to Weekly Creek. Primary land use is timber production, with stands consisting of young and mature timber. This tributary is a low to moderate gradient stream whose channel is constrained by hillslopes and terraces.

Reach	Length (m)	Year	%Open Sky	% Fines	% Gravel	% Pools	LWD	Riparian conifers
1	200	1997	1	12	68	22.5	21.6	0
2	885	1997	0	10	68	44.9	30.8	30
3	665	1997	2	4	32	36.0	72.9	61

Limiting Factors:

1. Riparian Conifers

Reach	Pools			Riffles		Shade	LWD		Riparian Conifers	
	% Area	Frequency	Depth	Gravel	Fines		No.	Vol.	>20"dbh	>35"dbh
1	M	D	M	D	M	D	D	M	U	U
2	D	D	M	D	M	D	M	D	U	U
3	D	M	U	M	D	D	M	D	U	Nd

Riparian conifers are limiting on the Section 31 Tributary to Weekly Creek. Pool habitat is moderate to desirable; high levels of LWD increase the quality of pool environments. This indicates that this tributary provides habitat for rearing and overwintering juvenile coho. Spawning habitat is adequate on this stream.

A.2.3 Lower Coquille Watershed

Summary

Note that this watershed was previously called the Mainstem Coquille. Only three streams (or tributaries) were identified and analyzed to determine limiting factors in coho habitat. ODFW AHI stream report data were used to conduct this analysis. Low order streams were the focus of these surveys. As a result, there is no habitat inventory data for the higher order mainstem Coquille River.

Within each stream analysis, this report presents two habitat inventory summary tables. The first table provides the actual percentages of six broad habitat benchmark criteria, as averaged for each reach. These six criteria were selected for use as described in the Oregon Plan 2002 Western Stream Report (Flitcroft et al. 2002):

1. Pool area greater than 35% of total habitat area
2. Fine sediments (<4mm diameter) in riffle units less than 12% of all sediments
3. Gravel (4-64m diameter) in riffle units greater than or equal to 35% of all sediments
4. Volume of large woody debris greater than 20m3 wood/100m stream length
5. Shade greater than 70%
6. Large riparian conifers (>0.5m dbh) more than 150 trees per 305m stream length

These six benchmarks were further broken down and analyzed according to ODFW habitat benchmark thresholds on a sliding scale (*Desirable – Moderate – Undesirable*) as defined in (Foster et al. 2001). Throughout the analysis, attention was given to the natural regime of the stream in order to present the most accurate representation of potential limiting factors.

To summarize, three analyses were conducted on this subwatershed. The majority of the reaches surveyed were limiting in large riparian conifers, LWD, fine sediments, and shade.

Habitat Component	Number of Streams Limiting	Total Number of Streams	Percentage of Streams Limited
Riparian conifers	3	3	100%
Fines	2	3	67%
LWD	3	3	100%
Gravel	1	3	33%
Pools	0	3	0
Shade	2	3	67%

Four streams in the Lower Coquille Watershed have been identified by ODEQ as being water quality limited:

Stream	River Mile	Parameter	Season	List Date
Bear Creek	0 to 13.2	Fecal Coliform	Winter/Spring/Fall	1998
	0 to 13.2	Dissolved Oxygen	Winter/Spring Fall	1998
Cunningham Creek	0 to 7.4	Fecal Coliform	Summer	1998
	0 to 7.4	Dissolved Oxygen	Year Around	1998
	0 to 7.4	Fecal Coliform	Winter/Spring/Fall	1998
Fishtrap Creek	0 to 4.7	Iron	Year Around	2002
Coquille River	4.2 to 35.6	Fecal Coliform	Winter/Spring/Fall	1998
	4.2 to 35.6	Chlorophyll A	Summer	1998
	0 to 4.2	Fecal Coliform	Year Around	1998
	21 to 35.3	Temperature	Summer	2002

Individual Stream Reports

Lampa Creek - Five reaches were surveyed on Lampa Creek. Primary land use is agriculture and timber production (second growth and young timber). With the exception of reach 2, whose average gradient is 10.2%, the average stream gradient of Lampa Creek is low. Its single channel is constrained by terraces and hillslopes.

Beaver activity (dams) was observed in reaches 2 through 5.

Reach	Length (m)	Year	%Open Sky	% Fines	% Gravel	% Pools	LWD	Riparian conifers
1	3984	1997	53	29	63	28	0	0
2	2321	1997	28	28	50	81	14	0
3	702	1997	12	28	61	72	19	0
4	860	1997	26	14	68	60	33	0
5	904	1997	29	28	62	83	20	0

Limiting Factors:

1. Riparian Conifers
2. LWD
3. Fines
4. Shade – reach 1

Reach	Pools			Riffles		Shade	LWD		Riparian Conifers	
	% Area	Frequency	Depth	Gravel	Fines		No.	Vol.	>20"dbh	>35"dbh
1	M	D	M	D	M	D	D	M	U	U
2	D	D	M	D	M	D	M	D	U	U
3	D	M	U	M	D	D	M	D	U	Nd
4	D	D	M	D	M	D	M	D	U	U
5	D	M	M	D	U	D	M	M	U	U

Large riparian conifers are limiting in this system. Riparian transects indicate that small conifers do make up a portion of the riparian community, but that they are not present in numbers large enough to meet the habitat benchmark criterion in the future. With the exception of pool frequency in reach 1, pool habitat is of moderate to desirable quantity to provide rearing and overwintering habitat for juvenile salmonids. LWD levels are low in reaches 1 through 3. Spawning habitat is available, but suspect due to the high percentage of fines present in potential spawning habitat.

Sevenmile Creek - Five reaches were surveyed on Sevenmile Creek. Primary land use is agriculture and grazing, wetland, and timber production (young and second growth). Sevenmile Creek is a low gradient stream whose single channel is typically constrained by hillslopes or terraces. Reach 2, however, has been identified as an unconstrained single channel. In reach 1, 20% of the stream's area is present in secondary channels.

Reach	Length (m)	Year	%Open Sky	% Fines	% Gravel	% Pools	LWD	Riparian conifers
1	3265	1994	76	100	0	32	1	0
2	957	1994	43	nd	nd	51	4	0
3	1281	1994	17	39	35	54	9	142
4	853	1994	34	43	5	66	25	30
5	2108	1994	35	37	8	52	28	12

Limiting Factors:

1. Riparian Conifers
2. LWD
3. Gravel
4. Fines
5. Shade

Reach	Pools			Riffles		Shade	LWD		Riparian Conifers	
	% Area	Frequency	Depth	Gravel	Fines		No.	Vol.	>20"dbh	>35"dbh
1	M	U	D	U	U	U	U	U	U	U
2	D	M	Nd	Nd	nd	U	U	U	U	U
3	D	M	M	D	U	D	M	U	U	U
4	D	D	M	U	U	M	M	M	U	U
5	D	M	M	U	U	M	D	M	U	U

The number of large riparian conifers is limiting in all reaches of Sevenmile Creek. It should be noted, however, that reach 1 is primarily used for grazing and agriculture, and part of reach 2 has been identified as a wetland. Portions of reaches 3 and 4 have also been identified as wetlands. These uses and designations restrict the number of large riparian conifers that are possible along these reaches. However, parts of reaches 3 and 4, and all of reach 4 has been designated as timber producing land, and reach 3 comes very close to reaching the minimum habitat benchmark criterion for large riparian conifers.

Pool habitat is moderate to desirable, on average, with the exception of low pool frequencies in reach 1. Although it appears that quality habitat exists for rearing and overwintering juvenile coho salmon, higher numbers and volumes of LWD would improve habitat conditions within existing pool environments. Given the current habitat benchmark criteria, there is presently no quality spawning habitat available on Sevenmile Creek due to very high percentages of fine sediments and very low percentages of gravel in riffles.

Shade is also limiting in reaches 1 and 2, after accounting for the size of the stream. This may be a function of the designated land use.

Sevenmile Creek Tributary - Two reaches were surveyed on the tributary to Sevenmile Creek. A portion of reach 1 has been designated as a wetland; the remainder of reach 1 and all of reach 2 is in timber production, with stands consisting of young, second growth, and large timber. Stream gradient is low, with virtually no area in secondary channels. Reach 1 is an unconstrained channel, which reach 2 is a single channel constrained by hillslopes.

Reach	Length (m)	Year	%Open Sky	% Fines	% Gravel	% Pools	LWD	Riparian conifers
1	812	1994	27	nd	nd	85	7	0
2	504	1994	37	nd	nd	66	20	0

Limiting Factors:

1. Riparian Conifers
2. LWD – reach 1

Reach	Pools			Riffles		Shade	LWD		Riparian Conifers	
	% Area	Frequency	Depth	Gravel	Fines		No.	Vol.	>20"dbh	>35"dbh
1	D	M	Nd	Nd	Nd	D	U	U	U	U
2	D	D	Nd	Nd	Nd	D	D	M	U	U

The number of large riparian conifers is limiting, but as in the Sevenmile Creek summary, in reach 1, the number of conifers that can survive in the riparian community may be limited by land use and designation. Although no depth data was available, pool habitat is moderate to desirable, indicating that overwintering and rearing habitat exists for juvenile coho. This could be improved with increases in numbers and volumes of LWD into the stream, especially in reach 1. No data exists for riffle habitat. The written report was not available for this stream; adequate summer flows are suspect.

A.2.4 Middle Fork Coquille Watershed

Summary

Forty streams (or stream groups, in the case of tributaries) were identified and analyzed to determine limiting factors in habitat for OC Coho Salmon in the Middle Fork Coquille Watershed. ODFW Aquatic Habitat Inventory stream report data was used to conduct this analysis. Low order streams were the focus of these surveys. As a result, there is no habitat inventory data for the higher order mainstem of the Middle Fork Coquille River.

Within each stream analysis, this report presents two habitat inventory summary tables. The first table provides the actual percentages of six broad habitat benchmark criteria, as averaged for each reach. These six criteria were selected for use as described in the Oregon Plan 2002 Western Stream Report (Flitcroft et al. 2002):

1. Pool area greater than 35% of total habitat area
2. Fine sediments (<4mm diameter) in riffle units less than 12% of all sediments
3. Gravel (4-64m diameter) in riffle units greater than or equal to 35% of all sediments
4. Volume of large woody debris greater than $20m^3$ wood/100m stream length
5. Shade greater than 70%
6. Large riparian conifers (>0.5m dbh) more than 150 trees per 305m stream length

These six benchmarks were further broken down and analyzed according to ODFW habitat benchmark thresholds on a sliding scale (*Desirable – Moderate – Undesirable*) as defined in (Foster et al. 2001). Throughout the analysis, attention was given to the natural regime of the stream in order to present the most accurate representation of potential limiting factors in the Middle Fork Coquille River system.

To summarize, forty analyses were conducted on this subwatershed. The majority of the reaches surveyed were limiting in large riparian conifers. Low amounts of large woody debris and poor quality pool habitat characterize the majority of the reaches, limiting the availability of rearing and overwintering habitats for juvenile coho. High percentages of fines in nearly half of the reaches may limit spawning success as well.

Habitat Component	Number of Streams Limiting	Total Number of Streams	Percentage of Streams Limited
Riparian conifers	39	40	98%
LWD	32	40	80%
Pools	27	40	68%
Fines	18	40	45%
Gravel	5	40	13%
Shade	1	40	3%

In addition, six streams have been determined to be water quality limited by ODEQ and are currently on the 303(d) list:

Stream	River Mile	Parameter	Season	List Date
Battle Creek	0 to 1.5	Temperature	10/1 – 5/31	2002
Boulder Creek	0 to 4	Temperature	Summer	2002
Middle Fork Coquille River	0 to 39.6	Temperature Fecal Coliform Dissolved Oxygen Temperature	Summer Winter/Spring/Fall Winter/Spring/Fall 10/1 – 5/31	1998 1998 1998 2002
Belieu Creek	0 to 3.1	Temperature	Summer	1998
Twelvemile Creek	0 to 10.2	Temperature	Summer	2002
Bingham Creek	0 to 2.4	Temperature	Summer	2002

Individual Stream Reports

Anderson Creek - Seven reaches were identified and surveyed. Riparian transects were not conducted in three reaches of Anderson Creek. The primary land use along this stream is second growth and old growth timber production.

Reach	Length (m)	Year	%Open Sky	% Fines	% Gravel	% Pools	LWD	Riparian conifers
1	197	1997	19	0	90	37.7	2.7	0
2	340	1997	1	1	79	63.2	12.4	No data
3	829	1997	0	5	74	50	21.7	No data
4	1258	1997	0	5	48	18	44.9	No data
Sec1-1	220	1997	0	1	100	25	10.5	61
Sec1-2	568	1997	1	3	60	20	52.8	122
Sec1A-1	271	1997	1	3	80	14.6	36.7	0

Limiting Factors:
1. Riparian Conifers in all measured reaches
2. Large Wood Debris
3. Pool Area, Frequency and Depth

Reach	Pools			Riffles		Shade	LWD		Riparian Conifers	
	% Area	Freq.	Depth	Gravel	Fines		No.	Vol.	>20"dbh	>35"dbh
1	D	M	D	D	D	D	U	U	U	U
2	D	D	M	D	D	D	U	U	No data	No data
3	D	D	M	D	D	D	M	M	No data	No data
4	U	U	U	D	D	D	M	D	U	U
Sec1-1	M	U	M	D	D	D	U	U	U	U
Sec 1-2	M	U	M	D	D	D	U	D	U	U
Sec 1A-1	M	U	M	D	D	D	M	D	U	U

Anderson Creek has desirable levels of shade, fines, and gravel in all reaches. In addition, the volume of LWD per 100m of stream length is desirable in reaches 3 and 4, as is the percentage of pools in reaches 1, 2 and 3.

The number of large riparian conifers is undesirable in all measured reaches. Pool depth is moderate in reaches 2 and 3, and undesirable in reach 4 of Anderson Creek. The percentage of the total stream area of Reach 4 that is comprised of pools is undesirable, as is the frequency of pools.

The two reaches of the Section 1 Tributary of Anderson Creek contain desirable levels of shade, gravel, and fines. These reaches contain moderate percentages of pool area and residual pool depth, but undesirable pool: channel width frequencies. The number and volume of LWD is undesirable in all instances, with the exception of LWD volume in Reach 2. The number of large riparian conifers is undesirable in both reaches.

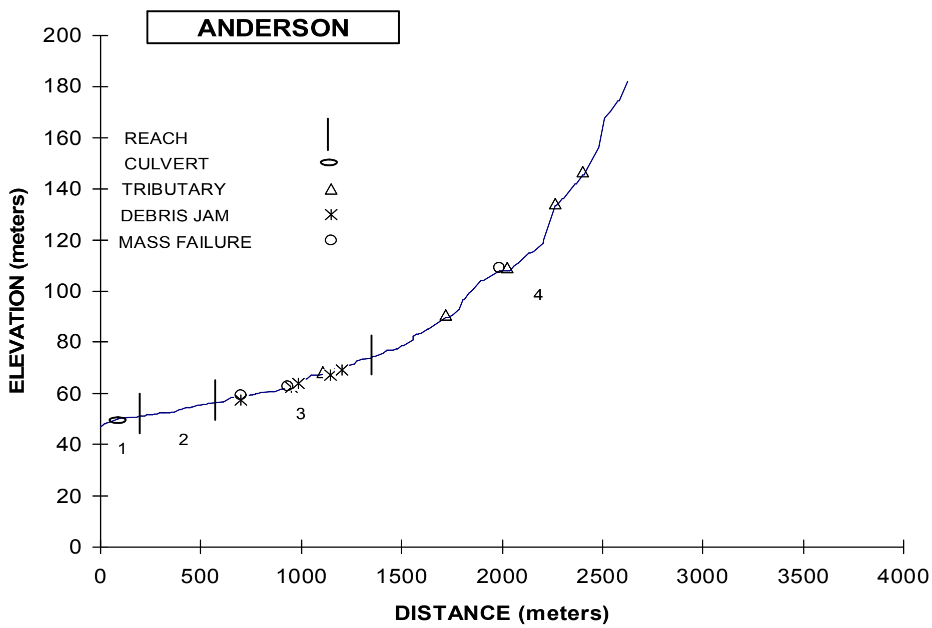
The Section 1A Tributary of Anderson Creek contains desirable levels of shade, gravel, fines, and volume of LWD. The number of LWD pieces, percentage of the stream comprised of pools, and residual pool depth is moderate. Pool frequency and the number of riparian conifers are undesirable.

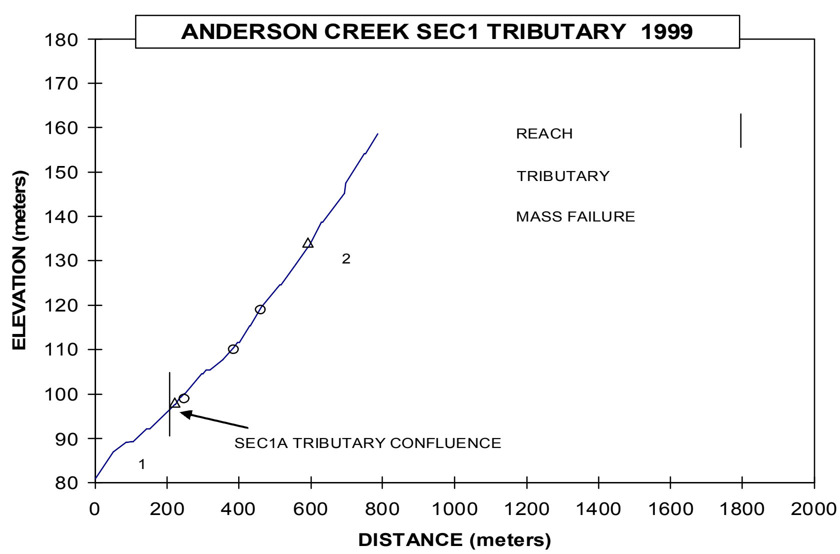
Anderson Creek and three reaches of its tributaries were surveyed in 1999. Analysis of the resulting basin reach summaries and associated reports indicate that, as a whole, this stream contains elements of habitat required to fulfill the life history requirements of Oregon Coast Coho salmon, with either moderate or desirable levels of the majority of the identified benchmark criteria. All reaches were limited in riparian conifers. However, all surveyed reaches had adequate shading, reaching 100% in some instances, which is the result of large numbers of hardwoods comprising the riparian zone. The volume of LWD was high (>20m3/100m) in four of the reaches, but was moderate to low in the remaining three reaches surveyed.

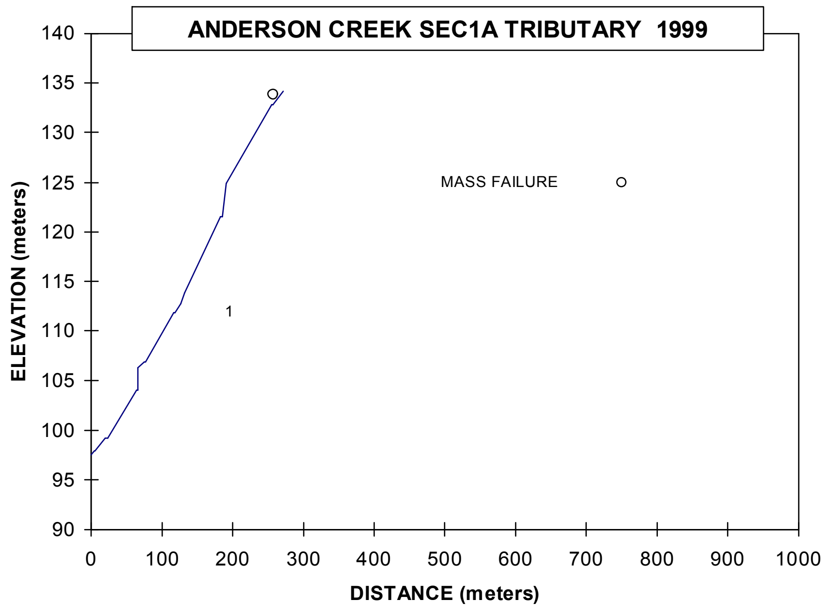
The percentage of pools available in Reach 4 of Anderson Creek and all reaches of the measured tributaries of Anderson Creek are low. It should be noted, however, that these are very high gradient reaches (8.6, 7.6, 10.8, and 13.5 percent slope, respectively), and as such, may not contain the structural capacity for large percentages of pools.

Off-channel habitat is limiting as a result of the headwater nature of the Anderson Creek system. However, Reach 1 contains a significantly larger percentage of side-channel habitat than the remainder of the surveyed reaches. One culvert crossing exists in Reach 1, along with a sizeable debris jam (photos included in report). These seem to be the only significant potential barriers to movement between reaches and habitat.

Stream Profile Graphs: Anderson Creek and Tributaries







Axe Creek - One reach was surveyed along Axe Creek, beginning at its confluence with Big Creek and continuing upstream 1312 meters. Primary land use along Axe Creek is mixed second growth and mature timber.

Reach	Length (m)	Year	%Open Sky	% Fines	% Gravel	% Pools	LWD	Riparian conifers
1	1312	2002	7	4	76	23	17.3	30

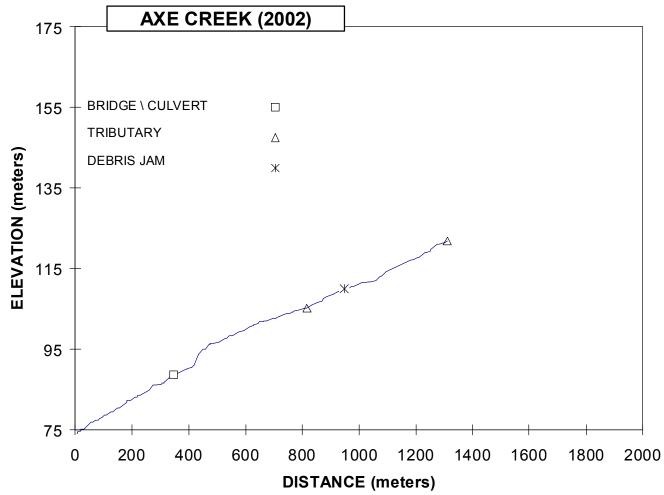
Limiting Factors:
1. Riparian Conifers
2. Large Wood Debris

Reach	Pools			Riffles		Shade	LWD		Riparian Conifers	
	% Area	Frequency	Depth	Gravel	Fines		No.	Vol.	>20"dbh	>35"dbh
1	M	M	M	D	D	D	M	U	U	U

Axe Creek has desirable levels of gravel, fines, and shade. Stream habitat surveys indicate that total pool area, pool frequency (channel width between pools), and residual pool depth are moderate, as is the number and volume of LWD per 100m. This reach has undesirable levels of riparian conifers greater than 20 inches dbh and greater than 35 inches dbh.

While the number of large riparian conifers is low, large numbers of deciduous and smaller coniferous trees comprise the riparian zone, thus providing ample shading and large wood debris source. Axe Creek drains a relatively constrained narrow valley. As such, very little side-channel habitat is available as overwintering habitat for juvenile salmonids.

Stream Profile: Axe Creek



Battle Creek - Two reaches of Battle Creek were identified; only one was surveyed. Primary land use along Battle Creek is conifer regeneration (e.g. young timber).

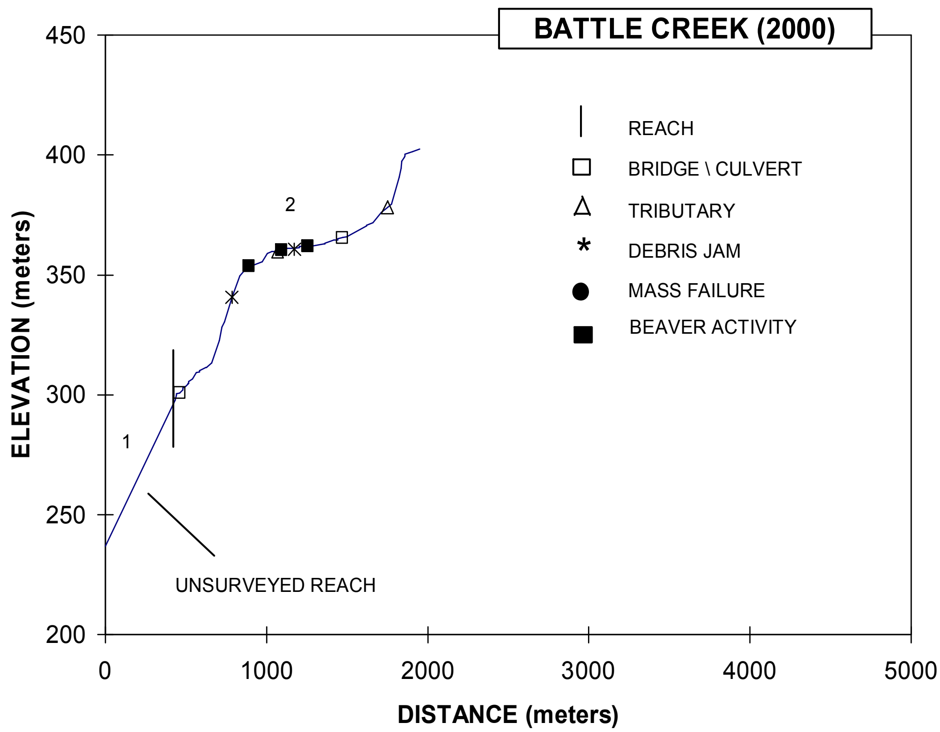
Reach	Length (m)	Year	%Open Sky	% Fines	% Gravel	% Pools	LWD	Riparian conifers
1		2002	No access					
2	1515	2002	15	48	25	14	9.1	0

Limiting Factors:
1. Riparian Conifers
2. Large Wood Debris
3. Fines
4. Pool Frequency

Reach	Pools			Riffles		Shade	LWD		Riparian Conifers	
	% Area	Freq.	Depth	Gravel	Fines		No.	Vol.	>20"dbh	>35"dbh
1	No Access									
2	M	U	D	M	U	D	U	U	U	U

Battle Creek has desirable levels of shade and pool depth. The percentage of total pool area and the percentage of gravel in riffles are moderate. The number and volume of LWD, pool frequency (as a channel width: pool frequency ratio), percentage of fines in riffles, and the number of large riparian conifers is undesirable in this reach of Battle Creek. This is a high gradient (6.9%) stream that is constrained by hillslopes. As surveyed, Battle Creek does not appear to possess habitat characteristics that would support the life history requirements of Oregon Coast Coho salmon. Although the level of shading along the stream was desirable, logging operations immediately upstream from Reach 2 have eliminated any riparian protection that may have been afforded Battle Creek in the past. This, of course, is a temporary phenomenon, but will most likely result in increased stream temperatures even within reaches where riparian vegetation, and shade, is not limiting.

Stream Profile Graph: Battle Creek



Bear Pen Creek - One reach of Bear Pen Creek was identified and surveyed in 2002. The dominant land use along this stream is timber production; the majority of the timber onsite is mature.

Reach	Length (m)	Year	%Open Sky	% Fines	% Gravel	% Pools	LWD	Riparian conifers
1	1136	2002	11	7	57	41	24.2	30

Limiting Factors:

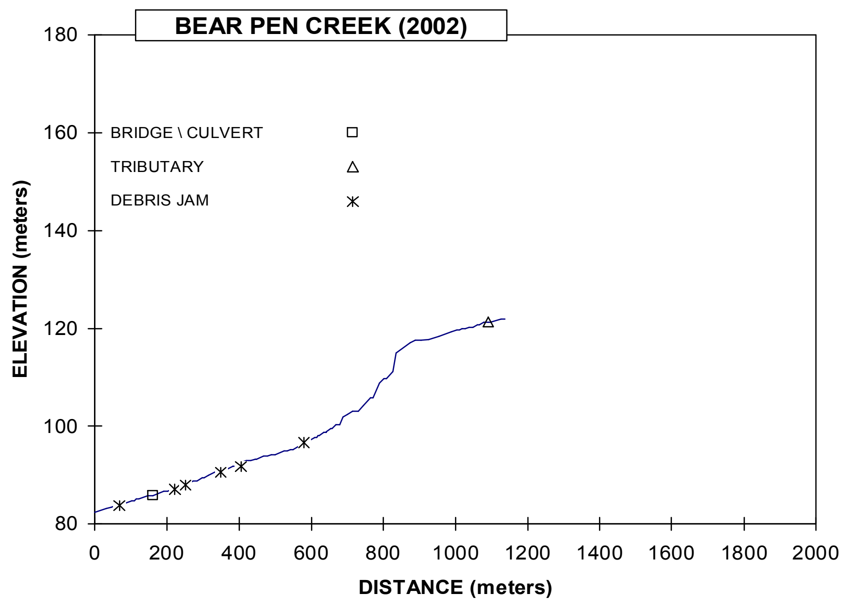
1. Riparian Conifers

Reach	Pools			Riffles		Shade	LWD		Riparian Conifers	
	% Area	Frequency	Depth	Gravel	Fines		No.	Vol.	>20"dbh	>35"dbh
1	D	D	M	D	D	D	M	M	U	U

Bear Pen Creek exhibits desirable levels of pool area and frequency, gravel, fines, and shade. Pool depth and number and volume of LWD are moderate. The number of large riparian conifers is undesirable.

Bear Pen Creek is a somewhat high gradient (3.5%) stream with some off-channel habitat available that may provide overwintering refugia for juvenile salmonids. Although it is deficient in riparian conifers, deciduous and small coniferous trees are abundant. The remainder of the habitat benchmark criteria are achieved, albeit moderately in some cases, indicating that Bear Pen Creek should provide quality spawning and rearing habitat for Oregon Coast Coho salmon, and may provide some off-channel overwintering habitat as well.

Stream Profile Graph: Bear Pen Creek



Belieu Creek - Three stream reaches were identified and surveyed on Belieu Creek. Timber production is the primary land use, with second growth, old growth (or mature), and young timber dominating reaches 1, 2 and 3, respectively.

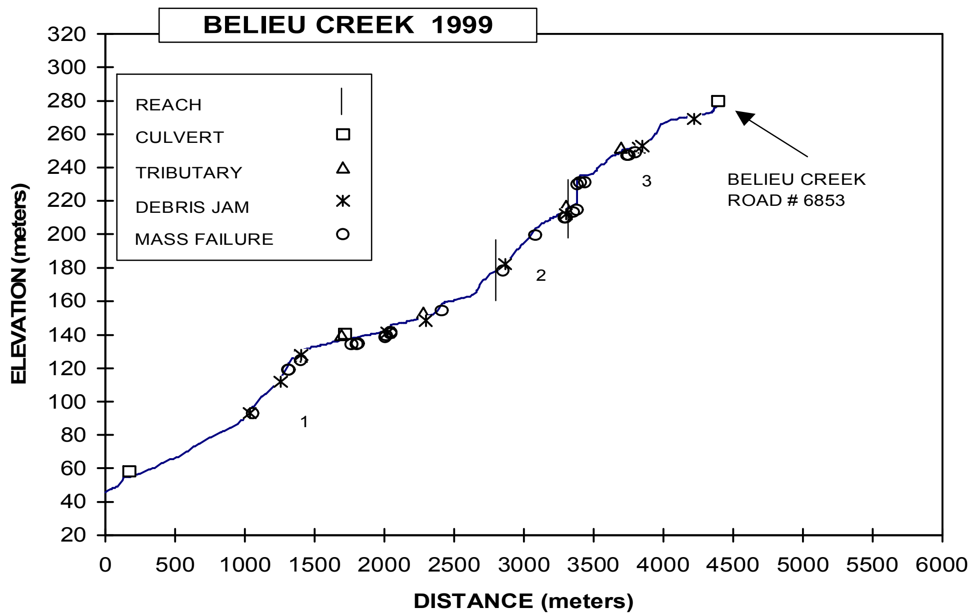
Reach	Length (m)	Year	%Open Sky	% Fines	% Gravel	% Pools	LWD	Riparian conifers
1	2815	1997	3	13	78	46.2	18.3	No data
2	508	1997	0	11	90	28.8	64.8	0
3	1070	1997	2	0	100	62.8	92.8	No data

Limiting Factors:
1. Riparian Conifers
2. Pool Depth

Reach	Pools			Riffles		Shade	LWD		Riparian Conifers	
	% Area	Freq.	Depth	Gravel	Fines		No.	Vol.	>20"dbh	>35"dbh
1	D	D	M	D	M	D	M	M	U	U
2	M	M	M	D	M	D	D	D	U	U
3	D	M	M	D	D	D	D	D	U	U

Belieu Creek is a high gradient stream (4.7%, 7.3%, and 5.7%) with little side channel habitat in the lower two reaches, but with a much higher percentage of side channel habitat in reach 3 that may provide overwintering habitat for juvenile salmonids. As in the majority of the streams in the Coquille watershed, the number of large riparian conifers is limiting. However, Belieu Creek contains adequate amounts of LWD, creating favorable instream pools and habitat complexity for coho salmon. In addition, the pool and riffle habitat available should provide quality spawning and rearing areas. Three culvert crossings were identified in the survey, which may create barriers to instream fish movement.

