WASHINGTON COAST SUSTAINABLE SALMON PLAN

WASHINGTON COAST

SUSTAINABLE SALMON PLAN

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This document is also available online at www.wcssp.org

There are points and references in this Plan – data, statistics, ESA requirements and recovery strategies – that some tribes in the Coast Region do not agree with. This Plan does not, nor is it intended to, interfere with or diminish tribal policy. WCSSP respects tribal sovereignty and strives to work cooperatively and respectfully with Coastal Tribes toward common objectives.

CONTENTS

List of Figures and Tables vi

Acknowledgements 1

Acronyms and Abbreviations 2

Executive Summary 5

Salmon Sustainability 6

Goals 6

Actions 7

Implementation 7

Planning for Uncertainty 7

Adaptation 8

Chapter 1 Introduction 9

Definition of a Sustainability Plan 10

Regional Setting, Lead Entities, and Indian Tribes 12

WRIA 20, Sol Duc - Hoh 16

WRIA 21, Queets - Quinault 17

WRIA 22/23, Lower Chehalis/Upper Chehalis 18

WRIA 24, Willapa 19

Chapter 2 Salmon Species and Status 22

Washington Coast Salmon 22

Chinook (*Oncorhynchus tshawytscha*) 24

Chum (*Oncorhynchus keta*) 26

Coho (*Oncorhynchus kisutch*) 28

Sockeye (*Oncorhynchus nerka*) 30

Steelhead (*Oncorhynchus mykiss*) 34

Coastal Cutthroat Trout (*Oncorhynchus clarki*) 37
Bull Trout (*Salvelinus confluentus*) 37
Salmon Populations Status 38
WDFW Salmonid Stock Inventory 1992, 2002 40
North American Salmon Stronghold Expert Ratings 2011 42
A Twenty-Year Perspective 43

Chapter 3 Critical Threats to Salmon Sustainability in the Washington Coast Region 48

Climate Change 49
Invasive Species 52
Hatchery and Harvest Interactions 53
Logging Practices That Impact Salmon 55
Oil Spills 59
Residential and Commercial Development That Impacts Salmon 59
Dredging and Filling 60
Removal and/or Lack of Large Woody Material 61
Shoreline Modification Including Dikes, Levees, Armoring, Bulkheads 62
Agricultural Practices That Impact Salmon 63
Roads, Culverts, Bridges, and Other Transportation Infrastructure 64
Water Pollution from Developed Land, Stormwater and Wastewater Pollution 65

Chapter 4 Desired Outcomes: Vision, Goals, and Objectives 73

Vision 73
Goals 73
Species Objectives 74
Habitat Objectives 74
  Headwaters/Uplands 75
  Wetlands, Small Lakes, and Ponds 76
  Tributaries 77
  Lakes 79
  Mainstems 80
  Estuaries 81
  Nearshore 82

Ocean....83
Time Frame....84

Chapter 5 Strategies and Actions 86

Overarching Partnership Strategy....86
Organize, Promote & Maintain Broad Partnerships that Support Wild Salmon Sustainability ..86
Strategies and Actions 87
A. Educate and Involve the Community to Protect, Restore and Maintain Ecosystem Values ...88
B. Protect and Restore Salmon Habitat Function 97
C. Support Hatchery and Harvest Practices Consistent with Wild Salmon Sustainability 106
D. Use Economic Tools to Protect, Restore and Maintain Ecosystem Values 110
E. Improve Regulatory Effectiveness to Achieve Salmon Sustainability.... 115

Chapter 6 Implementation, Monitoring and Adaptive Management 124

Implementation Strategy.... 124
Lead Entities 125
Public Involvement 125
Regional Technical Committee.... 125
Uncertainties 126
Data Gaps and Science 126
Legislation and Policy 126
Funding 127
Monitoring and Adaptive Management.... 127
Implementation Monitoring.... 128
Status and Trends Monitoring.... 128
Effectiveness Monitoring.... 129
Research 129
Data Management.... 130
Adaptive Management.... 130
Consistency and Coordination with Other Plans 131
Funding Strategy.... 132
Preliminary 2013 – 2015 Regional Habitat Project List.... 134

Appendix 1 Existing Salmon and Habitat Protection Plans in the Coast Region 145

Appendix 2 WDFW Salmon Stock Delineations 155

Appendix 3 North American Salmon Stronghold Partnership ("NASSP") Ratings 161

Appendix 4 Pacific Fishery Management Council ("PFMC") Stock Assessment and Fishery Evaluation 169

Appendix 5 WDFW Stock Assessments 204

Appendix 6 Inventory of Coastal Hatchery Programs 224

Appendix 7 Habitat Viability Charts and Assessments 252

Appendix 8 Selected Sources Used In Viability Charts 276

Appendix 9 Washington Coast Region Mainstem Rivers 293

Appendix 10 Washington Coast Sustainable Salmon Partnership 297

Creation of the Washington Coast Sustainable Salmon Partnership 297

Development of the Washington Coast Salmon Sustainability Plan 300

Appendix 11 Importance Of The Washington Coast In Salmon Recovery 303

Appendix 12 Needs Assessment 308

Executive Summary 309

Project Background 309

Individual Lead Entity Needs Assessment Workshops 311

WRIA 20: North Pacific Coast Lead Entity 312

WRIA 21: Quinault Indian Nation Lead Entity 313

WRIAs 22-23: Grays Harbor Lead Entity 314

WRIA 24: Pacific County Lead Entity 315

Regional Needs Assessment Workshop 315

Conclusion 318

Appendix 13 Planning Process and Analyses 319

Background 319
Scoping Workshop 319
Needs Assessment 322
Open Standards for Conservation - CAP 322
Planning Committee 324
Target Selection Workshop 325
Target Definitions 326
Nested Targets 327
Technical Workshop and Viability Metrics 329
Threat Identification and Ranking Workshop 333
Strategy Development Workshops 345
Strategy Refinement Workshops 350

Appendix 14 Planning Notes 360

"Parking Lots" 360
Strategies Not Chosen As Most Important 363

Appendix 15 Public Comments 367

Glossary 394

LIST OF FIGURES AND TABLES

FIGURES

	Page
Figure 1: Map of the Washington Coast Salmon Recovery Region	14
Figure 2: Map of Washington Coast Chinook Salmon ESU (Evolutionarily Significant Unit)	25
Figure 3: Map of Pacific Coast Chum Salmon ESU (Evolutionarily Significant Unit)	27
Figure 4: Map of Olympic Peninsula Coho Salmon ESU (Evolutionarily Significant Unit)	29
Figure 5: Map of Quinault Lake Sockeye Salmon ESU (Evolutionarily Significant Unit)	31
Figure 6: Map of Lake Pleasant Sockeye Salmon ESU (Evolutionarily Significant Unit)	32
Figure 7: Map of Lake Ozette Sockeye Salmon ESU (Evolutionarily Significant Unit)	33
Figure 8: Map of Olympic Peninsula Steelhead DPS (Distinct Population Segment)	35
Figure 9: Map of Southwest Washington Steelhead DPS (Distinct Population Segment)	36
Figure 10:Map of NASSP Washington Coast Strongholds: May 2011 Assessment	163

Figures 11. WDFW Stock Assessments and Trends (Winter Steelhead and Chum) 205

Dickey Winter Steelhead
Sol Duc Winter Steelhead
Calawah Winter Steelhead
Goodman Creek Winter Steelhead
Hoh Winter Steelhead
Queets Winter Steelhead
Clearwater Winter Steelhead
Upper Quinault Winter Steelhead
Lower Quinault Winter Steelhead
Moclips Winter Steelhead
Humptulips Winter Steelhead
Hoquiam Winter Steelhead
Chehalis Winter Steelhead
Wishkah Winter Steelhead
Wynoochee Winter Steelhead
Satsop Winter Steelhead
Skookumchuk/Newaukum Winter Steelhead
North River/Smith Creek Winter Steelhead
Willapa River Winter Steelhead
Palix Winter Steelhead
Nemah Winter Steelhead
Naselle Winter Steelhead
Bear River Winter Steelhead
Quinault Fall Chum
Humptulips Fall Chum
Chehalis Fall Chum
North River Fall Chum
Willapa Fall Chum
Palix Fall Chum
Nemah Fall Chum
Naselle Fall Chum
Bear River Fall Chum

Figure 12: Annual Hatchery Releases in WRIA 20	226
Figure 13: Annual Hatchery Releases in WRIA 21	231
Figure 14: Annual Hatchery Releases in WRIAs 22-23	235
Figure 15: Annual Hatchery Releases in WRIA 24	246
Figure 16: Graphic Depiction of the Open Standards/Conservation Action Plan Process	323
Figure 17: Example of Nested Targets	327
Figure 18: Example of Viability Chart	330
Figure 19: Threats Workshop Identification Chart	335
Figure 20: Situation Analysis	346
Figure 21: Conceptual Model: All Salmon Plan Strategies	349
Figure 22: A Conceptual Model of Strategies to Educate and Involve the Community to Protect, Restore and Maintain Ecosystem Values	351

Page

Figure 23: A Conceptual Model of Strategies to Protect and Restore Salmon Habitat Function 352

Figure 24: A Conceptual Model of Strategies to Support Hatchery and Harvest Practices Consistent with Wild Salmon Sustainability 353

Figure 25: A Conceptual Model of Strategies to Use Economic Tools to Protect, Restore and Maintain Ecosystem Values 354

Figure 26: A Conceptual Model of Strategies to Improve Regulatory Effectiveness to Achieve Salmon Sustainability 355

TABLES

Table 1. Coast Stock Status Overall Summary 1992 and 2002 (WDFW – SASSI and SaSI) 41
Table 2. Washington Coast Salmon Stronghold Ratings and Status (NASSP) 43
Table 3. A Comparative Summary of SASSI, SaSI and NASSP Ratings of Washington Coast Salmon and Steelhead Populations 44
Table 4. Impact of poor past and current forestry practices on salmonid habitat and the resulting biological effects on salmonids 58
Table 5. Objectives for Headwaters/Uplands 75
Table 6. Objectives for Wetlands, Small Lakes and Ponds 76
Table 7. Objectives for Tributaries 77
Table 8. Objectives for Sockeye Lakes 79
Table 9. Objectives for Mainstems 80
Table 10. Objectives for Estuaries 81
Table 11. Objectives for Nearshore 82
Table 12. Objectives for Ocean 83
Table 13. Coast Stock Status Summary 1992 And 2002 (WDFW –SASSI and SaSI) 155
Table 14. Salmon and Steelhead Stock List Presented By River Basin (WDFW) 156
Table 15. Washington Coast Salmon Stronghold Ratings and Status (NASSP/WSC) 162
Table 16. Washington Coast Salmon Stronghold Ratings and Status Listed by SaSI Stock and by River Basin 164

Tables/Graphs 17. PFMC Historical Record of Escapements to Inland Fisheries & Spawning Areas 170

B-23 Willapa Bay Fall Chinook terminal run size, catch, and spawning escapement
B-24 Willapa Bay Coho terminal run size, catch, and spawning escapement
B-25 Grays Harbor Chinook terminal catch, spawning escapement, and run size
B-26 Grays Harbor Coho terminal catch, spawning escapement and run size estimates
B-27 Treaty Indian gillnet catch of Chinook, Chum, and Sockeye Salmon in the Quinault River
B-28 Estimated inriver run size, catch, and escapement for Quinault River Coho
B-29 Estimated inriver run size, catch, and escapement of Queets River Spring/Summer Chinook
B-30 Estimated inriver run size, catch, and escapement of Queets River Fall Chinook
B-31 Estimated terminal run size, catch, and escapement for the Queets River Coho
B-32 Estimated inriver run size, catch, and escapement for Hoh River Spring/Summer Chinook
B-33 Estimated inriver run size, catch, and escapement for Hoh River Fall Chinook
B-34 Estimated inriver run size, catch, and escapement for Hoh River Coho
B-35 Estimated inriver run size, catch, and escapement for Quillayute River Spring/Summer Chinook
B-36 Estimated inriver run size, catch, and escapement for Quillayute River Fall Chinook
B-37 Estimated inriver run size, catch, and escapement for Quillayute River Coho

Page

Table 18. WRIA 20 Hatchery Releases 229
Table 19. WRIA 21 Hatchery Releases 233
Table 20. WRIAs 22-23 Hatchery Releases 240
Table 21. WRIA 24 Hatchery Releases 248

Table 22. Viability Chart: Headwaters/Uplands 253
Table 23. Viability Chart: Wetlands 255
Table 24. Viability Chart: Tributaries 258
Table 25. Viability Chart: Lakes 262
Table 26. Viability Chart: Mainstems 265
Table 27. Viability Chart: Estuaries 268
Table 28. Viability Chart: Nearshore 271
Table 29. Viability Chart: Ocean 272

Table 30. Revised Evaluation Methodology for Wetland Habitats, Table 5.2.1 of the *Centralia Flood Damage Reduction Project, Final Environmental Impact Statement, Appendix A.* (U.S. Army Corps of Engineers) 277

Table 31. Riparian Protection for Typed Waters in Western Washington 281

Table 32. Habitat Objectives, Table 3-3 of *Making Endangered Species Determinations of Effects for Individual or Grouped Actions at the Watershed Scale* (NMFS) 289

Table 33. Key Salmon Species and Salmon Life Stages Per Habitat 328
Table 34. Current Habitat Conditions in the Coast Region 331
Table 35. Preliminary Ranking of Threats, by Habitat 337
Table 36. Algorithm: Scope x Severity = Magnitude 343
Table 37. Algorithm: Magnitude x Irreversibility = Overall Threat Ranking 343
Table 38. Overall Ranking of Threats 344

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ACRONYMS AND ABBREVIATIONS

°C	degrees Centigrade
ACE	Army Corps of Engineers [or "Corps"] (federal)
AD	marking the ADIPOSE fin on hatchery salmon
ADT	average daily trips
AHA	All "H" Analysis
All-H	hatchery, harvest and habitat (including hydropower) (see GLOSSARY)
BC	background concentrations
BRT	Biological Review Team (NOAA/NMFS)
CAO	Critical Area Ordinance (see GLOSSARY)
CAP	Conservation Action Planning
CED	Chronic Environmental Deficiencies Program (WSDOT)
CFP	Certified Farm Plans
CFS	cubic feet per second
CIG	Climate Impact Group (University of Washington)
COR	Council of Regions (RCO)
Corps	Army Corps of Engineers [or "ACE"] (federal)
CREP	Conservation Reserve Enhancement Program (USDA)
CRP	Conservation Reserve Program (USDA)
CWMA	Cooperative Weed Management Area
CWT	coded-wire tags
DIP	Detailed Implementation Plan
DNR	Washington Department of Natural Resources
DO	dissolved oxygen (see GLOSSARY)
DPS	distinct population segment (see GLOSSARY)
Ecology	Washington Department of Ecology [or "ECY"]
ECY	Washington Department of Ecology [or "Ecology"]
EDT	Ecosystem Diagnosis and Treatment
EEZ	exclusive economic zone (see GLOSSARY)
ELJ	engineered logjam
ENSO	El Niño Southern Oscillation
EPA	Environmental Protection Agency (federal)
EQUIP	Environmental Quality Incentive Program (USDA)
ESA	Endangered Species Act (federal) (see GLOSSARY)
ESU	evolutionarily significant unit (see GLOSSARY)
FEMA	Federal Emergency Management Agency (federal)
FEMAT	Forest Ecosystem Management Assessment Team (federal)
FFA	Future Farmers of America
FFA	Forest and Fish Act (state)
FFFPP	Family Forest and Fish Passage Program (RCO)
FFR	Forest and Fish Report (state)
FMP	Fishery Management Plan
FPA	Forest Practices Act (state)
FPHCP	Forest Practices Habitat Conservation Plan (DNR)
FTE	full time equivalent

FWC	Fish and Wildlife Commission (state)
GHC	Grays Harbor County
GIS	Geographic Information Systems
GSRO	Governor's Salmon Recovery Office (RCO)
HCP	Habitat Conservation Plan
HGMP	Hatchery Genetic Management Plan
HPA	Hydraulic Project Approval (see GLOSSARY)
HSRG	Hatchery Scientific Review Group (federal)
HWS	Habitat Work Schedule
IAC	Interim Advisory Committee (WCSSP)
IBI	Index of Biotic Integrity
IFIM	Instream Flow Incremental Methodology (USGS)
ILA	Interlocal Agreement
ISC	Invasive Species Council (RCO)
ISF or IF	instream flow
K	kilogram, as in "k per sq. meter"
LE	Lead Entity (see GLOSSARY)
LEG	Lead Entity Group (see GLOSSARY)
LFA	Limiting Factors Analysis (see GLOSSARY)
LiDAR	Light Detection and Ranging
LOSC	Late Ozette Sockeye Steering Committee
LV	marking the LEFT VENTRAL fin on hatchery salmon
LWD	large woody debris (see GLOSSARY)
LWM	large woody material (see GLOSSARY)
MARXAN	a conservation planning software
mg/L	milligrams per liter
MRC	Marine Resource Committee
MSC	Marine Stewardship Council (an NGO)
MZ	management zone
NASSP	North American Salmon Stronghold Partnership
NEPA	National Environmental Policy Act
NGO	non-governmental organization
NMFS	National Marine Fisheries Service (NOAA) (see GLOSSARY) -- or "NOAA Fisheries Services"
NOAA	National Oceanic and Atmospheric Administration (federal)
NPCLE	North Pacific Coast Lead Entity
NPDES	National Pollution Discharge Elimination System
NPS	nonpoint source (pollution)
NRCS	Natural Resource Conservation Service (USDA)
NTU	nephelometric turbidity unit (see GLOSSARY)
NWIFC	Northwest Indian Fisheries Commission
OESF	Olympic Experimental State Forest
ONP	Olympic National Park
OT	the ear bone, OTOLITH, of a salmon
PDO	Pacific Decadal Oscillation (see GLOSSARY)
PFMC	Pacific Fishery Management Council
pH	chemical measure of acidity/basicity

PNRS	Pacific Northwest Research Station (USFS)
QIN	Quinault Indian Nation
RCO	Recreation and Conservation Office (state)
RCW	Revised Code of Washington
RFEG	Regional Fisheries Enhancement Group
RM #	river mile number
RMAP	Road Maintenance and Abandonment Plan (DNR) (see GLOSSARY)
RMZ	riparian management zone (see GLOSSARY) "riparian" and "r. functions"
ROC	Report on Consideration of Forming a Coastal Regional Governance Unit for Salmon Sustainability (WCSSP)
S/R	spawner-to-recruit ratio (see GLOSSARY)
SaSI	Salmonid Stock Inventory (2002) (WDFW)
SASSI	Salmon and Steelhead Stock Inventory (1992) (WDFW)
SEPA	State Environmental Policy Act
SHIRAZ	Salmon Habitat Integrated Resource Analysis: Zowie!
SSHIAP	Salmon and Steelhead Habitat Inventory and Assessment Project (NWIFC)
SMP	Shoreline Master Plans/Shoreline Master Program (Ecology) (see GLOSSARY)
Spp	species, plural
SRFB	Salmon Recovery Funding Board (state)
TBD	to be determined
TDR	Transfer of Development Rights
TFW	Timber, Fish, and Wildlife (DNR)
TNC	The Nature Conservancy (NGO)
U&A	Usual and Accustomed Area (see GLOSSARY)
USCG	U.S. Coast Guard
USDA	U.S. Department of Agriculture
USFS	U.S. Forest Service
USFWS	U.S. Fish and Wildlife Service
UW	University of Washington
VSP	Voluntary Stewardship Program
WAC	Washington Administrative Code
WCSSP	Washington Coast Sustainable Salmon Partnership
WDFW	Washington Department of Fish & Wildlife
WQS	Water Quality Standards (state)
WRIA	Water Resource Inventory Area (see GLOSSARY)
WRP	Wetlands Reserve Program (NRCS)
WSC	Wild Salmon Center (NGO)
WSDOT	Washington Department of Transportation
WWRP	Washington Wildlife and Recreation Program (RCO)
WWT	Washington Water Trust (NGO)

EXECUTIVE SUMMARY

The Washington Coast Sustainable Salmon Partnership developed this Plan to achieve its Vision:

> **All watersheds in the Washington Coast Region contain healthy, diverse and self-sustaining populations of salmon[1], maintained by healthy habitats and ecosystems, which also support the ecological, cultural, social, and economic needs of human communities.**

The Washington Coast Region represents the last best chance for the Pacific Northwest to get it right. We still have the fish, and we still have the watersheds. What we need is a road map to get us moving in the right direction. This Plan starts that journey. We need to do both: "Protect the Best" and "Restore the Rest," the two components of our motto and our outlook.

Does this mean that we have healthy salmon populations? No, it does not. But we have a fighting chance here of returning their habitats and their numbers to something closer to historical health.

Although salmon and steelhead populations in the Washington Coast Region ("Region") are seriously degraded from historical levels – experts suggest that the current abundance of coastal salmon runs is probably only about 10% of what it was a hundred years ago – they are healthier than anywhere else in the state.

They are healthier largely because their habitat is more intact than elsewhere. Protecting intact habitat needs to be given a high priority because it is far easier and less expensive to maintain good habitat than to recreate or restore degraded habitat. Science and common sense strongly suggest that investments made now in the Coast Region can significantly contribute to the successful restoration of wild salmon populations and will more likely ensure the long-term sustainability of wild salmon than recovery efforts elsewhere.

Despite the intact areas this region enjoys, significant areas remain with degraded habitat that need restoration to provide functioning habitat for salmon. Our Region includes four Lead Entity Groups (see map and descriptions in Chapter 1) which have developed particular strategies for habitat restoration, available at www.wcssp.org. Each of these strategies has prioritized project lists for protecting, preserving, and restoring habitat, as well as recommendations for solving data gaps. The lists are regularly updated as projects are completed or new ones are identified. This Plan seeks the commonalities in the four strategies for a unified approach to restoring strong salmon returns.

[1] Wherever the term "salmon" is used in this document it is meant to include fish of the genus *Oncorhynchus* (salmon, steelhead, and coastal cutthroat) and bull trout.

The Region only has two ESA-listed salmon species – Lake Ozette Sockeye and bull trout; the other salmon species in the Region are not listed. However, monitoring of these populations over the last thirty years by the Washington Department of Fish & Wildlife and the Native American tribes shows a clear overall downward trend. These data extend back to the mid 1970s. Historical accounts, from canneries and anecdotal reports, suggest that salmon populations were vastly larger than they are today. Fisheries managers up and down the coast agree that our salmon populations are at risk, and efforts should be made now to keep them from declining further.

Salmon Sustainability

This Plan was developed to protect the region's salmon habitats by bringing together coalitions and partnerships aimed at safeguarding and enhancing the natural function of the regional ecosystems on which salmon depend.

Salmon are a key component and indicator of healthy freshwater and estuarine ecosystems. Juveniles can be found at times throughout the entire ecosystem – from headwaters to ocean. They feed on invertebrates that are also indicators of water quality. They are sensitive to changes in water quality, temperature and turbidity, as well as to changes in river flows and nutrient cycles. More natural, diverse and productive ecosystems support healthier and diverse salmon populations; less healthy ecosystems have less capacity to grow juvenile salmon.

To ensure salmon populations are sustainable and will endure as integral parts of the ecosystem requires an ecosystem-wide perspective. The complexity of the interactions between salmon at different life stages with habitats and ecosystem processes that affect them requires an approach geared toward sustaining healthy and functioning ecosystem processes.

Goals

It is the primary goal of this Plan to prevent additional ESA listings of Washington Coast salmon and further diminished salmon populations through sustainability instead of ESA recovery planning. Further goals are:

- All of the region's salmon habitats and offshore waters are in a condition that will sustain healthy salmon populations.
- Regional land use decisions are benign in regards to salmon habitat, but if any damage results from such decisions, it is effectively mitigated.
- Regional hatchery practices will not impair wild fish populations and, where appropriate, will help to protect them.
- Harvest of salmon – commercial, recreational, subsistence and ceremonial – will help to support vibrant economies and communities without negatively impacting the sustainability of salmon populations.