Stream Profile Graph: Belieu Creek



Big Creek - Ten reaches were identified on Big Creek; eight of these were surveyed. Primary land use along Big Creek is timber production, with the majority of the reaches adjacent to mature timberlands.

Reach	Length (m)	Year	%Open Sky	% Fines	% Gravel	% Pools	LWD	Riparian conifers
1	858	2002	31	18	64	47	2.1	0
2	561	2002	No Access					
3	2375	2002	16	10	57	74	4.3	0
4	1353	2002	15	15	49	64	8.2	30
5	2154	2002	No Access					
6	1353	2002	19	8	65	72	3.1	0
7	2001	2002	25	6	66	61	3.4	0
8	1204	2002	16	4	43	48	5.4	0
9	5953	2002	11	8	44	39	9.1	17
10	1917	2002	10	9	60	38	13.4	110
Trib A-1	498	1994	7	10	40	13	38.6	122

Limiting Factors:
1. Riparian Conifers
2. Large Wood Debris
3. Pool Frequency and Depth – Tributary A

Reach	Pools			Riffles		Shade	LWD		Riparian Conifers	
	% Area	Freq.	Depth	Gravel	Fines		No.	Vol.	>20"dbh	>35"dbh
1	D	D	M	D	M	M	U	U	U	U
2	No Access									
3	D	M	D	D	D	D	U	U	U	U
4	D	M	M	D	M	D	M	U	U	U
5	No Access									
6	D	M	D	D	D	D	U	U	U	U
7	D	D	M	D	D	D	U	U	U	U
8	D	M	M	D	D	D	U	U	U	U
9	D	M	M	D	D	D	U	U	U	U
10	D	D	M	D	D	D	M	U	U	U
Trib A	M	U	U	D	D	D	M	D	U	U

The mainstem of Big Creek is a low gradient stream, with adequate spawning habitat. Rearing habitat is limited by low numbers and volumes of LWD in the stream, although in Tributary A, LWD is present in large enough quantities to meet habitat benchmark criteria. Potential rearing habitat exists in pools, but without adequate habitat complexity, its success is questionable. Riparian zones along this stream are comprised of deciduous trees which provide adequate shading to the surveyed stream reaches.

Boulder Creek - Five reaches were identified and surveyed in Boulder Creek. Primary land use is timber production, with the majority of timber in the regeneration/young timber stage.

Reach	Length (m)	Year	%Open Sky	% Fines	% Gravel	% Pools	LWD	Riparian conifers
1	1438	2000	42	28	22	73	5.7	20
2	2411	2000	33	38	33	75	17.2	71
3	975	2000	34	63	31	71	11	0
4	1722	2000	17	78	22	32.3	40.1	61
5	297	2000	7	NA	NA	0	55.9	122

Limiting Factors:
1. Riparian Conifers
2. LWD
3. Fines
4. Pool Area, Frequency, and Depth

Reach	Pools			Riffles		Shade	LWD		Riparian Conifers	
	% Area	Freq.	Depth	Gravel	Fines		No.	Vol.	>20"dbh	>35"dbh
1	D	D	D	M	U	U	U	U	U	U
2	D	D	D	M	U	M	M	U	U	U
3	D	D	D	M	U	M	U	U	U	U
4	M	U	M	M	U	D	M	D	U	U
5	U	U	U	NA	NA	D	M	D	U	M

Boulder Creek oscillates between high and low gradient reaches. Riparian conifers and LWD are limiting in the majority of reaches surveyed. Although pool habitat is not limited, adequate habitat complexity, spawning gravel and an overabundance of fine sediments in potential spawning riffles will most likely lessen the success of coho production in this stream. There is a low percentage of the total stream area in side channels because of the constrained nature of the stream system. Six bridges and numerous debris jams were identified along the survey route.

Bridge Creek - Two reaches were identified along Bridge Creek, but only one was surveyed due to landowner restrictions to access. Primary land use along bridge creek is timber production, with the majority of the stands composed of second growth timber and large timber.

Reach	Length (m)	Year	%Open Sky	% Fines	% Gravel	% Pools	LWD	Riparian conifers
1		2000	No Access					
2	2702	2000	21	33	26	30	26.3	61

Limiting Factors:

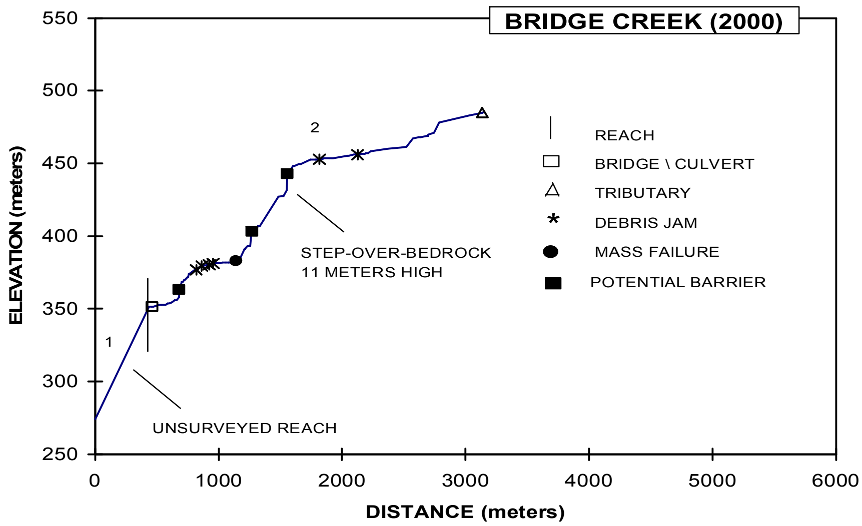
1. Riparian Conifers
2. Fines
3. Pool Frequency

Reach	Pools			Riffles		Shade	LWD		Riparian Conifers	
	% Area	Freq.	Depth	Gravel	Fines		No.	Vol.	>20"dbh	>35"dbh
1	No Access									
2	M	U	D	M	U	D	D	M	U	U

Bridge Creek is a high gradient stream that has little off-channel habitat/high flow storage capability due to its being constrained by terraces. The surveyed reach was limiting in riparian conifers, although LWD and shading was determined to be at levels considered desirable by the habitat benchmark criteria. The high percentage in fines in riffles presents potential difficulties for successful spawning. In addition, the frequency of pools is limiting, although the total percent of the stream comprised of pools (% area) and residual pool depth is adequate. Bridge Creek may provide rearing habitat because of the quantity of pools and habitat structure (LWD) available throughout the reach.

Three potential barriers to fish movement were identified by the survey crew.

Stream Profile Graph: Bridge Creek



Brownson Creek - Three reaches were identified and surveyed along Brownson Creek, and one reach along Tributary A. Primary land use is timber production, with the majority of the stands comprised of mixed second growth and young timber.

Reach	Length (m)	Year	%Open Sky	% Fines	% Gravel	% Pools	LWD	Riparian conifers
1	286	2002	24	11	86	57	4	0
2	316	2002	33	16	76	66	11.6	0
3	1220	2002	11	8	80	70	17.2	46
Trib A	1237	1994	26	23	73	44	8.2	0

Limiting Factors:

1. Riparian Conifers
2. LWD
3. Fines
4. Pool Frequency -Tributary A

Reach	Pools			Riffles		Shade	LWD		Riparian Conifers	
	% Area	Freq.	Depth	Gravel	Fines		No.	Vol.	>20"dbh	>35"dbh
1	D	M	M	D	M	D	U	U	U	U
2	D	D	M	D	M	M	M	U	U	U
3	D	M	M	D	D	D	M	U	U	U
Trib A	D	U	M	D	U	D	U	U	U	U

The surveyed reaches of Brownson Creek were low gradient, hillslope and terrace constrained reaches with little area in side-channel habitat. The number of large riparian conifers along the stream is limiting, as is the number and volume of LWD available to the stream and its inhabitants for habitat structure and complexity. Riparian vegetation is abundant, creating adequate shading for the stream. Suitable spawning habitat exists, but rearing and overwintering habitat is limited by a lack of structural complexity within pools.

The tributary to Brownson Creek is a low gradient stream, constrained by hillslopes. Riparian conifers, LWD, fines, and pool frequency were all limiting factors in this stream. Adequate gravel exists for spawning, but the high percentage of fines may inhibit spawning success.

Cole Creek - Two reaches were identified and surveyed along Cole Creek. Land adjacent to reach 1 is subject to heavy grazing; reach 2 land is primarily in timber production.

Reach	Length (m)	Year	%Open Sky	% Fines	% Gravel	% Pools	LWD	Riparian conifers
1	2471	1996	38	8	52	23.1	3.4	0
2	4456	1996	16	11	63	6.1	19.6	0

Limiting Factors:
1. Riparian Conifers
2. LWD
3. Pool Frequency and Area

Reach	Pools			Riffles		Shade	LWD		Riparian Conifers	
	% Area	Freq.	Depth	Gravel	Fines		No.	Vol.	>20"dbh	>35"dbh
1	M	U	D	D	M	M	U	U	U	U
2	U	U	D	D	D	D	M	U	U	U

Reach 1 of Cole Creek is a low gradient reach, constrained by terraces. Riparian vegetation is limiting, although it does not reach the threshold of 'undesirable' as defined by the habitat benchmark criteria, and is most likely related to the degree of grazing along this reach. Riparian conifers and LWD are very limited in this reach, and although residual pool depth is at a desirable level, the area and frequency of pool environments, coupled with a deficit in structural components for habitat complexity, preclude this portion of the stream from having adequate rearing habitat for juvenile salmonids.

Reach 2 of Cole creek is a high gradient reach, constrained by hillslopes. Although this is a timber-producing site, riparian conifers are limiting, as is LWD input to the stream. Pool area and frequency are limiting in this reach as well, although quality spawning habitat is present.

Dice Creek - Seven reaches were identified along Dice Creek. Primary land use is timber production, with second growth timber in the lower reaches and younger stands in the upper reaches.

Reach	Length (m)	Year	%Open Sky	% Fines	% Gravel	% Pools	LWD	Riparian conifers
1	694	2000	19	25	33	49.5	111.9	0
2	1889	2000	24	14	17	47.3	22.3	0
3	1214	2000	6	19	30	28.6	51.6	30
4	748	2000	8	23	23	26.4	68	122
5	741	2000	30	25	25	9.2	32.7	20
6	672	2000	14	24	31	5.6	129.1	152
7	680	2000	20	NA	NA	0	49.6	no data

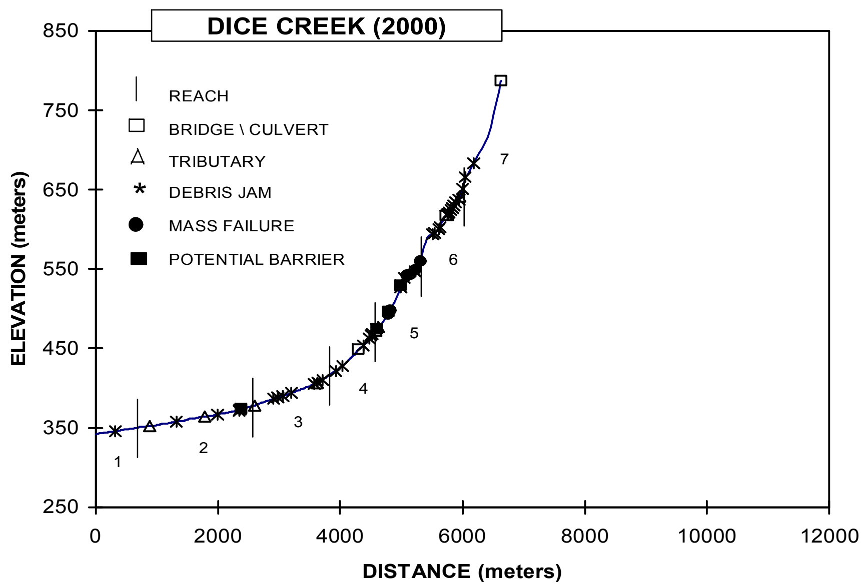
Limiting Factors:
1. Riparian Conifers
2. Fines
4. Pool Area, Frequency, and Depth

Reach	Pools			Riffles		Shade	LWD		Riparian Conifers	
	% Area	Freq.	Depth	Gravel	Fines		No.	Vol.	>20"dbh	>35"dbh
1	D	D	D	M	U	D	M	D	U	U
2	D	D	M	M	M	D	U	M	U	U
3	M	D	M	M	M	D	D	D	U	U
4	M	D	M	M	U	D	D	D	U	U
5	U	U	M	M	U	M	D	D	U	U
6	U	U	M	M	U	D	D	D	U	U
7	U	NA	NA	NA	NA	D	D	D	M	U

The surveyed reaches of Dice Creek are all high gradient (>3%), constrained reaches. Riparian conifers are limiting, but high numbers and volumes of LWD are present in the stream. Adequate levels of gravel exist, but are offset by high percentages of fine materials, which reduce the quality of potential spawning habitat considerably. The limitations apparent in pool characteristics may be a function of the high gradient nature of the stream. However, given the capacity for structural complexity in Dice Creek due to the high levels of LWD and other habitat components (i.e., boulders, *see basin summaries)*, deficits in pool area and frequency may be offset by the increased benefit of these components. In short, this stream may provide quality rearing habitat.

Numerous debris jams were identified throughout the survey, as were several potential barriers to fish passage.

Stream Profile Graph: Dice Creek



Fall Creek - Two reaches were identified and surveyed in Fall Creek. Land use is a mixture of rural residential, large and mature timber, and recent timber harvest.

Reach	Length (m)	Year	%Open Sky	% Fines	% Gravel	% Pools	LWD	Riparian conifers
1	630	2002	13	na	na	33	2.3	91
2	908	2002	12	na	na	22	4.2	0

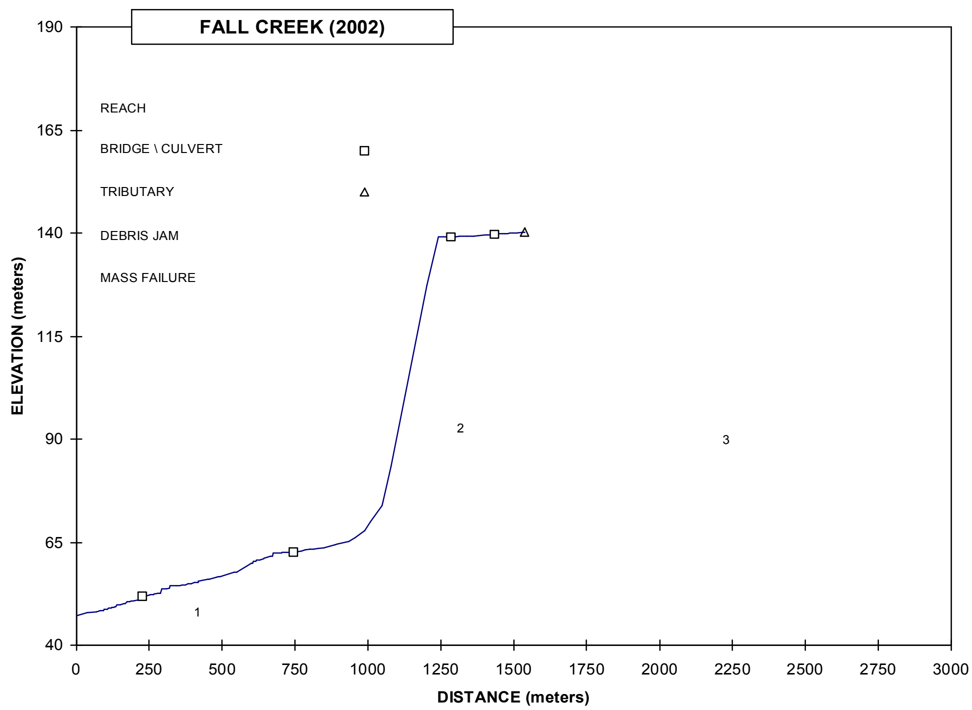
Limiting Factors:

1. Riparian Conifers
2. LWD
3. Pool Frequency
4. Summer Flow

Reach	Pools			Riffles		Shade	LWD		Riparian Conifers	
	% Area	Freq.	Depth	Gravel	Fines		No.	Vol.	>20"dbh	>35"dbh
1	M	M	M	NA	NA	D	U	U	U	U
2	M	U	M	NA	NA	D	U	U	U	U

Fall Creek is a low gradient, constrained stream. Large riparian conifers and LWD are limiting in the measured reaches. Pool frequency is limiting in reach 2, and the remaining pool characteristics in the stream are at moderate levels. Whether adequate spawning habitat is available is unknown, but given the lack of structural components and mediocre pool characteristics, this data is not indicative of quality spawning, rearing, or overwintering habitat for OC Coho salmon.

Stream Profile Graph: Fall Creek



Fetter Creek - One stream reach was identified and surveyed along Fetter Creek; the survey ended at a 6m barrier. Land use is primarily timber production and light grazing, with the majority of the stands consisting of second growth timber.

Reach	Length (m)	Year	%Open Sky	% Fines	% Gravel	% Pools	LWD	Riparian conifers
1	230	1994	3	nd	nd	0	3.9	0

Limiting Factors:

1. Riparian Conifers
2. LWD
3. Pool Area and Frequency
4. Summer Flow

Reach	Pools			Riffles		Shade	LWD		Riparian Conifers	
	% Area	Frequency	Depth	Gravel	Fines		Number	Volume	>20"dbh	>35"dbh
1	U	U	NA	NA	NA	D	U	U	U	U

Fetter Creek is a high (8.4%) gradient, hill-slop constrained stream with very high occurrence of bank erosion, and no secondary channel habitat. No data is available for the percentage of fines or gravel in riffles, but given the deficit of pool area and frequency, LWD, and large riparian conifers, and the high incidence of erosion, Fetter Creek appears to be very limiting in quality spawning, rearing, and overwintering habitat for OC Coho salmon.

Frenchie Creek - Two reaches were identified and surveyed in Frenchie Creek. Surrounding land is predominantly yielding second growth timber.

Reach	Length (m)	Year	%Open Sky	% Fines	% Gravel	% Pools	LWD	Riparian conifers
1	1410	1997	1	5	58	41.1	50.8	15
2	1450	1997	1	40	50	27.8	66.4	46

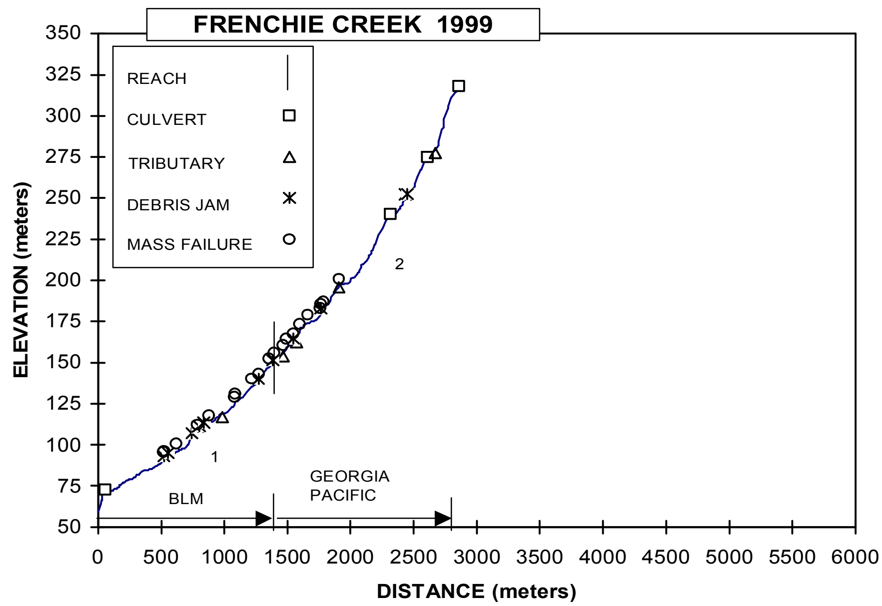
Limiting Factors:
1. Riparian Conifers
2. Fines

Reach	Pools			Riffles		Shade	LWD		Riparian Conifers	
	% Area	Frequency	Depth	Gravel	Fines		No.	Vol.	>20"dbh	>35"dbh
1	D	D	M	D	D	D	D	D	U	U
2	M	M	M	D	U	D	D	D	U	U

Frenchie Creek is a high gradient, hillslope-constrained stream. The number of large riparian conifers is limiting, but deciduous riparian vegetation provides ample quantities of shade to the stream. Reach 1 provides quality spawning and rearing habitat, with a desirable percentage of gravel available in spawning riffles, and similarly desirably low percentages of fines. High levels of fines in reach 2 may preclude spawning success. Quality pool characteristics exist and are augmented by large the amounts of LWD available as structural components to habitat complexity. Based on this information, Frenchie Creek appears to provide quality spawning and rearing habitat to salmonids.

Numerous debris jams and mass failures were identified throughout the survey. A culvert in reach 1 presents a potential barrier to fish movement.

Stream Profile Graph: Frenchie Creek



Holmes Creek - Two reaches were identified and surveyed along Holmes Creek. Land uses include rural residential and timber production, with stand ages ranging from young trees to second growth timber. Holmes Creek is a low gradient, terrace-constrained stream with very little second-channel habitat.

Reach	Length (m)	Year	%Open Sky	% Fines	% Gravel	% Pools	LWD	Riparian conifers
1	1306	2000	27	5	8	50.9	4.4	0
2	245	2000	19	5	5	1.3	5.2	0

Limiting Factors:

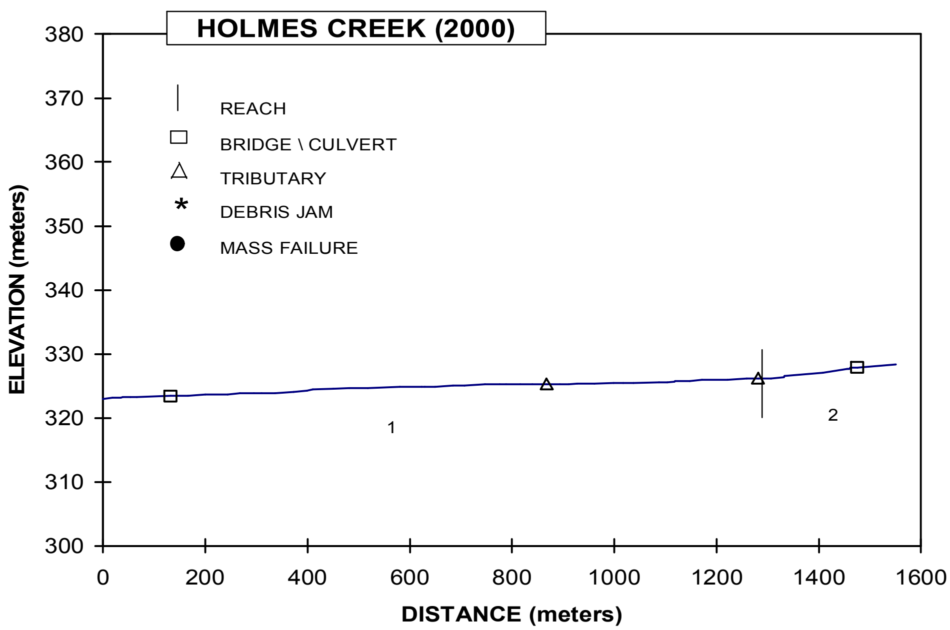
1. Riparian Conifers
2. LWD
3. Gravel
4. Pool Area, Frequency, and Depth

Reach	Pools			Riffles		Shade	LWD		Riparian Conifers	
	% Area	Frequency	Depth	Gravel	Fines		No.	Vol.	>20"dbh	>35"dbh
1	D	M	M	U	D	D	U	U	U	U
2	U	U	U	U	D	D	U	U	U	U

While the percentages of fines and shade are at desirable levels, the remainder of the habitat benchmark criteria is at levels that are less than desirable, if not undesirable. The number of riparian conifers continues to be a limiting factor, although the presence of dense deciduous riparian zones mitigates this limitation, to the extent that adequate shade and near-stream terrestrial communities are present.

The poor quality of pool habitats and low levels of gravel and LWD preclude this stream from providing quality spawning, rearing, or overwintering habitat for OC Coho.

Stream Profile Graph: Holmes Creek



Jones Creek - One reach was identified and surveyed along Jones Creek. Primary land use is timber production, with stands ranging from young trees to second growth timber. Jones Creek is a high gradient (10.2%), hillslope-constrained stream with a high proportion of boulders creating some structural complexity. The timing of the survey of Jones Creek was such that the majority of the stream units surveyed were "dry units," and as such, values for Percent Fines and Percent Gravel in riffles were not obtainable. There is very little off-channel habitat available.

Reach	Length (m)	Year	%Open Sky	% Fines	% Gravel	% Pools	LWD	Riparian conifers
1	535	2002	12	NA	NA	0	6	0

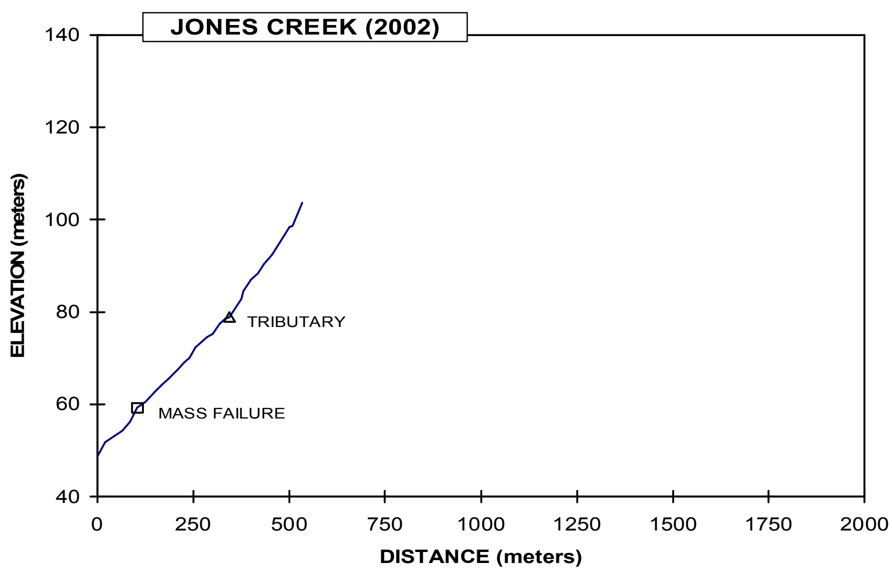
Limiting Factors:

1. Riparian Conifers
2. LWD
3. Pool Frequency and Depth
4. Summer Flow

Reach	Pools			Riffles		Shade	LWD		Riparian Conifers	
	% Area	Frequency	Depth	Gravel	Fines		No.	Vol.	>20"dbh	>35"dbh
1	NA	U	U	NA	NA	D	M	U	U	U

Because the majority of the stream was dry (in both 1994 and 2002), Jones Creek does not provide quality rearing habitat for juvenile salmonids. Quality of potential spawning habitat is unknown, given the lack of available information.

Stream Profile Graph: Jones Creek



King Creek - One reach was identified and surveyed in King Creek. Primary land use along King Creek is timber production, with the majority of the surrounding stands consisting of second growth timber. King Creek is a moderate gradient (3.1%), constrained alternately by hillslopes and terraces. Bank erosion and off-channel habitat are minimal. The primary instream habitat unit is riffles.

Reach	Length (m)	Year	%Open Sky	% Fines	% Gravel	% Pools	LWD	Riparian conifers
1	4779	1996	9	8	63	34	11.3	30

Limiting Factors:

1. Riparian Conifers
2. LWD
3. Pool Frequency

Reach	Pools			Riffles		Shade	LWD		Riparian Conifers	
	% Area	Freq.	Depth	Gravel	Fines		No.	Vol.	>20"dbh	>35"dbh
1	M	U	M	D	D	D	U	U	U	U

The number of large riparian conifers is limiting, but alleviated by the large number of deciduous and smaller coniferous trees comprising the riparian zone. LWD is limiting within the stream, and may compromise the quality of rearing and overwintering habitat available for juvenile salmonids. The quality of pool habitat is moderate, on average, throughout the stream. As noted previously, the majority of the instream habitat is comprised of riffles; desirable levels of gravel and fine sediments should provide quality spawning habitat.

Lake Creek - Two reaches were identified and surveyed on Lake Creek. Primary land use is timber production, with second growth timber and timber harvest dominating the landscape. Lake Creek is a high gradient (14.9%, 4.0%) stream constrained by hillslopes and terraces. Large boulders comprise the majority of the instream habitat; bank stability is good, although there is no side channel habitat.

Reach	Length (m)	Year	%Open Sky	% Fines	% Gravel	% Pools	LWD	Riparian conifers
1	680	1995	3	6	10	8.3	50.9	
2	934	1995	3	11	90	88.5	32.2	0

Limiting Factors:

1. Riparian Conifers
2. Gravel
3. Pool Area and Depth

Reach	Pools			Riffles		Shade	LWD		Riparian Conifers	
	% Area	Frequency	Depth	Gravel	Fines		No.	Vol.	>20"dbh	>35"dbh
1	U	M	M	U	D	D	D	D	U	U
2	D	D	U	D	M	D	D	D	U	U

The number of large riparian conifers is limiting, but alleviated by the large number of deciduous and smaller coniferous trees comprising the riparian zone. Gravel and percent pool area is limiting in reach 1. The number and volume of LWD pieces is at desirable levels, and combined with pool characteristics that are, on average, moderate to desirable, should provide adequate structural complexity for rearing and overwintering juvenile coho. Spawning habitat is limited by low levels of gravel in reach 1, but reach 2 contains desirable levels of gravel and may provide adequate spawning habitat for the reach.

Little Rock Creek - One reach was identified and surveyed on Little Rock Creek, beginning at its confluence with Upper Rock Creek. Primary land use is timber production, with the majority of stands consisting of young trees or second growth timber. Little Rock Creek is a high gradient (12.5%) stream constrained by hillslopes. Large boulders and cascades comprise a large proportion of the instream habitat and bank erosion is negligible.

Reach	Length (m)	Year	%Open Sky	% Fines	% Gravel	% Pools	LWD	Riparian conifers
1	3082	1995	4	16	34	11.2	8.3	0

Limiting Factors:
1. Riparian Conifers
2. LWD - volume
3. Pool Frequency

Reach	Pools			Riffles		Shade	LWD		Riparian Conifers	
	% Area	Frequency	Depth	Gravel	Fines		No.	Vol.	>20"dbh	>35"dbh
1	M	U	M	M	M	D	M	U	U	U

Riparian conifers are limiting along Little Rock Creek, but the amount of shade provided the stream is at a desirable level, indicating that the riparian community is abundant, but not of the ideal composition for a coast-range stream. Pool characteristics are moderate, as is to be expected in a stream dominated by boulder cascades; some habitat is available to rearing and overwintering juveniles, but accessibility may be limited due to several potential height barriers. LWD number and volume is less than desirable. The large number of boulders and other rock structures present may mitigate this deficiency in habitat structural material. Gravel and fines in riffles are at moderate levels; spawning habitat may be present, but limited.

Lower Rock Creek - Three reaches were identified and surveyed on Lower Rock Creek. Primary land use is agricultural use, light grazing, and second growth timber production. Lower Rock Creek is a low gradient stream constrained by terraces and hillslopes.

Reach	Length (m)	Year	%Open Sky	% Fines	% Gravel	% Pools	LWD	Riparian conifers
1	3229	1995	30	4	28	27.9	0.8	36
2	1073	1995	35	10	85	31.5	0.6	0
3	11042	1995	13	11	59	33.1	11.3	48

Limiting Factors:
1. Riparian Conifers
2. LWD

Reach	Pools			Riffles		Shade	LWD		Riparian Conifers	
	% Area	Frequency	Depth	Gravel	Fines		No.	Vol.	>20"dbh	>35"dbh
1	M	M	D	M	D	D	U	U	U	U
2	M	M	D	D	M	D	U	U	U	U
3	M	D	D	D	M	D	M	U	U	U

Riparian conifers were limiting along all surveyed reaches of Lower Rock Creek. However, the surveyors indicated that the majority of riparian vegetation consists of predominantly hardwoods between 3 and 50 cm in diameter. This riparian structure, while not ideal, does provide adequate shading to a stream of this size. Pool characteristics are moderate to desirable, providing adequate rearing and overwintering habitat for juvenile salmonids.

Limitations in the number and volume of LWD available to provide habitat complexity may limit the streams carrying capacity for juvenile salmonid populations. Spawning habitat is not limiting.

McMullen Creek - One reach was identified and surveyed in McMullen Creek. Primary land use along this stream is timber production, with the majority of the stands consisting of second growth timber. McMullen Creek is a moderate gradient (3.6%) stream constrained by terraces. At the time of the survey, 42% of the surveyed units were dry.

Reach	Length (m)	Year	%Open Sky	% Fines	% Gravel	% Pools	LWD	Riparian conifers
1	1341	1995	6	19	70	17.8	0.5	0

Limiting Factors:

1. Riparian Conifers
2. LWD
3. Pool Depth

Reach	Pools			Riffles		Shade	LWD		Riparian Conifers	
	% Area	Frequency	Depth	Gravel	Fines		No.	Vol.	>20"dbh	>35"dbh
1	M	D	U	D	M	D	U	U	U	U

McMullen Creek does not provide quality rearing habitat for juvenile salmonids because of low water levels during summer months. Shade is not limiting, but riparian conifers are nonexistent. The riparian community is dominated by deciduous trees between 3 and 15 cm in diameter. McMullen Creek is directly connected to the mainstem of the Middle Fork Coquille River. Quality spawning habitat in the creek is not limited by gravel or fines, and juvenile salmonids may travel downstream to the mainstem Middle Fork to find more suitable habitat during dry months.

Middle Fork Coquille River - Seven reaches were identified and six were surveyed along the Middle Fork Coquille River. The survey was conducted in the upper reaches of the Middle Fork, from its confluence with Twelvemile Creek and extended 15.5 km upstream. Primary land use was grazing and timber production, with the majority of stands consisting of second growth timber. These reaches of the Middle Fork Coquille River are low gradient and constrained by hillslopes and terraces. An artificial dam is present at 7.5 km upstream from the confluence with Twelvemile Creek. Bank erosion is high in reaches 2-6; the percentage of stream area in side channels is low.

Reach	Length (m)	Year	%Open Sky	% Fines	% Gravel	% Pools	LWD	Riparian conifers
1	2768	2000	38	37	32	64	1.6	0
2	3531	2000	29	18	22	86.4	0	no data
3	225	2000	34	13	10	94.5	0	0
4	1435	2000	43	14	11	88.1	1.1	0
5		2000	No access					
6	751	2000	26	55	40	82.3	12.9	91
7	472	2000	41	42	44	79	19.7	0

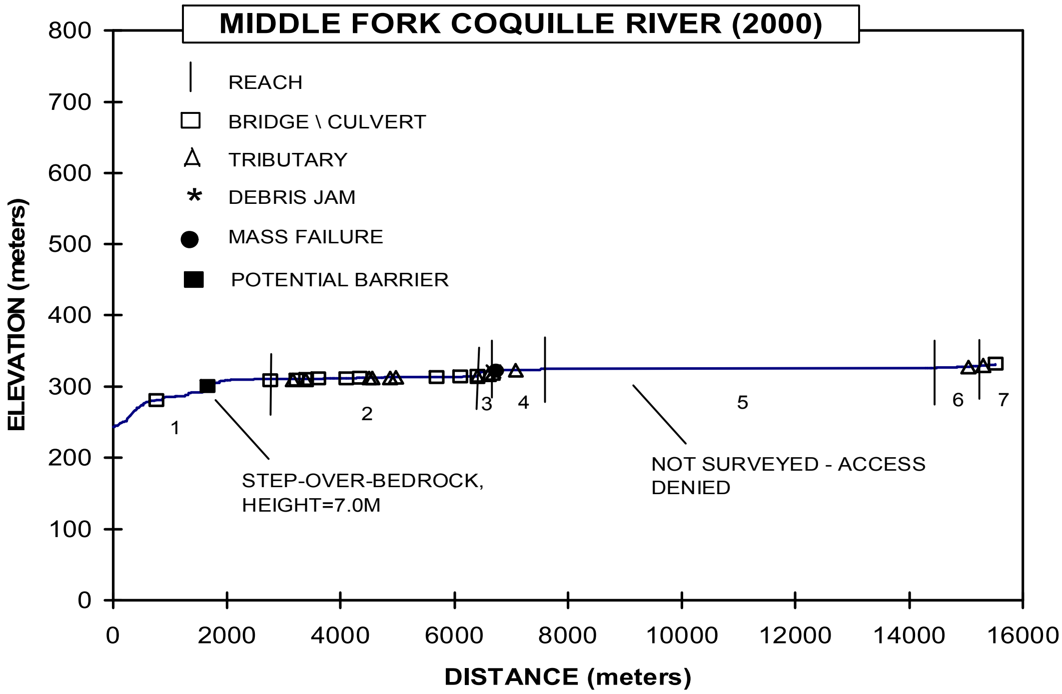
Limiting Factors:

1. Riparian Conifers
2. LWD
3. Fines
4. Gravel
5. Pool Depth – reach 3
6. Shade – reach 7

Reach	Pools			Riffles		Shade	LWD		Riparian Conifers	
	% Area	Frequency	Depth	Gravel	Fines		No.	Vol.	>20"dbh	>35"dbh
1	D	D	D	M	U	D	U	U	U	U
2	D	M	D	M	M	D	U	U	U	U
3	D	D	U	U	M	M	U	U	U	U
4	D	M	nd	U	M	M	U	U	U	U
5	No Access									
6	D	M	D	D	U	D	M	U	U	U
7	D	M	D	D	U	U	M	U	U	U

Riparian communities are limiting in large conifers, and are thus limited as a source of LWD to the stream. Hardwoods dominate the riparian zone and provide adequate shading, with the exception of reach 7, where shading was at an undesirable level. Pool characteristics, on average, are moderate to desirable, indicating that the potential for quality rearing and overwintering habitat exists. Reaches 1-3 have a fairly large number of boulders present that may provide some structural complexity to the pool habitats, but increases in LWD would be beneficial. Spawning habitat is available, although reaches 3 and 4 are limiting in the amount of gravel available, and reaches 1, 6, and 7 contain undesirable proportions of fine sediments, which may affect spawning success.

Stream Profile Graph: Middle Fork Coquille River



3

Myrtle Creek - Six reaches were identified and surveyed along Myrtle Creek, and one reach was surveyed on the Section 9W Tributary to Myrtle Creek. Primary land use along these reaches is grazing and second growth timber production. With the exception of reaches 4 and 6 of the mainstem, and the Myrtle Creek tributary, the majority of the reaches surveyed were low gradient. Reaches 4, 6, and the tributary had average gradients of 8.5%, 6.7%, and 8.2%, respectively. Habitat restoration in the form of cabled LWD is present in reach 1 of Myrtle Creek. In addition, two gabions were installed in the lower portion of the tributary to Myrtle Creek.

Reach	Length (m)	Year	%Open Sky	% Fines	% Gravel	% Pools	LWD	Riparian conifers
1	7850	1996	43	4	32	33	1.4	20
2	6546	1996	49	5	43	35	4.1	0
3	4361	1996	32	5	53	24.2	5.6	20
4	3901	1996	9	10	47	13.2	34.2	61
5	978	1996	21	20	76	46.2	49.4	0
6	4759	1996	12	15	57	19.6	89	0
Sec9W	728	1996	12	9	52	5.6	12.7	0

Limiting Factors:
1. Riparian Conifers
2. LWD
3. Fines – reach 5
4. Pool Area and Frequency

Reach	Pools			Riffles		Shade	LWD		Riparian Conifers	
	% Area	Frequency	Depth	Gravel	Fines		No.	Vol.	>20"dbh	>35"dbh
1	M	M	D	M	D	M	U	U	U	U
2	D	M	D	D	D	M	U	U	U	U
3	M	M	D	D	D	M	U	U	U	U
4	M	M	D	D	D	D	M	D	U	U
5	D	M	D	D	U	D	D	D	U	U
6	M	U	D	D	M	D	D	D	U	U
Trib	U	U	M	D	D	D	M	U	U	U

Riparian conifers limit the potential for LWD recruitment into the stream. However, riparian community is dominated by 3 to 15 cm hardwoods, which provide adequate levels of shading to the stream. Pool characteristics are moderate to desirable, indicating that adequate habitat is present for rearing and overwintering juveniles, especially in reaches 4-6 of Myrtle Creek, where LWD is available in desirable quantities. Spawning habitat is not limited, except possibly in reach 5 of Myrtle Creek, where the percentage of fine sediments present may create limitations to spawning success.

Rasler Creek - Two reaches were identified and surveyed on Rasler Creek. Primary land use is heavy grazing in reach 1 and second growth timber in reach 2. Rasler Creek is a high gradient stream, constrained by terraces and hillslopes, and with virtually no stream area in side-channel habitat.

Reach	Length (m)	Year	%Open Sky	% Fines	% Gravel	% Pools	LWD	Riparian conifers
1	1281	1996	7	29	24	12.3	3.3	0
2	11980	1996	0	13	13	3	17	0

Limiting Factors:
1. Riparian Conifers
2. LWD
3. Pool Frequency and Area
4. Gravel
5. Fines

Reach	Pools			Riffles		Shade	LWD		Riparian Conifers	
	% Area	Frequency	Depth	Gravel	Fines		Number	Volume	>20"dbh	>35"dbh
1	M	M	M	M	U	D	U	U	U	U
2	U	U	M	U	M	D	M	U	U	U

Rasler Creek is limited by a number of habitat elements. Riparian conifers are absent from a riparian community that is dominated by hardwood trees. The percentage of the total stream area comprised of pools, as well as pool frequency, are at undesirable levels in reach 2, but that may be a function of the high stream gradient (10.6%). Spawning habitat is moderate to undesirable in Rasler Creek, limited by high percentages of fine sediments in reach 1 and low percentages of gravel in reach 2.

Reed Creek - Four reaches were identified and three were surveyed on Reed Creek. The surveyed reaches are under heavy grazing pressure, with the exception of reach 4, where an exclosure prohibits livestock access. Reed Creek is a low gradient stream, with the lower three reaches constrained by terraces, while reach 4 is a broader valley with multiple terraces and much less constraint. The majority of habitat units surveyed were dry (58%) at the time of the survey, resulting in limited data collection abilities. Beaver activity was widespread throughout the stream.

Reach	Length (m)	Year	%Open Sky	% Fines	% Gravel	% Pools	LWD	Riparian conifers
1	990	2000	81	30	65	51.4	NA	0
2	No Access							
3	471	2000	44	NA	NA	19.9	2.6	0
4	1247	2000	33	NA	NA	40	10.9	no data

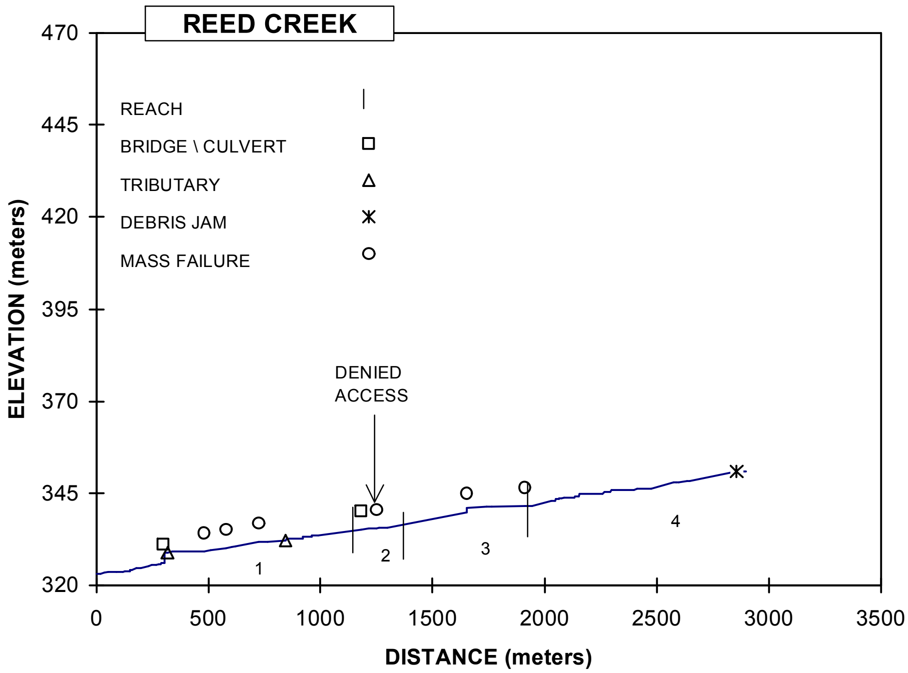
Limiting Factors:

1. Riparian Conifers
2. LWD

Reach	Pools			Riffles		Shade	LWD		Riparian Conifers	
	% Area	Frequency	Depth	Gravel	Fines		No.	Vol.	>20"dbh	>35"dbh
1	D	U	M	D	U	U	U	Nd	U	U
2	No access									
3	M	U	M	NA	NA	U	U	U	U	U
4	D	U	D	NA	NA	M	U	U	Nd	Nd

Reed Creek is limited in many habitat elements required to fulfill the life history requirements of Coho salmon. Adequate shading is not present, due to a limited riparian community. Large conifers are nonexistent in the riparian community, and the resulting low and undesirable levels of LWD in the stream system are a result. Low summer water level may result from grazing activity, loss of riparian cover and off channel water storage capabilities. In any event, the low water levels create poor pool characteristics, creating a deficit in available rearing habitat for juvenile salmonids. The amount of quality spawning habitat is unknown. Low water levels precluded surveys of gravel and fines in the majority of stream reaches.

Stream Profile Graph: Reed Creek



Salmon Creek - Three reaches were surveyed on Salmon Creek. Primary land use is grazing, rural residential, and timber production, with the majority of the stands consisting of young and second growth timber. At its confluence with the Middle Fork Coquille River, Salmon Creek is a low gradient stream, but it increases in gradient with increasing reach, until the average stream gradient is 12.6% in reach 3.

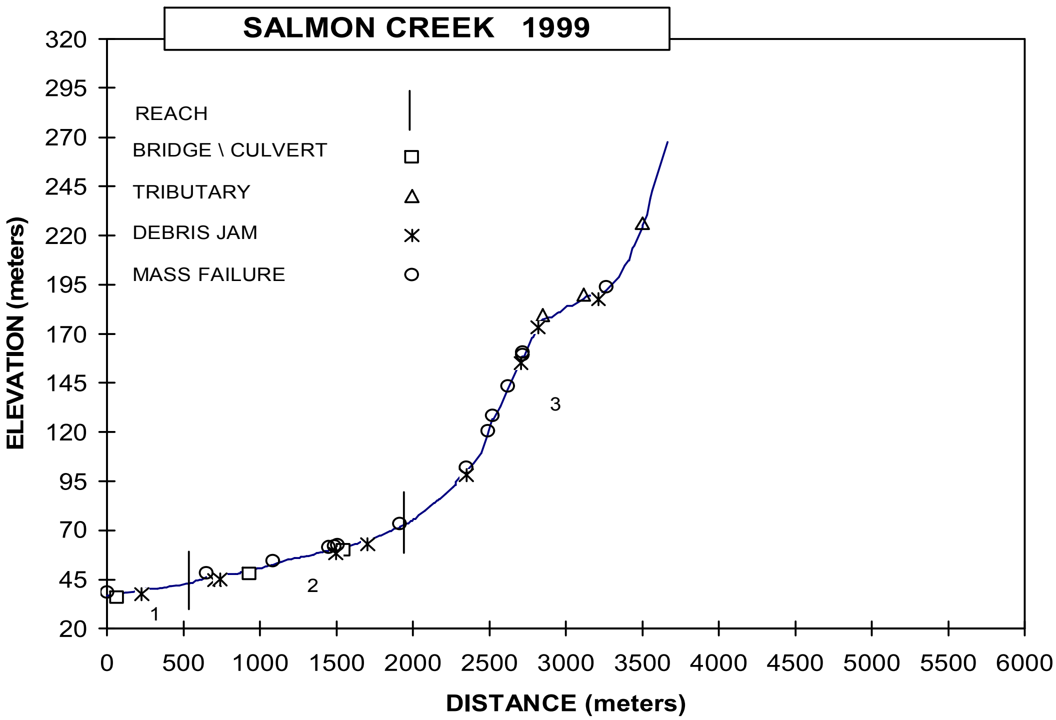
Reach	Length (m)	Year	%Open Sky	% Fines	% Gravel	% Pools	LWD	Riparian conifers
1	548	1997	4	25	60	38.9	1.4	ND
2	1943	1997	3	10	62	39.1	7.8	41
3	1175	1997	4	16	75	26	26.1	41

Limiting Factors:
1. Riparian Conifers
2. LWD
3. Fines – reach 1
4. Pool Frequency – reach 3

Reach	Pools			Riffles		Shade	LWD		Riparian Conifers	
	% Area	Freq.	Depth	Gravel	Fines		No.	Vol.	>20"dbh	>35"dbh
1	D	M	M	D	U	D	U	U	U	U
2	D	M	M	D	M	D	U	U	U	U
3	M	U	M	D	M	D	M	M	U	U

Low numbers of large conifers are present in the riparian communities. With the exception of reach 2, where some small conifers are present, riparian composition is typically hardwood species, between 3 and 15 cm in diameter. Pool characteristics on Salmon Creek are such that adequate rearing and overwintering habitat is available for juvenile coho salmon. The low level of LWD is of concern for pool complexity. Spawning gravel is available in desirable percentages; however, relatively high percentages of fines may decrease the effectiveness of spawning efforts. There are no reported barriers to fish movement.

Stream Profile Graph: Salmon Creek



Sandy Creek - Five reaches were surveyed on Sandy Creek. Primary land use in the Sandy Creek watershed is timber production, with stands consisting of second growth and large timber. Light grazing pressure occurs in reaches 1 and 2 of Sandy Creek, and some rural residential in reach 4. Average instream gradients are low in reaches 1-4, but high in reach 5 (26.3%).

Reach	Length (m)	Year	%Open Sky	% Fines	% Gravel	% Pools	LWD	Riparian conifers
1	3820	1994	38	26	46	60	1.4	0
2	1811	1994	24	13	39	39	2	0
3	6954	1994	12	12	24	36	2.8	68
4	715	1994	5	24	34	32	5.8	0
5	1627	1994	4	35	35	4	7.7	0

Limiting Factors:
1. Riparian Conifers
2. LWD
3. Fines
4. Pool Area, Frequency, and Depth – reach 5

Reach	Pools			Riffles		Shade	LWD		Riparian Conifers	
	% Area	Frequency	Depth	Gravel	Fines		No.	Vol.	>20"dbh	>35"dbh
1	D	M	M	D	U	D	U	U	U	U
2	D	D	M	D	M	D	U	U	U	U
3	D	D	M	M	M	D	U	U	U	U
4	M	D	M	M	U	D	U	U	U	U
5	U	U	U	D	U	D	U	U	U	U

Large conifers are limiting in the riparian community, but the high number of hardwoods provides desirable levels of shading to the stream. In reaches 1 through 4, pool characteristics and available habitat are at desirable levels, but the low numbers and volumes of LWD indicates low pool habitat complexity, which may limit the carrying capacity of these reaches for juvenile salmonids. Spawning habitat in these four reaches is adequate as well, although the percentage of fine sediments is at undesirable levels in reaches 1 and 4. In reach 5, the gradient increases from 1.7% in reach 4 to 26.3%. This steep gradient may preclude this reach of the stream from providing spawning, rearing, and overwintering habitat for coho.

Sandy Creek Tributaries - Eight tributaries to Sandy Creek were surveyed in 1994. Primary land use along these reaches is timber production, with the majority of the stands consisting of second growth and large timber. These tributaries tend to be moderately high gradient streams, ranging from 3.3% in Tributary E to 10.2% in Tributary B. Bank erosion is a common, high occurrence phenomenon, and there is virtually no available side-channel habitat in these hillslope-constrained drainages.

Reach	Length (m)	Year	%Open Sky	% Fines	% Gravel	% Pools	LWD	Riparian conifers
A	1987	1994	11	19	31	27	16.3	30
B	2727	1994	11	15	28	8	5.2	46
C	1395	1994	3	31	29	7	21.9	0
D	1071	1994	19	40	30	57	7.9	0
E	746	1994	10	36	27	3	13.5	0
F	930	1994	11	nd	nd	0	4.1	0
G	1097	1994	13	nd	nd		9.3	122
H	1538	1994	7	28	60	9	8.3	61

Limiting Factors:
1. Riparian Conifers
2. LWD
3. Fines
4. Pool Area and Frequency

Reach	Pools			Riffles		Shade	LWD		Riparian Conifers	
	% Area	Frequency	Depth	Gravel	Fines		No.	Vol.	>20"dbh	>35"dbh
A	M	M	D	M	M	D	M	U	U	U
B	U	U	M	M	M	D	U	U	U	U
C	U	U	M	M	U	D	M	M	U	U
D	D	D	M	M	U	D	M	U	U	U
E	U	U	M	M	U	D	M	U	U	U
F	No Data					D	U	U	U	U
G	No Data					D	M	U	U	U
H	U	U	M	D	U	D	M	U	U	U

Large conifers are limited in the riparian communities along these tributaries; however, ample shade is provided from the dense communities of riparian hardwoods. LWD recruitment levels are undesirable, on average, and would be enhanced by the presence of large conifers. Pool characteristics and available habitat is moderate to desirable in Tributaries A and D, but the remainder of the tributaries to Sandy Creek are limited in available rearing and overwintering habitat for juvenile coho. The habitat surveys indicate that gravel available for spawning habitat is of moderate quality, and high percentages of fine sediments in tributaries C, D, E, and H may decrease spawning success. No data was available for pool and riffle habitats in tributaries F and G. This may be a result of low water levels, as has been observed in previous sections, but the survey reports were not available in a readable format.

Shields Creek - Two reaches were surveyed on Shields Creek. Primary land use along this stream is timber production, with stands consisting of second growth and young timber. Shields Creek is a high gradient stream, increasing from 4.8% in reach 1 to 13.3% in reach 2, constrained by hillslopes and terraces. Bank erosion is low, and there are a high number of boulders in each reach.

Reach	Length (m)	Year	%Open Sky	% Fines	% Gravel	% Pools	LWD	Riparian conifers
1	388	1999	0	3	20	23.7	4.9	No Data
2	680	1999	1	8	40	38.8	6.7	

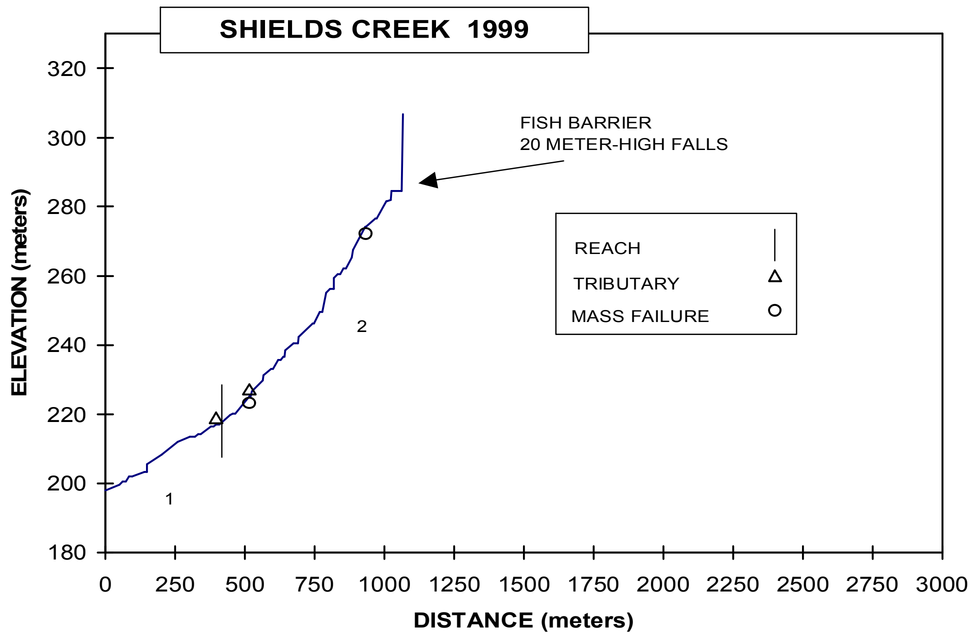
Limiting Factors:

1. LWD

Reach	Pools			Riffles		Shade	LWD		Riparian Conifers	
	% Area	Frequency	Depth	Gravel	Fines		No.	Vol.	>20"dbh	>35"dbh
1	M	M	D	M	D	D	U	U	No data	
2	D	D	D	D	D	D	U	U		

Although no data was entered by the survey crew regarding the number of large riparian conifers present, the Shields Creek written report (ODFW Aquatic Habitat Inventory Project) indicates that the riparian community consisted of hardwoods 3 to 15 cm in diameter. This indicates that, like the majority of reaches surveyed in the Middle Fork Coquille Watershed, large riparian conifers are limiting in Shields Creek. Also found in undesirable quantities is LWD. This decreases the habitat complexity of the available pool habitat, which otherwise, provides quality rearing and overwintering habitat for juvenile coho. However, the large number of boulders per 100 meters of stream length (198 in reach 1 and 155 in reach 2) adds a large degree of spatial variability to the stream environment and may mitigate for deficiencies in available LWD.

Stream Profile Graph: Shields Creek



Slater Creek - Five reaches were surveyed on Slater Creek. Primary land use is timber production, with the majority of the stands consisting of second growth timber. Slater Creek is a relatively low gradient stream in reaches 1 through 3, but its average gradient increases sharply to 5.5% in reach 4 and 10.1% in reach 5. Juvenile coho salmon were observed by the survey crew into reach 3.

Reach	Length (m)	Year	%Open Sky	% Fines	% Gravel	% Pools	LWD	Riparian conifers
1	1283	1997	4	4	50	48	6	0
2	746	1997	17	4	96	90	47	no data
3	1521	1997	4	2	38	48	32	0
4	773	1997	0	0	25	16	48	no data
5	1575	1997	1	4	45	21	77	0

Limiting Factors:

1. Riparian Conifers
2. LWD

Reach	Pools			Riffles		Shade	LWD		Riparian Conifers	
	% Area	Freq.	Depth	Gravel	Fines		No.	Vol.	>20"dbh	>35"dbh
1	D	D	D	D	D	D	U	U	U	U
2	D	D	D	D	D	D	D	D	No Data	
3	D	D	M	D	D	D	U	D	U	U
4	M	M	D	M	D	D	M	D	No Data	
5	M	M	D	D	D	D	D	D	U	U

Large conifers are limiting, but the abundance of riparian hardwoods provides enough shading to protect the stream. Pool characteristics are almost ideal, and the presence of ample quantities of LWD in all reaches except reach 1 indicates high quality coho rearing and overwintering habitat. This stream is dominated by cobble and gravel, thus providing high quality spawning habitat as well.

Slide Creek - Three reaches were surveyed along Slide Creek. Primary land use in this drainage is timber production, with stands consisting of second growth and mature timber. Slide Creek is a moderately high gradient stream constrained by terraces and hill slopes. Bank erosion is moderate; instream complexity resulting from boulders is moderate as well. There is very little area in side-channels.

Reach	Length (m)	Year	%Open Sky	% Fines	% Gravel	% Pools	LWD	Riparian conifers
1	715	1996	11	34	37	43.1	10.5	0
2	2354	1996	1	23	27	42	9	28
3	633	1996	3	13	42	24.3	48.5	101

Limiting Factors:

1. Riparian Conifers
2. LWD
3. Fines

Reach	Pools			Riffles		Shade	LWD		Riparian Conifers	
	% Area	Frequency	Depth	Gravel	Fines		No.	Vol.	>20"dbh	>35"dbh
1	D	M	M	D	U	D	U	U	U	U
2	D	M	M	M	U	D	U	U	U	U
3	M	M	M	D	M	D	D	D	U	U

Large conifers, while present in the riparian community in numbers greater than have been typically seen thus far, are still at undesirable levels according to the habitat benchmark criteria and the natural history of the Coquille Basin. It should be noted that large numbers of small coniferous trees are present in desirable numbers in these reaches, so that in time, the benchmark criteria will be met. Currently, adequate shade is provided by a predominantly hardwood riparian community. Pool habitat is moderate to desirable. The low levels of LWD in reaches 1 and 2 are a concern for habitat complexity, although desirable levels of LWD are present in reach 3, presumably creating complex pool habitat for rearing and overwintering juvenile coho salmon. The percentage of gravel is ample enough to present adequate spawning habitat, although the high percentages of fine sediments in reaches 1 and 2 may reduce the success of spawning efforts.

Slide Creek Tributaries - Five tributaries to Slide Creek were surveyed in 1996. Primary land use in these drainages is timber production, with stands consisting of second growth timber. These tributaries are high gradient streams, typically constrained by hill slopes or terraces. Bank erosion is minimal and there is very little stream area contained in side channels.

Reach	Length (m)	Year	%Open Sky	% Fines	% Gravel	% Pools	LWD	Riparian conifers
A	1371	1996	0	13	40	14.6	8.4	37
B	396	1996	1	23	33	7.6	4.9	30
C	250	1996	0	71	18	1	4.5	61
D	705	1996	1	13	40	9	16.7	41
E	552	1996	0	25	48	3.5	22.6	0

Limiting Factors:
1. Riparian Conifers
2. LWD
3. Pool Area and Frequency
4. Fines

Reach	Pools			Riffles		Shade	LWD		Riparian Conifers	
	% Area	Frequency	Depth	Gravel	Fines		No.	Vol.	>20"dbh	>35"dbh
A	M	M	M	D	M	D	U	U	U	U
B	U	M	M	M	U	D	U	U	U	U
C	U	U	M	M	U	D	M	U	U	U
D	U	U	M	D	M	D	D	U	U	U
E	U	U	M	D	U	D	M	M	U	U

Although the number of large riparian conifers is currently undesirable and does not meet habitat benchmark standards, large numbers of small riparian conifers are present in tributaries A-D, and will meet benchmark criteria in time.

Pool habitat is not present in adequate quality to support extensive overwintering or rearing of juvenile coho. LWD volume is typically at moderate to undesirable levels. Riffle habitat provides adequate quantities of gravel for spawning beds; however, the high percentage of fine sediments may decrease spawning success.

Smith Creek - Two reaches were surveyed along Smith Creek. Primary land use is timber production, with stands consisting of second growth timber. Smith Creek is a moderately high gradient stream that is constrained by hillslopes and terraces. There was no evidence of bank erosion occurring along the survey route, and very little side channel habitat available. Chicken wire has been placed as a channel stabilization structure in reach 1.

Reach	Length (m)	Year	%Open Sky	% Fines	% Gravel	% Pools	LWD	Riparian conifers
1	1275	1996	2	6	66	15	10.4	0
2	704	1996	0	13	45	2.4	30.1	61

Limiting Factors:
1. Riparian Conifers
2. Pool Area and Frequency
3. LWD

Reach	Pools			Riffles		Shade	LWD		Riparian Conifers	
	% Area	Frequency	Depth	Gravel	Fines		No.	Vol.	>20"dbh	>35"dbh
1	M	U	M	D	D	D	U	U	U	U
2	U	U	M	D	M	D	M	D	U	M

Large riparian conifers are nonexistent in reach 1 of Smith Creek. They are, however, present in relatively high numbers in reach 2 (183/1000 ft). Reach 2 also has a large number of small riparian conifers that will, in time, enable this reach to achieve this habitat benchmark. Reach 1 does not have any recorded riparian conifers, regardless of size, and its riparian community is dominated by hardwood trees and shrubs.

LWD is limiting in reach 1, presumably a result of its riparian community composition. Pool habitat in Smith Creek is moderate to undesirable, indicating this stream is not a good candidate for rearing or overwintering juvenile coho. Spawning habitat, as indicated by the data, is excellent. Juvenile salmonids may move downstream into King Creek in search of higher quality rearing habitat, but the difference in quality is not much.

Snow Creek - One reach was surveyed on Snow Creek. Primary land use is timber production, with stands currently consisting of second growth timber. This is a moderately high gradient stream that is constrained by hillslopes. Bank erosion is minimal and there are approximately 110 boulders per 100m. Very little area is contained in side channel habitat.

Reach	Length (m)	Year	%Open Sky	% Fines	% Gravel	% Pools	LWD	Riparian conifers
1	3727	1996	28	9	50	12	25	0

Limiting Factors:
1. Riparian Conifers (temporary)
2. Pool Area and Frequency

Reach	Pools			Riffles		Shade	LWD		Riparian Conifers	
	% Area	Frequency	Depth	Gravel	Fines		No.	Vol.	>20"dbh	>35"dbh
1	U	U	D	D	D	D	D	M	U	U

Small conifers are fairly abundant in the riparian community, which is dominated by hardwoods, and will eventually achieve the riparian conifer habitat benchmark, provided they survive. Pool habitat is less than adequate, in that pools comprise a small percentage of the total stream area, and there are not many of them. However, when pools are present, their depth is such that it may provide some habitat for rearing salmonids. LWD is present in moderate to desirable quantities, and combined with high numbers of instream boulders, there appears to be a high degree of habitat complexity. Spawning habitat is ideal in this stream as well, with high percentages of gravel and low percentages of fine sediments.

Swamp Creek - Three reaches were surveyed on Swamp Creek in 2002, which has its confluence with Big Creek. Primary land use in this drainage is timber production. Swamp Creek is a low gradient stream that is constrained by hillslopes and terraces. Bank erosion is moderate, and there is very little stream area in side channels.