Actions

The strategies in this Plan are organized into five separate categories: Education and Outreach, Habitat Protection and Restoration, Harvest and Hatcheries, Economic Tools, and Regulatory Effectiveness. Within each are a series of Strategies and Actions Steps crafted specifically to maintain naturally functioning ecosystem processes that will support abundant and increased salmon populations, while directly addressing or mitigating the identified critical threats to salmon sustainability.

Overall, the Plan contains twenty-four specific strategies addressed in 200 action steps, many of them well beyond the capacity of any one organization or agency. To address this challenge, the Plan is guided by an overarching strategy to organize, promote, and maintain broad partnerships through the four Lead Entity Groups ("LEGs") that make up WCSSP to support and pursue implementation of the strategies and actions. These partnerships include not only working with the co-managers of the fisheries (the State of Washington and the treaty tribes in the Region), but also federal and local agencies, key industries, private landowners, and non-governmental organizations ("NGOs"). The strategies and actions are detailed in Chapter 5.

Implementation

The key to the success of the Plan will be our ability to evaluate the effectiveness of its strategies and actions and our ability to implement them, both of which will require a wide range of steps, resources, and partnerships. Creation of a monitoring program is the first step, including implementation monitoring, status and trends monitoring, and effectiveness monitoring. Research and data management are key components of this process.

Implementation of the Plan requires a strategy of its own that is being developed as the next step in the planning process. This will include identifying, in a series of logical steps, how to reach specific end results. Defining steps as a series of objectives with appropriate indicators allows tracking progress along the way. The logic model also provides the means of understanding which needs must be met first and allows for appropriate sequencing of Plan actions.

An Implementation Strategy Team will lead this effort and track the progress of Plan implementation. The team will also identify benchmarks and measures to assess the implementation process, select and help develop implementation monitoring tools and procedures, work with the Regional Technical Committee to implement monitoring and analyses to evaluate progress and to ensure data consistency and compatibility, and prepare progress reports for communicating implementation achievements.

Planning for Uncertainty

Uncertainty is always present and might seriously impede Plan implementation. We currently see three major areas of uncertainty: data gaps, policy and legislation, and funding.

Data gaps include: data that for one reason or another have been collected but remain unused and unavailable; data not yet collected due to lack of resources; the unknown aspects of environmental conditions and ecosystem processes vital to salmon survival; and the effectiveness of specific actions to achieve intended results and their actual effects on habitat and salmon life history processes. A top priority in this Plan is to obtain funding for a dedicated staff position to undertake these data challenges.

The uncertainty of policy and legislation poses unique challenges, which can be partly addressed through strategies within the Plan. Effective policies and salmon-friendly[2] legislation depends on public support for protection of salmon habitats and ecosystems. Outreach is the key and will require targeted messaging to communities and decision-makers at all levels.

Perhaps the greatest unknown is funding. In addition to encouraging and creating ways to increase investment in protection of coastal salmon habitats, success requires coordination and cooperation among multiple state and federal agencies, private timberland owners, local communities and interest groups, and others who see the value of improving the condition of salmon and salmon habitats in the Coast Region.

The uncertainties accompanying Plan Implementation require monitoring on multiple levels to enable us to analyze whether the strategies and actions being implemented are achieving the intended results.

Adaptation

Adaptive Management will follow four steps:

1. analyzing raw data on a regular cycle of review to determine if the actions accomplished what was intended, what actually happened, what the likely causes were, and what opportunities are suggested to test thinking about improving actions;
2. using the experiences and information to confirm, modify or change future actions;
3. using the lessons learned to change and improve the strategies and actions in the Plan; and,
4. sharing the results of this analysis within and outside the Region to bring a broader understanding of the Plan as well as what changes to Plan strategies and action are needed and why.

With the input and assistance from dozens of stakeholders in the Region, we have created a Salmon Sustainability Plan that we think provides a good road map for achieving our goals and vision. It is exhaustive, but specific; based on best available science and common sense, but open to improvement. It is anchored in what the salmon need, but also what the people of the Region need.

[2] The term “salmon-friendly” means benign, at a minimum, or beneficial to salmon.

CHAPTER 1
INTRODUCTION

Developing this ***Washington Coast Sustainable Salmon Plan*** ("Plan") is a major first step on the path toward our vision:

> **All watersheds in the Washington Coast Region contain healthy, diverse and self-sustaining populations of salmon[3], maintained by healthy habitats and ecosystems, which also support the ecological, cultural, social, and economic needs of human communities.**

Salmon and steelhead populations in the Washington Coast Salmon Recovery Region ("Washington Coast Region", "Coast Region", or "Region") are healthier than anywhere else in the state. They are healthier largely because their habitat is more intact (Miller, 2003). There are very few hydropower dams or other kinds of large scale water diversions. The human population is low and slow-growing, less than 200,000 people in the 3.75 million acres of the Coast Region. This means that only a very small percentage of total land use is urban with its myriad risks to salmon habitat. Conversely, forested lands are abundant. Within the five Water Resource Inventory Areas ("WRIAs")[4] of the Coast Region, forest land ranges from a low of 69% to a high of 81% of the total WRIA area (Ecology, 2001). The 1999 passage of the Forest and Fish legislation (ESHB 2091, 1999) has largely ended the most detrimental timber harvest practices of the past. As a result a greater percentage of forest land means lower risk to salmon habitat. And, finally, large portions of the Region's watersheds are protected in National Park and other federal, state, and private conservation lands.

Protecting existing high-quality habitat such as that present throughout the Washington Coast Region should be given a high priority because it is far easier to maintain good habitat than to recreate habitat or to restore degraded habitat (Roni, et al., 2002). Scientific research and common sense strongly suggest that investments made now in the Washington Coast Region can significantly contribute to the successful restoration of wild salmon populations throughout the Pacific Northwest and will be more likely to ensure long-term sustainability of wild salmon than recovery efforts elsewhere.

In 2009-2011, a wide range of interested parties including federal, state, tribal and local government staff, NGO staff, and concerned citizens engaged in Plan development workshops (see Appendix 13)

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[3] Wherever the term "salmon" is used in this document it is meant to include fish of the genus *Oncorhynchus* (salmon, steelhead, and coastal cutthroat) and bull trout.

[4] http://www.ecy.wa.gov/apps/watersheds/wriapages/index.html

during which they identified and defined *for purposes of this Plan* eight (8) distinct habitats important to the salmon life cycle:

- **Headwaters/Uplands**
- **Wetlands, Small Lakes, and Ponds**
- **Tributaries**
- **Lakes**
- **Mainstems**
- **Estuaries**
- **Nearshore**
- **Ocean**

Despite degradation over the last century, the Region's watersheds still support dozens of *mostly* wild and *relatively* healthy salmon populations. We qualify "*mostly*" wild because many are influenced by hatchery production, and "*relatively*" healthy because by and large they are degraded from historical levels and some are in trouble. However, they do not yet warrant listing under the Endangered Species Act ("ESA"). A primary goal of this Plan is to see that they don't ever require ESA protection.

A major reason for protection and restoration of salmon, and one that should be acknowledged up front, is to ensure that the Washington Coast Region supports *harvestable* populations of salmon. The relationship between the people of this region and its salmon, like so many other places in the Northwest, is a large part of what defines us. Just as salmon are an integral part of the ecology and ecosystems here, they are integral to our cultures and economies as well. For this reason we cannot simply say all hatchery production is bad – well-managed hatchery production is necessary as long as habitats and wild salmon productivity are at diminished levels.

The Washington Coast Region represents the last best chance for the Pacific Northwest to get it right. We still have the fish, and we still have the watersheds. What we need is a road map to get us moving in the right direction. This Plan starts our journey.

Definition of a Sustainability Plan

A simple and elegant definition of sustainability is the capacity to endure. Usually the word appears as an adjective describing a type of activity: sustainable forestry, sustainable development, sustainable fisheries. Here we place the modifier on the fish themselves because we are seeking sustainable salmon, salmon runs that will endure as integral parts of the Washington Coast Region's ecosystems, economies, and cultures.

In the Coast Region, there are eight species of salmon comprised of at least 118 separate populations.[5] Each species uses a variety of habitats during different stages of their life. Some species are more closely associated with certain habitats, particularly during spawning and rearing, but they all move through and between habitats and are adapted to the varying conditions found throughout the Region's watersheds and offshore areas.

A plan to sustain eight species of salmon with complex and varied life histories, with all the associated habitat interactions and processes, requires an ecosystem-wide perspective. An ecosystem-based management approach simultaneously considers many natural and man-made processes, for example salmon migration, sediment transport, and salmon harvest (Bradbury, 1996).

Ecosystem management includes the following elements:

Sustainability. A precondition of ecosystem management is the assumption of intergenerational sustainability (Lubchenko et al., 1991; Christensen et al., 1996).

Goals. Rather than "deliverables" such as a certain number of fish, ecosystem-based management goals are articulated in terms of measurable "desired future trajectories" and "desired future behaviors" that are necessary for sustainability within an ecosystem (Christensen et al., 1996).

Sound Ecological Models and Understanding. Using best available science and the best current models and understanding of ecosystem function, ecosystem-based management emphasizes the role of processes and interconnections. Science at every level, from physiology and morphology to population dynamics and landscape processes, is relevant (Christensen et al., 1996).

Complexity and Connectedness. Of what we have learned from 100 years of natural resource management, few things are more significant than recognizing the importance of complexity and interconnections in the function of ecosystems (Peterson, 1993). Complexity and diversity are the key to resilience and adaptation to long-term change (Christensen et al., 1996).

Recognition of the Dynamic Character of Ecosystems. Change and evolution are inherent characteristics of ecosystems. Effective sustainable management of natural resources recognizes the context for all ecosystem processes and components and acknowledges that the spatial and temporal scales of ecological processes rarely align with the boundaries and time frames of natural resource management (Christensen et al., 1996).

Context and Scale. There is no single appropriate scale or time frame for ecosystem-based management (Christensen et al., 1996). Ecosystem processes take place at virtually every spatial and temporal scale, and how they function is always affected by the conditions of landscapes and behavior of systems around them (Levin, 1992).

[5] Delineations of salmon populations by the Washington Department of Fish and Wildlife are described in Chapter 2 and listed by river system in Appendix 2.

Humans as Ecosystem Components. A guiding principle of this planning process has been the perspective that humans are components of the ecosystem as are the salmon we seek to sustain. This is not only because salmon are culturally and economically critical to the Region's residents, but also because we cannot ignore the broader issues of population growth, climate change, and human perceptions about nature and natural resources.

Adaptability and Accountability. Ecosystem management is based on the upfront recognition that our knowledge is incomplete and will change. Goals and strategies must be seen as hypotheses to be tested by research and experience that is informed by carefully designed monitoring programs (Likens 1992). Goals and strategies must be open to adaptation over time based on new understandings and inevitable changes. Public understanding of the imperfections and experimental foundation of ecosystem-based management is also essential for the successful implementation of strategies and actions (Christensen et al., 1996).

Ambitious in its scope, this Plan will require cooperation and partnerships on a scale that will be challenging to maintain, but is increasingly necessary. The possibilities of success are nowhere more apparent and compelling than here, and interest is high. Fortunately, great work consistent with this Plan has been underway for more than a decade in watersheds throughout the Coast Region. It is the very people doing this work for the last ten years that have supported the idea and done much of the work to develop this Plan.

Regional Setting, Lead Entities, and Indian Tribes

Salmon Recovery Regions were established by the State of Washington in response to federal requirements that endangered species recovery plans be based on Evolutionarily Significant Units ("ESUs")[6]. The State responded to earlier ESA listings of Pacific salmon with an innovative, bottom-up approach to restoration known and widely-respected as "the Washington Way." Lead Entities – local, watershed-based organizations – were created by the Washington State legislature in 1998 (RCW 77.85.050 – 77.85.070[7]) to develop local salmon habitat recovery strategies and recruit organizations to conduct habitat restoration and protection projects to implement their strategies.

The recovery regions within Washington were delineated by the State based generally upon ESU geographies, and, as new salmon and steelhead populations were listed under ESA, locally-organized regional organizations were created to bring NOAA's National Marine Fisheries Service managers and scientists together with local stakeholders to develop and implement recovery plans.

[6] An ESU is a population, or group of populations, of salmon that is substantially, reproductively isolated from other populations and contributes substantially to the evolutionary legacy of the biological species. A more detailed explanation and description of Washington Coast Salmonid ESUs is located in Chapter 2.
[7] http://apps.leg.wa.gov/rcw/default.aspx?cite=77.85

However, most of Washington's Pacific coastal salmon populations have not warranted ESA listings, so the Washington Coast was the last regional organization to form, and unlike the other regions, the organization's genesis was not in response to ESA listings but rather in an effort to prevent them. The Washington Coast Sustainable Salmon Partnership ("WCSSP") was formed in 2008 as a cooperative undertaking of the Region's four Lead Entity Groups. These four Lead Entities are responsible for much of the salmon protection work undertaken in the Washington Coast Region over the last ten years.

The Washington Coast Region is defined as:

> **All of Washington's watersheds which drain directly into the Pacific Ocean between Cape Flattery in the north and Cape Disappointment in the south, together with their inland, estuarine and nearshore environments, lying within all or parts of Clallam, Jefferson, Grays Harbor, Pacific, Cowlitz, Mason, Lewis, Thurston and Wahkiakum Counties.**

The 3.75 million-acre Washington Coast Salmon Recovery Region is the combined geographic area of WCSSP's four Lead Entities, covering five Water Resource Inventory Areas ("WRIAs"). WRIA 20, called the Sol Duc–Hoh, is the area of the North Pacific Coast Lead Entity ("NPCLE"). WRIA 21, called the Queets – Quinault, is the area of the Quinault Indian Nation Lead Entity. WRIAs 22 and 23, called respectively the Lower and Upper Chehalis, are the area of the Grays Harbor County Lead Entity, also known as the Chehalis Basin Lead Entity. WRIA 24 is called the Willapa and, excluding a small area that drains south to the Columbia River, is the area of the Pacific County Lead Entity, also known as the Willapa Basin Lead Entity.

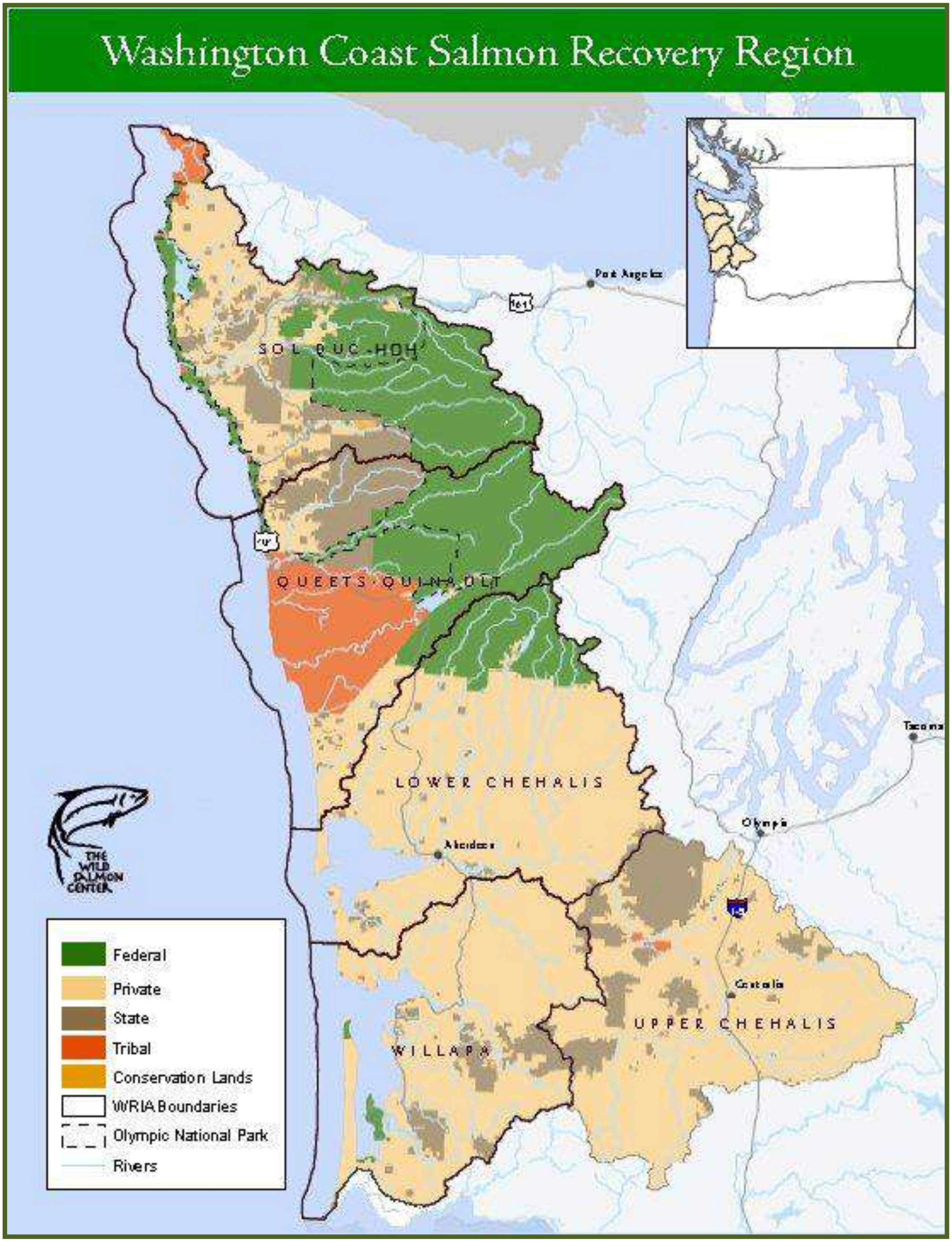

FIGURE 1: MAP OF THE WASHINGTON COAST SALMON RECOVERY REGION Map courtesy of the Wild Salmon Center

The northern portion of the region, WRIAs 20 and 21, form the west side of the Olympic Peninsula and contain diverse aquatic habitats as a result of varied topography and geology, glacial history, and seasonal heavy rainfall between 90 and 240+ inches a year. The Olympic Mountains contain a large contiguous area of undisturbed habitat within the Olympic National Park and are drained by some of the last remaining free-flowing, large glacially-influenced rivers in the lower 48 states.

Substantial portions of these two WRIAs are protected within Olympic National Park, and much of their combined coastlines and nearshore lie within the U.S. Fish and Wildlife Maritime Refuge and the NOAA Olympic Coast National Marine Sanctuary. In addition, certain stands of the U.S. Forest Service are protected from timber harvest under the federal Northwest Forest Plan of 1994 and some stands within state and private forests are not harvested pursuant to their respective Habitat Conservation Plans ("HCPs").[8]

The southern portion of the region, WRIAs 22, 23, and 24, are distinguished by the two large estuaries of Grays Harbor and Willapa Bay and their tributary rivers. Although less than in the north, rainfall in the southern half of the region is still between 60 and 140 inches a year. While the north part of WRIA 22 contains the watersheds of the southern Olympic Mountains, this portion of the Olympic range has no glaciers and is largely under the jurisdiction of the U.S. Forest Service.

Generally speaking, the southern Coast Region is dominated by shallower gradient rivers and streams than the north. It has a varied and fairly hilly topography, particularly the area known as the Willapa Hills in WRIAs 23 and 24, which rise to 3100 feet above sea level, and the eastern portion of WRIA 23, which extends into the foothills of the Cascade Range.

The south is also more heavily populated than the north, but it remains largely rural with most development concentrated along harbors, in river valleys, and along ocean beaches. The Upper Chehalis includes a portion of the I-5 highway corridor from south of the City of Olympia to south of the City of Chehalis; this area has been and will continue to be under greater pressure for more intense development.

The Role of Native American Tribes in the Region

Tribal governments and their jurisdictions are established in the Coast Region either by Executive Orders, or by treaties with the United States that preceded the establishment of the State of Washington. The latter are known as the "treaty tribes."

The treaty tribes with reservations in the Coast Region are the Quinault Indian Nation, the Hoh Tribe, the Quileute Tribe, and the Makah Tribe. In a 1974 Western Washington federal district court decision, Judge Boldt (and later the U.S. Supreme Court) affirmed that fishing rights of the treaty tribes did extend to their usual and accustomed ("U&A") areas well beyond their reservation boundaries, and that these

[8] Habitat Conservation Plans (HCPs) are agreements that landowners develop with federal regulators to manage endangered species on their property.

rights were *reserved* by the tribes in the treaties, not *granted* to them by the United States. Further, the tribal treaty share was 50% of the fishery, with each tribe fishing in its respective U&A. Finally, the treaty tribes and the State of Washington were held to be co-managers of the fishery. Ever since the Boldt decision in 1974, the fisheries have been jointly managed by the treaty tribes and the State of Washington (Boldt, *United States et al. v Washington,1979*).

Two Executive Order Tribes are federally recognized and have reservations in the Coast Region: the Chehalis Tribe and the Shoalwater Bay Tribe.[9] The Chinook Tribe, in the Lower Columbia and Willapa areas, continues to seek federal recognition.

There are points and references in this Plan – data, statistics, ESA requirements and recovery strategies – that some tribes in the Coast Region do not agree with. This Plan does not, nor is it intended to, interfere with or diminish tribal policy. WCSSP respects tribal sovereignty and strives to work cooperatively and respectfully with Coastal Tribes toward common objectives.

WRIA 20, SOL DUC - HOH

The Sol Duc–Hoh WRIA encompasses 935,250 acres and more than 80 miles of coastline starting in the north at Cape Flattery and extending south to include the Hoh River Basin. The major watersheds are the Ozette, Quillayute, and Hoh. Several smaller independent drainages are also located in WRIA 20 and include the Wa'atch and Sooes/Tsoo-yess Rivers, Goodman Creek, and Mosquito Creek.

At the north end of the WRIA are the independent drainages of the Wa'atch and Sooes/Tsoo-yess Rivers. South of these is the Lake Ozette Basin in the coastal plain between the Pacific and the Olympic Mountains, covering 77 square miles. Lake Ozette is the third largest natural lake in Washington State – approximately 8 miles from north to south and two miles wide, with a surface area of 11.8 square miles. To the south and to the east lies the Quillayute Basin, the largest drainage area in the WRIA, which is fed by the Dickey, Sol Duc, Calawah, and Bogachiel Rivers. The Quillayute system alone drains over 825 square miles. The Dickey watershed, like the Ozette, is in the coastal plain, while the Sol Duc, Calawah, and Bogachiel Rivers originate in the Olympic Mountains. The Hoh River Basin encompasses nearly 299 square miles. The river is heavily glacially influenced, with its headwaters encompassing nearly the entire Mt. Olympus massif. It has an extensive floodplain in its lower reaches.

Land ownership in WRIA 20 is dominated by federal, state, and private commercial forest holdings. Much of the upper watersheds and areas along the coast include late stage forests within the Olympic National Park. Three Native American tribes, the Makah, Quileute, and Hoh, hold reservation lands along the Pacific coast and, in accordance with their respective treaties, have additional reserved U&A

[9] Federally recognized tribes: This list is regularly updated. On September 22, 2010, the latest list came out and was published in the Federal Register, Vol. 75, No. 190, October 1, 2010. A supplemental publication added one tribe on October 27, 2010. This list can be viewed on the Bureau of Indian Affairs website: http://www.bia.gov/WhoWeAre/AS-IA/OFA/Index.htm, by downloading the Federal Register documents.

fishing rights that extend hundreds of square miles beyond their reservations. The lower elevations of the river systems are predominantly commercial forest lands, either privately or government-owned. The small City of Forks is the urban center of the area, surrounded by rural-residential, agricultural, and recreational land uses.

These watersheds have some of the most pristine upper reaches in the state, within the National Park. Collectively, they support some of the most extensive salmon life history diversity in the entire Region, and some of the strongest salmon populations. Salmon stocks in WRIA 20 have not been listed for federal protection, with the exception of Lake Ozette Sockeye and Hoh River Bull Trout (as part of the Coastal-Puget Sound DPS), which are listed as threatened under the Endangered Species Act.

The primary goal of the *North Pacific Coast Lead Entity Strategy* (see Appendix 1) is to maintain and improve ecosystem productivity and genetic diversity for all WRIA 20 salmon species by protecting the highly productive habitats and populations, and restoring impaired habitat and populations where the potential to recover exists.