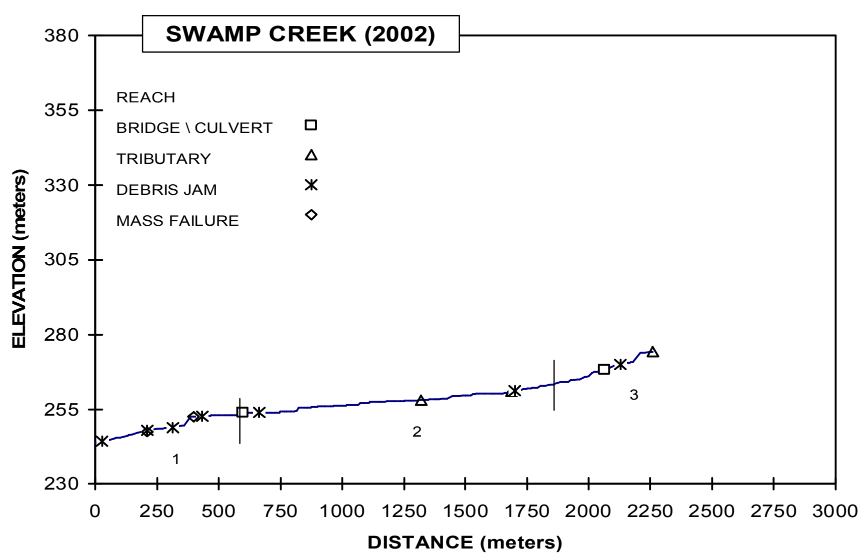
Reach	Length (m)	Year	%Open Sky	% Fines	% Gravel	% Pools	LWD	Riparian conifers
1	580	2002	13	19	23	36	25	0
2	1280	2002	17	46	48	83	11.9	91
3	400	2002	9	44	41	43	9.1	0

Limiting Factors:
1. Riparian Conifers
2. LWD
3. Fines

Reach	Pools			Riffles		Shade	LWD		Riparian Conifers	
	% Area	Frequency	Depth	Gravel	Fines		No.	Vol.	>20"dbh	>35"dbh
1	D	D	M	M	M	D	D	M	U	U
2	D	M	D	D	U	D	M	U	U	U
3	D	D	D	D	U	D	M	U	U	U

Large conifers are limited in all reaches of Swamp Creek. There is some documentation of small conifers in the riparian community, but only reach 1 currently has adequate numbers to meet benchmark criteria. Quality pool habitat exists for rearing and overwintering habitat and would be enhanced by improvements in the volume of LWD present. Moderate to desirable percentages of gravel exist in all reaches, indicating the potential for high quality spawning habitat, but the presence of large percentages of fines may limit spawning success.

Stream Profile Graph: Swamp Creek



Twelvemile Creek -Ten reaches were identified on Twelvemile Creek, and nine of these were surveyed. Primary land use in this drainage is timber production, with the majority of the stands consisting of second growth timber. Twelvemile Creek is a low gradient creek, with the exception of reach 9, whose average gradient is 13.7%. The stream channel is constrained by hillslopes and terraces. Instream channel complexity due to the presence of boulders is moderate, bank erosion is minimal, and there is little stream area in side channels.

Reach	Length (m)	Year	%Open Sky	% Fines	% Gravel	% Pools	LWD	Riparian conifers
1	1346	2000	38	27	19	44	4.8	41
2		2000	No Access					
3	667	2000	28	40	43	70.9	1.5	no data
4	525	2000	29	30	33	78.3	2.2	61
5	1681	2000	34	27	19	22.4	2.1	20
6	879	2000	30	37	29	32.9	1.7	0
7	2044	2000	27	20	59	62.4	15.8	24
8	237	2000	30	23	68	78.7	15.6	61
9	644	2000	44	23	56	49.7	0	no data
10	1065	2000	21	22	28	28.1	10.7	122

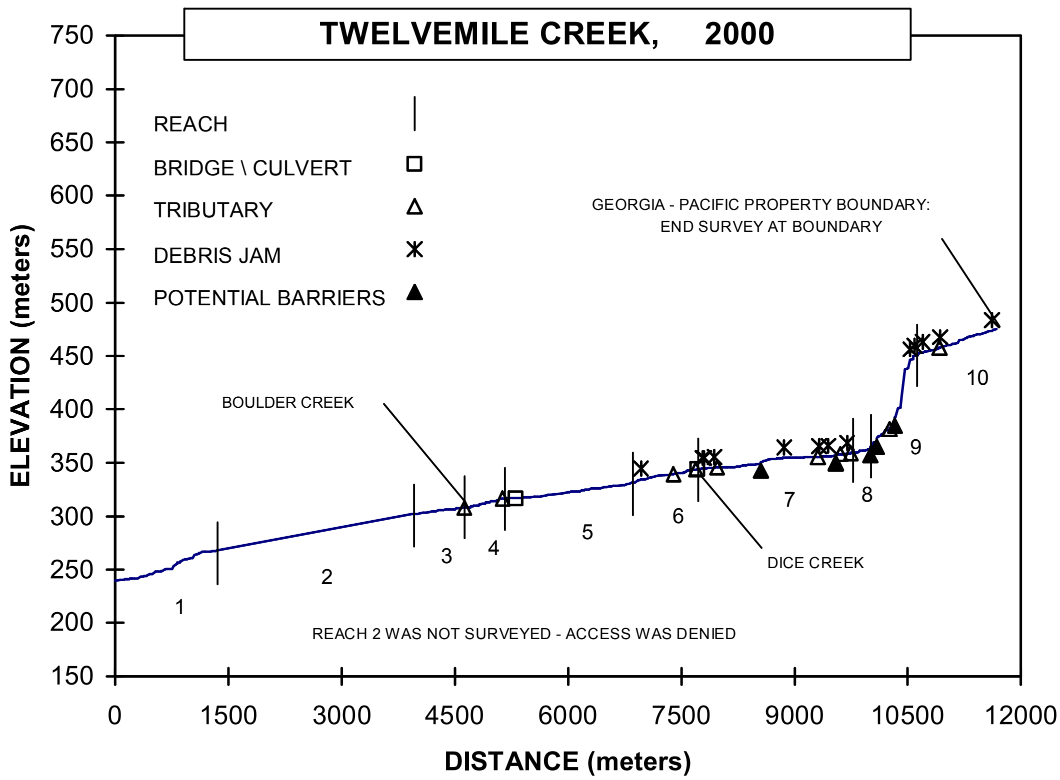
Limiting Factors:

1. Riparian Conifers
2. LWD
3. Fines

Reach	Pools			Riffles		Shade	LWD		Riparian Conifers	
	% Area	Frequency	Depth	Gravel	Fines		No.	Vol.	>20"dbh	>35"dbh
1	D	D	D	M	U	M	U	U	U	U
2	No Access									
3	D	M	D	D	U	D	U	U	U	U
4	D	M	D	M	U	D	U	U	U	U
5	M	M	D	M	U	M	U	U	U	U
6	M	D	D	M	U	M	U	U	U	U
7	D	M	D	D	U	D	M	U	U	U
8	D	D	M	D	U	M	U	U	U	U
9	D	D	D	D	U	U	U	U	U	U
10	M	D	D	M	U	D	U	U	U	U

Large conifers are limited in all reaches of Twelvemile Creek. The surveyed riparian communities consisted of a mix of hardwoods and small conifers. Shade is moderate to undersirable in reaches 1, 5, 6, 8, and 9. Pool habitat is moderate to desirable, and should provide adequate habitat for rearing and overwintering juvenile coho. LWD is limiting in the system; its presence would increase structural complexity in pool habitats. Moderate to desirable percentages of gravel are present for spawning, however, the high percentage of fine sediments may limit the success of spawning efforts.

Stream Profile Graph: Twelvemile Creek



Tributary to Twelvemile Creek - One reach was surveyed on the tributary to Twelvemile Creek. Primary land use on this drainage is timber production, with stands consisting of either second growth or large timber. This tributary is a moderately high gradient stream that is constrained by hillslopes. Bank erosion is low and there is very little area in side channels.

Reach	Length (m)	Year	%Open Sky	% Fines	% Gravel	% Pools	LWD	Riparian conifers
1	1663	2002	18	12	19	17.8	16.7	20

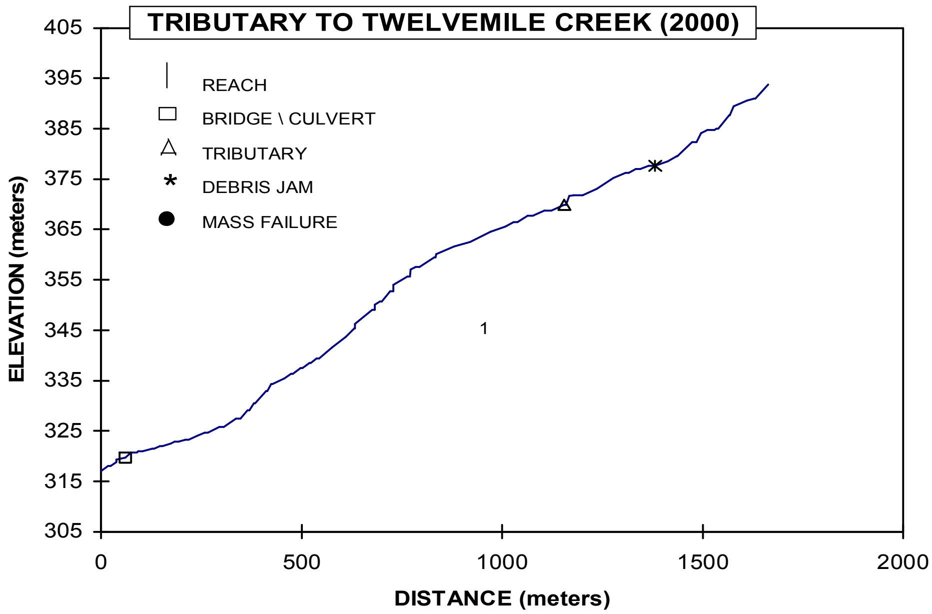
Limiting Factors:

1. Riparian Conifers
2. LWD
3. Pools
4. Gravel

Reach	Pools			Riffles		Shade	LWD		Riparian Conifers	
	% Area	Frequency	Depth	Gravel	Fines		No.	Vol.	>20"dbh	>35"dbh
1	M	M	M	M	M	D	M	U	U	U

Large conifers are limiting in this reach, although the hardwood-dominated riparian community is currently providing desirable amounts of shade to the stream. Pool habitat is moderate, with very little instream complexity that would normally result from adequate levels of LWD. The percentages of gravel and fine sediments are both moderate, indicating that spawning habitat is available, but may be marginal.

Stream Profile Graph: Tributary to Twelvemile Creek



Upper Rock Creek - Four reaches were identified on Upper Rock Creek in 1995. Primary land use along this drainage is timber production, with stands consisting of young and second growth timber. Upper Rock Creek is a moderate to high gradient stream, with average reach gradients ranging from 3.0% to 12.9%. The stream channel is constrained by hillslopes and terraces.

Reach	Length (m)	Year	%Open Sky	% Fines	% Gravel	% Pools	LWD	Riparian conifers
1	970	1995	17	8	10	38.1	3	0
2	10869	1995	18	19	27	42.4	15.6	60
3	3548	1995	17	22	74	86.6	36.6	48
4	1586	1995	3	37	61	42.6	67.7	0

Limiting Factors:
1. Riparian Conifers
2. LWD
3. Fines

Reach	Pools			Riffles		Shade	LWD		Riparian Conifers	
	% Area	Frequency	Depth	Gravel	Fines		No.	Vol.	>20”dbh	>35”dbh
1	D	M	M	M	D	D	U	U	U	U
2	D	D	M	D	M	D	U	U	U	U
3	D	M	D	D	U	D	D	D	U	U
4	D	U	M	D	U	D	D	D	U	U

Large conifers are limiting along these reaches, but the high number of hardwoods present in the riparian community provides adequate shade to the stream. Pool habitat is moderate to desirable, and should provide adequate rearing and overwintering habitat for juvenile coho, especially in reaches 3 and 4, where LWD inputs are at levels that contribute to the structural complexity of the stream. Gravel is present in adequate amounts to facilitate spawning success, and in reaches 1 and 2, the levels of fine sediments are low and should not limit coho reproductive success. Fine sediments are present in reaches 3 and 4 in proportions that are detrimental to successful spawning efforts.

Upper Rock Creek, Tributary 1 - One reach was surveyed on Tributary 1 of Upper Rock Creek. Primary land use in this drainage is timber production, with stands consisting of second growth timber. Tributary 1 to Upper Rock Creek is a moderately high gradient stream (3.9%), contrained by hillslopes, with no evident bank erosion.

Reach	Length (m)	Year	%Open Sky	% Fines	% Gravel	% Pools	LWD	Riparian conifers
1	772	1995	2	16	40	13.6	3.5	0

Limiting Factors:

1. Riparian Conifers
2. LWD
3. Pools

Reach	Pools			Riffles		Shade	LWD		Riparian Conifers	
	% Area	Frequency	Depth	Gravel	Fines		No.	Vol.	>20”dbh	>35”dbh
1	M	U	M	D	M	D	M	U	U	U

Large conifers are conspicuously absent from the riparian community. As in other stream reaches, however, large numbers of riparian hardwoods provide adequate shading to the stream. Pool habitat is adequate, but not of high quality, and is not improved by the moderate to undesirable levels of LWD present in the reach. Gravel and fines are present in proportions that should facilitate successful spawning efforts.

Upper Rock Creek, Section 18 Tributary - Three reaches were identified on the Section 18 Tributary to Upper Rock Creek. Primary land use in this drainage is timber production, with stands consisting of second growth and old growth timber. The Section 18 Tributary is a high gradient stream, constrained by hillslopes, with very little bank erosion, small percentages of total stream area in side channels, and a relatively large number of instream boulders.

Reach	Length (m)	Year	%Open Sky	% Fines	% Gravel	% Pools	LWD	Riparian conifers
1	372	1997	2	35	40	49.7	58.3	0
2	1336	1997	3	8	69	44.4	167.9	152
3	1897	1997	1	34	62	45.3	91.9	No data

Limiting Factors:

1. Riparian Conifers – reach 1
2. Fines - reaches 1 and 3

Reach	Pools			Riffles		Shade	LWD		Riparian Conifers	
	% Area	Frequency	Depth	Gravel	Fines		No.	Vol.	>20"dbh	>35"dbh
1	D	M	D	D	U	D	D	D	U	U
2	D	D	D	D	D	D	D	D	M	U
3	D	U	D	D	U	D	D	D	No Data	

Riparian conifers are limiting in both reaches 1 and 2; however, the number of 20-inch diameter conifers is moderate in reach 2. The only other limiting factor in this drainage is the high percentage of fines in riffles. This may have a detrimental effect on spawning habitat. Rearing and overwintering habitat for juveniles is of high quality, and appears to have the potential for a high degree of structural complexity as a result of high levels of LWD.

A.2.5 North Fork Coquille Watershed

Summary

Twenty-four streams (or stream groups, in the case of tributaries) were identified and analyzed to determine limiting factors in habitat for OC Coho Salmon. ODFW Aquatic Habitat Inventory stream report data was used to conduct this analysis. Low order streams were the focus of these surveys. As a result, there is no habitat inventory data for the higher order mainstem of the North Fork Coquille River.

Within each stream analysis, this report presents two habitat inventory summary tables. The first table provides the actual percentages of six broad habitat benchmark criteria, as averaged for each reach. These six criteria were selected for use as described in the Oregon Plan 2002 Western Stream Report (Flitcroft et al.2002):

1. Pool area greater than 35% of total habitat area
2. Fine sediments (<4mm diameter) in riffle units less than 12% of all sediments
3. Gravel (4-64m diameter) in riffle units greater than or equal to 35% of all sediments
4. Volume of large woody debris greater than 20m3 wood/100m stream length
5. Shade greater than 70%
6. Large riparian conifers (>0.5m dbh) more than 150 trees per 305m stream length

These six benchmarks were further broken down and analyzed according to ODFW habitat benchmark thresholds on a sliding scale (*Desirable – Moderate – Undesirable*) as defined in (Foster et al. 2001). Throughout the analysis, attention was given to the natural regime of the stream in order to present the most accurate representation of potential limiting factors in the North Fork Coquille River system.

To summarize, twenty-four analyses were conducted on this subwatershed. The majority of the reaches surveyed were limiting in large riparian conifers. The high percentage of fine sediments is of concern, as is the low number and volume of LWD and pool habitat.

Habitat Component	Number of Streams Limiting	Total Number of Streams	Percentage of Streams Limited
Riparian conifers	24	24	100%
Fines	17	24	71%
LWD	17	24	71%
Gravel	3	24	13%
Pools	12	24	50%
Shade	0	24	0%

Five streams in the North Fork Coquille Watershed have been identified by DEQ as being water quality limited:

Stream	River Mile	Parameter	Season	List Date
Cherry Creek	0 to 3.8	Temperature	Summer	1998
North Fork Coquille River	0 to 44.2 0 to 19.0	Temperature Fecal Coliform	Summer Winter/Spring/Fall	1998 1998
Woodward Creek	0 to 7.6	Temperature	Summer	1998
Alder Creek	0 to 3.1	Temperature	Summer	1998
Middle Creek	0 to 24.2	Temperature	Summer	1998

Individual Stream Reports

Vaughns Creek - Three reaches and one tributary were surveyed on Vaughns Creek. Primary land use is timber production, with stands consisting of large and old growth timber. Average stream gradient is low in Vaughns Creek, but high (15.3%) in the tributary. The surveyed reaches are composed of single channels constrained by hillslopes.

Reach	Length (m)	Year	%Open Sky	% Fines	% Gravel	% Pools	LWD	Riparian conifers
1	543	1997	8	27	36	20	38	0
2	1413	1997	10	11	51	51	26	30
3	1697	1997	28	11	38	23	14	0
Trib 1	154	1997	2	21	36	37	43	no data

Limiting Factors:

1. Riparian Conifers
2. LWD – reach 3
3. Fines – reach 1 of Vaughns Creek, reach 1 of tributary

Reach	Pools			Riffles		Shade	LWD		Riparian Conifers	
	% Area	Frequency	Depth	Gravel	Fines		No.	Vol.	>20"dbh	>35"dbh
1	M	M	D	D	U	D	D	D	U	U
2	D	M	M	D	M	D	M	M	U	U
3	M	U	U	D	M	D	U	U	U	U
Trib-1	D	M	M	D	U	D	D	D	No data	

Large riparian conifers are limiting in Vaughns Creek. LWD levels are undesirable in reach 3 of Vaughns Creek, although reaches 1 and 2 contain desirable and moderate levels, respectively. Pool habitat is moderate to desirable in reaches 1 and 2 of Vaughns Creek, and in the tributary as well; the structural complexity is most likely enhanced by high levels of LWD, indicates that these reaches are adequate for rearing and overwintering juvenile coho. Reach 3, however, is limited by pool frequency and depth. Spawning habitat is available in reaches 2 and 3 of Vaughns Creek and the tributary. Excess amounts of fine sediments in reach 1 of Vaughns Creek limit spawning potential in this reach.

North Fork Coquille River - Three reaches were surveyed on the North Fork Coquille River. Primary land use is timber production, with stands consisting of large and old growth timber. Average stream gradient is low to moderate, and the single channel is constrained by hillslopes. There is very little area contained in side channels.

Seven BLM habitat enhancement sites were identified along the surveyed portion of the stream. A 25-meter bedrock falls serves as a natural barrier to fish passage and marked the end of the survey. Numerous landslides, hillslope failures, and debris jams were documented in reaches 2 and 3.

Reach	Length (m)	Year	%Open Sky	% Fines	% Gravel	% Pools	LWD	Riparian conifers
1	6017	1997	4	7	18	70	12	0
2	2936	1997	6	9	36	48	55	30
3	1668	1997	6	10	23	37	121	30

Limiting Factors:
1. Riparian Conifers
2. LWD – reach 1

Reach	Pools			Riffles		Shade	LWD		Riparian Conifers	
	% Area	Frequency	Depth	Gravel	Fines		No.	Vol.	>20"dbh	>35"dbh
1	D	M	D	M	D	D	U	U	U	U
2	D	M	D	D	D	D	M	D	U	U
3	D	D	M	M	M	D	D	D	U	U

Large riparian conifers are limiting along these reaches. LWD is limiting in reach 1, although levels are moderate to desirable in reaches 2 and 3. Pool and spawning habitat is of moderate to desirable levels, indicating that these reaches provide adequate habitat for all life stages of coho salmon.

<u>Park Creek</u> - Three reaches were surveyed on Park Creek. Primary land use is timber production, with stands consisting of large and old growth timber. Average stream gradients increase from 0.6% in reach 1 to 16.3% in reach 3. The single channel is constrained by hillslopes and terraces.

The survey of Park Creek ended at a natural barrier to fish migration in reach 3. Debris jams and mass failures were present in reaches 1 and 2.

Reach	Length (m)	Year	%Open Sky	% Fines	% Gravel	% Pools	LWD	Riparian conifers
1	1282	1997	6	10	53	70	37	0
2	1602	1997	4	7	37	21	33	0
3	1155	1997	12	10	25	1	87	0

Limiting Factors:
1. Riparian Conifers
2. Pool Area and Frequency – reach 3

Reach	Pools			Riffles		Shade	LWD		Riparian Conifers	
	% Area	Frequency	Depth	Gravel	Fines		No.	Vol.	>20"dbh	>35"dbh
1	D	M	M	D	M	D	M	D	U	U
2	M	D	M	D	M	D	D	D	U	U
3	U	U	M	M	D	D	D	D	U	U

Large riparian conifers are limiting throughout the survey. Pool habitat is moderate to desirable, with the exception of pool area and frequency in reach 3. This may be a result of the high gradient in this reach. On average, the levels of LWD in the stream are desirable, indicating that instream structural complexity is good. Spawning habitat appears to be of high quality as well.

<u>Woodward Creek</u> - Three reaches were surveyed on Woodward Creek. Primary land use is rural residential in reach 1, timber production (large timber) in reach 2, and timber harvest in reach 3. Average stream gradient is low. The single channel is unconstrained.

Reach	Length (m)	Year	%Open Sky	% Fines	% Gravel	% Pools	LWD	Riparian conifers
1	859	1997	12	9	38	89	5	0
2	5267	1997	5	10	56	92	25	0
3	2619	1997	18	10	71	66	27	0

Limiting Factors:
1. Riparian Conifers
2. LWD – reach 1

Reach	Pools			Riffles		Shade	LWD		Riparian Conifers	
	% Area	Frequency	Depth	Gravel	Fines		No.	Vol.	>20"dbh	>35"dbh
1	D	M	D	D	D	D	U	U	U	U
2	D	M	D	D	M	D	D	M	U	U
3	D	M	D	D	M	D	D	M	U	U

The number of large riparian conifers is limiting, and there are currently very few small conifers present in the riparian community to increase this number in the future. LWD is limiting in reach 1. Pool and spawning habitat is available at adequate levels in all reaches, indicating that Woodward Creek provides quality habitat for coho salmon of all life stages.

Honcho Creek -Two reaches were surveyed on Honcho Creek. Primary land use is timber production, with stands consisting of second growth and old growth timber. Average gradient is moderate to high, and the single channel is constrained by hillslopes.

Numerous areas of hillslope encroachment and mass failure were identified during the survey. There were no barriers to fish passage on this stream.

Reach	Length (m)	Year	%Open Sky	% Fines	% Gravel	% Pools	LWD	Riparian conifers
1	558	1997	3	11	18	20	7	0
2	1339	1997	2	10	17	1	19	20

Limiting Factors:

1. Riparian Conifers
2. LWD – reach 1
3. Pool Area and Frequency – reach 2

Reach	Pools			Riffles		Shade	LWD		Riparian Conifers	
	% Area	Frequency	Depth	Gravel	Fines		No.	Vol.	>20"dbh	>35"dbh
1	M	M	M	M	M	D	U	U	U	U
2	U	U	D	M	M	D	M	U	U	U

The number of large riparian conifers is limiting, and there are currently few small conifers present in the riparian community to increase this number in the future. LWD is limiting in both reaches. Pool area and frequency is limiting in reach 2, and is only of moderate quality in reach 1. Spawning habitat is moderate, with percentages of gravel available that barely meet benchmark criteria.

Jerusalem Creek - One reach was surveyed on Jerusalem Creek. Primary land use is timber production, with stands consisting of large timber. Jerusalem Creek is a low to moderate gradient stream, whose single channel is constrained by hillslopes.

No barriers to fish passage existed on this stream at the time of the survey.

Reach	Length (m)	Year	%Open Sky	% Fines	% Gravel	% Pools	LWD	Riparian conifers
1	608	1997	6	23	71	10	16	0

Limiting Factors:
1. Riparian Conifers
2. Pool Area
3. Fines

Reach	Pools			Riffles		Shade	LWD		Riparian Conifers	
	% Area	Frequency	Depth	Gravel	Fines		No.	Vol.	>20"dbh	>35"dbh
1	U	U	M	D	U	D	M	U	U	U

The number of large riparian conifers is limiting, and the hardwood-dominated riparian community does not contain any small conifers at this point in time. The volume of LWD is limiting, as is the quantity of pool habitat. High percentages of fine sediments in riffles may decrease the success of spawning efforts.

Little Cherry Creek - Three reaches identified and three were surveyed on Little Cherry Creek. Primary land use is timber production, with stands consisting of large and second growth timber. Average stream gradient is moderately high, and the single channel is constrained by hillslopes.

The 2 meter high boulder step at unit 63 (2,117 m) may be a barrier to upstream fish passage and should be evaluated at winter flows. The crew reported numerous landslides and large debris jams throughout the survey. They reported one sluiced tributary (not on map) at unit 85 (2,548 m).

Reach	Length (m)	Year	%Open Sky	% Fines	% Gravel	% Pools	LWD	Riparian conifers
1	738	1997	No access					
2	984	1997	1	5	25	16	18	0
3	2058	1997	4	9	32	6	33	0

Limiting Factors:
1. Riparian Conifers
2. Pool Area and Frequency

Reach	Pools			Riffles		Shade	LWD		Riparian Conifers	
	% Area	Frequency	Depth	Gravel	Fines		No.	Vol.	>20"dbh	>35"dbh
1	No Access									
2	M	U	M	M	D	D	M	U	U	U
3	U	U	D	M	D	D	M	D	U	U

The number of large riparian conifers is limiting, and the hardwood-dominated riparian community does not contain any small conifers at this point in time. Pool habitat characteristics are marginal, with pool frequency at undesirable levels in reach 2 and 3, and pool area at undesirable levels in reach 3. LWD volume is limited in reach 2. Spawning habitat appears to be adequate, given moderate amounts of gravel and desirable amounts of fine sediments in riffles.

Bay Creek - Three reaches were surveyed on Bay Creek. Primary land use is agriculture and timber production (second growth timber). The average stream gradient of Bay Creek is low, and the single channel is constrained by hillslopes and terraces.

No barriers to fish migration existed over the surveyed length of Bay Creek at the time of the study.

Reach	Length (m)	Year	%Open Sky	% Fines	% Gravel	% Pools	LWD	Riparian conifers
1	1087	1998	6	81	14	62.7	8.7	122
2	1224	1998	10	54	33	83.8	17.9	0
3	793	1998	5	84	16	38	21.7	0

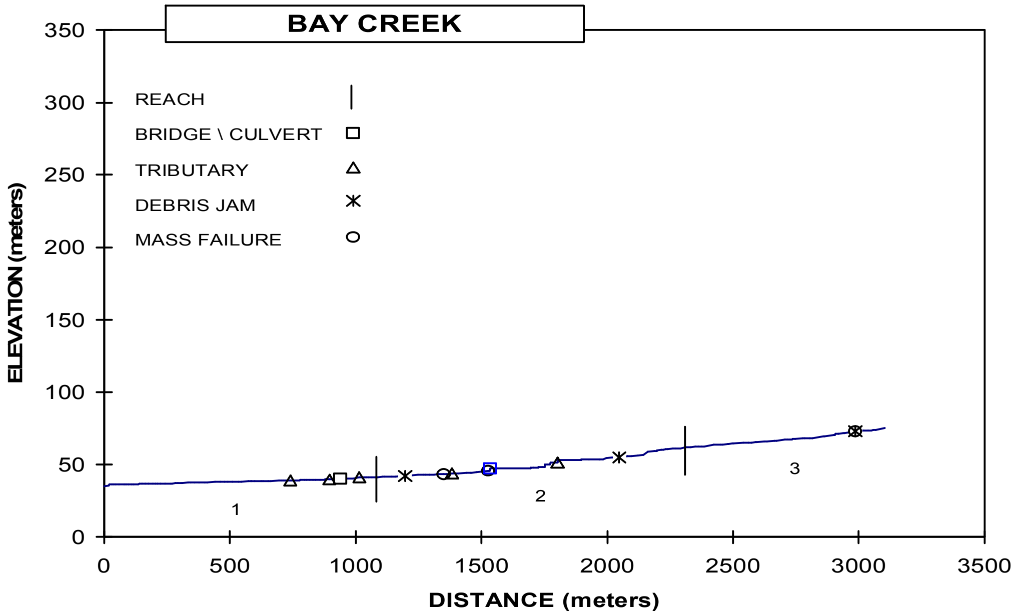
Limiting Factors:

1. Riparian Conifers
2. LWD
3. Fines
4. Gravel – reach 1

Reach	Pools			Riffles		Shade	LWD		Riparian Conifers	
	% Area	Frequency	Depth	Gravel	Fines		No.	Vol.	>20"dbh	>35"dbh
1	D	D	M	U	U	D	D	U	U	U
2	D	M	D	M	U	D	D	U	U	U
3	D	M	M	M	U	D	D	M	U	U

The number of large riparian conifers is limiting, and the hardwood-dominated riparian community does not contain any small conifers at this point in time. Pool habitat is moderate to desirable, indicating that rearing and overwintering habitat is available for juvenile salmonids. LWD, however, is limiting in volume. Spawning habitat is marginal; the amount of gravel present is moderate to undesirable, and the percentages of fine sediments are higher than benchmark criteria allow.

Stream Profile Graph: Bay Creek



Coak Creek - Three reaches were surveyed on Coak Creek. Primary land use is rural residential and timber production, with stands consisting of large timber. Coak Creek is a low gradient stream in the lower two reaches, but its gradient increases to 8% in reach 3. Little side channel habitat is available, and the single channel is constrained by hillslopes and terraces.

Significant beaver activity was observed in reach 1. In addition, reach 1 contains a culvert crossing. Reach 2 contains a natural potential barrier to fish migration.

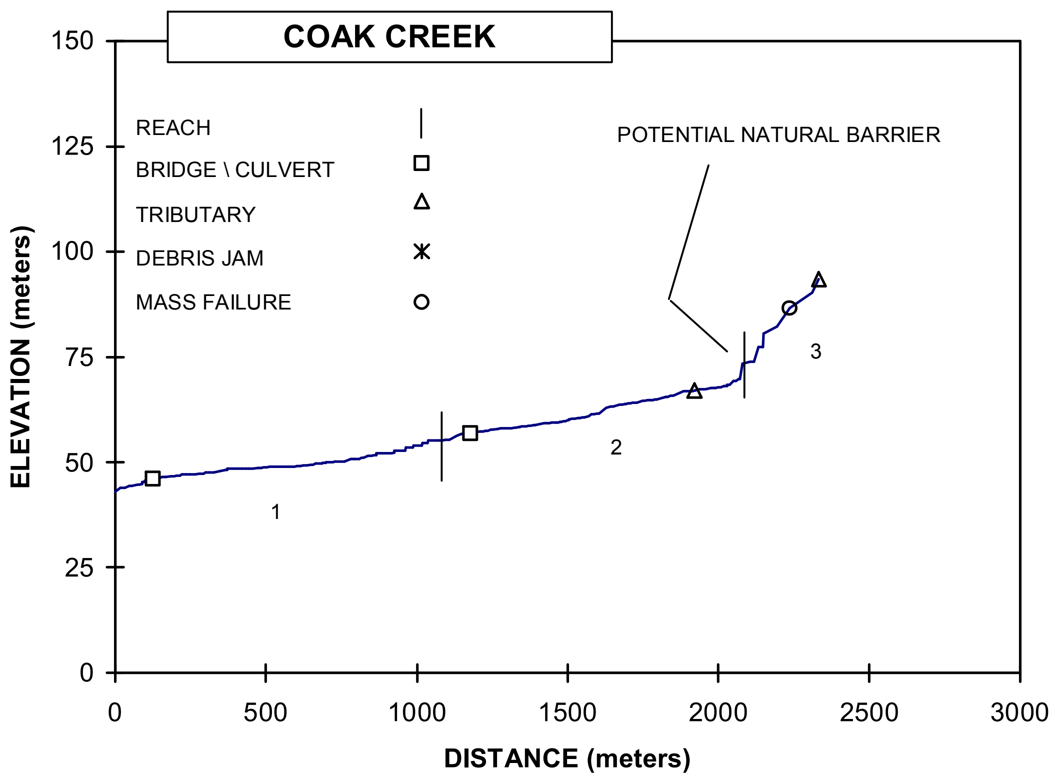
Reach	Length (m)	Year	%Open Sky	% Fines	% Gravel	% Pools	LWD	Riparian conifers
1	1086	1998	18	53	43	75.1	13	0
2	996	1998	13	55	40	52.1	70.1	0
3	252	1998	6	25	35	31.7	63.1	0

Limiting Factors:
1. Riparian Conifers
2. Fines

Reach	Pools			Riffles		Shade	LWD		Riparian Conifers	
	% Area	Frequency	Depth	Gravel	Fines		No.	Vol.	>20"dbh	>35"dbh
1	D	D	M	D	U	D	M	U	U	U
2	D	D	M	D	U	D	D	D	U	U
3	M	U	M	D	U	D	D	D	U	U

The number of large riparian conifers is limiting. Riparian transects do not indicate the presence of small conifers in the riparian community, although the high number of hardwood species provides adequate shading to the stream. Pool habitat is moderate to desirable, with the exception of pool frequency in reach 3, which may be a result of the higher gradient of the stream in that reach. LWD levels are high, for the most part, except for reach 1, which is limiting in LWD volume. The potential exists for high quality spawning habitat. However, high percentages of fine sediments in riffle environments preclude this stream a high quality classification.

Stream Profile Graph: Coak Creek



Johns Creek - Three reaches were surveyed on Johns Creek in 2002. Primary land use is agriculture and timber production, with stands consisting of young and second growth timber. Johns Creek is a low gradient stream whose single channel is constrained by hillslopes and terraces.

Reach	Length (m)	Year	%Open Sky	% Fines	% Gravel	% Pools	LWD	Riparian conifers
1	306	2002	21	16	65	59	2.9	0
2	1533	2002	10	22	53	25	7.1	41
3	1196	2002	8	10	45	12	12.7	20

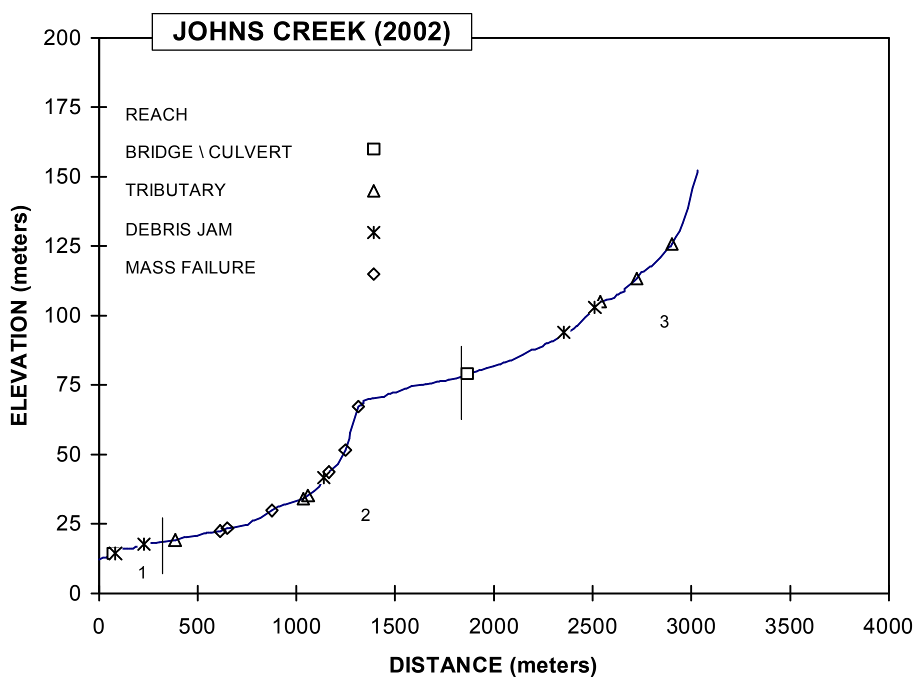
Limiting Factors:

1. Riparian Conifers
2. LWD
3. Fines – reach 2

Reach	Pools			Riffles		Shade	LWD		Riparian Conifers	
	% Area	Frequency	Depth	Gravel	Fines		No.	Vol.	>20"dbh	>35"dbh
1	D	D	M	D	M	D	U	U	U	U
2	M	M	M	D	U	D	U	U	U	U
3	M	U	M	D	M	D	M	U	U	U

The number of large riparian conifers is limiting, but this limitation is temporary given the number of small conifers present in the riparian community. Amounts of LWD are limiting, indicating that instream complexity is low. Pool habitat is moderate to desirable, on average, indicating that rearing and overwintering habitat is available for juvenile coho. Increased numbers and volumes of LWD would increase the quality of pool habitat for coho salmon. The levels of gravel and fine sediments in riffle habitats indicate that some quality spawning habitat exists in reaches 1 and 3. The high percentage of fine sediments in reach 2 may decrease the success of spawning efforts.

Stream Profile Graph: Johns Creek



Mast Creek - Four reaches were surveyed on Mast Creek. Primary land use is timber production, with stands consisting of young and second growth timber. Mast Creek is a low to moderate gradient stream whose single channel is constrained by hillslopes and terraces.

Beaver activity is prevalent in reaches 1 and 2.

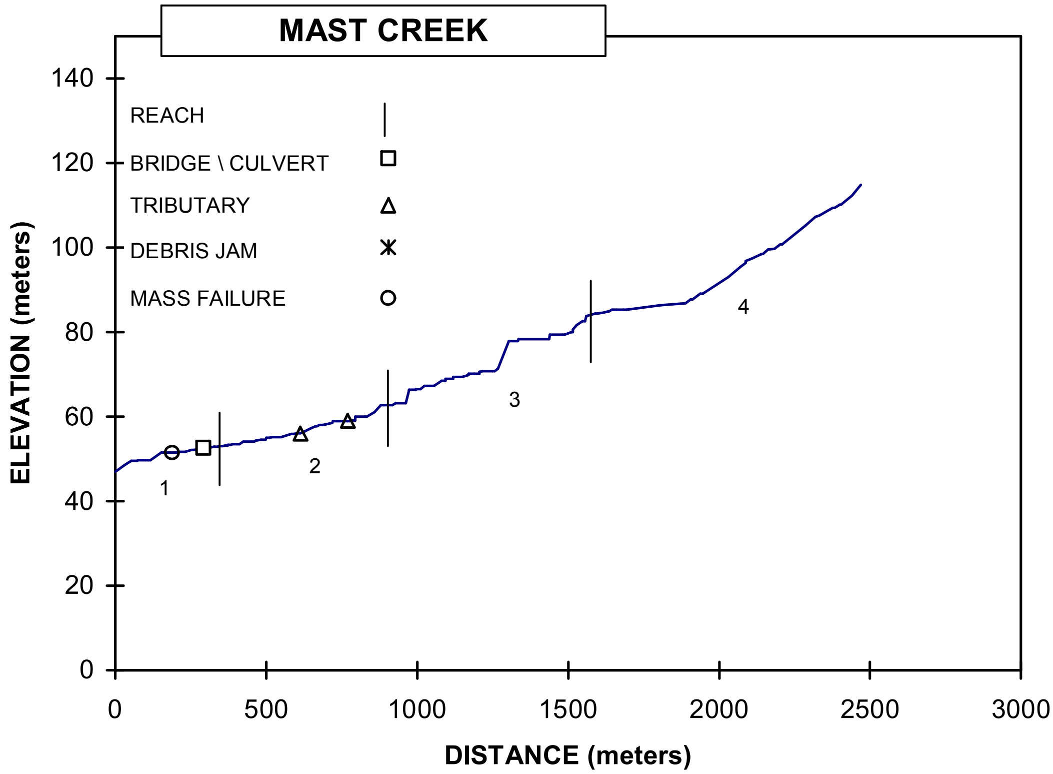
Reach	Length (m)	Year	%Open Sky	% Fines	% Gravel	% Pools	LWD	Riparian conifers
1	375	1998	4	37	37	54.6	10.9	61
2	545	1998	17	58	37	68	16.4	0
3	641	1998	12	80	21	77.4	80.7	0
4	910	1998	0	79	20	25.8	24.3	81

Limiting Factors:
1. Riparian Conifers
2. Fines
3. LWD

Reach	Pools			Riffles		Shade	LWD		Riparian Conifers	
	% Area	Frequency	Depth	Gravel	Fines		No.	Vol.	>20"dbh	>35"dbh
1	D	M	M	D	U	D	M	U	U	U
2	D	M	M	D	U	D	M	U	U	U
3	D	M	M	M	U	D	D	D	U	U
4	M	U	M	M	U	D	M	M	U	U

Large riparian conifers are limiting on Mast Creek. The riparian communities of reaches 2 and 3 contain high proportions of small conifers, indicating that this is a temporary limiting factor in these two reaches. LWD is limiting in volume in reaches 1 and 2. Pool habitatis moderate to desirable, on average, with the exception of pool frequency in reach 4. It appears that high quality rearing and overwintering habitat is available for juvenile coho on Mast Creek, although the structural complexity of this habitat could be improved with higher volumes of LWD in reaches 1 and 2. The potential for high quality spawning habitat exists, but is limited by high percentages of fine sediments in all reaches.

<u>Stream Profile Graph:</u> Mast Creek



<u>Steele Creek</u> - Five reaches were surveyed on Steele Creek, and one reach was surveyed on Tributary A to Steele Creek. Primary land use is rural residential on reach 1 of Steele Creek and Tributary A, and the remaining reaches of Steele Creek are used for timber production (second growth timber). Steele Creek and its tributary are low gradient streams, with little area contained in side channels. The single channel morphology is constrained by hillslopes and terraces.

Reach	Length (m)	Year	%Open Sky	% Fines	% Gravel	% Pools	LWD	Riparian conifers
1	1458	1998	4	45	25	73.1	9.7	37
2	666	1998	15	100	0	88.1	13.4	41
3	479	1998	24	80	20	83.2	10.7	no data
4	868	1998	10	100	0	87	9.8	0
5	1145	1998	11	90	10	88.9	5.3	30
Trib A	555	1998	6	86	12	85.2	9.2	122

Limiting Factors:

1. Riparian Conifers
2. LWD
3. Fines
4. Gravel

Reach	Pools			Riffles		Shade	LWD		Riparian Conifers	
	% Area	Frequency	Depth	Gravel	Fines		No.	Vol.	>20"dbh	>35"dbh
1	D	D	D	M	U	D	M	U	U	U
2	D	D	D	U	U	D	M	U	U	U
3	D	M	D	M	U	D	U	U	U	U
4	D	M	D	U	U	D	U	U	U	U
5	D	U	M	U	U	D	M	U	U	U
Trib A	D	D	D	U	U	D	U	U	U	U

Steele Creek: Large riparian conifers are limiting. Pool habitat is moderate to desirable, with the exception of reach 5, where pool frequency is lower than habitat benchmark criteria allow. Adequate pool habitat is provided in this stream, but could be improved by inputs of LWD (both in volume and number), which would increase structural complexity and the stream's carrying capacity for rearing and overwintering juvenile coho salmon. Potential spawning habitat is limited by low amounts of gravel in the stream. Where adequate amounts of gravel exist, high percentages of fines preclude these sites from consideration as quality spawning riffles.

Hudson Creek - One reach was surveyed on Hudson Creek. Primary land use is timber production, with stands consisting of second growth and large timber. Hudson Creek is a low gradient stream, with little area in side channels, whose single channel is constrained by hillslopes.

A large number of mass failures were identified along the reach.

Reach	Length (m)	Year	%Open Sky	% Fines	% Gravel	% Pools	LWD	Riparian conifers
1	5510	2002	15	26	35	54	14.5	135

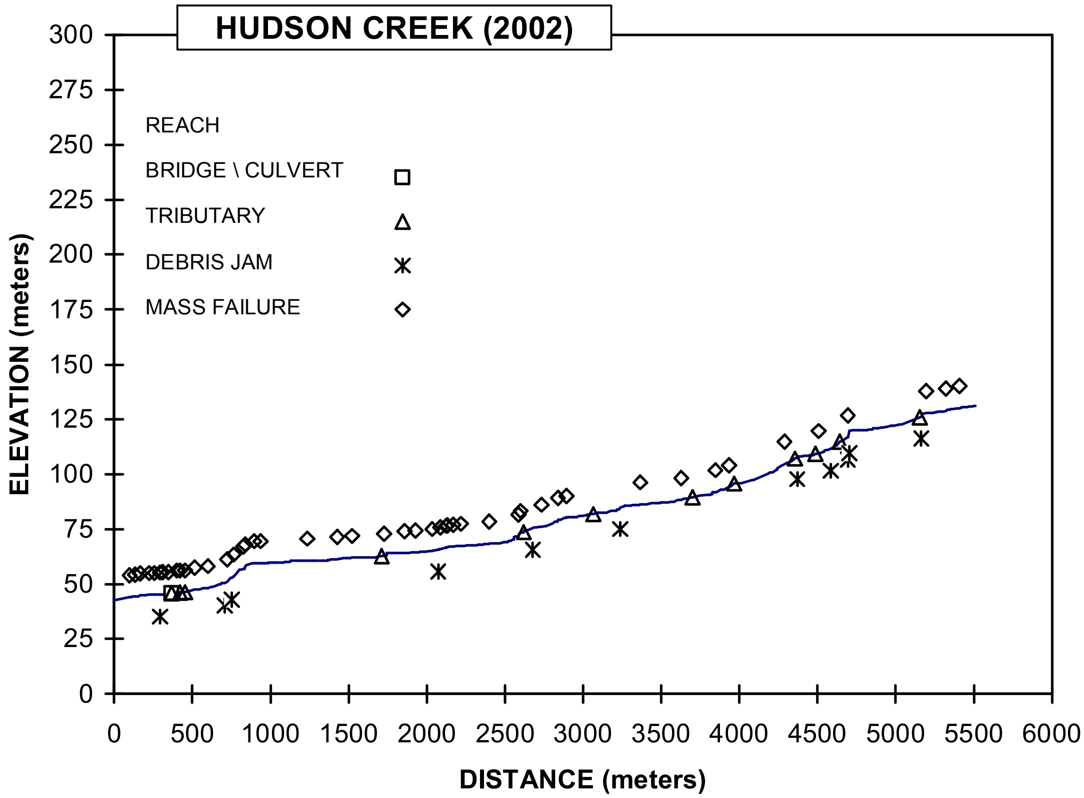
Limiting Factors:
1. Riparian Conifers
2. LWD
3. Fines

Reach	Pools			Riffles		Shade	LWD		Riparian Conifers	
	% Area	Frequency	Depth	Gravel	Fines		No.	Vol.	>20"dbh	>35"dbh
1	D	D	D	D	U	D	M	U	U	U

Although the number of large riparian conifers is less than the habitat benchmark criterion allows, riparian transects indicate that small conifers make up a large proportion of the riparian community. Therefore, the number of large riparian conifers is only a temporary limiting factor.

Pool habitat is of high quality, but would be improved by higher inputs of LWD into the stream. As is, however, Hudson Creek provides adequate habitat for rearing and overwintering juvenile coho. Spawning habitat is limited by high percentages of fine sediments in riffles.

Stream Profile Graph: Hudson Creek



Little North Fork Coquille River - Two reaches were surveyed on the Little North Fork Coquille River. Land use is a mix of timber harvest, young timber, mature timber, and large timber. The Little North Fork is a low to moderate gradient stream, with small amounts of its area contained in side channels, and whose main channel is constrained by hillslopes.

Reach	Length (m)	Year	%Open Sky	% Fines	% Gravel	% Pools	LWD	Riparian conifers
1	1451	2002	22	17	36	51	26.7	0
2	2710	2002	12	13	36	40	19.4	0

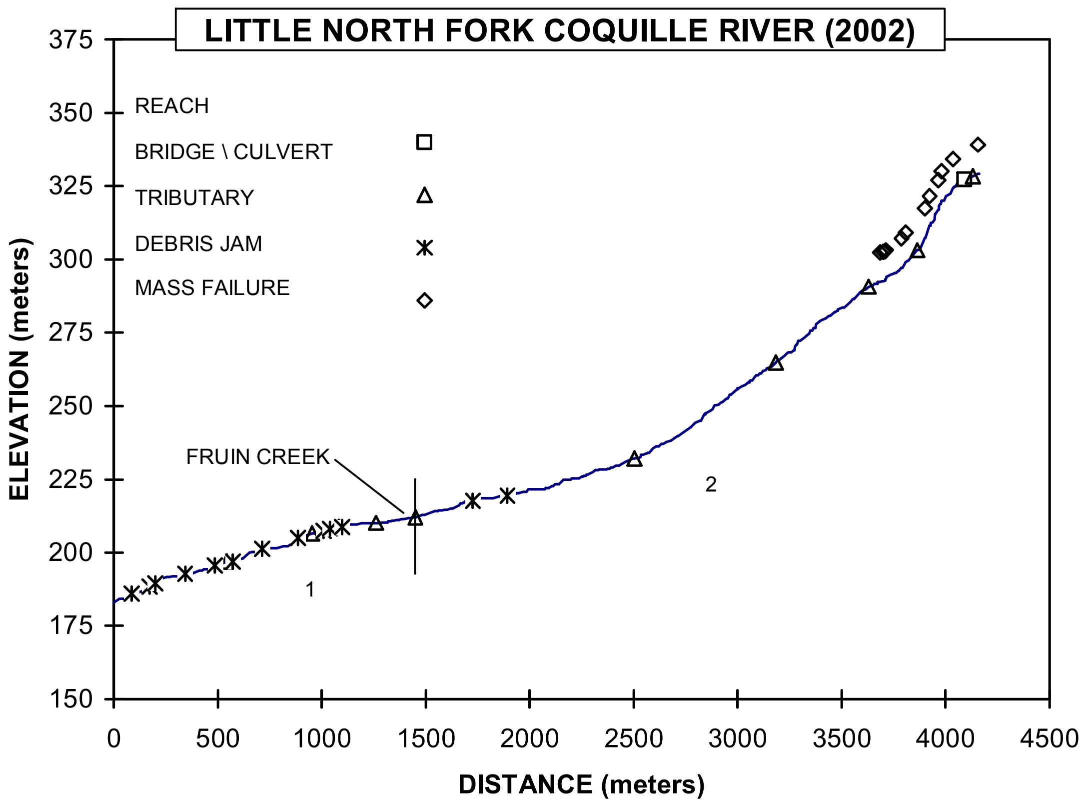
Limiting Factors:
1. Riparian Conifers
2. LWD – reach 2

Reach	Pools			Riffles		Shade	LWD		Riparian Conifers	
	% Area	Frequency	Depth	Gravel	Fines		No.	Vol.	>20"dbh	>35"dbh
1	D	M	M	D	M	D	D	M	U	U
2	D	D	M	D	M	D	M	U	U	U

Riparian transects survey results indicate that the riparian community is a mix of small conifers and hardwoods. While large riparian conifers are limiting currently, it appears that in time, this will no longer be a limiting factor for this stream.

Pool habitat is moderate to desirable, and combined with the moderate to desirable levels of LWD in the surveyed reaches, appears to provide adequate rearing and overwintering habitat for juvenile coho. LWD is limited in volume in reach 2. Quality spawning habitat exists.

Stream Profile Graph: Little North Fork



Wimer Creek - Two reaches were surveyed on Wimer Creek. Primary land use is grazing and timber production (mature timber). Wimer Creek is a low gradient stream in reach 1, but transitions to a moderately high gradient stream in reach 2 (5.6%). The single channel is constrained by hillslopes and terraces.

Reach	Length (m)	Year	%Open Sky	% Fines	% Gravel	% Pools	LWD	Riparian conifers
1	976	2000	43	70	29	88.5	6.7	0
2	1753	2000	1	14	71	59.9	22	30

Limiting Factors:
1. Riparian Conifers
2. LWD – reach 1
3. Fines – reach 1
4. Pool Frequency – reach 1

Reach	Pools			Riffles		Shade	LWD		Riparian Conifers	
	% Area	Frequency	Depth	Gravel	Fines		No.	Vol.	>20"dbh	>35"dbh
1	D	U	D	M	U	M	U	U	U	U
2	D	D	M	D	M	D	M	M	U	U

The number of large riparian conifers is limiting, and which may contribute to the low levels of LWD present in the stream. Pool habitat is adequate for rearing and overwintering juvenile coho, although pool frequency is limiting in reach 1. Spawning habitat is available in both reaches, but the high percentage of fine sediments in reach 1 may preclude it from being a successful spawning site.

Middle Creek - Five reaches were surveyed on Middle Creek. Primary land use is timber production, with stands consisting of second growth and large timber. The lower four reaches are low gradient; reach 5 transitions to an average gradient of 7.8%. Middle Creek is composed of a single channel which is constrained by hillslopes and terraces.

Numerous potential fish barriers exist near survey end including the Middle Creek Road culvert (unit 658) in T26S-R10W-S34SE. No fish were observed above this culvert. Numerous boulder-weir habitat structures are present in reaches 1-4. Beaver activity, including dams and ponds, was observed in all reaches. Mass failures were common in reach 5.

Reach	Length (m)	Year	%Open Sky	% Fines	% Gravel	% Pools	LWD	Riparian conifers
1	2176	1997	15	11	22	63.1	21.7	
2	4830	1997	16	15	37	48.5	10.6	
3	4126	1997	10	14	33	64.3	18.9	
4	2054	1997	8	16	34	73.3	31.2	20
5	1797	1997	7	7	75	47.2	38.5	9

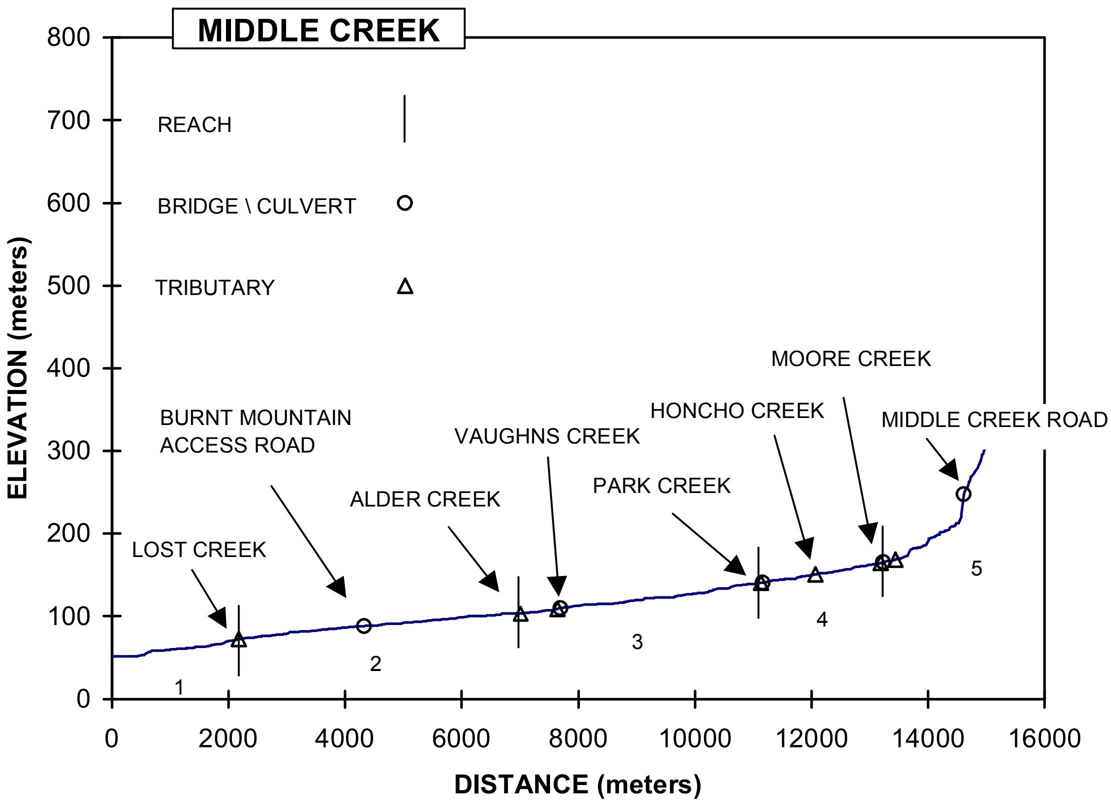
Limiting Factors:
1. Riparian Conifers
2. LWD – reaches 2 and 3

Reach	Pools			Riffles		Shade	LWD		Riparian Conifers	
	% Area	Frequency	Depth	Gravel	Fines		No.	Vol.	>20"dbh	>35"dbh
1	D	M	D	M	M	D	M	M	Nd	Nd
2	D	D	D	D	M	D	U	U	Nd	Nd
3	D	M	D	M	M	D	M	U	nd	Nd
4	D	M	M	M	M	D	M	D	U	Ned
5	D	D	M	D	D	D	M	D	U	Ned

In reaches where data is available, large riparian conifers are limiting. In reaches 2, 4 and 5, small conifers are present in the riparian community and may allow these reaches to achieve this habitat benchmark criterion in the future.

Pool habitat is moderate to desirable, and with the exception of reaches 2 and 3 where LWD is limiting, the levels of LWD in the stream is moderate to desirable as well, indicating that structural complexity exists in the stream. Rearing and overwintering habitat for juvenile coho is available. Spawning habitat is available as well.

Stream Profile Graph: Middle Creek



Cherry Creek - Five reaches were surveyed on Cherry Creek. Primary land use is timber production, with stands consisting of second growth and large timber. Cherry Creek is a low to moderate gradient stream whose channel is constrained by terraces and hillslopes.

Large numbers of mass failures on adjacent slopes were observed during the survey. These contributed to the high percentage of fines.

Reach	Length (m)	Year	%Open Sky	% Fines	% Gravel	% Pools	LWD	Riparian conifers
1	454	1994	14	44	38	20	10.7	0
2	455	1994	17	27	37	24	13.2	0
3	954	1994	11	31	41	6	6.5	0
4	580	1994	8	40	25	2	10.9	0
5	2382	1994	18	35	30	15	9.5	0

Limiting Factors:

1. Riparian Conifers
2. LWD
3. Fines
4. Pool Area and Frequency

Reach	Pools			Riffles		Shade	LWD		Riparian Conifers	
	% Area	Frequency	Depth	Gravel	Fines		No.	Vol.	>20"dbh	>35"dbh
1	M	M	D	D	U	D	U	U	U	U
2	M	M	M	D	U	D	U	U	U	U
3	U	U	M	D	U	D	U	U	U	U
4	U	U	M	M	U	D	M	U	U	U
5	M	M	M	M	U	D	U	U	U	U

Large riparian conifers are limiting in all reaches of Cherry Creek; riparian communities are dominated by hardwoods. Pool habitat is moderate, on average. Reaches 3 and 4 contain undesirable levels of pool area and frequency. LWD levels are undesirable; increasing these levels would add structural complexity to the moderate pool habitat available. Potential spawning habitat is available, but high percentages of fine sediments, presumably a result of the large number of mass failures observed along the stream, may limit spawning success.

<u>South Fork Cherry Creek</u> - Three reaches were surveyed on South Fork Cherry Creek. Primary land use is timber production, with stands consisting of second growth and large timber. Reaches 1 and 3 are high gradient, while reach 2 is a low gradient reach. The single channel of South Fork Cherry Creek is constrained by hillslopes and terraces.

Lack of available data in reach 3 is indicative of low summer flows.

Reach	Length (m)	Year	%Open Sky	% Fines	% Gravel	% Pools	LWD	Riparian conifers
1	878	1994	8	28	38	13	18.6	0
2	1172	1994	6	32	37	8	23.5	30
3	1465	1994	4	nd	nd	0	80.4	61

Limiting Factors:

1. Riparian Conifers
2. Fines
3. Pool Area
4. LWD

Reach	Pools			Riffles		Shade	LWD		Riparian Conifers	
	% Area	Frequency	Depth	Gravel	Fines		No.	Vol.	>20"dbh	>35"dbh
1	M	M	D	D	U	D	M	U	U	U
2	U	M	M	D	U	D	M	M	U	U
3	U	Nd	Nd	Nd	Nd	D	D	D	U	U

The number of large riparian conifers is limiting in this stream. Pool habitat is moderate, on average, although pool area is limiting in reaches 2 and 3. Levels of LWD are moderate to desirable, with the exception of reach 1, and should increase the structural complexity of the available pool environment. Spawning habitat is available in reaches 1 and 2, but is limited by high percentages of fine sediments.

North Fork Cherry Creek - Three reaches were surveyed on North Fork Cherry Creek. Primary land use is timber production, with stands consisting of large, mature, and old growth timber. The average stream gradient is low in reaches 1 and 2, but transitions to a high gradient (18.7%) in reach 3. The single channel is constrained by hillslopes and terraces.

Debris jams were numerous in the stream. A large mass failure in reach 3 buried the channel and served as a fish passage barrier.

Reach	Length (m)	Year	%Open Sky	% Fines	% Gravel	% Pools	LWD	Riparian conifers
1	413	1994	14	46	21	4	140.6	183
2	1839	1994	11	35	34	5	41.4	0
3	527	1994	5	nd	nd	0	24.8	61

Limiting Factors:

1. Riparian Conifers
2. Pool Area and Frequency
3. Fines

Reach	Pools			Riffles		Shade	LWD		Riparian Conifers	
	% Area	Frequency	Depth	Gravel	Fines		No.	Vol.	>20"dbh	>35"dbh
1	U	U	M	M	U	D	D	D	M	M
2	U	U	M	M	U	D	U	D	U	U
3	U	Nd	Nd	Nd	Nd	D	M	M	U	U

The number of large riparian conifers is limiting in reaches 2 and 3. Conifers, however, are present in the riparian community, and may enable these reaches, with time, to achieve habitat benchmark requirements.

Pool habitat is at undesirable levels, indicating that adequate rearing and overwintering habitat does not exist in this stream. Spawning habitat is marginal, with moderate levels of gravel and high percentages of fine sediments.

Alder Creek - Five reaches were surveyed on Alder Creek. Primary land use is timber production, with stands consisting of second growth, large, and mature timber. Average stream gradient is low in reaches 1 and 3, but high in the remaining reaches. The single channel is constrained by hillslopes and terraces.

Reach	Length (m)	Year	%Open Sky	% Fines	% Gravel	% Pools	LWD	Riparian conifers
1	2528	1994	11	14	65	18	10.4	15
2	578	1994	7	15	48	14	17.3	122
3	498	1994	9	12	55	8	4.1	0
4	761	1994	9	45	35	2	15	0
5	1153	1994	13	nd	nd	0	19.9	61

Limiting Factors:
1. Riparian Conifers
2. LWD
3. Pool Area and Frequency
4. Fines – reach 4

Reach	Pools			Riffles		Shade	LWD		Riparian Conifers	
	% Area	Frequency	Depth	Gravel	Fines		No.	Vol.	>20"dbh	>35"dbh
1	M	M	M	D	M	D	M	U	U	U
2	M	M	M	D	M	D	U	U	U	U
3	U	U	M	D	M	D	U	U	U	U
4	U	U	M	D	U	D	M	U	U	U
5	U	Nd	Nd	Nd	Nd	D	M	U	U	U

The number of large riparian conifers is limiting on Alder Creek. Pool habitat is marginal, with undesirable levels of pool area and frequency. LWD levels are moderate to undesirable as well, and increased levels of LWD may improve the quality of the pool habitat that is available. Spawning habitat is available, and is only limited in reach 4 by high percentages of fine sediments.

Moore Creek - One reach was surveyed on Moore Creek. Primary land use is timber production, with stands consisting of large and second growth timber. Moore Creek is a moderate gradient stream.

Reach	Length (m)	Year	%Open Sky	% Fines	% Gravel	% Pools	LWD	Riparian conifers
1	1452	1994	6	29	33	10	37.7	30

Limiting Factors:
1. Riparian Conifers
2. Pool Area
3. Fines

Reach	Pools			Riffles		Shade	LWD		Riparian Conifers	
	% Area	Frequency	Depth	Gravel	Fines		No.	Vol.	>20"dbh	>35"dbh
1	U	U	M	M	U	D	M	D	U	U

The number of large riparian conifers is limiting on Moore Creek. Pool habitat is marginal, with undesirable levels of pool area and frequency. LWD levels are moderate to desirable as well, the presence of LWD may improve the quality of the pool habitat that is available. Spawning habitat is available, and is only limited by high percentages of fine sediments in riffles.

Moon Creek - Four reaches were surveyed on Moon Creek. Primary land use is timber production, with stands consisting of young and second growth timber. Moon Creek is low gradient stream whose single channel is constrained by terraces and hillslopes.

The crew indicated only one possible barrier to fish passage, a culvert in unit 210 with a drop of 0.8m.