WRIA 21, QUEETS - QUINAULT

The Queets-Quinault WRIA covers 755,674 acres from Kalaloch Creek in the north to Conner Creek in the south, and includes approximately 65 miles of coastline. The major watersheds are the Queets/Clearwater and the Quinault. Other drainages include the Raft, Moclips, and Copalis Rivers, as well as several smaller independent ocean tributaries including Kalaloch, Whale, Wreck, Joe, and Conner Creeks.

East of Kalaloch is the Clearwater system, which drains the heavily forested foothills and western edge of the Olympics, joining the Queets shortly before it empties to the Pacific. The Queets Basin originates high in the mountains from its headwaters on the south slopes of Mount Olympus. The Quinault system headwaters lie deep within the Olympic Range, with the entire North Fork and most of the East Fork within Olympic National Park. Both the Queets and Quinault are large, glacially-fed systems. Lake Quinault lies at the foot of the mountains and, together with the lower Quinault River, lies within the Quinault Indian Reservation. The Raft River Basin is located within the coastal plain almost entirely within the Quinault Indian Reservation, between the Queets to the north and Quinault to the south. The Moclips and Copalis watersheds are lower gradient systems to the south of the Quinault, and lie within the coastal plain between the Olympics and the Pacific coast.

Land ownership in WRIA 21 is predominantly comprised of tribal, state, and federal forest holdings with the Quinault Indian Reservation ("QIN") occupying much of the central part of the WRIA. The upper reaches within Olympic National Park are predominantly late stage forest below the tree line, as is the coastal area north of the Quinault Indian Reservation. The entire WRIA constitutes a portion of the QIN U&A fishing area. The lower elevations in the south are predominantly private forest lands with small towns, rural-residential areas, and vacation homes scattered along the coast.

Like WRIA 20, the Queets-Quinault supports a high diversity of salmon species and life histories. Other than Queets Bull Trout/Dolly Varden (as part of the Coastal-Puget Sound DPS), there are no threatened or endangered salmon species in WRIA 21. A considerable amount of habitat suitable for bull trout is found in the upper Queets and Quinault systems.

The primary goal of the *WRIA 21 Queets/Quinault Salmon Habitat Recovery Strategy* (see Appendix 1) is to restore and protect normative ecological processes and functions in watersheds associated with all of the aquatic habitats that directly or indirectly support salmon species. Additional goals are to enhance environmental conditions as needed to facilitate recovery and/or safeguarding salmon life histories and stock genetics, and to establish a collaborative framework for coordinating restoration, protection, and enhancement activities.

WRIA 22/23, LOWER CHEHALIS/UPPER CHEHALIS

The Lower and Upper Chehalis WRIAs encompass 1,770,272 acres in a single watershed – the second largest watershed in Washington State – all draining to Grays Harbor. The large estuary of Grays Harbor and lower gradient rivers distinguish the Chehalis from the northern WRIAs. The major tributaries within the system are: the Humptulips, Wynoochee, and Satsop Rivers, which flow from the southern Olympic Mountains; the Hoquiam and Wishkah Rivers, located within the hilly plain south of the Olympics between the Humptulips and Wynoochee Basins; and the Cloquallum River, upstream of the Satsop, with its drainage area between the Olympic Mountains and the Black Hills.

Flowing into Grays Harbor on its south side, the Elk and Johns Rivers include large estuarine areas and wetlands. No other large drainages flow from the south side of the Chehalis, but many smaller tributaries flow north to the mainstem from the hills that form much of the boundary between the Lower Chehalis and Willapa WRIAs.

Near the Town of Elma, the Chehalis River Valley turns south and passes from WRIA 22 into WRIA 23 (Upper Chehalis). Several smaller independent streams feed the Chehalis from the Black Hills to the northeast and from the Lincoln Creek sub-basin to the southwest. The Black River Basin, a large and low gradient system drains the east side of the Black Hills and the adjacent plain north almost to the City of Olympia. From the Cascade foothills flow the Skookumchuck and Newaukum Rivers, joining the Chehalis on the north and south of the cities of Centralia and Chehalis. South of the City of Chehalis, the mainstem valley turns back to the west and the South Fork Chehalis, Upper Chehalis, and Lincoln Creek flow from the east side of the Willapa Hills.

Land ownership in the Chehalis Basin is more diverse than the watersheds in the northern part of the Coast Region, but is still predominantly federal, state, and private forest lands in the uplands of the mainstem valleys. In addition, the reservation of the Chehalis Tribe, formed by Executive Order rather than treaty, lies along the Chehalis River mainstem in WRIA 23. The south Olympics are within the Olympic National Forest, with a small amount protected in Wilderness Area status. The mainstem Chehalis River from the head of Grays Harbor up the valley is a mix of agricultural land, small towns, and the urban centers of Centralia, and Chehalis. The main tributary valleys contain a mix of rural-residential, agricultural and private forest lands, with, in general, more intensive land uses closer to the broad Chehalis River Valley. The Grays Harbor estuary is the commercial center of the Washington Coast, supporting the cities of Hoquiam and Aberdeen and the Port of Grays Harbor near the mouth of the Chehalis River. The estuary mouth is flanked on the north by the barrier beach/tourist community of Ocean Shores and on the south by the commercial and charter fishing community of Westport.

The Chehalis Basin supports somewhat less salmon life history diversity than the Sol Duc-Hoh and the Queets-Quinault Basins in the north. There are no listed salmon species in the Chehalis system, although Coastal-Puget Sound Bull Trout, which are listed as threatened by the U.S. Fish and Wildlife Service, are known to use the rivers of the Chehalis Basin for foraging.

The Chehalis Basin Salmon Habitat Restoration and Preservation Work Plan for WRIAs 22 and 23 (see Appendix 1) sets out specific strategies for restoring habitat for each of the thirteen management units in WRIA 22-23, noting recovery issues and identifying general recovery actions. In addition it outlines basin-wide strategies for invasive species and habitat barrier projects. The Chehalis Plan addresses the work based on thirteen management units: the Black, Boistfort, Cloquallum, Hoquiam-Wishkah, Humptulips, Lincoln, Newaukum, Satsop, Skookumchuck, South Harbor, and Wynoochee, as well as the Chehalis River mainstem and the Grays Harbor Estuary.

WRIA 24, WILLAPA

The Willapa Basin covers 783,392 square miles surrounding Willapa Bay. Similar to the Chehalis Basin and distinguishing the southern half of the Region from the north, the Willapa Bay estuary is a dominant feature of the basin, with over 100 miles of shoreline fed by low gradient rivers flowing from the surrounding heavily forested hills. The major tributaries include North River and Smith Creek, Willapa River, Palix River, Nemah River, Naselle River, and Bear River at the south. Along the west side of Willapa Bay is the Long Beach Peninsula, which separates the Bay from the Pacific Ocean.

The Willapa Bay watershed is among the most productive coastal ecosystems remaining in the continental United States. The Bay's tideflats make up a quarter of the productive shellfish growing waters in western North America. Nearly two-thirds of the entire Basin, which is most of the uplands, is in private commercial forestland ownership. The Shoalwater Bay Tribe, an Executive Order tribe like the Chehalis Tribe, has reservation land on the north shore of Willapa Bay close to the ocean. The Chinook Tribe is currently seeking federal recognition. Agricultural land makes up a significant portion of the remainder of the area in the larger river valleys and coastal plains, where, for instance, there are over 1,400 acres of cranberry bogs.

The towns of Raymond and South Bend lie along the Willapa River where it enters Willapa Bay, and numerous small settlements are located along the larger rivers and around the Bay. The Long Beach Peninsula contains the towns of Long Beach, Seaview and Ocean Park.

The Willapa Basin has the least diversity of salmon species of the five WRIAs in the Coast Region, but historically supported salmon in great numbers. There are no listed species in the basin. More intensive land use and timber harvests over a longer period of time have led to significant habitat degradation that the Lead Entity has been working for more than a decade to restore. With more intensive hatchery influence than elsewhere in the Region, the basin has kept overall fish numbers up, but this has presented other challenges to restoration of native fish populations. The majority of the streams in the Willapa Basin support salmon populations, while only a small portion cannot.

The overall goal of the *Pacific County Strategic Salmon Recovery Plan* (see Appendix 1) is to re-establish the connection between fish and their habitat through the identification and correction of human actions that have harmful effects on salmon survival.

In summary, not only differences in geology, but also in land use and population numbers, distinguish the north and south areas of the Coast Region, with more extensive development (urbanization) in the watersheds of the south and largely timber harvest activity in the forested areas of the north. While the watersheds of the north are more intact and "natural," areas exist that are in some cases seriously degraded from early settlement activities and historic timber harvest. While the watersheds of the south are more altered by development and urbanization, they are still dominated by commercial forest lands and have continued to support many strong salmon and steelhead populations. Despite these north/south differences, the landscapes of the entire Region are overall far less altered than elsewhere in the state and most salmon habitat has not been as degraded as elsewhere in the Pacific Northwest.

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CHAPTER 2
SALMON SPECIES AND STATUS

Washington Coast Salmon

A salmon "species" is defined by NOAA's National Marine Fisheries Service ("NMFS") as an "evolutionarily significant unit," or "ESU," based on two criteria: 1) the population must show substantial reproductive isolation; and 2) there must be an important component of the evolutionary legacy of the species as a whole. This definition was developed in response to a 1991 petition to list certain Pacific Northwest salmon runs under the Endangered Species Act ("ESA"), which specifically allows listing of "distinct population segments" ("DPS") of vertebrates as a species. NMFS uses the DPS designation for steelhead species, rather than the ESU. Between 1994 and 1999, NMFS's biological review teams identified 52 salmon ESUs and DPSs and evaluated whether they were at risk of extinction and should be considered for listing as threatened or endangered under the ESA.[10]

Scientists use the term "salmonid" to cover all salmon, steelhead and anadromous trout species. Wherever the term "salmon" is used in this document it is meant to include fish presence of the genus *Oncorhynchus* (salmon, steelhead, and coastal cutthroat) and bull trout (*Salvelinus confluentus*).

There are eight native salmon in Washington State, all of which are found in the Washington Coast Region: **CHINOOK** (*Oncorhynchus tshawytscha*); **COHO** (*Oncorhynchus kisutch*); **CHUM** (*Oncorhynchus keta*); **STEELHEAD** (*Oncorhynchus mykiss*); **SOCKEYE** (*Oncorhynchus nerka*); **BULL TROUT** (*Salvelinus confluentus*); **COASTAL CUTTHROAT TROUT** (*Oncorhynchus clarki clarki*); and, **PINK** (*Oncorhynchus gorbuscha*). Pink salmon are in our offshore and nearshore waters. They stray into coastal rivers, but at the time this Plan was drafted they only spawn in the watersheds of Puget Sound, primarily in odd-numbered years.

A population is defined by the Washington Department of Fish and Wildlife ("WDFW") as a scientifically designated, biologically distinct group of individuals (e.g., Quinault River Fall Chinook, Bear River Coho) adapted to life in the special conditions of its specific rivers and/or estuaries.

The Washington Coast Salmon Recovery Region ("Washington Coast Region", "Coast Region", or "Region") is defined by its geographic area and includes corresponding delineations of nine

[10] http://www.nwr.noaa.gov/ESA-Salmon-Listings/Salmon-Populations/Index.cfm

evolutionarily significant units or distinct population segments of salmon: **Washington Coast Chinook ESU; Pacific Coast Chum ESU; Olympic Peninsula Coho ESU; Southwest Washington Coho ESU; Lake Ozette Sockeye ESU; Lake Pleasant Sockeye ESU; Lake Quinault Sockeye ESU; Olympic Peninsula Steelhead DPS; and Southwest Washington Steelhead DPS.** Each of these salmon species is adapted for the suite of natural conditions found in the Washington rivers, streams and/or lakes where they spawn.

WDFW recognizes 118 individual anadromous salmon and steelhead population units, or stocks, native to Coast Region watersheds, twelve (12) identified populations of coastal cutthroat and three (3) of bull trout. Populations are defined based on several factors depending on the species, but generally by geographic distribution of the population, the location of spawning grounds, or the timing of spawning. In a very few cases, genetic analyses have provided data to support these delineations. The absence of genetic data for most of the Coast Region salmon populations remains a significant data gap.

Areas of disagreement remain among fisheries managers in the Coast Region about salmon populations' definitions and status. In some cases, tribal knowledge suggests that WDFW delineations are incorrect and that some populations or stocks should be combined and others split. Also, three additional population units[11] were recognized by experts in the North American Salmon Stronghold Partnership ("NASSP") expert rating process (see p. 42 and Appendix 3), but these have not been formally recognized by WDFW or the tribes.

Clearly there are issues for future study and analysis. Tribal perspectives are often supported by cultural and traditional ecological knowledge, and are developed and nurtured over centuries and many generations living and fishing in coastal watersheds. This is in addition to tribes' modern technical contributions as co-managers. Regional respect for this knowledge is great and efforts to incorporate this knowledge and understanding into region-wide perspectives and actions are a continuing part of the planning and adaptive management process.

In crafting a regional, ecosystem-based sustainability Plan, it is important to recognize that stark delineations of salmon populations, like rigid boundaries between habitats, can be less important than understanding and respecting the processes upon which healthy salmon populations and habitat quality depend. Still, a scientific approach requires data, and data often require determination of boundaries within which to measure. To this end, we are relying on the Washington Department of Fish and Wildlife, the co-manager tribes, and the extensive, although not yet complete, databases that identify where the Region's salmon are and how to characterize their status. The treaty tribes co-manage the salmon fishery with the State of Washington, and these governments collaborate to produce the databases available for use by the public.

[11] Personal communication with D. Ensmenger, Washington Programs Director, Wild Salmon Center, 2011.

Chinook (*Oncorhynchus tshawytscha*)

Chinook salmon are the largest of the Pacific salmon, with some individuals growing to more than 100 pounds. These huge fish are now rare; most mature chinook weigh less than 50 pounds. In Washington, chinook often spawn in large rivers, such as the Columbia or Snake, although they will also use smaller streams with sufficient water flow. They tend to spawn where the water flow is high. Because of their size they are able to spawn in larger gravel than most other salmon.

Chinook spawn on both sides of the Olympic and Cascade Ranges in Washington, some traveling hundreds of miles upstream to reach their spawning grounds. Because of the great distances they need to travel, these fish enter streams early and comprise the spring and summer runs. Fall runs spawn closer to the ocean and tend to use small coastal streams. All chinook reach their spawning grounds by fall, in time to spawn.

In the Washington Coast Region, chinook are found in all of the major rivers and some of the tributaries. All chinook in the Region are part of the **Washington Coast Chinook ESU,** which includes all naturally spawned populations of chinook in coastal basins north of the mouth of the Columbia River and extending along the western end of the Strait of Juan de Fuca to, but not including, the Elwha River. (Note: The populations of the Washington Coast Chinook ESU originating in watersheds that drain north into the Strait are in WRIA 19 and outside the geographic scope of WCSSP and this Plan.)

Based on run timing, regional biologists generally consider that there are two distinct life histories of the Washington Coast Chinook ESU: Fall Chinook and Spring/Summer Chinook. Fall Chinook begin spawning between early and late October, varying between river systems, and end spawning in late November or December. Spring/Summer Chinook begin entering rivers as early as April, begin spawning in late August, and conclude in mid-October. The distinction between Spring and Summer Chinook, where noted, is generally a matter of the river entry timing. Depending on the life history of chinook and the location, chinook fry rear in freshwater for one to six months with very few Spring/Summer Chinook staying up to a full year in freshwater before migrating. Chinook fry use mainstems of rivers as well as their tributaries for rearing.

WDFW identifies twenty (20) individual populations of Fall Chinook in coastal watersheds in all five coastal WRIAs, from the Sooes River in the north to the Naselle River in the south. Coast Region Spring/Summer Chinook, of which there are nine (9) identified populations, are primarily in larger systems draining the Olympic Mountains with one population in the Chehalis.

The map on the next page can be found at "Washington Coast" online at:
http://www.nwr.noaa.gov/ESA-Salmon-Listings/Salmon-Populations/Maps/Chinook-ESU-Maps.cfm

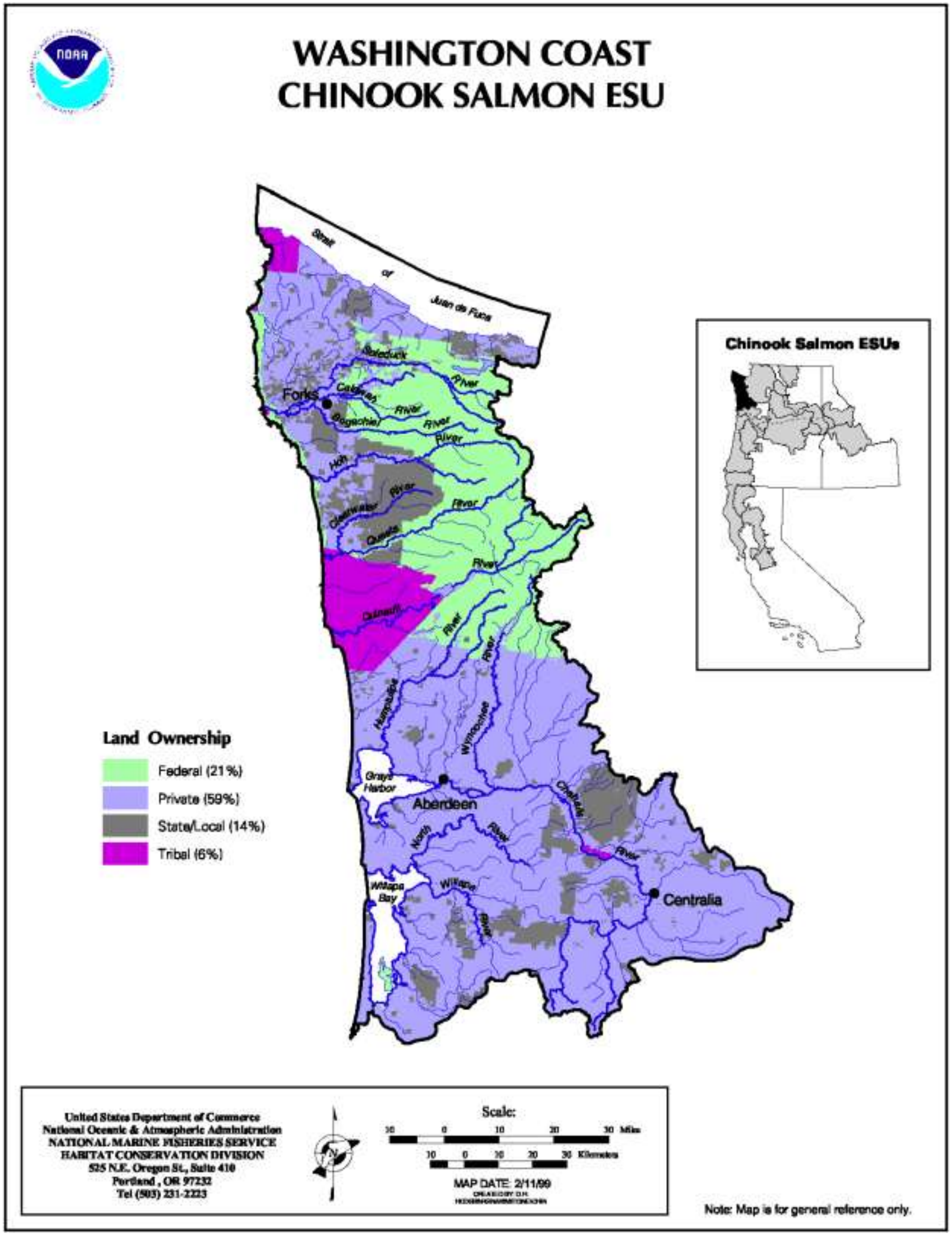


FIGURE 2: MAP OF THE WASHINGTON COAST CHINOOK SALMON ESU Map courtesy of the National Marine Fisheries Services, NOAA

Chum (*Oncorhynchus keta*)

Chum salmon are probably the least appreciated salmon species in Washington State. Of all salmon in the Coast Region, chum are the least likely to be consumed by people. They are not known for being strong swimmers and have very limited jumping abilities. If a stream is passable for chum, it is passable for all salmon. Male chum salmon develop large "teeth" during spawning that resemble canine teeth. This is one reason for their nickname of "dog salmon"; the other reason comes from Alaska where they are so abundant they are given to the dogs to eat. The current distribution of chum spans most of western Washington, including Puget Sound, the Coast Region, and several lower Columbia River streams. The chum in these three regions represent three genetically distinct population groupings.

In the Coast Region, chum are the species that has seen the greatest decline. Chum are present in the northern WRIAs 20 and 21, but are not considered a dominant species there. Chum need healthy estuaries, as they spend more time in estuaries than other salmon species. The southern WRIAs 22 and 24 contain Grays Harbor and Willapa Bay, two of the largest estuaries in Washington, where chum used to be the most dominant species. There are several possible reasons for decline of chum populations, including loss of habitat, overfishing, and poor water quality. In the Coast Region, chum populations have not shown strong resilience.

For their spawning grounds, chum use small coastal streams with low gradients and low velocities, as well as the lower reaches of larger rivers. Chum used to be found in almost all of the small, low gradient streams in the Region. They often use the same streams as coho, but coho move much farther up into the watershed and use high gradient streams, while chum generally spawn closer to saltwater in slower moving water. This may be due to their larger size, which requires deeper water to swim in, or to their poor swimming and jumping abilities. Either way, the result is watersheds generally divided between use by these two species. Chum fry do not rear in freshwater for more than a few days. Shortly after emerging, chum fry move downstream into the estuaries where they feed and rear for several months before heading out to the open ocean.

Chum populations in the Washington Coast Region are part of the larger **Pacific Coast Chum ESU**, which includes all naturally spawned populations of chum from the Pacific coasts of Northern California, Oregon and Washington to west of the Elwha on the Strait of Juan de Fuca. Fifteen (15) separate populations of Pacific Coast Chum are recognized by WDFW in the Washington Coast Region, with the largest concentration of stocks in the Willapa Basin.

The map on the next page can be found at "Pacific Coast" online at: http://www.nwr.noaa.gov/ESA-Salmon-Listings/Salmon-Populations/Maps/Chum-ESU-Maps.cfm

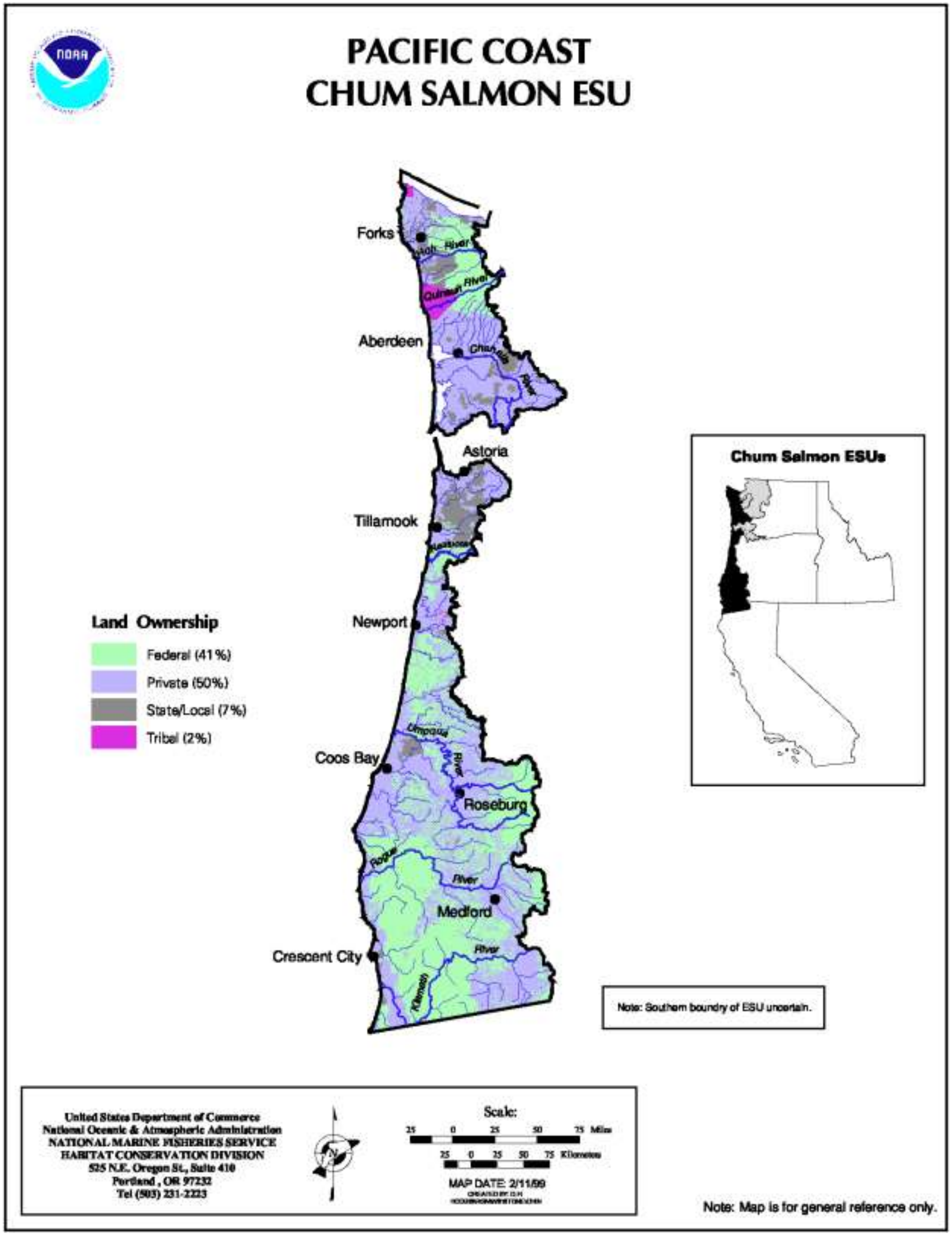


FIGURE 3: MAP OF THE PACIFIC COAST CHUM SALMON ESU Map courtesy of the National Marine Fisheries Services, NOAA

Coho (*Oncorhynchus kisutch*)

In the Coast Region, coho can be found in virtually every small coastal stream and the tributaries of the larger rivers. They prefer areas of mid-to-high velocity water, mid-to-high gradient streams with small-to-medium sized gravels. Returning coho frequently gather at the mouths of rivers and streams and wait for the water to rise, often after a rainstorm, before heading upstream to spawn. The higher flows and deeper water enable the fish to pass obstacles such as culverts, tidegates, logs, and beaver dams that would typically be impassable to chum and chinook. The watersheds of the Washington Coast Region are particularly favorable to coho. These populations have shown exceptional resilience. Coho numbers are on the rise all along the Coast Region. It is assumed that this is due mainly to projects that have replaced dozens of fish barrier culverts over the last decade, that has in turn opened up a tremendous amount of previously blocked coho habitat.

Coho have a very regular life history. It takes them about 18 months to go from egg to smolt. Coho lay their eggs in the gravels during the fall, the fry emerge from the gravel the next spring, and then rear in the stream for at least a year before making their way to the ocean.

Coho populations in the Coast Region are part of two ESUs, **Olympic Peninsula Coho**, which includes all naturally spawned populations in coastal watersheds from Point Grenville north, and **Southwest Washington Coho**, which includes all naturally spawned populations between the Columbia River and Point Grenville. The Olympic Peninsula Coho ESU extends beyond the Coast Region to include WRIA 19 along the Strait of Juan de Fuca. The Southwest Washington Coho ESU was originally part of a larger Lower Columbia River/Southwest Washington ESU. Lower Columbia Coho were identified as a separate ESU by NMFS and listed as threatened on June 28, 2005 (NMFS, 2005). The Southwest Washington ESU's status under the Endangered Species Act is currently identified as "undetermined," because the ESU has not been evaluated since its separation from the Lower Columbia Coho ESU.

WDFW has identified eighteen (18) separate populations of Olympic Peninsula Coho (in WRIAs 20 and 21), and fifteen (15) separate populations of Southwest Washington Coho (in WRIAs 21, 22 and 24). The Quillayute River Basin – comprised of the Dickey, Sol Duc, Calawah and Bogachiel Rivers – is unique in the Coast Region with the designation of separate Summer and Fall coho populations in the Sol Duc River.

The map on the next page can be found at "Olympic Peninsula" online at:
http://www.nwr.noaa.gov/ESA-Salmon-Listings/Salmon-Populations/Maps/Coho-ESU-Maps.cfm

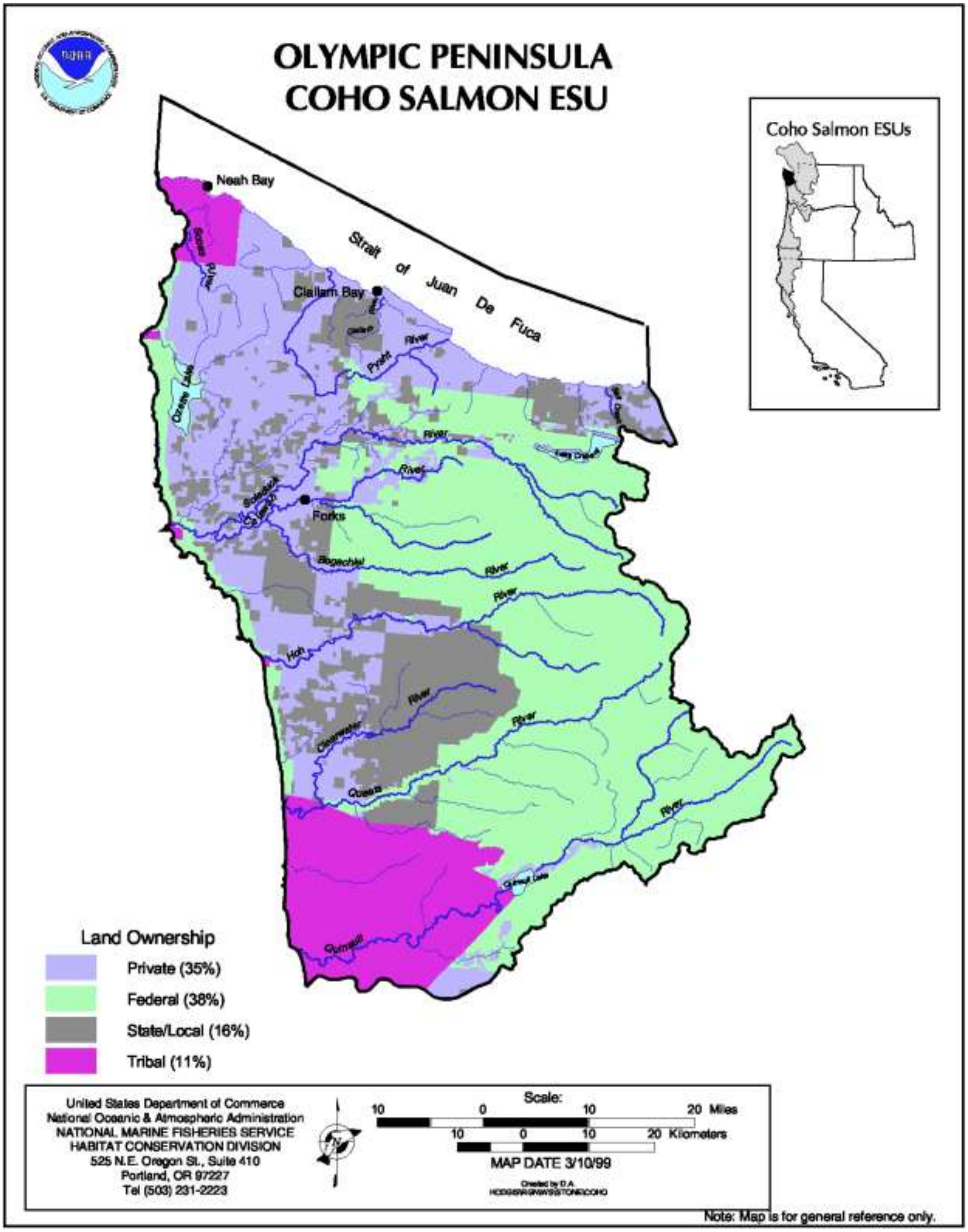


FIGURE 4: MAP OF THE OLYMPIC PENINSULA COHO SALMON ESU Map courtesy of the National Marine Fisheries Services, NOAA

Sockeye (*Oncorhynchus nerka*)

Sockeye salmon are unique in that, as fry, they require a lake to rear in. In Washington State, sockeye can be found in Lake Ozette, Lake Pleasant, and Lake Quinault – all located in the Coast Region – as well as Baker Lake, Lake Washington, and Lake Wenatchee elsewhere in the state.

Sockeye in the Coast Region are comprised of three distinct ESUs. **Lake Quinault Sockeye ESU** includes sockeye that spawn in the upper Quinault River watershed, primarily in mainstem side channels, and rear in Lake Quinault. The **Lake Pleasant Sockeye ESU** includes sockeye that ascend the Quillayute and Sol Duc Rivers and Lower Lake Creek to spawn in Lake Pleasant. The **Lake Ozette Sockeye ESU** includes beach spawners in Lake Ozette, as well as sockeye that spawn along the streams and tributaries flowing into Lake Ozette. The Lake Ozette Sockeye ESU is one of only two salmon populations in the Coast Region that are listed as threatened under the Endangered Species Act.

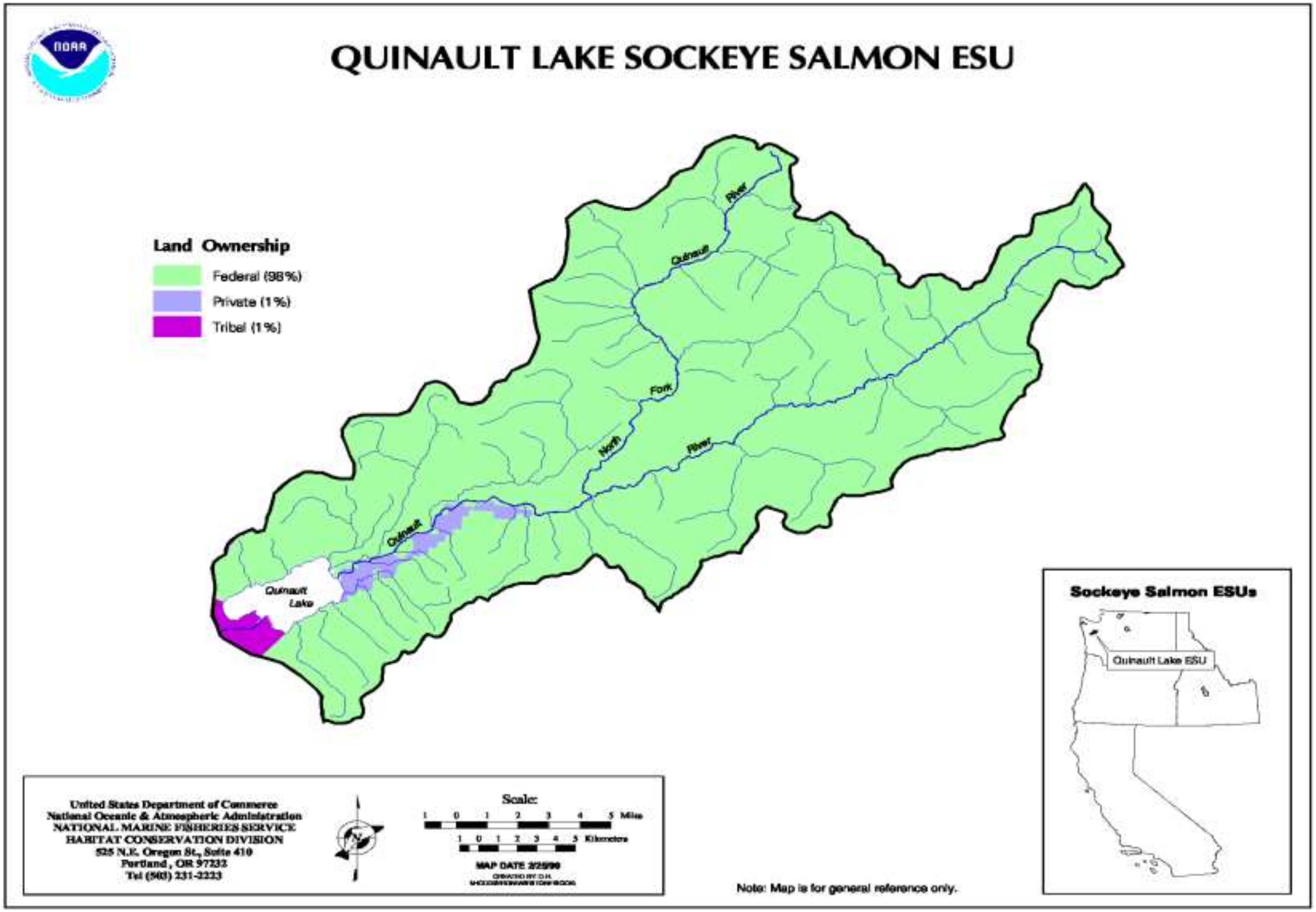
The tributary-spawning sockeye fry migrate downstream to the deep waters of nursery lakes upon emergence from spawning sites, and then rear for one or two years in the lake habitat before migrating to the ocean. Lake habitats are especially critical to sockeye. Good water quality and production of food organisms are important because survival in lakes can depend upon how fast sockeye grow to a size that reduces their vulnerability to predators.

Originally listed on March 25, 1999, Lake Ozette Sockeye had their threatened status reaffirmed in 2005 and again in 2011. The National Marine Fisheries Service ("NMFS") completed and formally adopted the *Lake Ozette Sockeye Recovery Plan* on May 29, 2009 (NMFS, 2009; see also Appendix 1). Recovery Implementation planning is currently underway cooperatively between NOAA and the Lake Ozette Steering Committee ("LOSC"), an informal group of stakeholders including residents, landowners, tribes, agencies and Clallam County. WCSSP actively supports and participates in meetings of the LOSC, and affirms the committee's conviction that restoration and recovery decisions are best made locally whenever possible.

The maps on the next three pages can be found at, respectively, "Quinault Lake," "Lake Pleasant," and "Ozette Lake" online at:
http://www.nwr.noaa.gov/ESA-Salmon-Listings/Salmon-Populations/Maps/Sockeye-ESU-Maps.cfm

FIGURE 5: MAP OF THE QUINAULT LAKE SOCKEYE SALMON ESU

Map courtesy of the National Marine Fisheries Services, NOAA



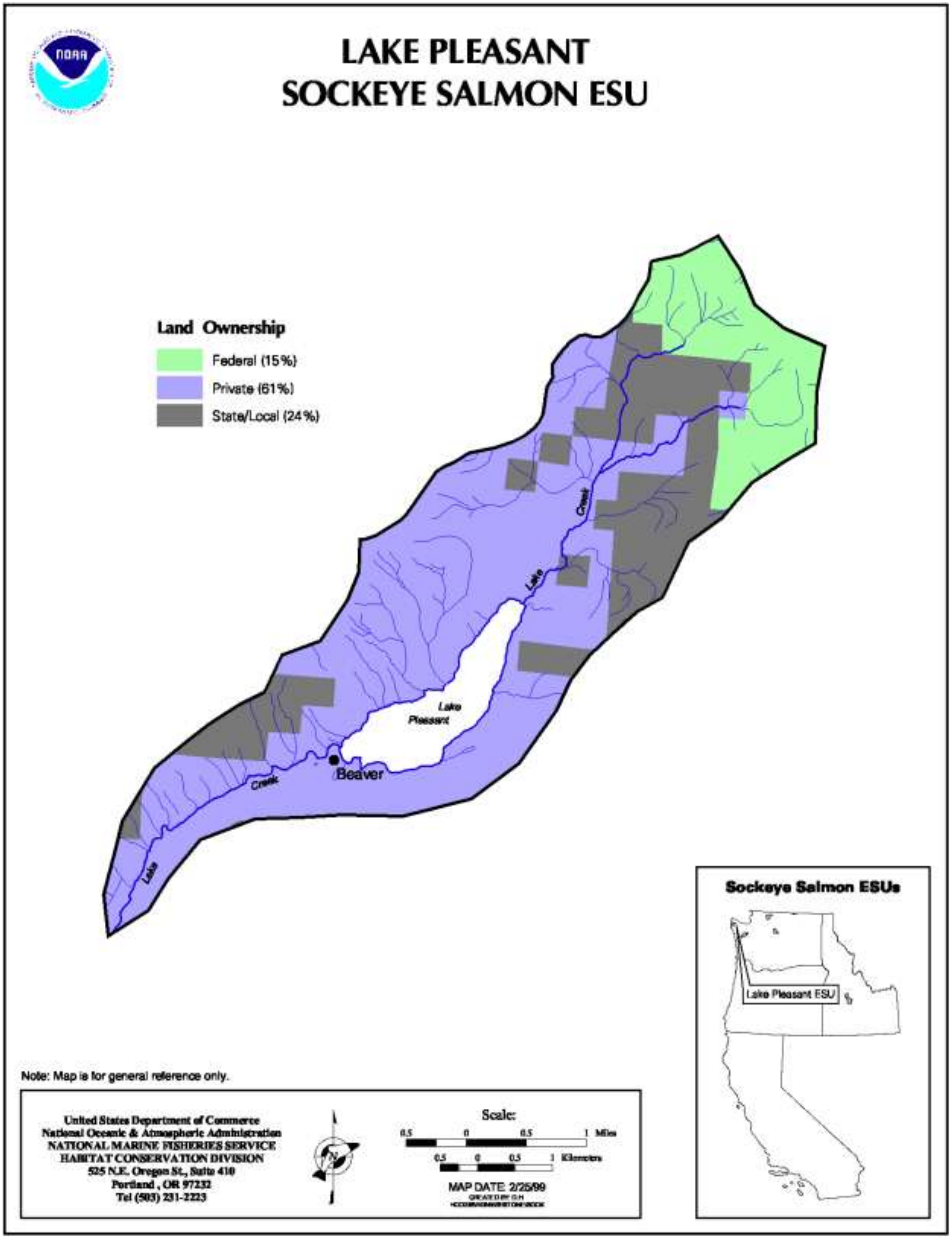


FIGURE 6: MAP OF THE LAKE PLEASANT SOCKEYE SALMON ESU Map courtesy of the National Marine Fisheries Services, NOAA

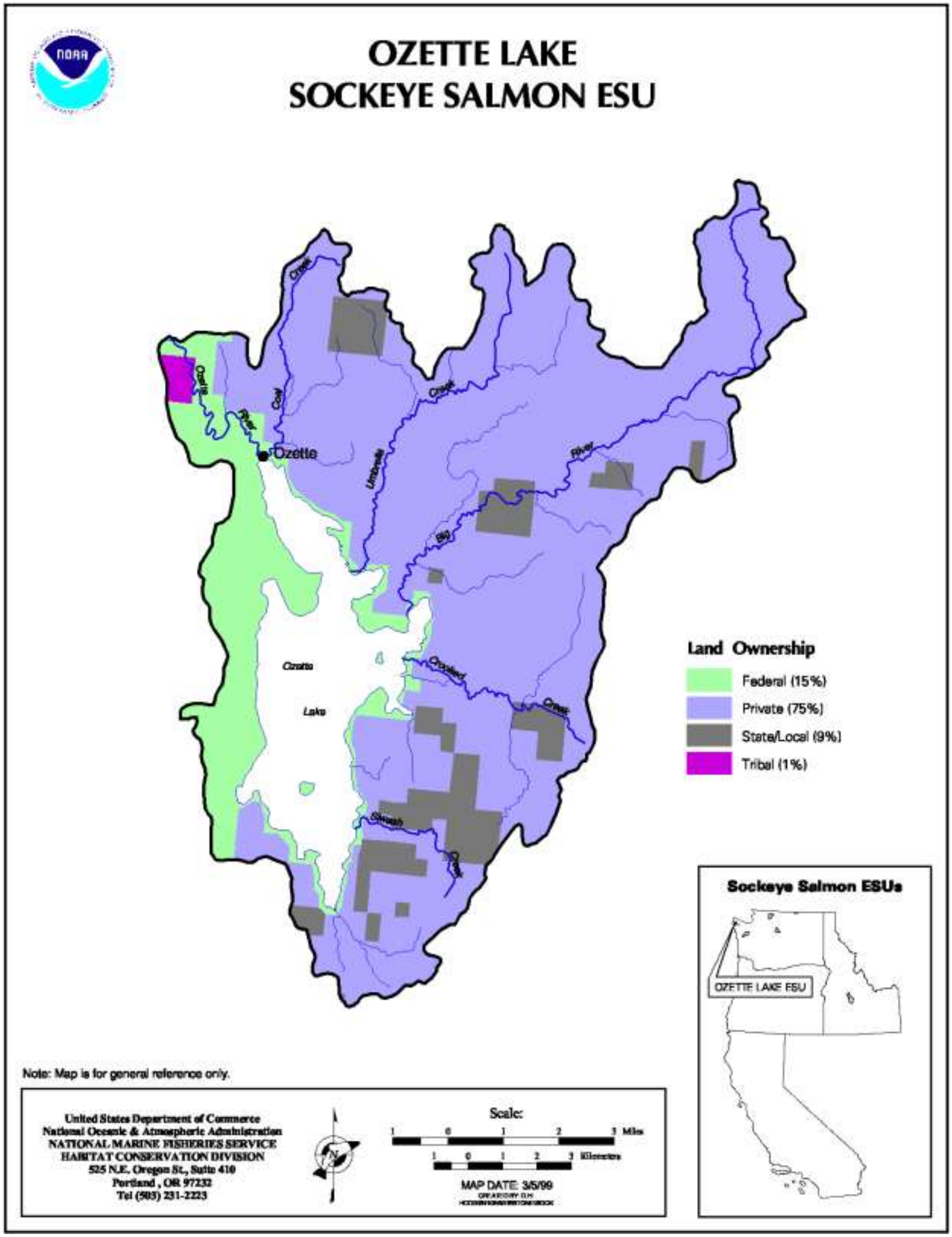


FIGURE 7: MAP OF THE LAKE OZETTE SOCKEYE SALMON ESU Map courtesy of the National Marine Fisheries Services, NOAA

Steelhead (*Oncorhynchus mykiss*)

Steelhead and rainbow trout are genetically the same species; rainbow trout live in freshwater only, whereas steelhead are anadromous. Unlike most salmon, steelhead can survive spawning and can therefore migrate back out to the ocean and then return to spawn multiple times.

Steelhead spawn in the spring. They generally prefer fast water in small-to-large mainstem rivers and medium-to-large tributaries. In streams with steep gradient and large substrate, they spawn between the steep areas where the water is flatter and the substrate is small enough to dig redds for their eggs. Steelhead fry emerge from the gravel in summer and generally rear for two or three years in freshwater, occasionally up to four years depending on the productivity of the stream. The steeper areas then make excellent rearing habitats for juveniles. Fry use areas of fast water and large substrate for rearing. They wait in eddies behind large rocks and allow the river to bring them food in the form of insects, salmon eggs, and smaller fish.

Like chinook, steelhead have two runs, a summer run and a winter run. Most summer runs are east of the Cascades, but like Spring/Summer Chinook, Summer Steelhead are found in many of the large Olympic mountain rivers within the Coast Region. WDFW recognizes nine (9) Summer Steelhead and thirty-one (31) Winter Steelhead populations, with a presence in all five WRIAs in the Coast Region.

Coastal steelhead populations are categorized into two Distinct Population Segments ("DPS"). **Olympic Peninsula Steelhead DPS** are in coastal watersheds north of, but not including, Grays Harbor, northward into the Strait of Juan de Fuca to west of the Elwha. **Southwest Washington Steelhead DPS** originate from tributaries to Grays Harbor and Willapa Bay, as well as tributaries to the Columbia River below the Cowlitz River in Washington and the Willamette River in Oregon. (Note: The Columbia River populations of steelhead are in the Lower Columbia Salmon Recovery Region.)