Reach	Length (m)	Year	%Open Sky	% Fines	% Gravel	% Pools	LWD	Riparian conifers
1	1499	1995	6	13	11	19.2	3.1	0
2	2600	1995	6	19	28	42.4	11.2	0
3	1504	1995	1	30	31	31.3	37.9	0
4	290	1995	20	58	40	0	16.5	60

Limiting Factors:
1. Riparian Conifers
2. LWD
3. Fines
4. Gravel – reach 1
5. Pool Area and Frequency – reach 4

Reach	Pools			Riffles		Shade	LWD		Riparian Conifers	
	% Area	Frequency	Depth	Gravel	Fines		No.	Vol.	>20"dbh	>35"dbh
1	M	D	M	U	M	D	U	U	U	U
2	D	M	M	M	M	D	M	U	U	U
3	M	M	M	M	U	D	D	D	U	U
4	U	U	M	D	U	D	U	U	U	U

The number of large riparian conifers is limiting on Moon Creek. Pool habitat is moderate to desirable, with undesirable levels of pool area and frequency in reach 4. LWD levels undesirable in reaches 1, 2, and 4. Increasing the levels of LWD may improve the quality of the pool environments. Spawning habitat is available, and is limited by high percentages of fine sediments in reaches 3 and 4, and by low levels of gravel in reach 1.

Moon Creek Tributary - Two reaches were surveyed on the tributary to Moon Creek. Primary land use is timber production, with stands consisting of young timber. Average reach gradient is low to moderate, and the single channel is constrained by terraces and hillslopes.

Reach	Length (m)	Year	%Open Sky	% Fines	% Gravel	% Pools	LWD	Riparian conifers
1	122	1995	1	17	35	25.8	135.5	
2	996	1995	1	26	35	19.1	32.7	12

Limiting Factors:
1. Riparian Conifers
2. Fines – reach 2

Reach	Pools			Riffles		Shade	LWD		Riparian Conifers	
	% Area	Frequency	Depth	Gravel	Fines		No.	Vol.	>20"dbh	>35"dbh
1	M	M	M	D	M	D	D	D	Nd	Nd
2	M	D	M	D	U	D	D	D	U	U

The number of large riparian conifers is limiting on this tributary to Moon Creek. Pool habitat is moderate; desirable levels of LWD should increase the structural complexity of the existing pool habitat, in effect, increasing the carrying capacity of the stream. Spawning habitat appears to be of good quality in reach 1, but high percentages of fine sediments in reach 2 may limit spawning success.

Blair Creek - Three reaches were identified on Blair Creek. Primary land use is grazing and timber production, with stands consisting of young timber. Blair Creek is a low gradient stream. Reaches 1 and 3 are composed of a single channel that is constrained by hillslopes and terraces. Reach 2 is a single channel, unconstrained reach.

Reach	Length (m)	Year	%Open Sky	% Fines	% Gravel	% Pools	LWD	Riparian conifers
1	314	1995	4	29	66	33.6	1.4	0
2	308	1995	15	53	48	0	0	0
3	827	1995	2	43	51	80.9	1.8	0

Limiting Factors:
1. Riparian Conifers
2. LWD
3. Fines
4. Pool Area, Frequency, and Depth

Reach	Pools			Riffles		Shade	LWD		Riparian Conifers	
	% Area	Frequency	Depth	Gravel	Fines		No.	Vol.	>20"dbh	>35"dbh
1	M	U	M	D	U	D	U	U	U	U
2	U	U	U	D	U	D	U	U	U	U
3	D	Nd	Nd	D	U	D	U	U	U	U

Large riparian conifers are limiting on Blair Creek. Pool habitat is marginal, and undesirable levels of LWD in the stream exacerbate this. Desirable levels of gravel in riffles indicates that potential spawning habitat exists, but high percentages of fine sediments may limit spawning success.

A.2.6 South Fork Coquille Watershed

Summary

Three streams (or stream groups, in the case of tributaries) were identified and analyzed to determine limiting factors in habitat for OC Coho Salmon. ODFW Aquatic Habitat Inventory stream report data was used to conduct this analysis. Low order streams were the focus of these surveys. As a result, there is no habitat inventory data for the higher order mainstem of the South Fork Coquille River.

Within each stream analysis, this report presents two habitat inventory summary tables. The first table provides the actual percentages of six broad habitat benchmark criteria, as averaged for each reach. These six criteria were selected for use as described in the Oregon Plan 2002 Western Stream Report (Flitcroft et al. 2002):

1. Pool area greater than 35% of total habitat area
2. Fine sediments (<4mm diameter) in riffle units less than 12% of all sediments
3. Gravel (4-64m diameter) in riffle units greater than or equal to 35% of all sediments
4. Volume of large woody debris greater than 20m3 wood/100m stream length
5. Shade greater than 70%
6. Large riparian conifers (>0.5m dbh) more than 150 trees per 305m stream length

These six benchmarks were further broken down and analyzed according to ODFW habitat benchmark thresholds on a sliding scale (*Desirable – Moderate – Undesirable*) as defined in (Foster et al. 2001). Throughout the analysis, attention was given to the natural regime of the stream in order to present the most accurate representation of potential limiting factors in the South Fork Coquille River system.

To summarize, only three analyses were conducted on this subwatershed due to limitations in available information. Broad conclusions drawn from this analysis are of course, limited as well, given the small sample size. Reaches were limiting by the number of large riparian conifers, high percentages of fine sediments, low amounts of LWD, and available pool habitat.

Habitat Component	Number of Streams Limiting	Total Number of Streams	Percentage of Streams Limited
Riparian conifers	1	3	33.3%
Fines	2	3	67%
LWD	1	3	33%
Gravel	0	3	0
Pools	1	3	33%
Shade	0	3	0

Five streams in the South Fork Coquille Watershed have been identified by DEQ as being water quality limited:

Stream	River Mile	Parameter	Season	List Date
Baker Creek	0 to 2.9	Temperature	Summer	2002
Dement Creek	0 to 6	Temperature	Summer	1998
Rowland Creek	0 to 4.6	Temperature	Sumer	1998
Salmon Creek	0 to 9.2	Temperature	Summer	1998
South Fork Coquille River	0 to 18.9	Temperature	Summer	1998
	19.3 to 42.2	Temperature	Summer	1998
	18.9 to 19.3	Temperature	Summer	2002
	0 to 18.9	Fecal Coliform	Winter/Spring/Fall	1998

Individual Stream Reports

Wooden Rock Creek - One reach was surveyed on Wooden Rock Creek. Primary land use is timber production, with stands consisting of second growth timber. Wooden Rock Creek is a low gradient stream, whose channel is constrained by hillslopes.

Stream	Reach	Length (m)	Year	%Open Sky	% Fines	% Gravel	% Pools	LWD	Riparian conifers
Wooden Rock Creek	760	1995	1	24	61	38	57.6	343.7	181

Limiting Factor:

1. Fines

Reach	Pools			Riffles		Shade	LWD		Riparian Conifers	
	% Area	Frequency	Depth	Gravel	Fines		No.	Vol.	>20"dbh	>35"dbh
1	D	D	D	D	U	D	D	D	M	U

Wooden Rock Creek presents quality habitat for rearing and overwintering juvenile coho. Spawning habitat is limited by the high percentage of fine sediments in riffles. The number of riparian conifers greater than 35" dbh is limiting; however, in time, this habitat benchmark criterion will be achieved given the high number of large riparian conifers already present.

Two by Four Creek - One reach was surveyed on Two by Four Creek. Primary land use is timber production, with stands consisting of second growth timber. Two by Four Creek is a moderately high gradient (8.9%) stream whose channel is constrained by hillslopes.

Stream	Reach	Length (m)	Year	%Open Sky	% Fines	% Gravel	% Pools	LWD	Riparian conifers
Two by Four Creek	2598	1996	1	2	17	37	9.4	48.9	92

Limiting Factors:

1. Riparian Conifers
2. Pool Area

Reach	Pools			Riffles		Shade	LWD		Riparian Conifers	
	% Area	Frequency	Depth	Gravel	Fines		No.	Vol.	>20"dbh	>35"dbh
1	U	M	M	D	M	D	M	D	U	U

The number of large riparian conifers is limiting. The percentage of pool area is at an undesirable level, although pool frequency and depth are moderate, indicating that juvenile rearing and overwintering habitat is moderately abundant. The levels of LWD in the stream are moderate to desirable, and most likely provide adequate habitat complexity. Spawning habitat is of good quality, as indicated by the moderate levels of fine sediments and desirable levels of gravel present at riffle sites.

Hayes Creek - Two reaches were surveyed on Hayes Creek. Primary land use is agriculture and timber production. Hayes creek is a high gradient stream whose channel is constrained by hillslopes.

Stream	Reach	Length (m)	Year	%Open Sky	% Fines	% Gravel	% Pools	LWD	Riparian conifers
Hayes Creek	1432	1995	1	7	16	53	38.7	3.2	No data
Hayes Creek	4694	1995	2	7	24	48	26	16.9	No data

Limiting Factors;

1. LWD
2. Fines – reach 2

Reach	Pools			Riffles		Shade	LWD		Riparian Conifers	
	% Area	Frequency	Depth	Gravel	Fines		No.	Vol.	>20"dbh	>35"dbh
1	D	M	U	D	M	D	M	U	No data	
2	M	D	M	D	U	D	D	U	No data	

Pool habitat, on average is moderate to desirable, although residual pool depth in reach 1 is undesirable. Fine sediments may limit spawning productivity in reach 2. The volume of LWD is at undesirable levels in both reaches.

Upper South Fork Coquille River - The data presented in the USFS stream survey reports is of a different format than the ODFW Aquatic Habitat Inventory data. It is from 1989-2001 USFS stream survey data. It did not make sense to attempt to force the USFS data into the established ODFW format, although many of the data are analogous. As a result, the data presented here are in a slightly different format but many of the same types of conclusions are drawn.

When synonymous relationships existed between the two data types, the ODFW *Desirable* to *Undesirable* sliding scale of habitat values was utilized.

Data was not available for the percentage of gravel and fines in riffles. In addition, LWD volume was not calculated in these data, nor was the number of large riparian conifers. Instead, as presented below, percentages were estimated of the contribution of the dominant species to the community within the reach. Also, the calculation of pool frequency was different, and an alternate manner for calculating values for pool frequency was not determined.

Johnson Creek - Three reaches were surveyed on Johnson Creek. This is a moderate gradient stream constrained by hillslopes, with a small percentage of reach one available in side channel habitat. One 35-foot dam exists in reach 2 of the measured stream.

Reach	Length (m)	Year	Pools			LWD	Riparian Conifers	
			% Area	Depth	Complex pools	No./100m	>20"dbh	>32"dbh
1	3776	2001	29.6	0.90	0	3.13	4	0
2	2400	2001	28.51	0.69	0	4.66	23	22
3	1056	2001	25.9	0.50	1	7.5	22	0

Limiting Factors:

1. LWD
2. Complex pools
3. Riparian conifers
4. Data: shade, % gravel and % fines in riffles
5. Fish passage

Reach	Pools			LWD	Riparian conifers	
	% Area	Depth	Complex Pools	No./100m	Overstory	Understory
1	M	D	U	U	Douglas fir	Big leaf maple
2	M	D	U	U	Douglas fir	W. Red cedar
3	M	D	M	U	Douglas fir	Big leaf maple

The presence of large conifers in the riparian community suggests that with succession and time, the potential exists for a sustainable coniferous source of LWD. Although not shown in the above tables, a high percentage of the smaller trees in the measured riparian communities consisted of coniferous species, specifically, Douglas fir.

LWD is limited in the stream; this is most likely due to the low percentages of large riparian conifers present. Pool area and depth are moderate to desirable, although the number of complex pools (those with >3 pieces of LWD present) is lower than desired, a direct effect of low LWD presence.

There appears to be rearing and overwintering habitat in Johnson Creek, especially in reach 1, where coho salmon were observed during the summer survey. Between 20 and 30 riffles per mile exist in each of the surveyed reaches, suggesting that spawning habitat exists. However, there is no data attesting to the quality of said riffle habitat. The presence of the 35-foot dam in reach 2 presents a potential barrier to fish passage.

Granite Creek - One reach was surveyed on Granite Creek. This is a high gradient stream constrained by hillslopes, with a low percentage of the measured reach available as side-channel habitat. One set of falls and one dam exists along this reach, the maximum height of the largest of these potential barriers being 11 feet (the heights of both are not provided).

Reach	Length (m)	Year	Pools			LWD	Riparian Conifers	
			% Area	Depth	Complex pools	No./100m	>20"dbh	>32"dbh
1	1008	2001	14.44	0.42	0	7.29	56	29

Limiting Factors:
1. Complex pools
2. LWD
3. Data: shade, % fines and % gravel in riffles

Reach	Pools			LWD	Riparian conifers	
	% Area	Depth	Complex Pools	Number/100m	Overstory	Understory
1	M	M	U	U	Douglas fir W. hemlock	W. hemlock

When the categories of large riparian conifers are combined, it can be determined that 85% of the riparian community is composed of large riparian conifers. This suggests that these communities are in the successional process of creating a sustainable coniferous source of LWD

LWD is limited in the stream. Pool area and depth are moderate, although the number of complex pools (those with >3 pieces of LWD present) is undesirable, a direct effect of low LWD presence.

There appears to be rearing and overwintering habitat in Granite Creek, although no fish species were documented during the survey. 34 riffles per mile exist in the surveyed reach, suggesting that spawning habitat exists. However, there is no data attesting to the quality of said riffle habitat.

The presence of the dam and the falls presents a potential barrier to fish passage. It was noted in the summary report that the data presented was suspect due to inadequate sample size.

Panther Creek - Two reaches were surveyed on Panther Creek. This stream is low gradient in reach 1, but high gradient in reach 2. A very low percentage of the stream area is present in side-channels. Two falls occur in reach 1, with a maximum height of 6 feet. Two falls occur in reach 2 as well, with a maximum height of 5 feet. It should be noted that Panther Creek enters the South Fork Coquille above Coquille Falls, which is a barrier to anadromy.

Reach	Length (m)	Year	Pools			LWD	Riparian Conifers	
			% Area	Depth	Complex pools	No./100m	>20"dbh	>32"dbh
1	2080	2001	57.86	0.63	0	3.89	31	22
2	1680	2001	31.08	0.49	0	2.26	18	46

Limiting Factors:
1. Complex pools
2. LWD
3. Riparian conifers
4. Data: shade, % fines and % gravel in riffles

Reach	Pools			LWD	Riparian conifers	
	% Area	Depth	Complex Pools	Number/100m	Overstory	Understory
1	D	D	U	U	Douglas fir	Douglas fir Red alder W. Hemlock
2	M	M	U	U	Douglas fir	Red alder P-O Cedar

In both reaches, over 50% of the riparian community is comprised of large riparian conifers, with a high percentage of coniferous species present as smaller timber (46% an 36%, respectively). This suggests that these communities are in the successional process of creating a sustainable coniferous source of LWD

LWD is limited in the stream. Pool area and depth are moderate to desirable, although the number of complex pools (those with >3 pieces of LWD present) is undesirable, a direct effect of low LWD presence.

There appears to be rearing and overwintering habitat in Granite Creek, although no fish species were documented during the survey. 31.5 riffles per mile exist in reach 1 and 54.3 riffles per mile exist in reach 2, suggesting that spawning habitat exists. However, there is no data attesting to the quality of said riffle habitat. The four falls presents potential barriers to fish passage.

Lockhart Creek - One reach was surveyed on Lockhart Creek. This is a high gradient stream constrained by hillslopes, with no available side-channel habitat. Three falls, two chutes, and one culvert exists along this reach, the maximum height of the largest of these potential barriers being 16.0 feet. Lockhart Creek is above Coquille Falls, a natural barrier to anadromy.

Reach	Length (m)	Year	Pools			LWD	Riparian Conifers	
			% Area	Depth	Complex pools	No./100m	>20”dbh	>32”dbh
1	864	1999	43.50	.41	0	8.28	66	0

Limiting Factors:
1. Complex pools
2. LWD
3. Data: shade, % fines and % gravel in riffles

Reach	Pools			LWD	Riparian conifers	
	% Area	Depth	Complex Pools	Number/100m	Overstory	Understory
1	D	M	U	U	Douglas fir	P-O cedar

Riparian transect surveys describe 66% of the riparian community as being comprised of conifers greater than 20" dbh. No conifers were observed in the larger (>32"dbh) category. Thirty-four percent of the riparian community was comprised of coniferous species, suggesting that this community is in the successional process of creating a sustainable coniferous source of LWD. LWD is limited in the stream. Pool area and depth are moderate to desirable, although the number of complex pools (those with >3 pieces of LWD present) is undesirable, a direct effect of low LWD presence.

There appears to be rearing and overwintering habitat in Lockhart Creek, although it appears to be limited in complexity. Resident rainbow trout were observed during the survey. Sixty-eight riffles per mile exist in the surveyed reach, suggesting that spawning habitat exists. However, there is no data attesting to the quality of said riffle habitat.

<u>Wooden Rock Creek</u> - One reach was surveyed on Wooden Rock Creek. This is a low gradient stream constrained by hillslopes, with no available side-channel habitat. There are no potential barriers to fish movement documented in this reach. Wooden Rock Creek is located above Coquille Falls, a natural barrier to anadromy.

Reach	Length (m)	Year	Pools			LWD	Riparian Conifers	
			% Area	Depth	Complex pools	No./100m	>20"dbh	>32"dbh
1	21.92	1997	69.13	0.61	0	3.46	37	0

Limiting Factors:

1. Complex pools
2. LWD
3. Riparian conifers
4. Data: shade, % fines and % gravel in riffles

Reach	Pools			LWD	Riparian conifers	
	% Area	Depth	Complex Pools	Number/100m	Overstory	Understory
1	D	D	U	U	W. red cedar	Red alder

Riparian transect surveys describe 37% of the riparian community as being comprised of conifers greater than 20" dbh. No conifers were observed in the larger (>32"dbh) category. Sixty-three percent of the riparian community was comprised of coniferous species, suggesting that this community is in the successional process of creating a sustainable coniferous source of LWD. LWD is limited in the stream. Pool area and depth are desirable, although the number of complex pools (those with >3 pieces of LWD present) is undesirable, a direct effect of low LWD presence.

There appears to be rearing and overwintering habitat in Wooden Rock Creek, although it appears to be limited in complexity. Cutthroat trout and unidentified dace species were observed during the survey. Twenty-one riffles per mile exist in the surveyed reach, suggesting that some spawning habitat exists. However, there is no data attesting to the quality of said riffle habitat.

Foggy Creek - One reach was surveyed. This is a low gradient stream constrained by hillslopes, with no available side-channel habitat. There are no potential barriers to fish movement, although this reach is above Coquille Falls, a natural barrier to anadromy.

Reach	Length (m)	Year	Pools			LWD	Riparian Conifers	
			% Area	Depth	Complex pools	No./100m	>20"dbh	>32"dbh
1	1488	1997	80.28	0.69	0	3.95	0	0

Limiting Factors:
1. Complex pools
2. LWD
3. Riparian conifers
4. Data: shade, % fines and % gravel in riffles

Reach	Pools			LWD	Riparian conifers	
	% Area	Depth	Complex Pools	Number/100m	Overstory	Understory
1	D	D	U	U	NA	NA

Riparian transect surveys describe a riparian community completely lacking in large trees. However, next size class of riparian trees comprises 93% of the total community. The overstory of this subset of the community is made of Western Red Cedar. This suggests that this community is in the successional process of creating a sustainable coniferous source of LWD. LWD is limited in the stream. Pool area and depth are desirable, although the number of complex pools (those with >3 pieces of LWD present) is undesirable, a direct effect of low LWD presence.

There appears to be rearing and overwintering habitat in Foggy Creek, although it appears to be limited in complexity. Cutthroat trout and an unidentified species of dace were observed during the survey. Twenty-one riffles per mile exist in the surveyed reach, suggesting that spawning habitat exists. However, there is no data attesting to the quality of said riffle habitat (i.e., percent fines, percent gravel).

South Fork Coquille River - Eight reaches were surveyed on the South Fork Coquille River. This is a high to low gradient stream constrained by hillslopes, with very little available side-channel habitat. The survey was initiated at Coquille Falls, a 75-foot barrier to anadromy.

Reach	Length (m)	Year	Pools			LWD	Riparian Conifers	
			% Area	Depth	Complex pools	No./100m	>20"dbh	>32"dbh
1	3168	1997	20.10	2.19	0	3.95	36	0
2	10304	1997	72.81	0.99	1	0.85	20	0
3	No Access	1997	--	--	--	--	--	--
4	480	1997	32.01	0.66	0	0.42	0	0
5	No Access	1997	--	--	--	--	--	--
6	1392	1997	71.75	0.45	0	0.22	0	0
7	1968	1997	69.15	0.48	1	3.10	0	0
8	5808	1997	95.91	0.64	0	2.43	27	0

Limiting Factors:

1. Complex pools
2. LWD
3. Riparian conifers
4. Data: shade, % fines and % gravel in riffles

Reach	Pools			LWD	Riparian conifers	
	% Area	Depth	Complex Pools	No./100m	Overstory	Understory
1	M	D	U	U	Unidentified conifer	Unidentified conifer
2	D	D	U	U	Unidentified conifer	Red alder
3	No Access					
4	M	D	U	U	N/A	N/A
5	No Access					
6	D	M	U	U	N/A	N/A
7	D	M	U	U	N/A	N/A
8	D	D	U	U	Douglas fir	Red alder Douglas fir

Riparian transect surveys describe a riparian community completely lacking in large trees in three reaches, and containing relatively low percentages of large trees in the remaining three measurable reaches. However, the percentage of conifers present in the next size class of riparian trees, small timber, comprises 80% of the total community in reach 2, 100% in reaches 4, 6, and 7 and 73% in reach 8. With the exception of reach 1, where the riparian community is dominated by sapling/pole red alder, the transect data suggests that these communities are in the successional process of creating a sustainable coniferous source of LWD.

LWD is limited in the stream. Pool area and depth are desirable, although the number of complex pools (those with >3 pieces of LWD present) is undesirable, a direct effect of low LWD presence.

There appears to be rearing and overwintering habitat in this portion of the South Fork Coquille River, although it appears to be limited in complexity. Cutthroat trout, resident rainbow trout, and an unidentified species of dace were observed during the survey. The number of riffles per mile exist in the surveyed reach ranges from 6.7 to 16.3, suggesting that limiting spawning habitat exists. However, there is no data attesting to the quality of said riffle habitat (i.e., percent fines, percent gravel).

Rock Creek - Two reaches were surveyed on Rock Creek. This is a moderate gradient stream constrained by hillslopes, with very little available side-channel habitat. There are no potential barriers to fish movement documented in this reach.

Reach	Length(m)	Year	Pools			LWD	Riparian Conifers	
			% Area	Depth	Complex pools	No./100m	>20"dbh	>32"dbh
1	1888	1997	23.91	0.76	0	1.12	70	0
2	3632	1997	22.44	0.72	0	2.47	66.9	0

Limiting Factors:
1. Complex pools
2. LWD
3. Data: shade, % fines and % gravel in riffles

Reach	Pools			LWD	Riparian conifers	
	% Area	Depth	Complex Pools	No./100m	Overstory	Understory
1	M	D	U	U	Douglas fir	Red alder
2	M	D	U	U	Douglas fir	Red alder

Riparian transect surveys describe a riparian community containing a high percentage of conifers greater than 20" in diameter. Although at the time of the survey there were no conifers present in the largest size class, with time, this gap should be filled. In addition, the remainder of the dominant tree species is classified as small timber, only one class size smaller than the large timber described here. This suggests that this plant community is in the process of creating a sustainable coniferous source of LWD. LWD is limited in the stream. Pool area and depth are desirable, although the number of complex pools (those with >3 pieces of LWD present) is undesirable, a direct effect of low LWD presence.

There appears to be rearing and overwintering habitat in Rock Creek, although it appears to be limited in complexity. Cutthroat trout, rainbow trout, and an unidentified species of dace were observed during the survey. Sixteen and thirteen riffles per mile exist in the surveyed reaches, suggesting that spawning habitat exists. However, there is no data attesting to the quality of said riffle habitat (i.e., percent fines, percent gravel).

Buck Creek - One reach was surveyed on Buck Creek. This is a low to moderate gradient stream constrained by hillslopes, with no available side-channel habitat. Two culverts present potential barriers to fish movement in this reach. Buck Creek is located above Coquille Falls, a natural barrier to anadromy.

Reach	Length(m)	Year	Pools			LWD	Riparian Conifers	
			% Area	Depth	Complex pools	No./100m	>20"dbh	>32"dbh
1	2416	1999	48.09	0.47	0	5.53	13	2

Limiting Factors:
1. Complex pools
2. LWD
3. Riparian conifers
4. Data: shade, % fines and % gravel in riffles

Reach	Pools			LWD	Riparian conifers	
	% Area	Depth	Complex Pools	Number/100m	Overstory	Understory
1	D	M	U	U	Douglas fir P-O cedar	Pacific yew Red alder

Riparian transect surveys describe a riparian community deficient in large trees. However, next size class (small timber) of riparian trees comprises 85% of the total community. The overstory of this subset of the community is made of Douglas fir. This suggests that this community is in the successional process of creating a sustainable coniferous source of LWD. LWD is limited in the stream. Pool area and depth are desirable, although the number of complex pools (those with >3 pieces of LWD present) is undesirable, a direct effect of low LWD presence.

There appears to be rearing and overwintering habitat in Buck Creek, although it appears to be limited in complexity. Cutthroat trout and resident rainbow trout were observed during the survey. Fifty-one riffles per mile exist in the surveyed reach, suggesting that spawning habitat exists. However, there is no data attesting to the quality of said riffle habitat (i.e., percent fines, percent gravel).

Sucker Creek - Two reaches were surveyed on Sucker Creek. This is a high gradient stream constrained by hillslopes, with no available side-channel habitat. Two falls and one dam exist on Sucker Creek, the maximum barrier height being 15 feet. This presents a potential barrier to fish passage.

Reach	Length(m)	Year	Pools			LWD	Riparian Conifers	
			% Area	Depth	Complex pools	No./100m	>20"dbh	>32"dbh
1	1248	2001	22.51	0.52	0	1.60	4	0
2	1936	2001	24.27	0.55	1	7.83	17	48

Limiting Factors:
1. Complex pools
2. LWD
3. Riparian conifers
4. Data: shade, % fines and % gravel in riffles

Reach	Pools			LWD	Riparian conifers	
	% Area	Depth	Complex Pools	Number/100m	Overstory	Understory
1	M	D	U	U	Douglas fir	Red alder
2	M	D	U	U	Douglas fir	W. hemlock P-O cedar

Riparian transect surveys describe the riparian community of reach 1 as deficient large trees, while a total of 65% of reach 2 is comprised of large riparian conifers. However, next size class (small timber) of riparian trees comprises 91% of the total community of reach 1 and 35% of the reach 2 community. The overstory of this subset of these communities is dominated by Douglas fir. This suggests that this plant community is in the process of creating a sustainable coniferous source of LWD

LWD is limited in the stream. Pool area and depth are desirable, although the number of complex pools (those with >3 pieces of LWD present) is undesirable, a direct effect of low LWD presence.

There appears to be rearing and overwintering habitat in Sucker Creek, although it appears to be limited in complexity. Cutthroat trout and rainbow trout were observed during the survey. Thirty riffles per mile exist in the reach 1 and 41 riffles per mile in reach 2, suggesting that spawning habitat exists. However, there is no data attesting to the quality of said riffle habitat (i.e., percent fines, percent gravel).

Poverty Creek - Two reaches were surveyed on Poverty Creek. This is a high gradient stream constrained by hillslopes, with very little available side-channel habitat. One 11-foot falls in reach two presents a potential barrier to fish passage.

Reach	Length(m)	Year	Pools			LWD	Riparian Conifers	
			% Area	Depth	Complex pools	No/100m	>20"dbh	>32"dbh
1	1360	2001	25.55	0.56	0	6.02	78	22
2	3024	2001	21.09	0.42	0	6.33	3	17

Limiting Factors:

1. Complex pools
2. LWD
3. Riparian conifers
4. Data: shade, % fines and % gravel in riffles

Reach	Pools			LWD	Riparian conifers	
	% Area	Depth	Complex Pools	No./100m	Overstory	Understory
1	M	D	U	U	W. hemlock Douglas fir	P-O cedar W. hemlock
2	M	M	U	U	W. hemlock	W. hemlock

Riparian transect surveys describe a riparian community dominated by large conifers in reach 1, but deficient in reach 2. However, in reach 2, the next size class of riparian trees comprises 79% of the total community. The overstory of this subset of the community is made of Western hemlock. This suggests that this community is in the successional process of creating a sustainable coniferous source of LWD.

LWD is limited in the stream. Pool area and depth are desirable, although the number of complex pools (those with >3 pieces of LWD present) is undesirable, a direct effect of low LWD presence.

There appears to be rearing and overwintering habitat in Poverty Creek, although it appears to be limited in complexity. Cutthroat and rainbow trout were observed during the survey. Thirty-seven riffles per mile exist in reach 1, and 41 riffle per mile exist in reach 2, suggesting that spawning habitat exists. However, there is no data attesting to the quality of said riffle habitat (i.e., percent fines, percent gravel).

Barker Creek - One reach was surveyed on Barker Creek. One culvert is present along the measured reach and may present a potential barrier to fish passage. Barker Creek is located above Coquille Falls, which serves as a barrier to anadromy.

Reach	Length (m)	Year	Pools			LWD	Riparian Conifers	
			% Area	Depth	Complex pools	No./100m	>20"dbh	>32"dbh
1	1600	1993	24.5	0.35	No data	7.14	43	0

Limiting Factors:
1. LWD
2. Riparian conifers
3. Data: shade, % fines and % gravel in riffles, complex pools

Reach	Pools			LWD	Riparian conifers	
	% Area	Depth	Complex Pools	No./100m	Overstory	Understory
1	M	M	No data	U	Red alder	Douglas fir Unidentified hardwood

Riparian transect surveys describe a riparian community deficient in large riparian conifers. The next size class (small timber) is dominated by hardwoods.

LWD is limited in the stream. Pool area and depth are desirable, although the number of complex pools (those with >3 pieces of LWD present) is undesirable, a direct effect of low LWD presence.

There appears to be some rearing and overwintering habitat in Barker Creek, although it appears to be limited in complexity. Resident rainbow trout were observed during the survey. There is no data regarding the amount of riffle habitat, or its quality.

A.3 Riparian Shade Analysis

This section contains data collected through grants with Oregon Department of Environmental Quality. It was combined with water temperature data to select candidate sites for restoring water temperature for summer parr.

A.3.1 Middle Fork Coquille Watershed

Of the 25 stream reaches that are posted on the 303(d) list, 21 exceed the 7-day maximum summer stream temperature limit for salmonids. Riparian vegetation plays a key role in determining the amount of solar radiation a stream absorbs. Estimates of the amount of riparian shade are given in Table A.3-1, along with the potential amount of shade that would be provided if the riparian community were in an optimal state (Follansbee *with* CWA 2003).

Table A.3-1. Current and potential shaded area of all streams assessed in the Middle Fork Coquille Watershed.

Subwatershed	Current Shaded Channel (%)	Potential or Target Shade (%)	Potential Shade Increase (%)
Middle Fork Camas mainstem	78	96	18
Wildcat Creek	92	99	7
Reed Creek	93	98	5
Kirkendall Creek	72	99	27
Thompson Creek	98	99	1
Noah Creek	92	99	7
Jim Belieu Creek	74	96	22
Holmes Creek	93	97	4
Camas Valley - all	86	97	11
Twelvemile Creek mainstem	76	96	20
Bridge Creek	88	99	11
Dice Creek	89	98	9
Boulder Creek	65	99	34
Twelvemile Creek - all	79	97	20
Middle Fork middle mainstem	59	79	20
Upper Rock Creek mainstem	86	96	10
Little Upper Rock Creek	88	99	11
Upper Rock Creek - all	87	96	9
Sandy Creek mainstem	83	96	13
Sandy Creek tributaries	95	99	4
Sandy Creek - all	91	98	7
Myrtle Creek	73	94	21
Lower Rock Creek	79	94	15
Belieu Creek	94	97	3
Big Creek and small tributaries	90	97	7
Swamp Creek	94	98	4
Bear Creek	98	99	1
Axe Creek	97	98	1
Brownson Creek	97	99	2
Fall Creek	93	98	5
Big Creek - all	93	98	5
Middle Fork lower mainstem	54	81	27
Middle Fork Coquille River – all	80	97	17

The solar energy input has been calculated for the latitude of the Middle Fork Coquille Watershed at 2440 British thermal units (Btu)/square foot/day using a flat plane solar collector. This means that a square foot of stream that is totally unshaded would receive 2440 Btu/square foot/day of solar energy during a full, clear day in August. The current solar loading for any given stream reach is calculated by multiplying the total possible load (2440 Btu/square foot/day) by the area of the stream channel that is unshaded. Table A.3-2 shows current shade and target shade provided by watershed regions as well as for the entire Middle Fork Coquille Watershed. The lower half of the table shows the current and target solar loading. The difference between current and potential future conditions is shown in the last column.