The maps on the next two pages can be found at, respectively, "Olympic Peninsula" and "Washington Coast" online at:
http://www.nwr.noaa.gov/ESA-Salmon-Listings/Salmon-Populations/Maps/Steelhead-ESU-Maps.cfm

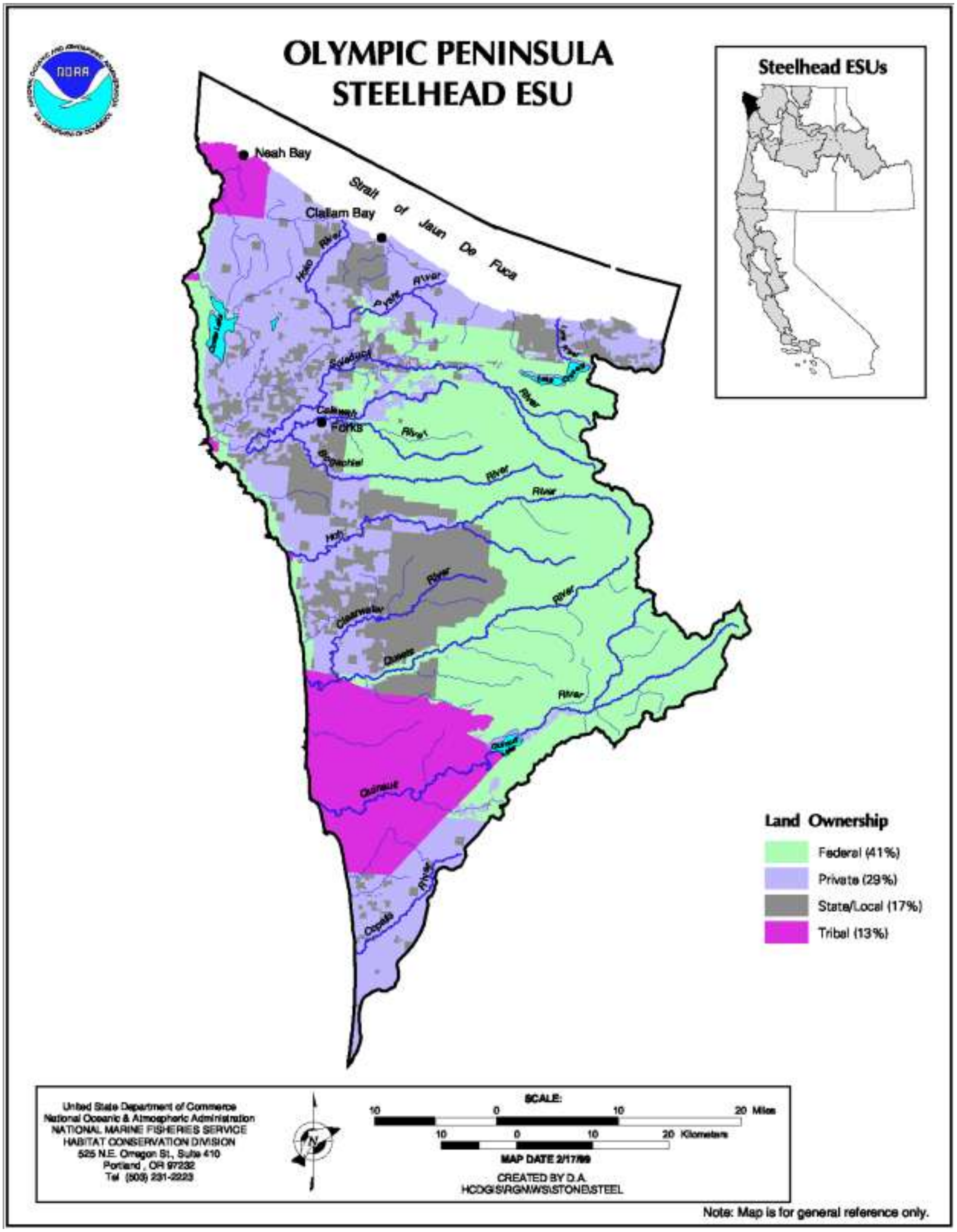


FIGURE 8: MAP OF THE OLYMPIC PENINSULA STEELHEAD SALMON DPS Map courtesy of the National Marine Fisheries Services, NOAA

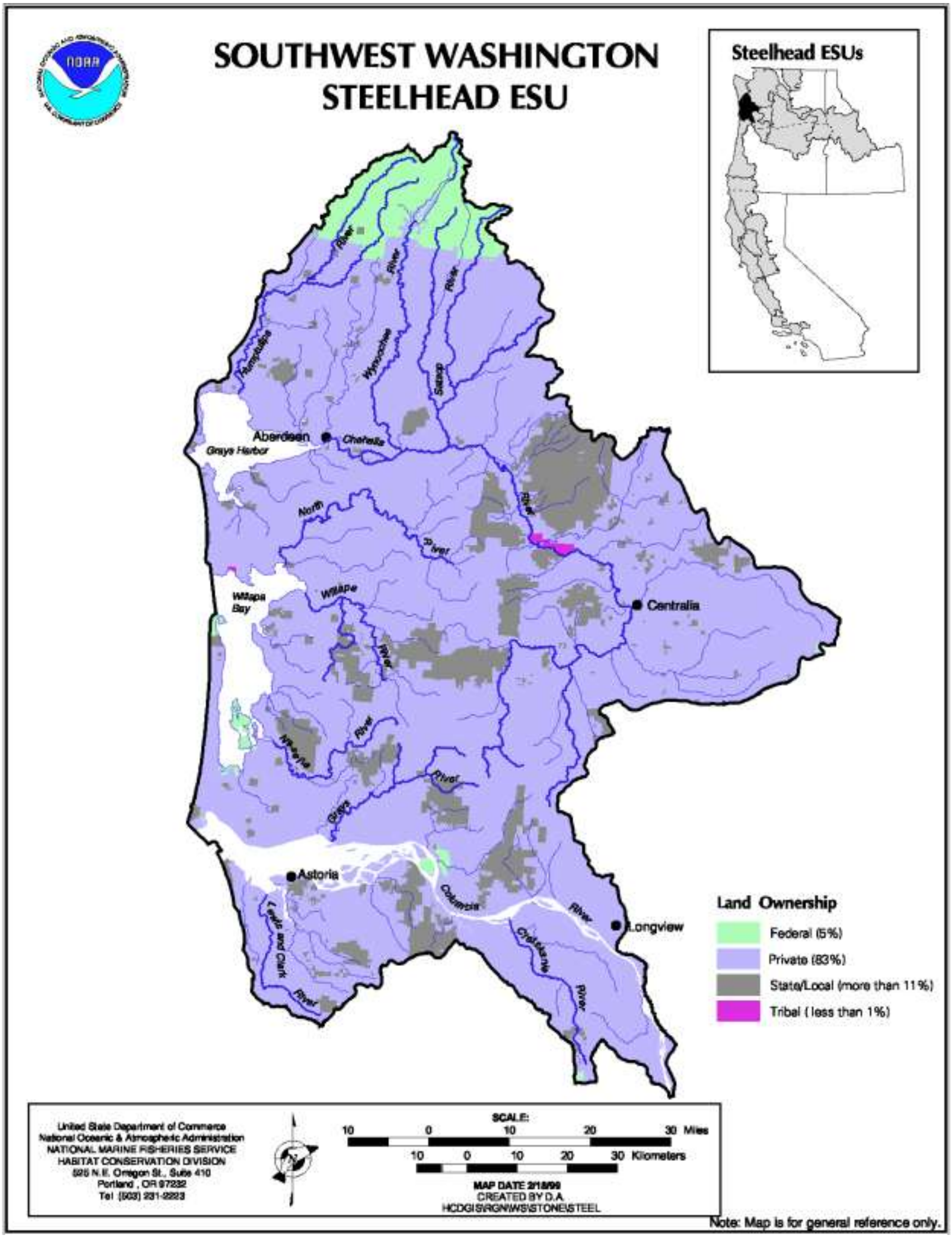


FIGURE 9: MAP OF THE SOUTHWEST WASHINGTON STEELHEAD SALMON DPS Map courtesy of the National Marine Fisheries Services, NOAA

Coastal Cutthroat Trout (*Oncorhynchus clarki*)

Of the thirteen (13) subspecies of cutthroat trout indigenous to North America, only the coastal cutthroat is anadromous. Coastal cutthroat have complex life histories, and not all are anadromous. In any given body of water, some coastal cutthroat may migrate to sea, while others become resident fish. In fact, the offspring of resident fish may migrate, while the offspring of anadromous fish may become resident fish.

Coastal cutthroat spawn over a long period, from December through May. They seek smaller streams where the flow is minimal and the substrate is small, almost sand. They prefer the upper-most portions of these streams, areas that are too shallow for other salmon. Most cutthroat rear instream for two to three years before first venturing into salt water. Emerging fry are less than an inch long, and are poorly able to compete with larger coho and steelhead fry for resources. To compensate, cutthroat fry use headwaters and low-flow areas that coho and steelhead avoid.

Unlike other anadromous salmon that spend multiple years feeding far out in the ocean, cutthroat prefer to remain within a few miles of their natal stream. They do not generally cross large open-water areas. Some will overwinter in freshwater and only feed at sea during the warmer months. In rivers with extensive estuary systems, cutthroat may move around in the intertidal environment to feed, and run upriver or out to sea on feeding migrations.

There are two Distinct Population Segments of coastal cutthroat trout identified within the Washington Coast Region – **Olympic Peninsula Coastal Cutthroat DPS** and **Southwest Washington Coastal Cutthroat DPS**. Stocks comprising the Olympic Peninsula DPS are identified as Ozette, Quillayute, Hoh, Queets, Raft/Quinault, and Moclips/Copalis. The Southwest Washington DPS includes the following population delineations: Humptulips, Chehalis, Willapa, Naselle/Bear, Mid-Willapa, and North/Smith/Cedar. Although the individual stocks identified by WDFW are distinguished by geographic distribution of spawning grounds, many spawning locations are unknown.

Bull Trout (*Salvelinus confluentus*)

Bull trout were listed as threatened in the coterminous United States on November 1, 1999 by the U.S. Fish and Wildlife Service ("USFWS") (USFWS, 1999). Bull trout are believed to be distributed throughout many of the major watersheds and associated tributary systems in the Coast Region. Their life history patterns include anadromous, fluvial,[12] and possibly resident. Anadromous bull trout have

[12] Describes fish species that spend most of their lives in larger streams and rivers, but use smaller tributaries for spawning

complex migration patterns and use a number of nearshore and estuarine areas and independent freshwater streams for foraging, migration and overwintering

USFWS, as part of its recovery planning, has identified three core areas for bull trout in the Coast Region: the Hoh River, the Queets River, and the Quinault River. Foraging, migration, and overwintering habitat in the Coast Region has been identified by USFWS as the entire nearshore coast, as well as Goodman Creek, Mosquito Creek, Cedar Creek, Steamboat Creek, Kalaloch Creek, Raft River, Moclips River, Joe Creek, Copalis River, Grays Harbor, and the Lower Chehalis, Humptulips, Wishkah, Wynoochee, and Satsop Rivers (USFWS, 2004). For critical habitat designations, see http://www.fws.gov/pacific/bulltrout/finalcrithab/index.cfm?unit=1

The USFWS has stated that distribution and abundance of most local populations on the Olympic Peninsula are poorly understood (USFWS, 2004, p. 151). In some cases, no spawning information is available, so the presence of multiple age classes is used to identify populations.

WDFW and USFWS identify three separate populations within the Washington Coast Region: Hoh River Bull Trout, Queets River Bull Trout, and Quinault River Bull Trout. The Hoh River may have the largest population of bull trout on the Washington Coast (Mongillo, 1993). Interviews with anglers and WDFW employees suggest that the Hoh River population was greatly reduced from 1982 to 1992. The reasons for this decline are basically unknown; however, Mongillo (1993) reported that local anglers believed overfishing contributed to the decline. He also suggested that increased timber harvest during that time period may have led to habitat loss.

Research on bull trout by the National Park Service using radio and acoustic telemetry has demonstrated that the anadromous life history form is present in the Hoh river, and that individuals can migrate large distances to forage and overwinter in other freshwater systems along the coast (Brenkman, 2007). It is expected that the same life history behavior exists in bull trout from the Queets and Quinault core areas as well.

WDFW data also suggests there may be a stock in the Chehalis/Grays Harbor system, and a credible historical account (Mongillo, 1993) of documented large fluvial bull trout exists for the Satsop River, but the USFWS has concluded this area currently does not support spawning.

Salmon Populations Status

We often point to the relative health of salmon populations of the Coast Region, compared to those in the Puget Sound and the Columbia Basin. The Coast Region watersheds offer an opportunity found nowhere else in Washington to restore sustainable wild populations before they become threatened or endangered. But how are they doing . . . really?

There are several circumstances that complicate the process of rating population or stock status. When a wild stock experiences an extremely low survival, it is sometimes difficult to know if that survival is within the normal range for the stock, or if it is entering a depressed state caused by an unusual or infrequent climate cycle or other natural event (e.g., seismic activity causing landslides, etc.) or by human impacts (e.g., habitat destruction, overfishing or hydro projects). Naturally-produced salmon stocks exhibit wide variations in survival, caused in part by changes in freshwater stream flows from droughts or flooding, ocean conditions and biological interactions such as competition and predation (Cooper and Johnson, 1992). It is not uncommon for wild stocks to experience one or two extremely low-survival years each decade, resulting in low adult returns. Similarly, natural variation also provides years of above-average production.

Despite this, some stocks are experiencing survivals that are so low that they are clearly below the level of natural variation. Short-term databases can make the rating problem more difficult because, with only a few years of observation, it is likely that the lowest natural survivals may not have been documented. The possibility of survival rate cycles for various stocks also can create difficulty in rating stock status. These cycles may be associated with weather-related impacts on freshwater spawning and rearing success, or even genetically-controlled cyclic productivity conditions. The apparent existence of cycles in survival and production data complicates the task of identifying depleted stocks, since poor stock performance could be the result of natural cyclic variation. Species interactions may also play a role, where one species' abundance may influence the survival and subsequent abundance of another species.

WDFW has maintained data estimating wild escapement since the late 1970s on dozens of the Coast Region's 118 recognized salmon and steelhead populations in their Salmonid Stock Inventory ("SaSI"). However, these data are based upon index streams extrapolated to the area occupied by the population and rely on relatively simple assumptions that cannot take into account density-dependent effects or stream-specific variation in productivity or survival. As a result, the use of the terms "healthy," "depressed" and "critical" as status determination in SaSI is somewhat subjective. Some tribes, and others, object to the use of the term "healthy" to describe any coastal salmon populations because it misrepresents the fact that all stocks are diminished from historical levels.

Further, SaSI doesn't take into account changes over time in the spawner-to-recruit relationship of a stock. Spawner-recruit theory offers a way of evaluating the health and productivity of populations, rather than using an annual snapshot of abundance, by mathematically describing the relationship between the number of fish produced and the size of the spawning population. The theory is based, in part, on observations that in some populations, as the size of the reproductive population increases, the number of offspring produced per adult, actually decreases. In order to effectively manage a fishery, the theory is expressed in a mathematical formula or model of density dependence.

The theory is used as a way of identifying, based upon the number of spawning adults in one generation, the number of fish produced by that generation that can be harvested while maintaining an adequate number of spawning returns to sustain a viable population.

Assessments of the status of Washington Coast Region salmon populations are imperfect. That much is clear. Delineations of populations themselves and the way in which populations' survival, or escapement, is measured provide only pieces of information which are extrapolated to develop assessments for management purposes. These assessments, even with room for improvement, are still useful. From a regional perspective they point to an unmistakable trend over the last twenty years: salmon populations in the Washington Coast Region have been declining.

The coastal salmon population status information included here is from two sources: WDFW's Salmonid Stock Inventory (WDFW/SASSI, 1992, and WDFW/SaSI, 2002), and the North American Salmon Stronghold Partnership expert ratings (NASSP, 2011). Two acronyms are associated with WDFW's stock status reports: SASSI and SaSI. They refer specifically to the 1992 Salmon and Steelhead Stock Inventory ("SASSI") and the 2002 Salmonid Stock Inventory ("SaSI") which was expanded in that report to include coastal cutthroat and bull trout, although data on these species is limited.

WDFW Salmonid Stock Inventory 1992, 2002

SaSI 2002 is based upon stock assessments developed through field surveys. Different methods are used, but most often the data are based on season-cumulative redd counts in index reaches (annually surveyed sections of a stream) and supplemental survey observations (selected reaches that are done less frequently), expanded to basin total escapement estimates. Using escapement estimates over periods of years to account for natural variations in populations, SaSI rates salmon populations in the Coast Region one of four ways – Healthy*, Depressed, Critical, and Unknown using the following definitions:

> **"Healthy"*:** The term 'healthy' covers a wide range of actual conditions, from robust to those without surplus production for harvest. Just because a stock is listed as healthy does not mean managers have no current concerns or that production levels are adequate or have not declined substantially from previous levels.
>
> **Depressed:** A depressed stock is one whose production is below expected levels, based on available habitat and natural variation in survival rates, but above where permanent damage is likely.
>
> **Critical stocks** are those that have declined to the point that the stocks are in danger of significant loss of genetic diversity, or are at risk of extinction.
>
> **Unknown:** For many stocks, there simply is insufficient information to rate them. Many of these are historically small populations and could be especially vulnerable to any negative impacts. There is an immediate need to collect more information on them.

*Here it is important to again point out that many who have participated in the development of this Plan and continue to dedicate their careers to the health of Washington Coast salmon take strong exception to the use of the term "Healthy" to describe any of the salmon in this Region.

We include the term "healthy" because it is the term used by WDFW in reporting on salmon stock status, but each time it carries with it the caveat of our concerns. A better term might be "stable," but still, in our view and based on WDFW's numbers, these populations are at risk.

These populations may be able to endure, but our goal of sustainability is larger – harvestable populations for the human communities whose existence depends at least in part on salmon fishing. It is not enough to keep a species off the ESA list. That may merely preserve it as a "museum piece" capable of reproducing the species. The goal of sustainability at harvestable levels is the real goal of recovery. Salmon were harvestable before ESA became a factor, and by returning them to those levels, both the needs of fishing communities and of other species in the ecosystem will be met.

WDFW published inventories on population status in 1992 and 2002. Data sufficient to draw any conclusion at all are available for only 65% of the Washington Coast Region salmon populations. More recent information, including total natural spawner numbers, is available from WDFW through 2009 or 2010[13] for less than half the Region's populations. The data are considered in many cases preliminary and subject to revision.   Status ratings have not been updated by WDFW since 2002. SaSI ratings for all WDFW-identified population delineations are included in Appendix 2.

Table 1. Coast Stock Status Overall Summary

Source: Washington Dept. of Fish and Wildlife (WDFW) 1992 SASSI and 2002 SaSI

COAST STOCK STATUS SUMMARY – 1992 and 2002				
	1992		2002	
	No. of stocks	Percent of stocks	No. of stocks	Percent of stocks
Healthy stocks	65	57%	63	54%
Depressed stocks	8	7%	13	11%
Critical stocks	0	0%	1	<1%
Extinct stocks	0	0%	0	0%
Not Rated stocks	Not applicable		0	0%
Unknown stocks	42	37%	41	35%
Total	115		118	

[13] Online at: http://wdfw.wa.gov/mapping/salmonscape/index.html

North American Salmon Stronghold Expert Ratings 2011

In 2010, the Wild Salmon Center ("WSC"), on behalf of the North American Salmon Stronghold Partnership ("NASSP"), sought to identify watersheds within the Washington Coast Region that would fit the definition of "Salmon Strongholds." The NASSP Charter (NASSP, 2009) defines a **Stronghold** as:

> *Status conferred to a defined geographical unit which meets biological criteria for abundance, productivity, diversity (life history and run timing), habitat quality, or other biological attributes important to sustaining viable populations of wild Pacific salmon throughout their range. The term stronghold refers to a watershed, multiple watersheds or other defined spatial units where populations are strong, diverse, and the habitat has a high intrinsic potential to support a particular species, or suite of species.*

The first step in the process of identifying Strongholds is an assessment of salmon population units based upon the biological criteria of abundance, productivity, life history diversity, and percent natural-origin spawners.

In 2009 and 2010, WSC solicited the expert opinions of fisheries biologists and other experts throughout the Coast Region to rate coastal salmon populations. A summary of the results is included in Appendix 3. Many of the same experts who provide data for WDFW's SaSI ratings provided the Wild Salmon Center with their knowledge and understanding of these populations. In the WSC assessment, the experts also provided a rating of their own certainty associated with each of their population unit ratings. The ratings underwent confidence testing using a Decision Support Model to identify population units that are Strong, Weak, or Research, as defined below:

> **Strong:** A population unit that exhibits relatively little influence from hatchery fish on spawning grounds (> 75% natural origin spawners), expresses most of its life history diversity traits, and has relatively high wild abundance and productivity, relative to its ecoregion or ESU. Expert certainty (within and across reviewers) is high.
>
> **Weak:** A population unit that exhibits relatively high influence from hatchery fish on spawning grounds (> 25%), does not express most of its life history diversity traits, and has relatively low abundance and productivity. The category includes extirpated population units. Expert certainty (within and across reviewers) is high.
>
> **Research:** A population unit that requires additional scientific analysis and/or improved expert certainty to qualify as either strong or weak.

Table 2. Washington Coast Salmon Stronghold Ratings and Status

Population Unit Rating	No. of Units	Percent of Units
Strong	49	41%
Research	47	39%
Weak	22	19%
TOTAL Population Units	118	-

Source: North American Salmon Stronghold Partnership (NASSP)

This step in the process of identifying Salmon Strongholds, based upon expert opinion, is the most up-to-date assessment of coastal salmon and steelhead populations. The assessment provides a useful, regional-scale summary from the perspective of the experts that know the populations best. It also leads directly to the identification of which basins in the region could be most important to sustaining viable populations of wild Pacific salmon. These basins within the Coast Region are depicted in Appendix 3.

A Twenty-Year Perspective

Twenty years are not a long time to compare data. For a comprehensive understanding of salmon population trends, one really needs to look no further than historical accounts of fish so abundant that "you could cross streams on their backs," or historical records of canneries located up and down the Washington Coast. From these accounts alone we know there are a lot less salmon than there used to be.

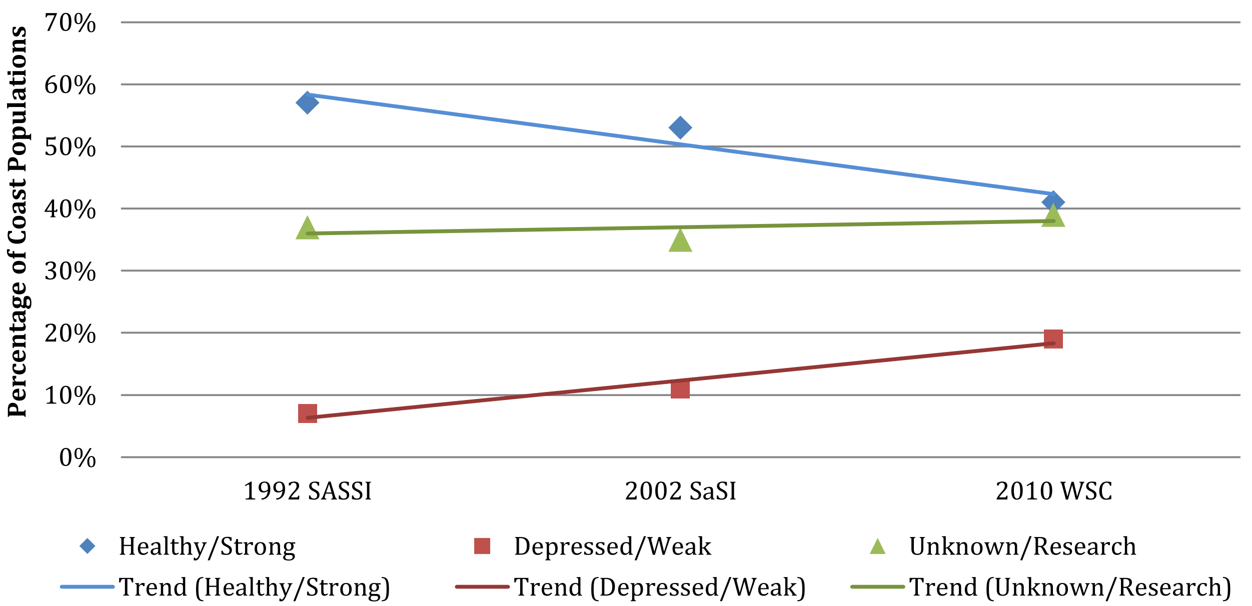
Data from the Pacific Fishery Management Council includes historical estimates of spawning escapement and terminal run size dating back to 1976 or 1977 for chinook and coho in the Quillayute, Hoh, Queets, Quinault (coho only), Grays Harbor (Chehalis), and Willapa. These data suggest that coho numbers have been *increasing* in each of these watersheds over the last 30 to 35 years, while chinook numbers in the north have been declining. This information is included as Appendix 4, including graphs generated from the data depicting escapement trends over the period. These trends are calculated for the entire time period of the data set, and may not reflect the most recent trend of the population.

WDFW's ten-year perspective, taken from two "snapshots," one in 1992 and the next in 2002, shows that "Healthy" populations dropped from 57% to 54% of the total delineations, and "Depressed" populations rose from 7% to 11% of the total. In the same time, one salmon population, Lake Ozette Sockeye, changed status to "Critical," and became listed as threatened under the Endangered Species Act. Likewise, Coastal-Puget Sound Bull Trout were listed as threatened under ESA in 1999. Having discussed our concern with terminology above, we need only add that simply the use of the term "Healthy" paints a very misleading picture.

In 2010 the NASSP population rating process used an entirely different procedure, and what defines "Strong" in that process does not equate to "Healthy" in the SASSI/SaSI ratings. Nor does "Weak" equate with "Depressed." "Research" may well be very similar to "Unknown" in these two rating systems. Still, for the sake of discussion – and perhaps a broader perspective – we asked what would happen if we accepted a little more than the usual uncertainty and combined the two rating systems as *approximate* depictions of salmon populations over a twenty-year period?

The result is no surprise, and provides what is perhaps a very useful image. The x axis represents salmon populations in 1992, 2002 and 2010, and the y axis represents the percentage of total Coast Region salmon populations.

Table 3. A Comparative Summary of SASSI, SaSI and NASSP Ratings of Washington Coast Salmon and Steelhead Populations



Note: This chart is not intended as an accurate or definitive depiction of actual salmon population status.

As imperfect as this comparison is, it does point to something fisheries managers and biologists in the Coast Region all know: Washington Coast Region salmon populations, as good as they may be compared to so many others in the state, are still in trouble. We know that threats to their sustainability are serious. Some situations are getting better with completion of restoration projects, combined with improvements in harvest management, land use regulations and enforcement, while others are getting worse.

As is evident, there is a great need in the Washington Coast Region to get a better handle on data concerning salmon populations; this is one of the major activities identified in this Plan. However, it is obvious, from both the hard data that do exist and the observations of seasoned experts and stakeholders, that salmon populations in the Coast Region are declining. Despite this, and simultaneously, Coast Region salmon and their habitats can be sustained. These two realities, although they could be more precisely documented, are the basis of this Plan.

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CHAPTER 3
CRITICAL THREATS TO SALMON SUSTAINABILITY IN THE WASHINGTON COAST REGION

The major threats to the sustainability of salmon populations in the Washington Coast Region are complex and interconnected. By and large, they are the results of human activities that directly or indirectly cause the degradation of habitat, or environmental conditions that reduce habitat capacity and/or survival rates of regional salmon populations. The extent to which these threats have had an impact on salmon is a direct result of their cumulative impact over time. For instance, climate change, which is a newer and growing threat, has had less impact to date than removing riparian forests a hundred years ago. However, the level of a threat's severity also considers the scope and irreversibility, making climate change more critical than legacy timber practices or lack of large wood in streams. Addressing these threats and their causes -- by mitigating their direct impacts, by intervening to remove or change what causes them, by pursuing active restoration and protection on the ground, or by reaching out to and involving the public in these activities -- form the basis of all strategies and actions detailed in this Plan.

The critical threats to the Region's salmon described in this chapter were derived from ratings of the condition of the eight habitats listed in Chapter 1. These threats were identified and ranked by workshop participants (many of whom had particular expertise) and interested stakeholders. WCSSP's planning committee and regional scientists first identified the key attributes and indicators of habitat condition required to sustain healthy salmon populations. *Indicators* included, for example, such factors as temperature, dissolved oxygen, and turbidity for the *attribute* of water quality. Then, experts from around the Region provided ratings for each of these indicators. This work is summarized in the Habitat Viability Charts in Appendix 7. A detailed description of the process is located in Appendix 13 – Planning Process and Analyses.

It is beyond the scale of this initial planning process to collect and analyze all of the existing data on habitat conditions throughout the almost four million acres of the Coast Region. The assessments of habitat condition in this Plan are high-level, generalized conclusions based on the professional knowledge of regional workshop participants. Where possible they provided regional averages of those conditions. Some conditions vary from watershed to watershed, or even from reach to reach (stream segment) in a single system. In instances where conditions were notably different in different WRIAs, or in the north of the Region compared to the south, these differences were noted.

The ratings told us, generally, in what way the Region's salmon habitats are degraded. Then, advisors from diverse government and non-profit sectors as well as other interested parties systematically examined each habitat for the five WRIAs and identified every threat that might have led to the degradation. Each threat on the list was then evaluated in terms of scope, severity, and irreversibility using consistent metrics and procedures to rank them. All of this is explained in further detail, with supporting documentation, in Appendix 13 - Planning Process and Analyses.

Once the workshop provided the comprehensive list of all major threats to each habitat, the threats were combined and ranked again, based on severity and commonality across all the defined habitats. From that exercise, twelve threats rose to the top as the most important and were brought forward for strategy development.

Following is a brief description of the twelve most critical threats around which the Plan strategies were crafted. They are presented here in order, with the most critical listed first, based on their overall severity and magnitude. The climate change discussion is the most detailed because WCSSP considers it to be the most critical, and in some ways least understood, threat to the long-term viability and health of salmon in the Coast Region.

Climate Change

IMPACTS: ALL HABITATS

In the Pacific Northwest, climate change will produce increasing air temperature, changes in annual and seasonal precipitation, declining snowpack, alterations to streamflows and flood risk, increasing summer water temperature, rising sea level, higher storm frequency and increasing ocean acidification (Climate Impacts Group (CIG), 2009). Major climate impacts on salmon productivity will also include altered or reduced access to habitat and refugia, and food web changes (Climate Change Impacts Workshop, 2009). It is highly likely that this will have significant implications for Pacific salmon throughout both their freshwater and marine life history stages.

The specific effects on salmon populations are difficult to predict with certainty given the complexity of the environmental changes themselves and the complexity of salmon species, life stages, and habitats. The many interacting variations in ecosystems (e.g., changes in timing and availability of prey) will render individual species and populations more vulnerable. Vulnerability will depend on exposure, sensitivity and adaptive capacity (Dawson et al., 2011). Reduced salmon abundance and genetic diversity, and reduced habitat heterogeneity, availability and function will decrease the overall resilience of salmon and their capacity to adapt to climate change. Therefore, it is important to consider all factors – changing climate factors, habitat impacts, and the adaptive capacity of individual populations – when assessing climate change impacts to salmon.

Freshwater Habitats. Significant changes to both water temperature (with increasing high temperatures and higher low temperatures) and stream flows will affect freshwater habitat for salmon throughout the Coast Region. Depending on a species' timing of life history stages, reduced summer flow, shorter duration of spring snow runoff because of reduced snow packs, and increased magnitudes of fall and winter flooding events can all have varying negative impacts on salmon (Mantua et al., 2009, Figure 11). Higher water temperatures and lower stream flows will reduce habitat connectivity and refugia, increase migration energy requirements, and may reduce fecundity and reproductive success. Also, with higher water temperatures, adult and juvenile salmon will be increasingly susceptible to disease, predation and competition (McCullough et al., 2005; Environmental Protection Agency (EPA), 2007). According to the Climate Impacts Group these changes to freshwater habitat conditions will "likely cause severe problems for salmon stocks that are already stressed from already degraded freshwater and estuarine habitat" (CIG, 2004).

Marine Habitats. Salmon spend a significant portion of their life cycle in the marine environment. While there is still some uncertainty about the range of effects of changing ocean conditions that can be directly attributed to climate change, there are clearly changes that are occurring or are predicted to occur. The ocean, while still chemically basic (pH over 7.0), is becoming more acidic, including waters affecting Washington State (Huppert et al., 2009). This can adversely impact prey availability for young salmon. Sea surface temperatures are increasing, which will likely increase ocean stratification, although winds may offset this by driving upwelling and maintaining productivity (Wang et al., 2010). The combination of these factors may result in reduced smolt and adult growth, and reduced survival. Also significant for salmon abundance and productivity is the Pacific Decadal Oscillation, which affects ocean conditions and marine food webs (Mantua et al., 1997). The Pacific Decadal Oscillation and sea surface temperatures affect the quality of copepod prey for salmon, which is directly linked to salmon survival. And, as sea level rises and flooding increases in estuaries, there will be increased human pressure for shoreline armoring, which leads to reduced habitat quantity and quality for salmon in estuarine and nearshore areas (Huppert, 2009).

Salmon Species Vulnerability. As noted above, individual salmon species vulnerability to climate change depends on exposure, sensitivity and their adaptive capacity, and on the timing and dependency of life history stages on the freshwater and marine environments (Dawson et al., 2011). In the Washington Coast Region, more highly vulnerable species may include bull trout, spring/summer chinook, and sockeye; medium vulnerability species may be summer steelhead and fall chinook; and less vulnerable species may be winter steelhead and fall coho, based on predictions from life history characteristics (Climate Change Impacts Workshop, 2009; Jim Jorgenson, 2011 personal correspondence). Maintaining life history diversity will be essential for salmon persistence over time (Beechie et al., 2006), especially in a changing climate.

Climate change impacts on Washington Coast Region salmon were considered during overall Plan development and have informed strategy development. The following questions were raised during the development of this Plan:

- How will climate change impacts affect salmon species and habitats?
- Which climatic factors are most significant?
- Where are the greatest sensitivities (biological and ecological vulnerability)?
- Which critical threats have the potential to be greatly exacerbated by climate change?

- What are probable human responses to climate change that may affect salmon and their habitats?
- What are some key unknowns that need answers and/or attention?
- What are potential solutions or strategies to these climate change impacts?

The following are the critical threats to salmon that are likely to be exacerbated by climate change, and the human responses to climate change that will negatively affect salmon:

- Expansion of invasive species
- Alteration of fish disease patterns and likely increased levels of occurrence of fish disease
- Greater habitat loss due to increased area of unsuitable habitat conditions resulting from climate change
- Increased shoreline armoring and diking (human response to rising sea levels and increased levels of winter/spring runoff); that is, unresolved issues of human safety versus salmon habitat health
- Altered development patterns and shifts in current use patterns of water sources, affecting the hydrological needs of salmon (e.g., altered water flows; less water quantity)
- Reduced wild fish numbers, which are necessary to protect the genetic diversity and therefore resiliency of fish populations
- Hatchery influence on native fish (e.g., genetic homogeneity, disease risk)
- Increased predation on salmon
- Reduced prey at ocean life stage

We have also identified the key unknowns to inform future research and monitoring:

- Analysis of refugia to determine their locations and condition, factoring in climate change (build off current USFS research)
- The effects of ocean acidification on salmon and their prey
- The identification of resilient populations in the Coast Region and ways to best manage for resilience and existing life history diversity/variability
- The possibility of fire becoming more of a problem in certain areas in the Coast Region
- Developments and changing conditions that may demand attention as the effects of climate change increase
- The best ways to maintain high variability (complex environments), habitat diversity and functional ecological processes
- The design of restoration projects to accommodate for changing conditions (for example, road and habitat restoration projects designed to accommodate for changing flow and sediment regimes)

The impacts of climate change on salmon in the Washington Coast Region are likely to be significant. The adaptive capacity of salmon to climate change would be increased greatly by improved freshwater, estuarine and nearshore habitat conditions, as well as maintenance of genetic and life history diversity across salmon life cycles. The adaptation of salmon and, ultimately, their survival will require management actions that increase habitat quality and enhance diversity. Salmon and their habitats will require monitoring of key measures that assess changing conditions, the salmon responses to those changes, and management success in addressing them. These results should then be used to adjust strategies over time (Lawler, IN PRESS). This foundation of adaptive management will be critical to ensure wild salmon sustainability in an uncertain climate future.

For more information on the climate change, see the University of Washington Climate Impacts Group (CIG) website: http://cses.washington.edu/cig/

Invasive Species

IMPACTS: HEADWATERS/UPLANDS, WETLANDS, LAKES, MAINSTEMS, ESTUARIES, AND NEARSHORE

Invasive species, both plant and animal, are non-native species that are introduced into local habitats, aggressively propagate, and damage local flora and fauna. For salmon in the Coast Region at this point in time, invasive plants such as knotweed (*Polygonum*) in riparian corridors and Brazilian *Elodea* in stream beds are having the greatest negative effect. Knotweed degrades native habitats by quickly overwhelming the soil, water and nutrients of native plant species, as well as creating less shade than native plants. This in turn creates a physical environment very different from that in which salmon evolved and are able to flourish. Submerged invasive plants, like Brazilian *Elodea* and *Hydrilla*, create massive mats of plant material that both inhibit physical movement of fish and degrade dissolved oxygen levels in the water. Other invasive species threats to salmon and salmon habitat include zebra and quagga mussels, non-native game fish in lakes and rivers, and *Spartina* in estuaries (personal correspondence with David Heimer, Washington Department of Fish & Wildlife, and Wendy Brown, Recreation & Conservation Office, 2010).

Invasive species are introduced through a wide variety of pathways such as contaminated hay or seed, mud on vehicles, ornamental garden plants, wildflower mixes, erosion control plantings, yard waste dumping, aquariums and water gardens, ballast water and hull fouling on boats (Thurston County, p. 2; personal correspondence with David Heimer, WDFW, and Wendy Brown, RCO). More recently, the arrival of debris from the 2011 Japanese tsunami on Washington beaches poses an unknown threat of introducing new invasive species. Invasive species, once established, are difficult to eradicate. For instance, "knotweed can grow 6 inches per day in May and June. Fragments as small as .5 inch can start new infestations" (Thurston County, p. 40-41). Despite this, effective management or eradication of invasive species is possible. Treatment of knotweed using approved herbicides works.

As with other threats to salmon, prevention is the most effective and least expensive way to avoid the deleterious effects of invasive species. Although WCSSP's coastal Lead Entities and other groups have and will likely continue to carry out eradication projects, this Plan will also focus on education and outreach about preventing invasive species, including supporting the many programs in the Region already focused on this problem.

For more information on invasive species, see the Washington Invasive Species Council website: www.invasivespecies.wa.gov/

Hatchery and Harvest Interactions

IMPACTS: TRIBUTARIES, MAINSTEMS, ESTUARIES, NEARSHORE, OCEAN

Continuation of sustainable salmon harvest is integral to our desire to protect wild salmon.

The first response to earlier declines in salmon numbers was to build and operate hatcheries with little consideration of the impact on wild populations. Fisheries managers generally believed a fish was a fish and they could produce as many as they wanted in what were basically fish factories. We have since learned that hatchery fish can pose risks to wild fish through diseases and increased rates of competition with and predation on naturally spawned populations. When hatchery fish spawn in the wild, reduced fitness and reproductive success may adversely affect the entire "integrated" population. Still, better hatchery management has the potential to further the vision and goals of this Plan.

Hatcheries were built along the Pacific Coast to supplement harvest of wild fish and, in many cases, to replace lost natural production caused by habitat degradation from historic timber harvest, development (e.g., dams, agriculture, industry, urban use), and fishing at unsustainable levels. Timber lands can be managed in more salmon-friendly ways, but many other land development changes are not reversible and complete mitigation is not possible. In most cases, wild production cannot be restored to historic levels and hatchery production is, in part, mitigation of lost wild production. Recent advances have made possible artificial rearing techniques that are scaled to supplement wild populations or preserve genetic wild progeny of natural-origin broodstock where habitat recovery is still ongoing. Still, these methods may not always be sensitive to the time required for the population to adapt and survive as naturally spawned and reared fish in a changing, stressed ecosystem.

Harvest and hatchery issues are complex, involving international boundary issues and impacting the broad array of regional commercial fishing interests and fisheries dating back thousands of years that have driven the economy, trade and culture of coastal peoples. The issues involve not only U.S.-Canadian and other Pacific Ocean agreements but, just as importantly, treaties between the United States and the successor governments of certain Indian tribes and nations in Washington known as the “treaty tribes.” These treaties are also binding on the State of Washington. The recent historic industrialization and development of coastal fisheries and encroachment of broader industrial development have pushed fishing allocation, conservation and management issues to a critical level of attention across the migratory range of salmon and their prey species.

Earlier fish harvest management controls in Washington State were limited to merely closing the most terminal (i.e., closest to the river mouth) fishing areas one at a time, river by river, while allowing ocean harvest to increase, thereby putting greater pressure on fish stocks from rivers that had been closed. The 1981 federal *Hoh v Baldrige* case affirmed the right of certain Pacific Coast treaty tribes (Quileute, Hoh, and Quinault) to calculate salmon share on a river-by-river, run-by-run basis, based on joint decisions of the state and tribal co-managers.[14]

Some economically important salmon runs in the Coast Region are a mix of harvestable wild and hatchery fish, while others consist almost solely of wild fish. Reduction or control of harvest impacts on the various runs has been well documented. Similar documentation of habitat restoration, relative to salmon population abundance, at a basin or major sub-basin scale is needed. In the meantime, regarding decisions on hatchery and harvest, this Plan supports good decision-making through filling data gaps, advancing a regional perspective, and bringing together work groups that include a balanced set of various disciplines to discuss and more fully understand potential mixes of wild and hatchery fish and their ecological interaction. Such disciplines may include geneticists, fish behavioral scientists, aquatic entomologists, microbiologists, fisheries biologists, ecologists, aquatic geomorphologists, and biometricians, as well as hatchery managers.

Improved techniques for artificial rearing and use of escapement goals for most salmon have led to significant reductions in harvest rates for coastal salmon runs since the late 1970s. Since the U.S.-Canada Treaty, which led to the Pacific Salmon Commission in the mid-1980s, protocols to reduce coho and chinook ocean harvests have also been adopted. Significantly, the combination of escapement goals and catch-sharing principles have shifted overall catch and escapement of coho to the terminal fishing areas, with chinook also partially shifted. Where hatchery fish return to the same terminal area and timing is close to or the same as the wild fish, hatchery harvest tends to be reduced from former rates, in order to meet wild escapement objectives.

Hatcheries are relied upon to provide a substantial portion of the coho, Chinook and steelhead harvested in the Coast Region salmon fisheries. There are significant short- and long-term problems that can result from artificial rearing in hatcheries, including increasing the risk of exposing wild fish to diseases and parasites. The potential increased exposure of wild fish to pathogens are a real concern, but perhaps most important is the potential long-term genetic and adaptive deterioration of wild salmon stocks. As populations' genetic diversity decreases they may become more susceptible to disease, may lose their ability to compete successfully against their own and other species, and may fail to adapt successfully to even minor habitat changes (Stouder, 1997, p. 4). Because of these risks, the Hatchery Scientific Review Group ("HSRG") recommendations emphasize the importance of maintaining high levels of dispersion of wild run fish in natural habitats relative to the size and dispersion of hatchery fish, particularly in regards to the use of rearing and spawning habitat. HSRG further recommends the isolation of some wild steelhead runs from hatchery runs through a no-hatchery policy (i.e., Wild

[14] In implementing this case, co-managers (state and named tribes) affirmed the principle that the weakest coho run would limit the tribal and non-tribal fisheries in the ocean to one-half of harvestable coho (in excess of the escapement goal) available from the weakest runs, to be shared equally (treaty/non-treaty) in each respective terminal fishery (Jim Jorgensen, personal correspondence 2011).

Salmonid Management Zones) in order to preserve the genetic integrity of an increasingly weakened species.

Concerns about the continued viability of natural salmon runs also stem from the potential loss of the expansive, diverse network of habitats that support a broad diversity of subpopulations, as well as the potential impact on such declining populations by interbreeding with one or more hatchery populations having different genetic traits. Improved techniques for artificial rearing have occurred in recent years, primarily in response to the genetic and disease issues, but they still do not replace the subpopulation diversity found in health wild populations. Other improvements in hatchery management include better selection of brood stock (hatchery segregated or wild integrated), fish nutrition, rearing density, water quantity and quality, effluent control issues, and an effort to decrease straying of multi-generation hatchery fish to the natural spawning grounds.

It is apparent that there are no easy answers and many different ways of addressing hatchery and harvest interactions. The rights and responsibilities to maintain harvestable fisheries, and the productive habitat that requires, must be balanced with the potential conflicts regarding different levels of wild-versus-hatchery production in Coast Region watersheds. This Plan's support of good decision-making through collecting data on a regional scale, filling data gaps, and bringing together fisheries ecologists, geneticists, geological scientists, habitat biologists, and hatchery managers for discussion to further define and understand these issues is intended to foster a multi-disciplinary approach that advances comprehensive fisheries protection consistent with effective land use and regulatory decision-making to protect and restore both fisheries and habitat.

For an inventory of Coastal Hatchery Programs, see Appendix 6.

Logging Practices That Impact Salmon

IMPACTS: HEADWATER/UPLANDS, TRIBUTARIES, WETLANDS AND OFF-CHANNEL, MAINSTEMS, LAKES, ESTUARIES

Numerous studies have directly linked past logging practices, including forest management and road placement, to deleterious effects on many habitat-forming processes that drive the freshwater habitat complexity upon which salmon depend (National Research Council, 2002; Gregory & Bisson, 1997; FEMAT, 1993). These practices generally resulted in harmful biological effects on salmon (see Table 4 below**)**, which reduced their ability to recover from natural disturbances and adapt to threats in other life-cycle stages, and ultimately exacerbated population declines (Waples et al., 2009; Bisson et al., 2009; Wofford et al., 2005). Research over the last decade has demonstrated important linkages in habitat processes between headwater streams, upland forests, and downstream fish-bearing rivers and streams, indicating these linkages must be taken into account to effectively maintain high-quality freshwater salmon habitat (e.g. Miller & Burnett, 2008; Pollock et al., 2004; Reeves et al., 2003; Gomi et al., 2002).

The disturbances along fish-bearing channels that can be attributed to past logging practices have ranged from timber harvests on steep slopes and drainages, to roads built in the forests for lumber trucks, to devegetated surfaces, to inadequately maintained culverts – all of which have the potential to increase sediment load through runoff or bank instability, thereby harming fish habitat. In some cases ground water has been intercepted by road cut excavations. Where large enough buffers have not been provided, there has been loss of larger tree recruitment from the riparian area into the channel. In some cases 100 or more years will be needed to restore appropriate tree species within a tree length of the current channel (the standard for recruitability), both because of tree age and channel migration patterns.

Because timber harvest has been and remains the dominant land use in much of the Coast Region, the results of poor practices, whether prior to or subsequent to the *Forest Practices Act*[15] (also called the *Forests and Fish Act,* see Glossary) with its improved regulations and practices, remain a major cause of current habitat degradation. In general, the degraded habitat conditions that are the most prevalent across the forested parts of the Washington Coast Region are:

- excess sediments embedded in spawning gravels from, for example, hydrologically immature forests and from roads
- a dearth of large woody material in streams
- a loss of off-channel and side-channel habitat features
- a loss of connection between the rivers and their floodplains
- elevated stream temperatures
- a reduction of suitable habitat as a result of man-made barriers

Despite all of the above, current timber practices as specified in The Forest Practices Act are slowing the decline and, in some cases, have significantly improved the quality of the forested riparian habitats in the Region. This Act directed the adoption of the goals of the *Forests and Fish Report* into the State Forest Practices Rules (Title 222 WAC) administered by the Washington Department of Natural Resources. Table 4 below provides a detailed look at the impacts of historic timber practices on salmon and habitats; nearly all of them have been influenced positively through implementation of modern Best Management Practices under The Forest Practices Act. Road Maintenance and Abandonment Plans (RMAP), required of all large (industrial) and some small forest landowners, have already corrected hundreds of fish passage barriers and significantly reduced road runoff and sediment input to streams (Dubé, K. et al, 2010).