Table A.3-2. Current shade, target shade, and solar loading of the Middle Fork Coquille Watershed.

Watershed	Current Shade	Target Shade	Reduction
Camas Valley	86	97	11
Large Tributaries	83.6	96.3	12.7
Middle/Lower Mainstem	57.5	75.5	18
Entire Middle Fork Coquille River	80	97	17
Watershed	**Current Solar Load**	**Target Solar Load**	**Reduction**
Camas Valley	342	73	269
Large Tributaries	400	91	309
Middle/Lower Mainstem	1037	598	439
Entire Middle Fork Coquille River	488	73	415

Adapted from Follansbee 2003.

A.3.2 North Fork Coquille Watershed

Estimates (2002) of the amount of riparian vegetation and associated shade are available for the North Fork Coquille and are given in Table A.3-3, along with current dominant land use and the potential amount of shade that would be provided if the riparian community were in an optimal state (Follansbee *with* CWA 2002).

Table A.3-3. Current and potential shaded area of all streams assessed in the North Fork Coquille Watershed.

Subwatershed	Land Use	Current Shaded Channel (%)	Potential or Target Shade (%)	Potential Shade Increase (%)
Fairview (FAIR01-13)	Forest	75	78	3
Fairview (FAIR14-49)	Ag/RR*	67	80	13
Echo (ECHO01-74)	Ag/RR	48	73	25
Hudson Creek HUD01-35)	Forest	86	97	13
Middle Creek (MIDL01-119)	Forest	89	93	4
Middle Creek (MIDL120-147)	Ag/RR	75	91	16
Park Creek (PARK01-22)	Forest	93	97	4
Vaughn Creek (VAUN01-10)	Forest	86	97	11

Alder Creek (ALDR01-11)	Forest	93	98	5
Cherry Creek (CHER01-20)	Forest	74	96	33
Cherry Creek (CHER21-30)	Ag/RR	74	96	22
Weimer Creek (WEIM01-12)	Forest	63	96	33
Johns Creek (JONS01-16)	Forest	95	98	3
Llewellyn Creek (LLE01-17)	Forest	77	97	20
Upper North Fork (UNC01-106)	Forest	86	94	7
North Fork Creek (NFCr01-17)	Forest	92	97	5
Whitley (WHIT01-49)	Forest	83	91	8
Moon Creek (MOON01-29)	Forest	94	95	1
Evans Creek (EVAN01-07)	Ag/RR	82	86	4
Woodward Creek (WOOD01-26)	Forest	89	96	7
Steinnon Creek (STEIN01-15)	Forest	86	97	11
Steele Creek (STEEL01-15)	Forest	95	98	3
North Fork Coquille River	All Land Uses	81	91	10

***Ag/RR** denotes Agriculture/Rural Residential. Adapted from Follansbee 2002.

The solar load was calculated for the latitude of the North Fork Coquille watershed at 2440 Btu/square foot/day using a flat plane solar collector. Table A.3-4 shows current shade and target shade by watershed regions.

Table A.3-4. Current shade, target shade, and solar loading of the North Fork Coquille Watershed by land use allocation.

Watershed	Current Shade	Target Shade	Reduction
Forest Lands	87	95	8
Agricultural and Rural Residential Lands	69	85	16
Entire North Fork Coquille River	81	91	10
Watershed	**Current Solar Load**	**Target Solar Load**	**Reduction**
Forest Lands	276	122	154
Agricultural and Rural Residential Lands	756	366	390
Entire North Fork Coquille River	463	220	243

Adapted from Follansbee 2002.

A.3.3 Lower South Fork Coquille Watershed

Estimates of the amount of riparian vegetation and associated shade are available for the Lower South Fork Coquille River (below the city of Powers and the Siskiyou National Forest Boundary). These data and the potential riparian shade condition are quantified in Table A.3-5. This project was conducted by Clearwater BioStudies, Inc. & PWA (2001) in conjunction with the CWA.

Table A.3-5. Current and potential shaded area of stream reach by mile in the Lower South Fork Coquille Watershed.

Subwatershed	**Land Use**	**Current Shaded Channel** (%)	**Potential or Target Shade** (%)	**Potential Shade Increase** (%)
Lower SF Coquille River – mainstem only	Forest	27	45	18
	Ag/RR	15	39	24
	All	16	40	24
Dement Cr and tributaries	Forest	85	93	8
	Ag/RR	76	90	14
	All	83	93	10
Yellow Cr and tributaries	Forest	91	94	3
	Ag/RR	80	92	12
	All	87	93	6
Hayes Cr and tributaries	Forest	84	93	9
	Ag/RR	85	92	7
	All	84	93	9
Steinnon Cr (STEIN01-15)	Forest	86	97	11
Steele Cr (STEEL01-15)	Forest	95	98	3
Lower SF Coquille River	All Land Uses	81	91	10

***Ag/RR** denotes Agriculture/Rural Residential. From Clearwater BioStudies, Inc & PWA. Ltd (2001).

A. 4 Watershed Attributes

This section provides a generalized description of the watershed attributes affecting coho life stages for each of the five watersheds.

A.4.1 East Fork Coquille Watershed

This is the steepest of the Coquille River watersheds, with an average gradient of 70 feet per mile (CWA 1997). The East Fork Coquille River is a large tributary of the Coquille River, running west from its headwaters east of Sitkum (CWA 1997).

The majority of the reaches presented in this analysis are steep, low-order, headwater streams often composed of single channels constrained by hillslopes and terraces. Very little off-channel habitat remains. Early logging practices stripped large conifers from the riparian buffers, and although the surveyed reaches were typically well shaded, the deficiency in large riparian conifers was obvious. Riparian conifers appear to be, in effect, a "keystone" habitat element in that they provide a long-term source of large wood to the stream, which in turn, facilitates pool development, structural complexity, and gravel retention. Currently riparian systems are dominated by shrubs and hardwoods, with few exceptions. Hardwoods, such as alder and myrtle, will provide large wood to the stream, but the longevity of these pieces is less, which is why coniferous riparian species are preferred. Detailed reach by reach analyses of the surveyed tributaries are provided in Appendix A.2. Table A.4-1 summarizes the habitat conditions that limit the production and success of coho.

Table A.4-1. Watershed Attributes Affecting Coho Life Stages in the East Fork Coquille Watershed.

Life Stage	Water Quality and Quantity	Habitat Connectivity	Aquatic and Riparian Habitat Characteristics and Processes	Other Impacts
Adult migration and holding	Periodic low flows are aggravated by irrigation withdrawals; the disconnection from the floodplain and subsequent loss of wetlands limits off-channel potential for water storage. Low summer flows and poor riparian condition increase late summer/early fall water temperatures.	A few culverts throughout the watershed present potential barriers to adult habitat.	Riparian areas are limited in the number of large conifers present on most tributary streams. Limited wood in the tributaries and river channel has reduced the frequency and depth of pools and limited adult hiding cover. Loss of wetland, floodplain, and off-channel habitats in the lower channel has affected the quality and quantity of adult holding areas. The presence of invasive plants along the lower reaches limits the growth of robust native vegetation needed for habitat and channel formation processes.	
Adult spawning/		A few culverts throughout the	Limited wood in tributary streams has reduced retention of spawning gravels.	

egg incubation		watershed present potential barriers to adult habitat.	Mass failures, roadbed washes, and other indicators of poor bank stability have resulted in high sediment inputs, which limit available spawning sites and incubation success.	
Fry and juvenile rearing and migration	Naturally low summer flows are aggravated by water withdrawals, which may increase water temperatures. High water temperatures in the mainstem East Fork and Elk Creek do not provide optimal conditions for juvenile rearing.	A few culverts throughout the watershed present barriers to juvenile access to rearing and refuge habitat.	Limited wood in the tributaries and river channel has reduced the frequency and depth of pools, thus limiting juvenile rearing and refuge habitat. Riparian areas along the river and tributaries are limited in conifers. Loss of wetland, floodplain, and off-channel habitats have affected the quantity and quality of juvenile rearing and refuge areas.	Introduced fish species (small- and large-mouth bass) prey on juveniles. Salmon carcasses are reduced from historical levels.

The BLM conducted a watershed analysis of the East Fork Coquille River in 1998 (USDI 1998). They found that settlement of the watershed resulted in changes in hydrologic conditions, including the removal of instream habitat structure and riparian vegetation, which has resulted in incising of the river channel. Sediments that were once either deposited on the floodplain or stored in slackwater areas behind LWD are now being carried downstream. Historic splash damming, and more recently, regeneration forestry and associated road building have increased the rate of landslides, stream torrents, and sediment delivery. The removal of the riparian canopy has resulted in increases in summer stream temperatures.

A.4.2 Lower Coquille Watershed

This watershed was previously known as Mainstem Coquille. This portion of the river stretches 36 miles, from its mouth at the Pacific Ocean to its confluence with the South Fork Coquille and drains an area of 172 square miles. The Coquille River estuary is long and narrow, consisting of 763 acres. Despite its size, the estuary provides important feeding, spawning, breeding, nesting, and rearing habitats for many terrestrial and aquatic species (CWA 1997). Although some channeling has occurred, the mainstem channel maintains connectivity with the floodplain. However, off-channel habitat quality is much reduced. Many tributaries have been disconnected from their respective floodplains and experience accelerated sedimentation into stream channels (CWA 1997).

Only three streams were surveyed on the Lower Coquille River with the ODFW Aquatic Habitat Inventory monitoring program, which limits the conclusions that may be drawn with regard to the entire watershed. However, when these results are examined in light of previous analyses (i.e., the CWA 1997), generalizations for limiting factors for coho can be drawn. The surveyed tributaries to the Lower Coquille River were typically very low gradient reaches, with some off-channel wetland habitat available. These reaches were less constrained than the headwater-type tributaries of the North, East, Middle, and South Forks. A detailed reach by reach analysis of the surveyed tributaries is provided in Appendix A.2. Table A.4-2 summarizes the habitat conditions that limit the production and success of coho.

Table A.4-2. Watershed Attributes Affecting Coho Life Stages in the Lower Coquille Watershed.

Life Stage	Water Quality and Quantity	Habitat Connectivity	Aquatic and Riparian Habitat Characteristics and Processes	Other Impacts
Adult migration and holding	Periodic low flows are aggravated by irrigation withdrawals. Low summer flows and poor riparian condition increase late summer/early fall water temperatures. High levels of fecal coliform and dissolved oxygen may affect adult survival and/or productivity.	A few culverts throughout the watershed present potential barriers to adult habitat.	Riparian areas along most tributaries are deficient in large conifers. Limited wood in the tributaries and river channel has reduced the frequency and depth of pools and limited adult hiding cover. Loss of wetland, floodplain, and off-channel habitats in the lower channel has affected the quality and quantity of adult holding areas. The presence of invasive plants along the lower reaches limits the growth of robust native vegetation needed for habitat and channel formation processes.	
Adult spawning/ egg incubation		A few culverts throughout the watershed serve as barriers to spawning habitat.	Limited wood in tributary streams has reduced retention of spawning gravels. Mass failures, roadbed washes, and other indicators of poor bank stability have resulted in high sediment inputs, which limit available spawning sites and incubation success.	
Fry and juvenile rearing and migration	Naturally low summer flows are aggravated by water withdrawals, which may increase water temperatures. High water temperatures, high levels of fecal coliform, and low levels of DO in the mainstem and many tributaries do not provide optimal conditions for juvenile rearing.	A few culverts throughout the watershed present barriers to juvenile access to rearing and migration habitat.	Limited wood in the tributaries and river channel has reduced the frequency and depth of pools, thus limiting juvenile rearing and refuge habitat. Riparian areas along the river and tributaries are limited in conifers. Loss of wetland, floodplain, and off-channel habitats has affected the quantity and quality of juvenile rearing and refuge areas.	Introduced fish species (small- and large-mouth bass) may prey on juveniles. Salmon carcasses are reduced from historical levels.

Although the number of streams available in the AHI database is relatively small, the BLM conducted a watershed analysis (USDI 1997) of Middle Main Coquille River. In their analysis of the aquatic habitat, they concluded that the combined impacts of agricultural practices, past timber harvest practices, and the associated land management activities have degraded stream habitat conditions. Some of the general effects of these impacts are:

- A reduction in the potential for LWD and gravel recruitment to the stream through harvest of large conifers next to, and upslope from, streams.
- A reduction of the amount of LWD currently in the streams through active removal projects associated with stream cleaning, salvage, and the facilitation of road construction.
- The presence of culverts in the subwatershed which either partially or entirely block fish and amphibian passage.
- The presence of roads parallel to streams disconnects the stream from its riparian community, and can present barriers to woody debris and gravel recruitment to the stream from upslope areas.
- Road construction along streams has resulted in the establishment of alders next to the stream channels, thus reducing the future recruitment of large, durable conifers.

The watershed analysis goes on to describe the effects agricultural practices have had on stream integrity as follows: “Some of the primary reasons for the degraded conditions are stream-bank damage from livestock, down-cutting of streams due to the removal of stream-side vegetation and in-stream structure, the confinement of stream channels, and a decrease in future recruitment potential of durable large woody debris” (USDI 1997).

A.4.3 Middle Fork Coquille Watershed

The Middle Fork a tributary of the South Fork, with its confluence just south of Myrtle Point (CWA 1997). The Middle Fork is 40 miles from its confluence with the South Fork to the headwaters in Camas Valley and drains 310 square miles, making it the largest of the Coquille River watersheds (CWA 1997).

The Middle Fork Coquille River has an average gradient of 35 feet per mile, but the majority of the tributaries surveyed in the ODFW Aquatic Habitat Inventory project are of moderate to high gradient. These streams are typically single-channel systems, constrained by hillslopes or terraces, with very little off-channel or side-channel habitat. Riparian communities are dominated by hardwood and herbaceous species, and are noticeably deficient in large conifers. The low numbers of riparian conifers leads to a deficit of LWD and quality pool habitat, which was a characteristic of the majority of the streams surveyed. In addition, nearly one-half of the surveyed streams contained undesirable levels of fine sediments. Forty stream systems were analyzed in the Middle Fork Watershed. A detailed reach by reach analysis is presented in Appendix A.2. Table A.4-3 summarizes the habitat conditions that limit the production and success of coho.

Table A.4-3. Watershed Attributes Affecting Coho Life Stages in the Middle Fork Coquille Watershed.

Life Stage	Water Quality and Quantity	Habitat Connectivity	Aquatic and Riparian Habitat Characteristics and Processes	Other Impacts
Adult migration and holding	Periodic low flows are aggravated by irrigation withdrawals. Low summer flows and poor riparian condition increase late summer/early fall water temperatures. Undesirable levels of dissolved oxygen and fecal coliform, and high winter temperatures do not provide optimal conditions for adult migration.	A few culverts throughout the watershed present potential barriers to adult habitat.	Riparian areas along most tributaries are deficient in large conifers. Limited wood in the tributaries and river channel has reduced the frequency and depth of pools and limited adult hiding cover. Loss of wetland, floodplain, and off-channel habitats in the lower channel has reduced the adult holding areas. Invasive plants along the lower reaches limit native vegetation needed for habitat and channel formation processes.	
Adult spawning/ egg incubation	Undesirable levels of dissolved oxygen and fecal coliform, and high winter temperatures do not provide optimal conditions for adult spawning or egg incubation.	A few culverts throughout the watershed serve as barriers to spawning habitat.	Limited wood in tributary streams has reduced retention of spawning gravels. Poor bank stability has resulted in high sediment inputs, which limit available spawning sites and incubation success.	
Fry and juvenile rearing and migration	Naturally low summer flows are aggravated by water withdrawals, which may increase water temperatures. High water temperatures, virtually year-round in Battle Creek, and during the summer in others, do not provide optimal conditions for juvenile rearing. High levels of fecal coliform and low levels of DO in the Middle Fork Coquille do not provide optimal conditions for juvenile rearing or migration.	A few culverts throughout the watershed present barriers to juvenile access to rearing and migration habitat.	Limited wood in the tributaries and river channel has reduced the frequency and depth of pools, thus limiting juvenile rearing and refuge habitat. Riparian areas along the river and tributaries are limited in conifers. Loss of wetland, floodplain, and off-channel habitats has affected the quantity and quality of juvenile rearing and refuge areas.	Introduced fish species (small- and large-mouth bass) may prey on juveniles. Salmon carcasses are reduced from historical levels.

In 1994, the BLM conducted a watershed analysis of the Middle Fork Coquille Watershed, which briefly summarized the conditions of the watershed (USDI 1994). In the lower reaches, the channel is deeply down-cut and disconnected from its floodplain. The entire length of the Middle Fork Coquille River and portions of nearly every tributary stream are constrained by road fills. In general, the entire drainage has a deficit of in-stream structure and channel complexity, with the exception of a few isolated reaches on some tributaries. Historical logging and splash damming practices radically altered the species composition of the riparian community, so that the current riparian community is typified by hardwood species, such as red alder. This change has placed limitations on the size, amount, and durability of any LWD that may enter the stream, which in turn affects in-stream structural complexity, gravel retention, and overall habitat quality.

A.4.4 North Fork Coquille Watershed

The North Fork Coquille River drains 154 square miles and joins the mainstem Coquille River near Myrtle Point (CWA 1997). Running southward 53 miles from its headwaters to its mouth, the North Fork has a gradient of 30 feet per mile (CWA 1997). The majority of the streams surveyed were of moderate to high gradients, typically composed of single channels constrained by either hillslopes or terraces. Very little off-channel habitat was available, most likely due to the geological make-up of these headwater-type streams. Twenty-four stream systems were analyzed within the North Fork Watershed. All of these were limited in the number of large riparian conifers; riparian communities were dominated by hardwood and herbaceous species. In addition, the majority of the surveyed systems contained undesirable levels of fines, LWD, and pool habitat. Detailed reach by reach analyses of the surveyed tributaries are provided in Appendix A.2. Table A.4-4 summarizes the habitat conditions that limit the production and success of coho.

In 2001, the BLM conducted a watershed analysis of the North Fork Coquille River (USDI 2001). Their report indicated that large areas of the flood plain have been cleared and drained for development. The loss of vegetation that once maintained streambank stability has resulted in increased streambank erosion. The loss of wood recruitment to the channel, along with the loss of streambank vegetation, has reduced channel roughness and complexity. This, in turn, has resulted in higher stream velocities, which contribute to increased streambank erosion and down-cutting, and the loss and/or simplification of habitat, especially the aquatic refuge habitat that is critical during high flows.

The removal of streamside and floodplain vegetation has decreased the floodplain roughness, which normally slows the movement of flood waters so that sediment deposition occurs out on the floodplain. With less floodplain roughness, more sediment remains suspended in the flood waters to be deposited farther downstream.

Table A.4-4. Watershed Attributes Affecting Coho Life Stages in the North Fork Coquille Watershed.

Life Stage	Water Quality and Quantity	Habitat Connectivity	Aquatic and Riparian Habitat Characteristics and Processes	Other Impacts
Adult migration and holding	Periodic low flows are aggravated by irrigation withdrawals. Low summer flows and poor riparian condition increase late summer/early fall water temperatures. Undesirable levels of fecal coliform in the mainstem North Fork do not provide optimal conditions for adult migration.	A few culverts throughout the watershed present potential barriers to adult habitat.	Riparian areas are limited in the number of large conifers present on most tributary streams. Limited wood in the tributaries and river channel has reduced the frequency and depth of pools and limited adult hiding cover. Loss of wetland, floodplain, and off-channel habitats in the lower channel has affected the quality and quantity of adult holding areas. The presence of invasive plants along the lower reaches limits the growth of robust native vegetation needed for habitat and channel formation processes.	
Adult spawning/ egg incubation	Undesirable levels of fecal coliform in the mainstem North Fork do not provide optimal conditions for adult spawning.	A few culverts throughout the watershed may serve as barriers to spawning habitat.	Limited wood has reduced retention of spawning gravels. Mass failures, roadbed wash-outs, and other indicators of poor bank stabilization have resulted in high sediment inputs, which limit available spawning sites and incubation success.	
Fry and juvenile rearing and migration	Naturally low summer flows are aggravated by water withdrawals, which may increase water temperatures. High water temperatures exceed optimal conditions for juvenile rearing. High levels of fecal coliform in the mainstem do not provide optimal conditions for juvenile rearing or migration.	A few culverts throughout the watershed present barriers to juvenile access to rearing and migration habitat.	Limited wood in the tributaries and river channel has reduced the frequency and depth of pools, thus limiting juvenile rearing and refuge habitat. Riparian areas along the river and tributaries are limited in conifers. Loss of wetland, floodplain, and off-channel habitats has affected the quantity and quality of juvenile rearing and refuge areas.	Introduced fish species may prey on out-migrating smolts. Salmon carcasses are reduced from historical levels.

Much of the channel complexity, or roughness, provided by LWD has been removed, which has changed the flow from a turbulent or varied-velocity profile, to a laminar or consistent-velocity profile. As a result, the amount of backwater or low velocity, depositional areas provided by turbulent flow has been reduced. This has facilitated the down-cutting of the channel as well.

With respect to in-stream habitat conditions, the results for the North Fork Coquille River are identical to those determined by the BLM for the mainstem channel. The combined impacts of splash damming, agricultural practices, past timber harvest practices, and the associated land management activities have degraded stream habitat conditions. Some of the general effects of these impacts are:

- A reduction in the potential for LWD and gravel recruitment to the stream through harvest of large conifers next to, and upslope from, streams.
- A reduction of the amount of LWD currently in the streams through active removal projects associated with stream cleaning, salvage, and the facilitation of road construction.
- The presence of roads parallel to streams disconnects the stream from its riparian community, and can present barriers to woody debris and gravel recruitment to the stream from upslope areas.
- Road construction along streams has resulted in the establishment of alders next to the stream channels, thus reducing the future recruitment of large, durable conifers.
- Land management activities associated with roads, bridges, agriculture, and other infrastructure have significantly reduced the ability of stream channels to recruit and retain large wood. In some areas, these and other land management land activities caused stream channels to down-cut (*i.e.* incise). Deeply incised large channels do not retain significant amounts of key pieces of wood.

A.4.5 South Fork Coquille Watershed

The river is 63 miles in length, with an average gradient of 47 feet per mile (CWA 1997). Its headwaters are located south of Powers in the Siskiyou National Forest, and it drains 288 square miles. Only three stream systems were surveyed by ODFW during their Aquatic Habitat Inventory Project, and these were located on the lower South Fork, downstream from the National Forest boundary. The USFS Powers Ranger District conducted stream surveys similar to those performed by ODFW on many of the tributaries to the South Fork. Reach data collected via US Forest Service surveys differed slightly from the ODFW AHI data. The objective of this portion of the report was to find a way to combine the results from the different surveys, although a direct comparison was not possible for many stream indicator variables. A reach-by-reach analysis is presented in Appendix A.2. Table A.4-5 shows the habitat conditions that limit the production and success of coho.

Table A.4-5. Watershed Attributes Affecting Coho Life Stages in the South Fork Coquille Watershed.

Life Stage	Water Quality and Quantity	Habitat Connectivity	Aquatic and Riparian Habitat Characteristics and Processes	Other Impacts
Adult migration and holding	Periodic low flows are aggravated by irrigation withdrawals. Low summer flows and poor riparian condition increase late summer/early fall water temperatures. Undesirable levels of fecal coliform in the mainstem South Fork do not provide optimal conditions for adult migration.	Numerous culverts throughout the watershed present potential barriers to adult refuge habitat.	Riparian areas along most tributaries are deficient in large conifers. Limited wood in the tributaries and river channel has reduced the frequency and depth of pools and limited adult hiding cover. Loss of wetland, floodplain, and off-channel habitats in the lower channel has reduced adult holding areas. Invasive plants along the lower reaches limit the development of native vegetation needed for habitat and channel formation processes.	
Adult spawning/ egg incubation	Undesirable levels of fecal coliform in the mainstem South Fork do not provide optimal conditions for adult spawning.	Numerous culverts throughout the watershed serve as barriers to spawning habitat.	Limited wood in tributary streams has reduced retention of spawning gravels. Mass failures, roadbed wash-outs, and poor bank stability, cause high sediment inputs, which reduce available spawning sites and incubation success.	
Fry and juvenile rearing and migration	Naturally low summer flows are aggravated by water withdrawals, which may increase water temperatures. High water temperatures exceed optimal conditions for juvenile rearing. High levels of fecal coliform in the mainstem exceed optimal conditions for juvenile rearing or migration.	Numerous culverts throughout the watershed present barriers to juvenile access to rearing and refuge habitat.	Limited wood in the tributaries and river channel has reduced the frequency and depth of pools, thus limiting juvenile rearing and refuge habitat. Riparian areas along the river and tributaries are limited in conifers. Loss of wetland, floodplain, and off-channel habitats has affected the quantity and quality of juvenile rearing and refuge areas.	Salmon carcasses are reduced from historical levels.

The BLM conducted a watershed analysis of the Lower South Fork Coquille River (south of the Siskiyou National Forest boundary) in 1996 (USDI 1996). The agency determined that historic clearing of the riparian community has led to the channel incising and its subsequent disconnection from its floodplain. As a result, increased sediment loads are being carried downstream, and the water table in the South Fork Coquille River valley has lowered.

The USFS conducted a watershed analysis of the Upper South Fork Coquille River in 1995 (USDA 1995). They determined that LWD sources were limiting within the watershed, as a result of harvest, scouring of debris flows, salvage logging, and historic splash damming. Many riparian communities are currently dominated by hardwood species, which are of lower quality as a LWD source than are conifers.

A.4.6 Summary

Riparian condition was found to be limiting in all watersheds. The historical removal of riparian vegetation and the subsequent disconnection of the historic floodplain have, in many cases, severely impacted the system's ability to properly function. Fortunately, within each watershed, many sub watersheds continue to provide quality spawning habitat that is well connected to high quality summer and overwintering habitat. For a reach-by-reach analysis of habitat factors affecting the 132 assessed streams, refer to Appendix A.2.

A.5 Data Gaps of Environmental Conditions Affecting Coho

A.5.1 Pesticides and Persistent Bio-accumulative Toxic Pollutants

Pesticides are agents used to prevent, destroy, repel, or mitigate pests (Norris et al. 1991). Persistent bio-accumulative toxic pollutants (PBTP), also refer to as bio-accumulative toxins, are harmful, long-lived chemicals and metals that accumulate in animal tissue. Bio-accumulation is the uptake by an organism of a chemical or metal from its environment. Many chemicals and metals are both pesticides and PBTP. The effects of pesticides and PBTP on salmonids and their food web, including humans, are often indirect (i.e., occurring at a different time or place), difficult to predict, and not fully understood. Pesticides and PBTP have the potential to reduce both the reproduction and survival of salmonids.

Prior to the late 1960s, many chemicals were used without knowledge of their long-term effects or proper safeguards. For example, pulp juice, a water-soluble product produced at many lumber mills, was used as a popular dust abatement material on many forest roads within the subbasin. However, it found its way to forest streams during the fall and winter rains. It was eventually found to be harmful and was replaced by safer products.

Herbicides such as 2,4-d and 2,4,5-t were aerially applied to large tracts of private, State, and federal forest lands to reduce competition of hardwoods on sites to be managed for conifers. Early on, this was done without adequate measures to prevent its delivery to water courses. Today, better technology and greater effort are used to better limit its delivery to water courses.

The Environmental Protection Agency (EPA) was formed to regulate use of pesticides and toxins. EPA requires all pesticides be clearly marked as to their environmental hazard and proper use, with the objective to limit adverse effects to water quality and aquatic biota. Pesticides purchased for commercial use is registered, although their location, rate and manner of application is not closely monitored. Pesticides and PBTP sold for general use are not registered nor is their use monitored. Today, forest herbicides and insecticides are applied aerially with great precision and few, if any, known effects to aquatic systems. While this form of regulation is largely effective, many instances of polluted waterways have been documented outside the subbasin. Whether the level and type of PBTP is affecting coho presence or survival is unknown.

A.5.2 Carcass-derived Nutrients

Historically, the carcasses of spawned salmon and lamprey contributed significant amounts of nitrogen and phosphorus compounds to headwater stream reaches, the nutrients most limiting production in oligotrophic systems (Bilby et al. 1996). The ecological relationships between carcass density, juvenile growth, and the number of returning adults have not been well quantified. Research conducted by Bilby et al. (1996) and others has documented: 1) anadromous fish carcasses increase marine-derived nutrients within aquatic and terrestrial systems; 2) increasing marine-derived nutrients, particularly in streams with inherently low primary productivity, can increase growth of juvenile salmonids; 3) larger smolts have higher marine survival rates; and 4) detection of statistically significant differences in the number of returning adult spawners in treated verses untreated streams is complicated by natural intra-annual variability in the run size in studied streams.

Studies have not produced consistent findings. ODFW is currently conducting a study to determine the potential benefit of increasing marine-derived nutrients within the subbasin, but the preliminary results are inconclusive. Many studies have implied a benefit from carcasses to terrestrial wildlife and watershed nitrogen inputs, but quantifying results has been difficult. More experiments are required to establish the relationship between the response of juvenile salmon and their food webs to carcass abundance and distribution and to determine the processes by which these relationships operate (IMST 2001). This information would provide a scientific basis for establishing a target post-harvest population size that accommodates a desired level and distribution of carcasses.

A.5.3 Estuary Conditions

The estuary is that portion of the subbasin where salt and freshwater mix. It includes the Coquille River upstream to river mile-10 near Bear Creek, tributary streams, and connected salt marshes, coastal and intertidal areas, sloughs, bays, harbors, lagoons, and inshore waters. The estuary is relatively small compared to the size of the subbasin. Stream channel alterations and land reclamation has decreased available estuarine and off-channel habitat. Stream channel alterations and the associated removal of riparian vegetation have altered the hydrograph of the Coquille River at its mouth as well as the holding capacity of the alluvial floodplain. The reduction of the quality and quantity of estuary habitats undoubtedly reduced their capacity to rear coho juveniles.

The CCA (2005) found the overall condition of the estuaries within the ESU, relative to their use by juvenile coho, to not be a threat to recovery. This is not to say that estuaries, including the Coquille estuary, are unimportant to coho rearing. Historical estuarine habitat was much more abundant and diverse than it is today. Estuarine habitat conditions were greatly altered during development of the surrounding lowlands; however, they do not prevent rearing use by juvenile coho, nor are they thought to be a cause of significant increased mortality. Monitoring and research has documented out-migrating coho smolts generally reside in the estuary for two to three weeks as they acclimate to their new marine environment. In addition, the estuary provides some level of juvenile rearing yearlong.

The effects of tide gate structures on fish migration are poorly understood. The CWA is currently developing pilot activities to achieve a better understanding of tide gates and related issues. These projects seek to find which installations are problematic and which are not. Examples of pilot projects include retrofitting, block and tackle, and pet door installations in the Red Creek and Hatchet Creek areas.

Many estuarine streams have been channeled and straightened to maximize agricultural production. These changes have resulted in corresponding fish habitat losses in the mid-slope and tidal portions of the stream system. However, these drainage ditches could be managed to provide off-channel habitat.

Predation of juvenile coho within the estuary and Lower Coquille River has been confirmed, but the impact to the overall mortality budget has not been determined. Predators include cormorants, herons, mergansers, river otters, pinnepeds, striped bass, large-mouth bass, and other marine fish.

A.5.4 Hatchery Impacts

Hatchery-reared salmon and steelhead can impact wild anadromous salmonids through competitive interaction, genetic introgression, and disease transmission (Willamette Restoration Initiative 2004). In addition, hatchery fish often stray large distances and spawn far from their hatchery of origin. Recently, hatchery-produced coho stocked in the Columbia River system appeared on spawning grounds of many coastal streams, including the Coquille River tributaries.

The subbasin's coho population has been affected by hatchery supplementation since 1918. From 1908 to 1958, there were 6.5 million presmolts and fry, from Columbia River stock, reared in the Coos hatchery and released in the Coquille subbasin. The Butte Falls Hatchery was also used to rear smolts from adults returning to the Bandon Hatchery, the subbasin's sole hatchery located at Ferry Creek, near, Bandon, OR and managed by ODFW. Since 1990, the number of smolts released annually in the subbasin to supplement the recreational fishery varied considerably, but averaged 50,000.

Releases of hatchery coho smolts into the Coquille River system were reduced beginning with the 1994 brood year. In an effort to reduce the amount of straying, a large proportion of the hatchery smolts were held in acclimation facilities at Sevenmile Creek and Ferry Creek, both of which are located within the Coquille River estuary, prior to release (ODFW 2005, personal communication). Prior to 1998, the number of hatchery fish on the spawning grounds was estimated from the proportion of recovered carcasses found to have "hatchery" scale patterns. However, beginning with adults returning in 1998, almost all hatchery fish had been marked (*i.e.* fin-clipped) prior to their release to reduce error (Coho Assessment 2005). From 1998 to 2000, the proportion of hatchery-reared coho on the spawning ground was zero within the entire Mid-South Coast population strata. Based on a cursory review of spawner abundance data for the Coquille population, hatchery-reared fish comprised 0-6% of the total adult spawners. Based on monitoring conducted within the ESU, hatchery smolt survival rates ranged from 1% during years of extremely low ocean survival to 10% during years of medium ocean survival. Not all released hatchery stock is identifiable as to hatchery of origin. However, in 2001, 6% of the surveyed hatchery spawners in the Coquille subbasin were identified as strays of Columbia River stock.