Fish habitats with functioning forested riparian habitat generally create better conditions for salmon than those associated with stream habitats in areas of human population growth, or industrial, agricultural, and commercial development. Put simply, harvestable working forests are better for salmon than other human land uses. This fact, plus the economic and cultural importance of forests and timber harvesting in the Coast Region, justifies the focus in this Plan on encouraging the timber industry

[15] Chapter 76.09 RCW, enacted pursuant to the 1999 Forests and Fish Report.

and local jurisdictions to continue to put into place salmon-friendly practices. Timber practices have definitely improved in recent decades and this Plan supports that trend while discouraging the conversion of timber resources to residential, industrial, or agricultural use that would further fragment and degrade salmon habitat.

Table 4. Impact of poor past and current forestry practices on salmonid habitat and the resulting biological effects on salmonids

From: Davis, L., and Schroeder, J. 2009. Internal science assessment of Washington's coastal rivers. Seattle: The Nature Conservancy of Washington.

HABITAT ATTRIBUTE and (REFERENCES[16])	HOW POOR PAST AND CURRENT FORESTRY ALTERS ATTRIBUTE	EFFECT ON ATTRIBUTE AND ASSOCIATED ECOSYSTEM PROCESSES	BIOLOGICAL IMPACT ON SALMONIDS
HYDROLOGIC FLOWS **(a, m, n, v)**	Roads and harvest areas modify hillslope drainage networks by: * Increasing impermeable surface area, disrupting water infiltration * Directly transporting water to streams * Removing water storage mechanisms (vegetation, tree canopies, moss) * Altering snow interception, retention, and melt rates	Alters timing and magnitudes of low and peak flows, which can in turn: * Alter stream thermal regimes and productivity * Reduce habitat complexity through channel scour and gravel/wood loss (high flows) * Alter other physical processes contributing to sediment transport and storage; channel geometry; and bank stability	* Alters timing of discharge-related life-cycle cues (e.g., for migration) * Increases scour-related mortality of eggs and alevins (high flows) * Flushes juveniles downstream and out of rearing habitat (high flows) * Increases crowding and competition (low flows) * Increases vulnerability to predation (low flows) * Restricts access to habitat
TEMPERATURE **(a, b, c, d, e, f, g, h, i, j, k, l)**	* Reduces forest cover, decreasing shade over stream and along upstream headwaters and uplands (cumulative effects) * Alters flow and sediment regimes, reducing water depth	Increases: * Water temperature	High temperatures can: * Increase mortality * Create severe metabolic stress * Alter migration and breeding (thermal barriers) * Increase susceptibility to disease * Block access to habitat (thermal barriers)
SEDIMENT **(a, m, t, v, w, x, y, z)**	* Increases frequency of debris flows and landslides triggered from forest harvests and roads; landslides generally contain less wood and more sediment than under natural conditions * Increases surface erosion from impermeable road surfaces (direct routing to stream) and harvested areas	Increases: * Fine sediment loading and sediment deposition in gravels * Infiltration of interstitial spaces in spawning gravels with fine sediment * Channel aggradation * Water turbidity	In the case of fines: * Suffocates incubating eggs and fry * Reduces stream productivity and food sources * Causes respiratory failure of adults and juveniles (suspended sediment) In the case of coarse debris: * Reduces spawning habitat quality * Blocks access to habitat (debris jams, channel aggradation)
LARGE WOOD **(a, o, p, q, r, s, t)**	* Removes wood from adjacent riparian forests * Removes wood from upland and headwater riparian forests (these areas can contribute more than half of wood found in fish-bearing streams) * Increases magnitude of peak flow events due to loss of instream wood	Reduces amount of large wood in streams available to disrupt flow and route water, resulting in: * Increases in gravel scour * Increases in bank erosion * Decreases in channel sinuosity and stability * Reduction in number of pools and off-channel features	* Reduces cover from predators * Reduces off-channel habitat and pools for rearing and refugia from peak flows * Increases susceptibility to peak flows resulting from channel simplification * Reduces availability of organic substrate for food sources (e.g., macroinvertebrates)
HABITAT CONNECTIVITY **(a, m, t, u)**	* Poor construction of roads and/or poor maintenance of culverts interrupt and/or disconnect floodplains and streams * Poor material choices for roads and/or steep slopes increase likelihood of debris and sediment and harvest-triggered landslides	* Decreases available upstream habitat * Decreases available off-channel and side channel habitats * Blocks fish passage	* Diminishes spawning, rearing, and foraging habitat * Reduces availability of refugia for fish from peak flow events * Increases crowding and competition

[16] See next page for references a – z.

Much of the information in the above table is taken from: (a) Gregory and Bisson, 1997. Readers should refer to this review for original sources. Additional references include: (b) Farrell et al., 2008; (c) Bartholow, 2005; (d) EPA, 2007; (e) McCullough, 1999; (f) Spence et al., 1996; (g) Pollock et al., 2004; (h) Constantz et al., 1994; (i) FEMAT, 1993; (j) Johnson and Jones, 2000; (k) Beschta et al., 1987: (l) Doughty et al., 1991; (m) Gucinski et al., 2001; (n) Jones et al., 2000; (o) Bisson et al., 1987; (p) Czarnomski et al., 2008; (q) May and Gresswall, 2003; (r) Benda et al., 2002; (s) Reeves et al., 2003; (t) Furniss et al., 1991; (u) Montgomery, 2004; (v) Wemple et al., 1996; (w) Litschert and MacDonald, 2009; (x) Trombulak and Frissell, 2000; (y) Montgomery et al., 2000; (z) Cederholm et al., 1981.

Oil Spills

IMPACTS: ESTUARIES, NEARSHORE, OCEAN

Small oil spills occur quite frequently, and are dealt with under the Water Pollution threat discussion later in this chapter. Here we deal with the potential of large, catastrophic oil spills analogous to the 1989 Exxon Valdez oil spill in Alaska or the 2010 oil spill in the Gulf of Mexico. With the "education" that all of us received as a result of these two disasters, the potential negative effects on salmon populations of such a spill along the outer coast of Washington probably do not need to be enumerated here. Whether a large spill occurred within an estuary (Grays Harbor or Willapa Bay, for example), along the rugged coast of the northern part of the Region, or further out at sea, the consequences for salmon, who use ALL these bodies of water, would likely be dramatic. It is clear that prevention of oil spills is the best, and perhaps the only real, approach to this threat. To that end, this Plan contains the few strategies available, including working to move shipping lanes out further from the shoreline. Even that, however, would probably not totally protect the Coast Region from the effects of a catastrophic oil spill since clean-up technology is far from perfect. The other line of defense against the deleterious effects of a large oil spill is preparedness. We can work to mitigate such effects by putting into place the kind and quantity of equipment and personnel necessary, and by maintaining a coordinated action plan for containment and clean-up. Many segments of our coastal communities and industries will be affected if a catastrophic oil spill should occur. Jurisdiction for response to oil spills lies with the U.S. Coast Guard, and, within Washington State, the Department of Ecology. This Plan seeks to help empower a wide-ranging partnership of coastal industries, people and governments to work to prevent as well as to prepare for any such spill.

Residential and Commercial Development That Impacts Salmon

IMPACTS: ALL HABITATS EXCEPT OCEAN

Residential and commercial land development includes the building of roads, parking lots and other impervious surfaces required by such development. Where it occurs, development is a threat to the health of freshwater, estuarine, and nearshore habitats by disrupting salmon habitat functions and processes, such as natural flows and storage of rainwater, and degrading and fragmenting salmon habitat. Development can also degrade water quality through inputs of contaminants, and reduce cover and functionality of forests (e.g. Quinn, 2005; Van Sickle et al., 2004; Roy et al., 2003). The biological impacts of development on salmon are similar to those from past logging practices (see Table 4 above). In addition, industrial, commercial and residential wastes and disposal practices can add toxic chemicals. Further, the permanence of development can make it much more costly and difficult, if not impossible, to restore ecological processes vital to salmon systems (Burnett et al., 2007; Van Sickle et al., 2004; Beechie et al., 1994). As a result, where it occurs, it is generally considered to be a more severe threat to salmon than timber harvest (Beechie et al., 1994). Nonetheless, salmon habitat in the Coast Region is, on the whole, in much better condition than other areas in Washington because of its low human population and related land development; there are only about 200,000 people in the whole Coast Region (U.S. Census, 2010). This Plan is proactive in protecting salmon habitat as future residential and commercial development is considered in the Coast Region, working to identify and put in place solutions that support both the human population and economy, and healthy salmon populations.

Dredging and Filling

IMPACTS: TRIBUTARIES, MAINSTEMS, ESTUARIES, WETLAND AND OFF-CHANNEL

"Diking, draining, and filling – primarily for urban and industrial development, agriculture and the creation of pasture land – are most common in estuaries and tidal sloughs but also occur in wetlands and floodplains. Loss of estuarine and riverine wetland habitat can potentially affect all salmon" (NRC, 1996, p. 183). "The estuary provides an ideal area of rapid growth [for salmon], and some salmon species are heavily dependent on estuaries, particularly Chinook, chum, and to a lesser extent pink salmon. Estuaries contain new food sources to support the rapid growth of salmon smolts, but adequate natural habitat must exist to support the detritus-based food web, such as eelgrass beds, mudflats, and salt marshes. Also the processes that contribute nutrients and woody debris to these environments must be maintained to provide cover from predators and to sustain the food web. Common disruptions to these habitats include dikes, bulkheads, dredging and filling activities, pollution, and alteration of downstream components such as lack of woody debris and sediment transport." (Smith, 1998, p. 13). Dredging and filling activities have similar deleterious effects in whatever habitat they occur, particularly disruption of normal instream processes and excess and/or inappropriate sediment. In extreme cases, fill from dredging completely clogs salmon habitat. Although dredging and filling are required by some important human and economic activities, this Plan promotes salmon viability as a key consideration when dredging and filling decisions are made, and it promotes solutions that balance the needs of those who propose to dredge with the need for healthy salmon habitats. Jurisdiction over dredging and filling is primarily through the Army Corps of Engineers, with the U.S. Environmental Protection Agency having an oversight role regarding approval of permits.

Removal and/or Lack of Large Woody Material

[Note: "Large Woody Material" (LWM) was until recently known as "Large Woody Debris" (LWD).]

IMPACTS: HEADWATERS/UPLANDS, WETLANDS, TRIBUTARIES, MAINSTEMS, ESTUARIES

"Perhaps no other structural component of the environment is as important to salmon habitat as large woody debris, particularly in coastal watersheds. Numerous reviews of the biological role of large woody debris in streams in the Pacific Northwest (e.g., Harmon et al., 1986; Bisson et al., 1987; Gregory et al., 1991) have concluded that woody debris plays a key role in physical habitat formation, in sediment and organic-matter storage, and in maintaining a high degree of spatial heterogeneity (i.e. habitat complexity) in stream channels" (NRC, 1996, p. 194).

There has been a recent state-wide move to refer to "large woody debris" as "large woody material," to acknowledge the importance of saving it, rather than removing it from streams as was once the practice. The importance of LWM in channel morphology is now widely recognized. Large woody material can be absent from a hydrologic system for several reasons. It may have been removed, or it may not have been present or recruited in the first place. If it has not been recruited, that can be because there are insufficient large trees in proximity to feed the stream or river, or because there are blockages, such as dams, culverts or bridges, that do not allow LWM to move through the system.

As part of the Pacific Northwest's geological history, the rivers in this region have interacted with glacial outwash soils, forming vast alluvial deposits of mostly fine materials, which have been continually reworked by these river systems. As a result, riparian zones and stream channels have little resistance to erosion. In addition, streambeds in this Region rarely contain bedrock formations that influence channel-shaping forces. Therefore, a major channel-influencing factor for the Pacific Northwest coast has been large woody material. The enormous trees that once dominated the landscape played a critical role in creating stream structure and complexity once the trees had been recruited by channel movement or after they had died and fallen. Logs in the channel stabilized streambeds by slowing the flow and absorbing/transferring energy; this occurred mostly as larger pieces became lodged, trapping more jammed wood behind them, and then were at least partially buried, thereby stabilizing the banks of the channel and any associated stream structure. Logs and jams also encouraged the formation of pools through scour. A series of logs jammed in a large river may initially reflect the response to a natural shift in a river's meander over time, then, subsequently, precipitate a shift in the channel meander patterns, creating multiple channels. This leads to braided channel patterns that more or less reflect a dynamic equilibrium, with the islands becoming increasingly vegetated. The result is generally the development of more complex habitat that benefits salmon.[17]

Pools, and the transition areas between pools and riffles, are important habitat for adult and juvenile salmon. The slow water of pools allows the fish to rest, and the depth provides protection from

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[17] See "Pools and "riffles" and "Riparian-Riparian Function" in the Glossary, as well as http://gis.ess.washington.edu/grg/publications/pdfs/Montgomery_and_Abbe.pdf

predators, as well as cooler water. Riffles are fast-moving sections of a stream that exhibit a moderate level of surface disturbance. Riffles are often associated with gravel or cobble streambeds and therefore can be good spawning areas. Many streams and rivers naturally adopt an alternating pool-riffle character. The meandering shape of the channel organizes the energy of the flow such that pools form at the bends and riffles form in the sections between the bends. This configuration provides a good ratio of habitat types for salmon use.[18]

The relative importance of pools depends on their size, depth, cover, and complexity. Riffles and the transition areas to pools, or in some cases uniform channel sections called runs or glides, provide important areas for spawning and cobbled areas for juvenile salmon rearing cover. The gravel/cobble substrate provides the critical production of a large variety of aquatic insects (in particular, macroinvertebrates) that provide essential juvenile salmon prey/food. In contrast, off-channel habitat usually contains only pools with fine substrate used primarily by overwintering steelhead, coho and cutthroat trout, which feed on a homogenous pasture of midge larvae, emerging adult midges, and "no-seeums" (tiny gnats) reared within the fine sediment.

It is almost impossible to overstate the critical role that large woody material plays in creating salmon habitat and sustaining salmon. In their salmon recovery strategies, the four Lead Entity groups in the Coast Region have clearly identified the lack of large woody material as a major problem. This Plan includes strategies to address the problem and support effective and coordinated region-wide solutions.

Shoreline Modification Including Dikes, Levees, Armoring, Bulkheads

IMPACTS: WETLANDS AND OFF-CHANNEL, TRIBUTARIES, MAINSTEMS, ESTUARIES, NEARSHORE

"Aquatic habitats in floodplain areas can be very important for some [salmon] species and life stages . . . that use the sloughs and backwaters of floodplains to overwinter since this provides a refuge from high flows. Floodplains also help dissipate water energy during floods . . . lessening the impact of floods on incubating salmon eggs. Floodplains also provide coarse beds of alluvial sediments through which subsurface flow passes. This acts as a filter of nutrients and other chemicals to maintain high water quality" (Smith, 1998, p. 40).

However, in a cultural and economic system that is built upon land ownership, loss of land to the force of flowing water is countered with bank protection and bank armoring. While bank protection successfully eliminates the impacts on land ownership, the hydrologic system loses an important enriching process. Placement of armoring can also alter the channel migration pattern and divert erosional action further downstream, with unanticipated impacts. If bank armoring is repeated

[18] See http://www.geo.oregonstate.edu/classes/geo582/week_5_2_wood_and_stream_channel_form/montg_etal_wrr_95.pdf

systematically across the landscape, the hydrologic system is at risk of a fundamental reduction in complexity and productivity.

"There are two major types of human impact to floodplain functions. First, channels are disconnected from their floodplain. This occurs laterally as a result of the construction of dikes and levees. The second major type of impact is loss of natural riparian and upland vegetation. Conversion of these (coniferous) forested areas to impervious surfaces, deciduous forest, meadows, grasslands, and farmed fields has . . . eliminated off-channel habitats such as sloughs and side channels, increased flow velocity during flood events, reduced subsurface flows, and simplified channels . . . Disconnection of stream channels from their floodplain due to levee and dike construction increases water velocities, which in turn increase scour of the streambed. Salmon that spawn in these areas may have reduced egg-to-fry survival due to the scour" (Smith, 1998, p.40 - 41).

Similarly, armoring and bulkheads built by landowners along waterways create instream habitats inhospitable to salmon by changing instream flows, simplifying channels, and removing spawning and hiding areas. Roads built in or near the channel migration zones are often protected from erosion with hardened bank armoring, which invariably causes increase flow velocities and scour downstream, compounding problems elsewhere in the system. Dike construction has also eliminated wetlands in the Coast Region, essential for the successful life stages of several salmon species. As climate change increases, wetlands will become more important as refugia. For all these reasons, this Plan focuses on removal or modification of dikes, armoring, bulkheads and the like, beginning with outreach and communication on the negative effects of these constructions, as well as promoting more salmon-friendly shoreline modification alternatives.

The salmon recovery strategies of each of the Lead Entity groups in the Coast Region make it clear that problems for salmon caused by shoreline modification, such as diking and armoring, are top priorities to address.

Agricultural Practices That Impact Salmon

IMPACTS: HEADWATERS/UPLANDS, TRIBUTARIES, MAINSTEMS, ESTUARIES, WETLANDS AND OFF-CHANNEL

Farming is a prevalent land use in the Coast Region, primarily in the southern WRIAs 22, 23, and 24. Many key rivers, streams, and estuarine habitats are in close proximity to agricultural lands. Significant portions of floodplains have been cleared for agricultural purposes while stream channels have been filled or moved, leaving little functioning riparian habitat within many lowland floodplains and estuaries. Historic tidally-influenced salt marsh habitat has been converted to agricultural uses through diking and filling.

Historically, in order to promote successful agriculture, clearing of mature riparian vegetation was encouraged, resulting in degraded riparian habitat throughout floodplains in the Coast Region. Reduced channel complexity and loss of riparian forests contributed to the lack of instream woody material, and therefore reduced instream habitat quality and complexity while also causing increased channel scour and channel cutting along the banks of major stream segments. Channelization of streams, loss of wetlands, and the construction of drainage ditches have altered the hydrology of the Region, increasing the magnitude and severity of peak stream flows and contributing to decreased summer low flow and increased temperatures. Drainage ditches have also been a pathway to bring more pesticides and sediment into stream reaches. Pollutants from farming chemicals and cow manure have made their way into adjacent waterways and adversely affected the water quality of salmon-bearing streams.

Ranching is a significant use of agricultural lands in the Region, and miles of salmon-bearing rivers, streams, and wetlands are not adequately fenced and are therefore accessible to livestock. While in some cases this is intentional to provide drinking water, livestock access to rivers and streams leads to bank trampling, riparian degradation, bank erosion, and water quality degradation.

Like timber harvest, farming is an important human cultural and economic activity in the Coast Region. And like timberlands, agricultural land is far more beneficial and preferable for salmon than urbanized development. A strong and sustainable farming community is key to sustaining Coast salmon populations. The condition of salmon habitats adjacent to agricultural lands has, in many areas of the Region, benefitted directly from voluntary conservation measures and incentive-based programs administered by conservation districts and the US Department of Agriculture. The success of these programs, such as the Conservation Reserve Enhancement Program (CREP) and the Environmental Quality Incentives Program (EQUIP), serve as a model for continuing efforts to support salmon sustainability *and* strong agricultural communities. The newly established Voluntary Stewardship Program (VSP), administered by the Washington Conservation Commission, allows counties and farmers to work together to protect critical areas without creating new critical areas ordinances. This program provides direct benefits to agriculture and salmon and should be promoted and encouraged. New opportunities with environmental markets and ecological services should be explored for their potential benefits to farms and forests.

This Plan is focused on providing information about salmon-friendly agricultural practices and persuading the farming community of their effectiveness and importance. The Plan focuses on the use of incentive-based methods, environmental markets, and strategic acquisitions along critical stretches of habitat, to achieve desired future conditions for streams running through or near agricultural lands.

Roads, Culverts, Bridges, and Other Transportation Infrastructure

IMPACTS: HEADWATERS/UPLANDS, TRIBUTARIES, MAINSTEMS, ESTUARIES, WETLANDS AND OFF-CHANNEL

Poor salmon habitat has been shown to directly correlate to higher road density (Cederholm, et al., 1981). Road construction can negatively impact a myriad of factors affecting salmon habitat, including sedimentation, increases in fine sediments and sediment transport, stream flow characteristics, channel and floodplain complexity, water pollution, and access to spawning areas. Whether roads are gravel or paved, the hardened surfaces (called "impervious surfaces") disrupt natural percolation of rainwater and collect pollutants which then wash off into the nearest stream or wetland. In the case of paved roads, the paving materials themselves can contain pollutants that find their way into the watershed. When a road crosses a river or stream, it is by means of a bridge or culvert, or an associated dike, which may completely cut off the waterway. If a bridge or culvert is not properly engineered according to state and federal protocols, it can seriously disrupt channel and sediment flows, thereby negatively affecting the nature and channeling of the waterway and making it unsuitable for many salmon life stages. Bridges and culverts may become complete or partial barriers to fish passage. Mass wasting, landslides and other results of land destabilization brought about by road construction and road and culvert failures are a major problem in the Coast Region (Smith, 2000).

Another historic problem in the Region is the existence of logging and other roads running near stream channels. These roads restrict the functioning of a viable riparian area and can also separate stream channels from their floodplain, thus constricting the historic channel meander patterns. Roads that are no longer used or needed should be decommissioned and removed. Other roads need to be relocated by using incentives or limiting reliance by governments on "emergency repair" or mitigation programs to continue or correct habitat impacts caused by these roads. All four of the Lead Entity groups' salmon recovery strategies identify culverts and other road infrastructures as major hindrances to salmon viability in their area.

Water Pollution from Developed Land, Stormwater and Wastewater Pollution

IMPACTS: HEADWATERS/UPLANDS, WETLANDS AND OFF-CHANNEL, TRIBUTARIES, MAINSTEMS, AND ESTUARIES

History has provided the clearest lessons about water pollution in the Coast Region. "Anaerobic conditions often occurred in upper Grays Harbor, the estuary of Washington's Chehalis River system, during the 1920s and 1930s in response to effluents from two sulfite pulp mills, three municipal sewage-treatment plants, and agricultural runoff (Ericksen & Townsend, 1940). One pulp mill, built in 1928 near the mouth of the Hoquiam River in Grays Harbor, exerted a biochemical oxygen demand of 115,000 kg/d, a load equivalent to the raw sewage produced by 1.4 million people (Seiler, 1989)." This is in a county whose population 80 years later, in 2010, was only about 72,000 (U.S. Census, 2010).

"Water quality was degraded during low river flows from May to October into Grays Harbor and was severely damaging to chinook, coho, and steelhead. This apparently did not substantially affect chum salmon, which emigrated earlier than the other species and did not rear in the upper estuary. Pollution-abatement efforts have reduced sewage and industrial discharges over the last two decades and the upper estuary is no longer anaerobic in summer, but experimental releases of smolts from hatcheries upstream have shown that pollution still exists in Grays Harbor and that exposure of smolts to poor water quality has reduced seawater adaptation, increased infestation by a trematode parasite, lowered disease immunity, and possibly increased vulnerability to predation by birds and squawfish. Smolts in the Chehalis River system survive at roughly half the rate of smolts from a nearby, relatively unpolluted river (Seiler, 1989)" (NRC, 1996, p. 198).

Water pollution has many causes, including the impervious surfaces in residential and commercial developments, improperly managed industrial effluents or spills, improper disposal of waste, ineffectiveness of local regulatory ordinances, and the cumulative effects of small oil spills and many individual decisions to improperly dispose of polluting products. Demands for increased withdrawal from these surface waters further increases the concentration and levels of pollution encountered by the salmon that use these areas.

In addition, the overall health of instream processes, determined by many other threats discussed in this chapter, can directly affect the ability of a waterway to mitigate the effects of various levels of pollutants in more or less effective ways. As with other threats, wide-ranging outreach and communication, as well as data collection, are strategies to overcome the negative effects of water pollution in the Coast Region.