In 2003, ODFW adopted the Fish Hatchery Management Policy which acknowledged that interactions between hatchery and naturally produced salmonids can occur at broad scales and that these interactions may have adverse effects on coho populations. The new policy defined how hatcheries would be used to ensure conservation of both naturally spawned and hatchery spawned native fish. To help facilitate this effort, they joined forces with Oregon State University and in 2005 constructed the Oregon Hatchery Research Center, a new research hatchery and education center on Fall Creek, a tributary to the Alsea River.

As of 2004, approximately 50,000 smolts are released annually in the lower one-third of tidewater to reduce potential interactions with wild fish. Returning adults are fewer than 6% of the total spawning population within the subbasin. Based on limited studies, the Bandon hatchery produces about 2% of the strays found in Oregon streams. Stocking of coho smolts into the Coquille system is proposed to be eliminated because of a poor return to in-subbasin creel.

Overall, historic hatchery management has likely had a small but negative effect on the viability of wild coho runs within the subbasin. Discontinuation of the hatchery supplementation program in the subbasin will eliminate competition between hatchery and naturally spawned smolts and provide for natural development of adapted traits.

A.5.5 Out-of-Subbasin Conditions

Coho salmon spend approximately half of their life, and attain the majority of growth, while at sea. Commercial harvest and food availability play an important role in growth, survivorship, and reproductive success. Therefore, many factors relating to coho success occur outside the subbasin. The majority of the factors described below are not readily rectified through human intervention. It is also important to note that there are undoubtedly many extrinsic factors affecting the success of salmonids that researchers, scientists and managers are not aware of at this time.

Nearshore

El Nino events, combined with other climatic and oceanic phenomena, have caused a shift in ocean conditions over the past two decades, impacting salmon returns (NMFS 2000 in Willamette Restoration Initiative 2004). Based on the cyclic nature of the oceanic and climatic regimes, conditions are likely going to become more favorable for fish in the next decade (NMFS 2000 in Willamette Restoration Initiative 2004).

Ocean Productivity

Because ocean conditions affect coho survival, they play a major role in determining coho population size. Seemingly small changes in ocean productivity cause relatively large changes in ocean survival. For example, variations of less than 15% ocean survival can cause a ten-fold change in population size. The following information was taken from the draft Willamette Subbasin Plan (Willamette Restoration Initiative 2004). Ocean conditions strongly affect overall salmon survival. Early ocean life is widely considered to be a time of particularly high mortality. In recent years, a growing body of evidence from field, tagging, and correlation studies shows that Pacific salmon experience large year-to-year fluctuations in survival rates of juvenile fish making the transition from freshwater to marine environment (Hare et al.1999 in Willamette Restoration Initiative 2004). Climate-related changes have the most effect on salmon survival very early in the salmon's marine life history (Pearcy 1992, Francis and Hare 1994 in Willamette Restoration Initiative 2004).

The Pacific Decadal Oscillation is a pan-Pacific, recurring pattern of ocean-atmospheric variability that alternates between climate regimes every 20-30 years (Hare et al. 1999 in Willamette Restoration Initiative 2004). The Pacific Decadal Oscillation affects water temperatures off the coast of Oregon and Washington and has cold (negative) and warm (positive) phases (Hare et al. 1999 in Willamette Restoration Initiative 2004). A positive Pacific Decadal Oscillation brings warmer water to the eastern North Pacific, reducing upwelling of nutrient-rich cooler water off the coast of North America and decreasing juvenile salmon survival (Hare et al. 1999 in Willamette Restoration Initiative 2004). The negative phase has the opposite effect, tending to increase salmon survival.

Climatic changes are manifested in both adult returns and harvests. Mantua et al. (1997) found evidence of an inverse relationship between harvests in Alaska and off the coast of Oregon and Washington. The negative phase of the Pacific Decadal Oscillation resulted in larger harvests of Columbia River stocks and lower harvests of Alaskan stocks. In the positive phase, warmer water resulted in lower harvests (and runs) in the Columbia River, but higher harvests in Alaska. Phase reversals occurred around 1925, 1947, 1977, and possibly 1999. The periods from 1925-1947 and from 1977-1999 were periods of low returns to the Columbia River, while periods from 1947-1977 and the current period are periods of high returns.

Marine Predation

The CCA (2005) determined marine predation by native pinnipeds and/or birds may impact some coho populations within the ESU. Because pinnepeds such as the Stellar sea lion, California sea lion and harbor seal are federally protected under the 1972 Marine Mammal Act, their numbers have steadily increased following their protected status. But ODFW assessments indicate this predation was not responsible for the very poor survival and returns of coho during the 1990s. ODFW further concluded that whatever levels of marine predation that occurred during the 1990s did not cause any of the populations in the ESU to fail the VSP population viability criteria. However, there is insufficient information to determine if marine predation is reducing population viability. ODFW has proposed research to attempt to quantify the type and level of predation from pinnepeds.

El Nino/Southern Oscillation

For the last 35 years, scientists have documented, with few exceptions, persistent changes in ocean currents and temperatures off the California, Oregon, and Washington coasts. These changes appear to create a more hostile environment for rearing salmon and may be a cause of declining ocean survival.

The El Nino-Southern Oscillation, commonly referred to as El Nino and La Nina, like the Pacific Decadal Oscillation, affects water temperatures off the coast of Oregon and Washington and has both a cold (i.e., negative) and warm (i.e., positive) phase. El Nino-Southern Oscillation events are much shorter than Pacific Decadal Oscillation events in that events typically occur every 2-7 years and last 12-18 months. Positive El Nino-Southern Oscillation events occur more frequently during positive Pacific Decadal Oscillation phases and less frequently during negative Pacific Decadal Oscillation phases (Hare et al. 1999). El Nino-Southern Oscillation events intensify or moderate the effects of Pacific Decadal Oscillation changes on salmon survival. A positive El Nino-Southern Oscillation event also results in higher North Pacific Ocean temperatures, while a negative event (La Nina) results in lower temperatures. Positive El Nino-Southern Oscillation events occur more frequently during positive Pacific Decadal Oscillation phases and less frequently during negative Pacific

Decadal Oscillation phases (Hare et al. 1999). Pacific Decadal Oscillation and El Nino-Southern Oscillation also affect freshwater habitat of salmon. Positive Pacific Decadal Oscillation and El Nino-Southern Oscillation events generally result in less precipitation in the subbasin. Lower stream flows result in higher water temperatures and a longer outmigration.

Climate Change

Climate change on a longer term than the Pacific Decadal Oscillation could have a large impact on the survival of Pacific coho. Finney et al. (2000) used lake sediment elemental composition to find evidence of very long term cycles of abundance of sockeye salmon in the Bristol Bay and Kodiak Island regions of Alaska over the past 300 years. No doubt, there have been similar variations in the abundance of salmon returning to the subbasin.

Computer models generally agree that the climate in the Pacific Northwest will become, over the next half century, gradually warmer and wetter, with an increase in precipitation in winter and warmer, drier summers (FS 2004). These trends mostly agree with observed changes over the past century. Wetter winters would likely mean more flooding of certain rivers and landslides on steep coastal bluffs (Mote et al. 1999) with higher levels of wood and grass fuels and increased wildland fire risk compared to previous disturbance regimes (Forest Service 2004). The region's warm, dry summers may see slight increases in rainfall, according to the models, but the gains in rainfall will be more than offset by losses due to increased evaporation. Loss of moderate-elevation snowpack in response to warmer winter temperatures would have enormous and mostly negative impacts on the region's water resources, forests, and salmon (Mote et al.1999). Among these impacts are a diminished ability to store water in reservoirs for summer use, and spawning and rearing difficulties for salmon.

Climate models lack the spatial resolution and detailed representation of critical physical processes that would be necessary to simulate important factors like coastal upwelling and variation in currents. Different models give different answers to how climate change will affect patterns and frequencies of climate variations such as El Nino-Southern Oscillation and Pacific Decadal Oscillation.

For the factors that climate models can simulate with some confidence, however, the prospects for many Pacific Northwest salmon stocks could worsen. The general picture of increased winter flooding and decreased summer and fall streamflows, along with elevated stream and estuary temperatures, would be especially problematic for in-stream and estuarine salmon habitat. For salmon runs that are already under stress from degraded freshwater and estuarine habitat, these changes may cause more severe problems than for more robust salmon runs that utilize healthy streams and estuaries.

While it is straightforward to describe the probable effects of these environmental patterns individually, their interaction is more problematic. The main question appears to be the duration of the present favorable (i.e., for salmon) Pacific Decadal Oscillation period and the timing and intensity of the subsequent unfavorable period. Prudence suggests planning for a shorter favorable period and a subsequent longer, if not more intense, unfavorable period.

A.6 List of Sites for Restoring Slow-water Refugia

The depletion of slow-water refugia was found to be the key limiting factor. This section identifies nearly 260 miles of sites, listed by watershed and stream reach, where restoration work should take place. The top priority watersheds are Lower Coquille and North Fork Coquille.

A.6.1 Lower Coquille Watershed

The stream reaches within the Lower Coquille Watershed which have HIP overwintering habitat are shown by subwatershed and reach in Table A.6-1. Any of these sites which are currently in a degraded condition are candidates for restoration.

Table A.6-1. HIP coho overwintering habitat within the Lower Coquille Watershed - listed by subwatershed, stream, reach and miles.

Subwatershed	Stream	Reach 1]	Miles 2]
Coquille River Estuary	Mainsten Coquille floodplain	Entire	7.0
	Ferry Cr	Mouth to tributary A	0.6
		tributary A to Geiger Cr	1.0
		Above Geiger Cr	0.7
	Ferry Cr Trib A	Entire	0.5
	Geiger Cr	Entire	2.1
	Spruce Hollow	Upper	0.3
	Spring Cr	Entire	1.8
	Mainstem Coquille tributary A	Entire	1.3
	Mainstem Coquille tributary B	Entire	0.5
	Fahys Cr	Entire	1.4
	Fahys Cr tributary A	Entire	1.0
	Mainstem Coquille tributary C	Entire	0.3
	Sevenmile Cr	Mouth to tributary A	2.5
		tributary A to tributary B	1.0
		tributary B to tributary C	0.6
		Above tributary C	1.1
	Sevenmile tributary A	Lower	0.5
	Sevenmile tributary B	Entire	0.6
	Sevenmile tributary C	Lower	0.6
	Sevenmile tributary D	Entire	0.2
	Offield Cr	Entire	1.1
		Subbasin Total	**26.7**
Lower Coquille River	Mainsten Coquille floodplain	Entire	11.1
	Lowe Cr	Entire	0.6
	Lampa Cr	Mouth to tributary A	1.5
		Above tributary A	1.8
	Lampa Cr tributary A	Entire	0.4
	Alder Cr	Entire	1.5
	Hatchet Slough	Entire	2.2
	Hatchet Slough tributary A	Entire	0.6
	Mainstem Coquille tributary D	Entire	2.0
	Mainstem Coquille tributary E	Entire	1.2
		Subbasin Total	**22.9**
	Mainstem Coquille floodplain	Entire	2.7
		Mouth to tributary A	0.7

Beaver Slough	Beaver Slough	tributary A to tributary B	0.7
		tributary B to Beaver Cr	1.9
		Above Beaver Cr	1.1
	Beaver Slough tributary A	Below tributary A	1.0
		Above tributary A	0.9
	Beaver Slough tributary A tributary A	Entire	0.4
	Beaver Slough tributary B	Entire	2.2
	Beaver Cr	Mouth to tributary A	0.3
		Trib A to tributary B	1.3
		Above tributary B	1.3
	Beaver Cr tributary A	Entire	0.6
	Beaver Cr tributary B	Entire	0.3
	China Cr	Mouth to Trib A	1.7
		Above Trib A	0.9
	China Cr tributary A	Entire	0.7
		Subbasin Total	**18.7**
Cunningham Cr	Mainstem Coquille floodplain	Entire	5.6
	Fat Elk Cr	Mouth to tributary A	1.2
		Above tributary A	1.8
	Fat Elk tributary A	Entire	0.2
	Pulaski Cr	Mouth to tributary A	1.0
		Above tributary A	3.2
	Pulaski Cr tributary A	Entire	0.2
	Cunningham Cr	Mouth to Calloway Cr	0.8
		Calloway Cr to Coffee Cr	2.8
		Above Coffee Cr	2.5
	Cunningham Cr tributary A	Entire	1.1
	Calloway Cr	Entire	2.0
	Budd Cr	Entire	0.7
	Coffee Cr	Lower	1.1
	Dye Cr	Entire	1.5
	Cold Cr	Lower	0.2
	Rink Cr	Entire	2.7
		Subbasin Total	**28.6**
Hall Cr	Mainstem Coquille	Entire	7.1
	Glen Aiken Cr	Mouth to Harlin Cr	0.6
		Above Harlin Cr	0.8
	Mainstem Coquille tributary A	Lower	0.7
	Fishtrap Cr	Mouth to Little Fishtrap Cr	1.3
		Above Little Fishtrap Cr	2.6
	Little Fishtrap Cr	Lower	0.5
	Rollan Cr	Lower	0.4
	Gray Cr	Lower	2.5
		Upper	1.1
	Hall Cr	Mouth to tributary A	0.2
		Trib A to Rich Cr	3.0
		Rich Cr to tributary B	1.5
		Above tributary B	3.5
	Hall Cr tributary A	Entire	1.7
	Hall Cr tributary A tributary A	Entire	0.5
	Rich Cr	Lower	0.7
	Hall Cr tributary B	Entire	0.7
	Hall Cr tributary C	Entire	0.5

	Grady Cr	Entire	1.9
		Subbasin Total	**31.8**
Bear Cr	Bear Cr	Mouth to Bill Cr	3.0
		Bill Cr to Randleman Cr	1.0
		Randleman Cr to Mack Cr	2.8
		Above Mack Cr	3.5
	Bill Cr	Lower	0.5
		Upper	2.0
	Randleman Cr	Entire	1.0
	Bear Cr tributary A	Lower	0.5
	Randleman Cr tributary A	Lower	0.1
	Mack Cr	Lower	0.6
	Monroe Cr	Lower	0.3
	Little Bear Cr	Lower	0.2
		Subbasin Total	**15.5**
		Watershed Total	**144.0**

1] Reaches are taken from Map 2. Coho HIP Overwintering Habitat (Appendix A).
2] Values represent the total distance of the HIP coho overwintering site as estimated from the Candidate Sites for Restoring High Intrinsic Potential Coho Overwintering Habitat map. Because HIP is seldom continuous in nature, the values often include some intermixed areas of lower quality habitat. Therefore, the values shown in the table typically overestimate the actual distance of HIP sites.

A.6.2 North Fork Coquille Watershed

The stream reaches within the North Fork Coquille Watershed which have HIP overwintering habitat are shown by subwatershed and reach in Table A.6-2. Any of these sites which are currently in a degraded condition are candidates for restoration.

Table A.6-2. HIP coho overwintering habitat within the North Fork Coquille Watershed - listed by subwatershed, stream, reach and miles.

Subwatershed	Stream	Reach 1]	Miles 2]
Upper NF Coquille River	NF Coquille above Little NF	Lower	1.6
	NF Coquille tributary C	Lower	0.2
	Fruin Cr.	Lower	0.2
	Little N F	Upper	0.2
	NF Coquille tributary Y to Little N F	Upper	0.2
	NF Coquille tributary A	Lower	0.1
	NF Coquille tributary B	Lower	0.2
	NF Coquille tributary Y	Lower	0.3
	NF Coquille Giles Cr. to tributary A	Lower	0.7
	NF Coquille tributary A to tributary B	Entire	0.2
	N F Coquille tributary B to tributary Y	Lower	0.5
	Giles Cr.	Upper	0.3
	Neely Cr.	Lower	0.2
	Moon Cr.	Lower	0.5
	Moon Cr. tributary A	Lower	0.1
	Moon Cr. tributary B	Lower	0.1
		Subbasin Total	**5.6**

Middle Cr. –Cherry Cr.	Alder Cr.	Mouth to tributary A	0.8
		tributary A to tributary B	0.6
		Above tributary B	0.1
	Alder Cr. tributary A	Lower	0.3
	Alder Cr. tributary B	Lower	0.1
	Middle Cr.	Mouth to Honcho Cr.	0.3
		Above Honcho Cr.	0.5
		Above Vaughns Cr.	0.5
	Coak Cr.	Lower	0.9
		Upper	0.2
	Middle Cr. tributary B	Entire	1.2
	Middle Cr. tributary A	Lower	0.3
		Upper	0.2
	Mast Cr.	Lower	0.2
		Upper	0.5
	Cherry Cr.	Mouth to tributary A	3.7
		tributary A to Little Cherry Cr.	1.0
		Above tributary A	0.3
	Cherry Cr. tributary A	Entire	0.1
	Little Cherry Cr.	Lower	0.1
	Lost Cr.	Entire	1.0
		Subbasin Total	**12.9**
Woodward Cr – Hudson Cr.			
	Blair Cr.	Upper	0.3
		Lower	0.4
	Steele Cr.	Entire	2.3
	Steele Cr. tributary A	Entire	1.3
	Steele Cr. tributary B	Entire	0.3
	N F Coquille tributary A	Entire	0.7
	N F Coquille tributary B	Entire	0.6
	Evans Cr	Below tributary A	4.9
		Above tributary A	0.8
	Evans Cr. tributary A	Entire	0.1
	Steinon Cr	Lower	0.7
	N F Coquille tributary C	Entire	0.7
	Hudson Cr.	Entire	2.5
		Subbasin Total	**15.6**
Lower N F Coquille	NF Coqilee tributary A	Entire	0.3
	Llewellyn Cr	Entire	1.7
	NF Coqilee tributary B	Entire	0.8
	Wimer Cr	Entire	0.7
	Wood Cr	Entire	1.3
	Schoolhouse Cr	Lower	0.3
	NF Coquille tributary C	Entire	1.1
		Subbasin Total	**6.2**
		Watershed Total	**40.3**

1] Reaches are taken from Map 2. Coho HIP Overwintering Habitat (Appendix A).
2] Values represent the total distance of the HIP coho overwintering site as estimated from the Candidate Sites for Restoring High Intrinsic Potential Coho Overwintering Habitat map. Because HIP is seldom continuous in nature, the values often include some intermixed areas of lower quality habitat. Therefore, the values shown in the table typically overestimate the actual distance of HIP sites.

A.6.3 East Fork Coquille Watershed

The stream reaches within the East Fork Coquille Watershed which have HIP overwintering habitat are shown by subwatershed and reach in Table A.6-3. Any of these sites which are currently in a degraded condition are candidates for restoration.

Table A.6-3. HIP coho overwintering habitat within the East Fork Coquille Watershed - listed by Subwatershed, stream, reach and miles.

Subwatershed	Stream	Reach 1]	Miles 2]
Yankee Run	Weekly Cr	Lower	0.9
		Upper	0.5
	Yankee Run	Below tributary A	1.3
		Above tributary B	0.7
	Yankee Run tributary A	Lower	0.8
	Steel Cr	Lower	0.3
		Subbasin Total	**4.5**
Elk Creek – EF Coquille	Elk Cr	Lower	1.0
		Upper	0.3
	SF Elk Cr	Middle	0.4
		Subbasin Total	**1.7**
Brewster Canyon	EF Coquille tributary A	Entire	0.5
		Subbasin Total	**0.5**
		Watershed Total	**6.7**

1] Reaches are taken from Map 2. Coho HIP Overwintering Habitat (Appendix A).
2] Values represent the total distance of the HIP coho overwintering site as estimated from the Candidate Sites for Restoring High Intrinsic Potential Coho Overwintering Habitat map. Because HIP is seldom continuous in nature, the values often include some intermixed areas of lower quality habitat. Therefore, the values shown in the table typically overestimate the actual distance of HIP sites.

A.6.4 Middle Fork Coquille Watershed

The stream reaches within the Middle Fork Coquille Watershed which have HIP overwintering habitat are shown by subwatershed and reach in Table A.6-4. Any of these sites which are currently in a degraded condition are candidates for restoration.

Table A.6-4. HIP coho overwintering habitat within the Middle Fork Coquille Watershed - listed by subwatershed, stream, reach and miles.

Subwatershed	Stream	Reach 1]	Miles 2]
Big Creek	Big Cr	Mouth to Fall Cr	0.5
		Fall Cr to Brownson Cr	2.4
	Brownson Cr	Mouth to tributary A	0.3
	Brownson Cr tributary A	Middle	0.3
		Subbasin Total	**3.5**
Indian Cr.	Indian Cr	Upper	0.6
	MF Coquille	Salomon Cr to Myrtle Cr	1.3
	Salmon Cr	Lower	0.6
		Subbasin Total	**2.5**
Sandy Creek	Sandy Cr	Mouth to tributary A	3.6
		Above tributary A	0.8
	Sandy Cr tributary A	Lower	0.5

	Subbasin Total		**4.9**
Slater Cr.	MF Coquille above Rock Cr	Lower	0.3
	Subbasin Total		**0.3**
Upper Rock Creek	Rock Cr	Lower	0.4
	Subbasin Total		**0.4**
Rock Cr	Rock Cr below Rasler Cr	Lower	0.4
		Lower and Middle	0.5
	Rock Cr tributary A	Entire	0.7
	Subbasin Total		**1.6**
Myrtle Cr	Myrtle Cr	Mouth to Rock Cr	2.8
		Above Rock Cr	0.2
	Subbasin Total		**3.0**
Watershed Total			**16.2**

1] Reaches are taken from Map 2. Coho HIP Overwintering Habitat (Appendix A).
2] Values represent the total distance of the HIP coho overwintering site as estimated from the Candidate Sites for Restoring High Intrinsic Potential Coho Overwintering Habitat map. Because HIP is seldom continuous in nature, the values often include some intermixed areas of lower quality habitat. Therefore, the values shown in the table typically overestimate the actual distance of HIP sites.

A.6.5 South Fork Coquille Watershed

This watershed is the lowest in priority for restoring overwintering habitat. This is because not much is known about the inherent potential of this watershed to provide high quality overwintering habitat. Anecdotal information suggests that a high proportion of summer parr may leave this watershed to overwinter elsewhere. However, this may be a relatively recent adaptation to degraded conditions resulting from past and present land management practices, particularly in the lower gradient reaches of the mainstem channel. The stream reaches within the South Fork Coquille Watershed which have HIP overwintering habitat are shown by subwatershed and reach in Table A.6-5. Any of these sites which are currently in a degraded condition are potential sites for restoration.

Table A.6-5. HIP coho overwintering habitat within the South Fork Coquille Watershed - listed by subwatershed, stream, reach and miles.

Subwatershed	**Stream**	**Reach** 1]	**Miles** 2]
Catching Creek	Matheny Cr	Lower	1.0
		Upper	0.2
	Catching Cr	Mouth to Horse Hollow	6.2
		Horse Hollow to Ward Cr	1.3
		Ward Cr to MF Catching Cr	2.4
		MF Catching Cr to Roberts Cr	1.5
		Above Roberts Cr	1.0
	Horse Hollow	Lower	0.3
	SF Coquille	NF Coquille to MF Coquille	4.7
	Ward Cr	Middle	1.7
	Wildcat Cr	Lower	1.0
	Cove Cr	Entire	1.5
	Bettys Cr	Entire	0.6
	Beaverdam Branch	Entire	1.2
	MF Catching Cr	Mouth to Koontz Cr	0.6
		Above Koontz	1.3

	Koontz Cr	Entire	0.8
	Knight Cr	Entire	0.3
	Roberts Cr	Entire	1.2
	SF Coquille tributary A	Entire	1.3
		Subbasin Total	**30.1**
Dement Creek	Warner Cr	Lower	0.6
	SF Coquille	Confluence with MF Coquille to tributary A	5.5
	Rhoda Cr	Lower	0.5
		Upper	0.4
	SF Coquille R tributary A	Entire	0.5
	SF Coquille	Trib A to Dement Cr	1.3
		Above Grants Cr	0.6
	Dement Cr	Mouth to Russell Cr	1.5
		Russell Cr to tributary A	0.7
		Above tributary A	0.3
	Dement Cr Trib A	Entire	0.3
	Mill Cr	Entire	0.7
		Subbasin Total	**12.9**
Rowland Creek	SF Coquille	Below Long Tom Cr	1.3
	Long Tom Cr	Middle	0.1
	Rowland Cr	Lower	0.4
		Middle	0.5
		Upper	1.0
	Baker Cr	Lower	0.2
		Upper	0.3
	Woodward Cr	Lower	0.3
		Upper	0.5
		Subbasin Total	**4.6**
Salmon Cr	Salmon CR	Mouth to Deer Cr	0.3
		Pyburn Cr to Dude Cr	1.4
		Above Deer Cr	0.6
	Riggs Cr	Entire	0.2
	Dude Cr	Lower	0.3
	Tim Cr	Entire	0.6
		Subbasin Total	**3.4**
Mill Creek	Mill Cr	Lower	0.5
		Upper	0.4
	Hays Cr	Lower	0.2
		Subbasin Total	**1.1**
		Watershed Total	**52.1**

1] Reaches are taken from Map 2. Coho HIP Overwintering Habitat (Appendix A).
2] Values represent the total distance of the HIP coho overwintering site as estimated from the Candidate Sites for Restoring High Intrinsic Potential Coho Overwintering Habitat map. Because HIP is seldom continuous in nature, the values often include some intermixed areas of lower quality habitat. Therefore, the values shown in the table typically overestimate the actual distance of HIP sites.

A.6.6 Summary

The HIP overwintering habitat is summarized by watershed, subwatershed, and stream miles in Table A.6-6. Fig. A.6-1 shows the spatial distribution of HIP overwintering habitat within the subbasin.

Table A.6-6. Summary of HIP coho overwintering habitat by watershed, subwatershed and miles.

Watershed	Subwatershed	Miles
NF Coquille	Moon Cr	5.6
	Middle Cr – Cherry Cr	12.9
	Woodward Cr – Hudson Cr	15.6
	Lower NF Coquille	6.2
	Watershed Total	**40.3**
EF Coquille	Yankee Run	4.5
	Elk Cr – EF Coquille	1.7
	Brewster Canyon	0.5
	Watershed Total	**6.7**
MF Coquille	Big Cr	3.5
	Indian Cr	2.5
	Sandy Cr	4.9
	Slater Cr	0.3
	Upper Rock Cr	0.4
	Rock Cr	1.6
	Myrtle Cr	3.0
	Watershed Total	**16.2**
SF Coquille	Catching Cr	30.1
	Dement Cr	12.9
	Rowland Cr	4.6
	Salmon Cr	3.4
	Mill Cr	1.4
	Watershed Total	**52.4**
Lower Coquille	Coquille River Estuary	26.7
	Lower Coquille River	22.9
	Beaver Slough	18.7
	Cunningham Cr	28.6
	Hall Cr	31.8
	Bear Cr	15.0
	Watershed Total	**144.2**
Subbasin Total		**259.5**

Figure A.6-1. Spatial distribution of coho HIP overwintering habitat in the Coquille Subbasin.

A.7 List of Sites for Restoring Water Temperature

Elevated water temperature was found to be reducing abundance of summer parr. This section identifies the approximately 33 miles where restoration to improve water temperature for summer parr would be most effective. Sites are listed by stream or stream reach and watershed. The criteria for site selection are a recorded summer 7-day maximum average temperature of ≤64°F and the inherent potential to increase the stream shade by >20%. These sites were identified using the best available data. As more data becomes available, more sites could be identified. The North Fork Coquille watershed is the top priority.

A.7.1 North Fork Coquille Watershed

The stream reaches within the North Fork Coquille Watershed which were selected as the best sites for restoring water temperature are shown in Table A.7-1.

Table A.7-1. Candidate sites for restoring water temperature in the North Fork Coquille Watershed- listed by stream and reach.

Stream	**Reach**	**Length** (feet)
Little NF Coquille River	NFC 081, 082 S	1,600
NF Coquille River	NFC 003 b, 014, 019, 043, 057, 067, 089	9,908
NF Coquille River Creek	NFCr 12 S	500
NF Coquille River Section 9-10 tributary	WHIT 06b middle	1,050
NF Coquille River Whitley Reach	WHIT 02 W	750
NF Coquille River Section 16 tributary	WHIT 06 a S	4,500
NF Coquille River Whitley Reach	WHIT 36, 47 S, 48 S, 49,	5,950
Whitley Creek	WHIT 39 W, 39 E	800
Evans Creek	EVAN 7	400
Woodward Creek	WOOD 08, 13, 15, 19, 26	6,946
Steinnon Creek	STEIN 02, 15	3,696
NF Coquille River Fairview Reach	FAIR 03, 04 S, 06 W, 14 W, 20, 28, 30 E, 33, 38 W, 40 S, 41-42 a, 43, 44 E	19,300
NFCR Fairview Reach Sec 35 tributary	FAIR 48	1,900
Middle Creek	MIDL 007a, 004 S, 049a, 066, 068 S, 069a, 081, 082, 106a, 108 E, 120, 121, 122, 123, 128, 129 S, 132, 146, 147	19,569
Vaughn Creek	VAUN 01 E, 06 E, 09	3,432
Alder Creek	ALDR 07	1,918
Cherry Creek	CHER 14b, 30, 35, 36a, 36b E, 37	18,086
Weimer Creek	WEIM 01, 10 S, 11, 12	4,768
Llewellyn Creek	LLE 11 S, 12, 14 E, 14 W, 15 E, 15 W, 16	5,100
Watershed Total		**110,173**

Source: ODEQ.

A.7.2 East Fork Coquille Watershed

Shade data from East Fork Coquille River Water Quality Restoration Plan (2000) and temperature data from ODEQ were evaluated. The only stream that qualified as a candidate site for restoring water temperature was the West Fork of Brummit Creek. Dead Horse Creek had excellent potential for restoring stream shade, but lacked temperature data. Other stream reaches may be suitable, but not enough data are available at this time to identify additional sites.

A.7.3 Middle Fork Coquille Watershed

The stream reaches within the Middle Fork Coquille Watershed which were selected as the best sites for restoring water temperature are shown by stream, reach, and length in Table A.7-2. Salmon Creek and Bielieu Creek have desirable water temperatures, but lack riparian shade data.

Table A.7-2. Candidate sites for restoring water temperature in the Middle Fork Coquille Watershed- listed by Stream and Reach.

Stream	Reach	Length
Upper Rock Creek	UPROCK 13, 24, 26	8674
Wildcat Creek	WILD 04, 06B	4408

Source: ODEQ.

A.7.4 South Fork Coquille Watershed

The stream reaches within the South Fork Coquille Watershed which were selected as the best sites for restoring water temperature are shown in Table A.7-3. In addition to the stream reaches listed below, Panther Creek (i.e., PAN 1 and 5), Wooden Rock Creek (i.e., WOO 4, 6, 18, 20, 21, 3.1, 7B and 7C), Clear Creek (i.e., CLE 6) and Foggy Creek (i.e., FOG 6) meet the riparian shade criteria, but lack temperature data needed for verification.

Table A.7-3. Candidate sites for restoring water temperature in the South Fork Coquille Watershed- listed by stream and reach.

Stream	Reach	**Length** (feet)
Yellow Creek	YE1-1, 2	4625
Hayes Creek	HA1-1, 3-1, 8	5195
Coal Creek	COA2, 3, 4, 5, 7, 3B.2, 3C.3, 5A, 5C.1	24,100
Johnson Creek 2]	JOH6, 9, 10; POV6; NIC2, C5	9250
Rock Creek 2]	ROC7, 12, 13; NFK1	6750

Sources: Shade data from Geomorphic and Riparian Assessment of the Lower South Fork of the Coquille River 2003. Temperature data from Draft South Fork Coquille WQMP (FS field data) and ODEQ.

A.7.5 Lower Coquille Watershed

Streams within the Lower Coquille Watershed with the best sites for restoring water temperature are shown in Table A.7-4. Note that for Bear and Hatchet Creeks, reach descriptions for temperature and shade data sets were not readily compatible. Therefore, further evaluation would be needed to validate specific reach locations.

Table A.7-4. Candidate sites for restoring water temperature in the Lower Coquille Watershed- listed by stream and reach. 1]

Stream	Reaches which meet temperature criteria	Reaches which meet temperature criteria
Lampa Creek	LA03, 04, 06, 07, 08	LA03, 04, 06, 07, 08
Bear Creek	Kudo	BR 07, 16, 20A, 20B, 34, 35, 36
Hatchet Creek	Upper Trib A, Trib B, Whale Cove	HT01, 02, 06B, 07, 10, 11

Sources: ODEQ and CWA.

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