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CHAPTER 4
DESIRED OUTCOMES: VISION, GOALS, AND OBJECTIVES

Vision

The Plan's vision is what the Washington Coast Region should look like in the future:

> **All watersheds in the Washington Coast Region contain healthy, diverse and self-sustaining populations of salmon, maintained by healthy habitats and ecosystems, which also support the ecological, cultural, social, and economic needs of human communities.**

Goals

In order to achieve this vision, several key goals have to be met along the way. The first was articulated in 2007 as a reason to form the Washington Coast Sustainable Salmon Partnership:

> **Avoid additional ESA listings and further diminished [salmon] populations in the Washington Coast Region through sustainability instead of ESA recovery planning.**
>
> (Triangle, 2007)

Over the course of this planning process, the following additional goals have been formulated and agreed upon by scientists, tribal leaders, policy makers, and concerned citizens. It is through achieving each of these that our vision will be realized.

- All of the region's salmon habitats and offshore waters are in a condition that will sustain healthy salmon populations.
- Regional land use decisions are benign in regards to salmon habitat and/or any damage from those decisions is effectively mitigated.
- Regional hatchery practices do not impair wild fish populations and, where appropriate, will help to protect them.
- Harvest of salmon – commercial, recreational, subsistence and ceremonial – help to support vibrant economies and communities without negatively impacting the sustainability of salmon populations.

These goals are as much about people as they are about salmon. Only through changes in people's behavior can we achieve our vision of biologically diverse and productive ecosystems, resilient to disturbances and climate change, for the benefit of the Washington Coast Region's salmon and people. It is through encouraging changes in behavior that we seek to protect our watersheds so that within them there are strong and sustainable wild salmon populations far into the future.

Ultimately, though, our success will be measured by the strength and diversity of salmon populations.

Species Objectives

Many of the Washington Coast's salmon populations are in decline while some, particularly coho, appear to be doing well in recent years. Rather than focusing on only those populations in decline, this Plan's approach is to look at entire watersheds and to help create the conditions that support fully functioning, biologically diverse, natural ecosystems. Following this model, the Plan's primary objective is to maintain all Coast Region salmon populations at sustainable and harvestable levels[19].

> **By 2040, salmon populations that comprise all or portions of the seven Evolutionarily Significant Units of sockeye, coho, chum and chinook salmon and two Distinct Population Segments of steelhead within the Washington Coast Region consistently meets intrinsic habitat potential and exceed sustainable harvest.**

Habitat Objectives

The habitats in which salmon spend their lives are varied – from small streams and wetlands where coho rear, to the open ocean where they all grow to adulthood. Different life stages of the different species depend upon specific habitats and specific conditions within those habitats. After the first planning workshop identified eight habitats critical to salmon life history (see Chapter 1), technical experts identified which life stages are dependent upon each habitat, which species' needs are most inclusive of all other salmon species needs, and what conditions meet those needs.

From these specific conditions we extrapolated the specific, measurable objectives we must achieve in each of the eight identified habitats. For the purposes of the Plan, each salmon habitat is defined by how it is used by salmon rather than as a standardized water body definition. These definitions are at the beginning of each habitat heading below. Tables listing the indicators of each habitat objective are below. For complete details and explanations of specific metrics, see Appendix 7, Habitat Viability Charts and Assessments.

[19] Harvestable levels describe a population's or stock's size (measured as abundance or escapement) above a point at which exploitation (described as "take" or "harvest") will not reduce escapement to a point below which the population would not be expected to be able to sustain itself.

HEADWATERS/UPLANDS

For the purposes of this Plan, Headwaters and Uplands were defined as ***all those parts of the landscape in any watershed above which salmon are not found*.** This includes streams above fish access, generally a 20% gradient, and *all* uplands, whether forest, farm or town. Although salmon do not use headwaters/uplands directly, what happens there affects environment and habitat downstream.

Headwaters/Uplands Objectives:

By 2040, an ecologically significant extent of headwater landscape areas across the Washington Coast Region will have functional processes that support healthy downstream conditions for salmon, including:

- Water quality conditions, including, but not limited to, temperature, dissolved oxygen, and turbidity levels that are necessary for salmon health at all freshwater life stages;
- Conditions that support sufficient water quantity for salmon spawning and rearing;
- Sufficient buffer widths on streams and wetlands, and intact natural habitat to provide adequate large woody material (LWM), shade, channel diversity/connectivity, spawning gravel, and refugia; and
- General conditions that provide appropriate amounts of clean gravel of suitable sizes for spawning.

Table 5: Objectives for Headwaters/Uplands

INDICATOR	CONDITION to support SALMON LIFE STAGES		
Water Quality	**Spawning**	**Core Summer Habitat**	**Rearing and Migration**
Temperature	Exceeds 13° C less than 7 days per year	Exceeds 16° C less than 7 days per year	Exceeds 17.5° C less than 7 days per year
Dissolved Oxygen	Occurrences below 6.5 mg/L less than 7 days per year (Rearing and Migration)		
Turbidity	Does not exceed 5 NTUs over BC when BC is ≤50 NTUs, or does not exceed a 10% increase over BC when BC is >50 NTUs		
Uplands Condition	**Juvenile Rearing/Foraging**		
Riparian Buffer Widths	50' – 100'		
Riparian Condition and Composition	Riparian reserve system provides adequate shade, LWM recruitment, connectivity, and includes known refugia 80 - 90% intact; 50 - 75% riparian vegetation similar to potential natural community/composition		
Sediment Needs	**Spawning**		
Gravel Abundance	Clean spawning gravel present in majority of watershed as appropriate to geomorphic setting		
Water Quantity	**All Life History Stages**		
Riparian Forest Seral Stage	Approaching maturity		

WETLANDS, SMALL LAKES, AND PONDS

For the purposes of this Plan, Wetlands, Small Lakes, and Ponds became somewhat of a catch-all habitat. In other words, these are the places that are ***important as fish habitat but that do not fit any of the definitions of the other habitats.***

<u>Wetlands, Small Lakes, and Ponds Objective</u>:

> **By 2040, critical wetland habitat that is part of the anadromous fish network across the Washington Coast Region will exist, be accessible, and provide increased capacity and healthy conditions for salmon populations, including:**

- Water quality conditions, including, but not limited to, temperature, dissolved oxygen, and turbidity levels that are necessary for salmon health at all freshwater life stages;
- Sufficient buffer widths and intact natural habitat to provide adequate LWM, refugia, and shade;
- Sufficient nutrient forage (native in-water vegetation) to support abundant juvenile salmon populations;
- High connectivity with sufficient access to refugia and migration routes to support abundant salmon populations; and
- General conditions that provide appropriate amounts of clean gravel of suitable sizes for spawning.

Table 6: Objectives for Wetlands, Small Lakes, and Ponds

INDICATOR	CONDITION to support SALMON LIFE STAGES		
Water Quality	**Spawning**	**Core Summer Habitat**	**Rearing & Migration**
Temperature	Exceeds 13° C less than 7 days per year	Exceeds 16° C less than 7 days per year	Exceeds 17.5° C less than 7 days per year
Dissolved Oxygen	Below 8.0 mg/L (includes rearing and migration) less than 7 days per year	Below 9.5 mg/L less than 7 days per year	Below 6.5 mg/L (rearing only) less than 7 days per year
Turbidity	Does not exceed 5 NTUs over BC when BC is ≤50 NTUs, or does not exceed a 10% increase over BC when BC is >50 NTUs (spawning and incubation)		
Riparian Condition	**All Life History Stages**		
Buffer Widths	100' – 200' for wetlands greater than 1 acres 50' – 100' for wetlands less than 1 acre		
Riparian Condition and Composition	Riparian reserve system provides adequate shade, LWM recruitment, connectivity. Known refugia 80-90% intact; 50-75% riparian vegetation similar to potential natural community/composition		
In-water Vegetation	**Juvenile Rearing/Foraging**		
Dominance of native v. non-native species	Community structure dominated by native species, but some exotic species may be present		
Floodplain/Connectivity	**Juvenile Holding**		
Habitat Refugia	Habitat refugia are still present in a majority of the watershed. Existing refugia have adequate buffering		
Sediment Needs	**Spawning/Incubation**		
Fines and Embeddedness	12% - 14% or less		

TRIBUTARIES

For the purposes of this Plan, Tributaries were defined as ***fish bearing streams with a mean annual flow less than 1,000 cubic feet per second (CFS)*** in recognition that flow is a critical factor in salmon use. This definition was derived from the Washington State definitions of Waters of Statewide Significance (http://www.ecy.wa.gov/programs/sea/sma/st_guide/jurisdiction/SSWS.html).

Tributaries Objective:

By 2040, Washington Coast Region tributary streams that provide critical salmon habitat will have:

- Water quality conditions, including, but not limited to, temperature, dissolved oxygen, and turbidity levels that are necessary for salmon health at all freshwater life stages;
- Conditions that support sufficient water quantity for salmon spawning and rearing;
- Sufficient buffer widths and intact natural habitat to provide adequate LWM, shade, channel diversity/connectivity, spawning gravel, macroinvertebrate habitat and refugia;
- Sufficient macroinvertebrates and nutrient forage (native in-water vegetation) to support abundant juvenile salmon populations;
- Connected key habitats, including floodplains, pools and off-channel; and
- General conditions that provide appropriate amounts of clean gravel of suitable sizes for spawning.

Table 7: Objectives for Tributaries

INDICATOR	CONDITION to support SALMON LIFE STAGES		
Water Quality	**Spawning**	**Core Summer Habitat**	**Rearing & Migration**
Temperature	Exceeds 13° C less than 7 days per year	Exceeds 16° C less than 7 days per year	Exceeds 17.5° C less than 7 days per year
Dissolved Oxygen	Below 8.0 mg/L less than 7 days per year (includes rearing and migration)	Below 9.5 mg/L less than 7 days per year	Below 6.5 mg/L less than 7 days per year (rearing only)
Turbidity	Does not exceed 5 NTUs over BC when BC is ≤50 NTUs, or does not exceed a 10% increase over BC when BC is >50 NTUs		
Riparian Condition	**All Life History Stages**		
Buffer Widths	100' – 215' or more		
Riparian Condition and Composition	Known refugia 80-90% intact; 50-75% riparian vegetation similar to potential natural community/composition		
Large Woody Material	LWM recruitment is frequent in majority of watershed		
Floodplain/Connectivity	**Spawning/Incubation, Juvenile Rearing,**		
Aquatic Types & Conditions	Present off-channel habitat areas are accessible at least during the winter and spring flows. Riparian and floodplain areas are generally well connected to upstream and downstream areas.		
Forage Abundance	**Juvenile Rearing/Foraging**		
Macro-Invertebrates	Multimetric IBI score: 30-40		
Marine Derived Nutr.	Consistently meets escapement goals (juvenile rearing/foraging)		
Abundance	**Adult Migration**		
Run Size	Meets intrinsic habitat potential and exceeds sustainable harvest		
Water Quantity	**Spawning/Incubation, Juvenile Rearing/Foraging**		

Hydrology	Hydrologic regime has minimal changes from undisturbed conditions. One element may have been modified. Effect is felt primarily in a portion of the basin rather than throughout the watershed.
Pool Frequency	**Juvenile Rearing/Foraging, Juvenile Outmigration**
	Pools with sufficient depth and surface cover frequent throughout watershed.
Sediment Needs	**Spawning and Incubation**
Fines & Embeddedness combined	12% - 14%
Gravel	Dominant substrate is gravel or cobble

LAKES

For the purposes of this Plan, Lakes were defined, specifically, as ***the three lakes within the region that support sockeye populations: Ozette, Pleasant, and Quinault***. Other lakes are few and relatively small and are categorized with Wetlands, Small Lakes, and Ponds in this plan.

Sockeye Lakes Objective:

By 2040, the Washington Coast Region sockeye lakes (Ozette, Pleasant, and Quinault) will have:

- Water quality conditions, including, but not limited to, temperature, dissolved oxygen, and turbidity levels that are necessary for salmon health at all freshwater life stages;
- Natural riparian conditions, with adequate buffer widths, to provide adequate LWM, refugia, and shade;
- Sufficient zooplankton and nutrient forage (native vegetation) to support abundant juvenile salmon populations;
- Connectivity with streams for migration and, in the case of Lake Quinault (and sometimes Lake Ozette) for spawning; (For channel-spawning sockeye, see Tributaries for desirable conditions regarding buffers, LWM, etc.)
- Conditions that provide appropriate amounts of clean gravel of suitable sizes for lake spawners (Lake Pleasant and Lake Ozette).

Table 8: Objectives for Sockeye Lakes

INDICATOR	CONDITION to support SALMON LIFE STAGES		
Water Quality	**Spawning/Incubation**	**Core Summer Habitat**	**Rearing & Migration**
Temperature – exceedances per year	Exceeds 13° C less than 7 days per year	Exceeds 16° C less than 7 days per year	Exceeds 17.5° C less than 7 days per year
Temperature - °C	7° to 13° diel thermocycle (Juvenile Rearing/Foraging)		
Dissolved Oxygen	Below 8.0 mg/L less than 7 days per year (includes rearing and migration)	Below 9.5 mg/L less than 7 days per year	Below 6.5 mg/L less than 7 days per year (rearing only)
Turbidity	Does not exceed 5 NTUs over BC when BC is ≤50 NTUs, or does not exceed a 10% increase over BC when BC is >50 NTUs (Spawning/Incubation)		
Shoreline Condition	**Juvenile Rearing/Foraging**		
Buffer Widths	100' – 215'		
Riparian Condition and Composition	Riparian reserve system provides adequate shade, LWM recruitment, and connectivity. Known refugia 80-90% intact; 50-75% riparian vegetation similar to potential natural community/composition		
Forage Abundance	**Juvenile Rearing/Foraging**		
Zooplankton Trawl Index	Mix of large non-evasive and small or evasive prey (e.g., Diaphanosoma)		

MAINSTEMS

Similar to the flow rationale defining Tributaries, for the purposes of this Plan, Mainstems are defined as ***rivers and streams with a mean annual flow of 1,000 CFS or greater***, also known as shorelines of statewide significance west of the Cascades.
(http://www.ecy.wa.gov/programs/sea/sma/st_guide/jurisdiction/SSWS.html). A list and description of all Mainstem Rivers in the Coast Region is located in Appendix 9.

Mainstems OBJECTIVE:

By 2040, an ecologically significant extent of critical mainstem rivers in the Washington Coast Region will have:

- Water quality conditions, including, but not limited to, temperature, dissolved oxygen, and turbidity levels that are necessary for salmon health at all freshwater life stages;
- Sufficient buffer widths and intact natural habitat to provide adequate LWM, shade, channel diversity/connectivity, and spawning gravel;
- Connected key habitats, including floodplains and off-channel; and
- General conditions that provide appropriate amounts of clean gravel of suitable sizes for spawning.

Table 9: Objectives for Mainstems

INDICATOR	STATUS to support SALMON LIFE STAGES		
Water Quality	Spawning	Core Summer Habitat	Rearing & Migration
Temperature	Exceeds 13° C less than 7 days per year	Exceeds 16° C less than 7 days per year	Exceeds 17.5° C less than 7 days per year
Dissolved Oxygen	Below 8.0 mg/L less than 7 days per year (includes rearing and migration)	Below 9.5 mg/L less than 7 days per year	Below 6.5 mg/L less than 7 days per year (rearing only)
Turbidity	Does not exceed 5 NTUs over BC when BC is ≤50 NTUs, or does not exceed a 10% increase over BC when BC is >50 NTUs		
Riparian Condition	All Life History Stages		
Buffer Widths	100' – 215'		
Riparian Condition and Composition	Riparian reserve system provides adequate shade, LWM recruitment, and connectivity. Known refugia 80-90% intact; 50-75% riparian vegetation similar to potential natural community/composition		
Large Woody Material	LWM recruitment is frequent in majority of the watershed		
Floodplain/Connectivity	Juvenile Rearing/Foraging		
Aquatic Types and Conditions	Present off-channel habitat areas are accessible at least during the winter and spring flows. Riparian and floodplain areas are generally well connected to upstream and downstream areas		
Sediment Needs	Spawning/Incubation		
Fines and Embeddedness	12% - 14%		
Abundance	Adult Migration		
Run Size	Meets intrinsic habitat potential and exceeds sustainable harvest		

ESTUARIES

For the purposes of this Plan, Estuaries are defined as ***the area from the head of tide to the outermost headlands separating the estuary from the ocean***. This necessarily includes sections of rivers that would generally be considered mainstems, but their categorization as a part of the estuary is in recognition of how they are most used by salmon.

Estuaries OBJECTIVE:

By 2040, estuaries of importance for salmon populations in the Washington Coast Region will have increased quantity of functioning salmon habitat, improved connectivity, and conditions that support salmon abundance, including:

- Water quality conditions including, but not limited to, temperature, dissolved oxygen, and turbidity levels that are necessary for salmon health at estuarine life stages;
- Sufficient buffer widths and intact natural habitat to provide adequate LWM, refugia, and shade;
- Increased extent of eelgrass and other native aquatic plants to provide refugia;
- Sufficient forage prey to support abundant salmon populations; and
- More than 80% of historic extent of estuary area in natural state.

Table 10: Objectives for Estuaries

INDICATOR	STATUS to support SALMON LIFE STAGES
Water Quality	Adult Migration/Staging
Temperature	16.0° or less
Dissolved Oxygen	5.0 mg/L or more
Sediment/Nutrient Input	Moderate interruption of estuarine circulation and nutrient and sediment delivery (All life history stages)
Shoreline Condition	All Life History Stages
Buffer Widths	100' – 215'
Condition and Composition	Riparian reserve system provides adequate shade, LWM recruitment, and connectivity. Known refugia 80-90% intact; 50-75% riparian vegetation similar to potential natural community/composition
Large Woody Material	Large-sized (key piece) LWM recruitment frequent in majority of watershed
Forage Abundance	Juvenile Rearing/Foraging
Mudflat Productivity	100 – 500 k. per square meter *corphium salmonis*
% coverage of Eelgrass	
Forage Fish Abundance – herring, sandlance	
Estuarine Extent	All Life History Stages
% intact historic	Estuary provides for most (greater than 80% intact) of its historical area extent and diversity of shallow water habitat types including vegetated wetlands and marshes, tidal channels, submerged aquatic vegetation, tidal flats and large woody material.
Abundance	All Life History Stages
Run Size	Meets intrinsic habitat potential and exceeds sustainable harvest

NEARSHORE

For the purposes of this Plan, the Nearshore habitat is ***that part of the ocean from the ordinary high water line of the shore out to a depth of 60 feet, otherwise known as the photic zone***.

Nearshore OBJECTIVE:

By 2040, nearshore habitats of the Washington Coast Region will be functional and in good ecological condition, with:

- Maintained or improved nearshore water quality, eelgrass and kelp to support salmon at relevant life stages (smolt, juvenile, migrating adults).
- Maintained or improved habitat that supports abundant Nearshore forage fish populations (e.g., surf smelt)

Table 11: Objectives for Nearshore

INDICATOR	STATUS to support SALMON LIFE STAGES
Water Quality	Juvenile Rearing/Foraging, Adult Foraging
% coverage of kelp in reference areas	
Forage Abundance	
Trends in nesting success of seabirds Rhinoceros Auklet on Tatoosh & Destruction Islands	
Surf smelt abundance	

OCEAN

For the purposes of this Plan, the Ocean is defined as ***everything waterward of a depth of 60 feet***. Although we have no role or capacity to participate in management of the oceans, and the Coast Region's salmon migrate far outside what could be considered Washington State waters, it is in this habitat where salmon spend the majority of their lives. This critical habitat is included in the Plan to emphasize its importance to all salmon.

Ocean OBJECTIVE:

In 2040 the ocean environment will continue to support and/or have improved conditions necessary for the production of a sufficient prey base to sustain abundant juvenile and adult salmon populations.

Table 12: Objectives for Ocean

INDICATOR	STATUS to support SALMON LIFE STAGES
PDO	Juvenile Foraging
Annual Trend in the PDO Index	Cool regime <10 years
ENSO	(Sub)Adult Foraging
Annual Trend in the ENSO Index	Normal variation
Forage Abundance	(Sub)Adult Foraging
Annual Copepod Diversity Index	Mix of low-fat Southern and high-fat Northern Zooplankton
Juvenal Salmon Sampling	(Sub)Adult Foraging
Annual June Spring Chinook Juvenile Samplings	3 to 5 per kilometer towed
Annual September Coho Juvenile Sampling	3 to 5 per kilometer towed
Water Quality	(Sub)Adult Foraging
Ocean Acidity (pH)	7.9 or higher

Time Frame

Thirty years to reach the Plan's objectives is based on the recognition that many critical habitat objectives will only be reached when an ecologically significant extent of freshwater and estuarine riparian forests in the region begin to approach maturity. Functioning riparian habitat is an essential link in the chain of ecosystem function.

In 1999 the Forest and Fish Law was passed and changes made to forest practice rules (Title 222 WAC). Since then, state and private forest lands have been guided by standards for forest practices, particularly road construction and riparian buffers, implemented specifically to protect and restore aquatic habitat.

Under these rules, by 2040 most existing riparian forest buffers in the Coast Region will begin to approach maturity and, in turn, begin to meet the Plan's habitat objectives for riparian condition and composition. When riparian habitats reach this point it will lead directly to measurable improvements throughout the freshwater ecosystems. That, together with other habitat restoration and protection efforts made during that time, will ensure that we meet our objectives.

This Plan seeks to avoid additional ESA listings by restoring and protecting habitats at an ecosystem scale, by helping to steer regional land use toward supporting salmon sustainability, and by encouraging hatchery and harvest practices that protect wild salmon populations while ensuring harvest levels that will help support local communities and maintain sustainable economies.

A broad coalition of partners is already working toward many of the Plan's goals and objectives. WCSSP seeks to bring coherence and focus to the efforts of many by also building broader and more inclusive partnerships, and by increasing coordination and cooperation.

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CHAPTER 5
STRATEGIES AND ACTIONS

Overarching Partnership Strategy

ORGANIZE, PROMOTE & MAINTAIN BROAD PARTNERSHIPS THAT SUPPORT WILD SALMON SUSTAINABILITY

When the Washington State legislature created the Lead Entity Program[20] in 1998, it had the foresight to encourage the organization of salmon recovery around natural watersheds, not man-made jurisdictional boundaries, which often crisscross over several watersheds. This structure has two immediate benefits:

- It directs us to work in the same way that salmon live, in watersheds; and
- It requires us to work in partnerships involving the many people, groups and jurisdictions that have interest in a watershed.

The four Lead Entity Groups that make up the Washington Coast Sustainable Salmon Partnership ("WCSSP") have for many years each exemplified the partnership of citizens, governments, and non-profit organizations. This meant that WCSSP was itself formed on a strong foundation of partnerships; in fact, arguably the most potent motivation for the four Lead Entities to form the WCSSP partnership was their increased ability to achieve their goals if they grouped together. This motivation has overcome many differences in perspective, in resources, in the nature of their watersheds, and in what different partners view as "best available science." Just during the planning process, it has become evident that we can resolve differences in order to focus on action; that, contentious as it can be, everybody needs to "be at the table" to achieve any goal. It is also clear that many citizens, local groups, governments, and non-profit organizations are interested in supporting work to "protect the best and restore the rest" salmon and habitats in the Washington Coast Region.

Partnerships are not only required by the scale and nature of our task, but are also the most powerful way to achieve our goals. In addition, establishing partnerships to protect and sustain wild salmon will immeasurably strengthen the "capacity" of the Region to achieve its vision and goals and create a solid foundation for all future action. WCSSP, along with its founding Lead Entity Groups, is uniquely suited to strengthen these interactions because, like the Lead Entities, its only "interests" are salmon protection, restoration and sustainability. WCSSP can bring together people and groups that might not otherwise sit

[20] Within the Salmon Recovery Act (Chapter 77.85 RCW). Online at: http://apps.leg.wa.gov/rcw/default.aspx?cite=77.85

down and talk, whether for economic reasons, ideological reasons, lack of resources, or merely the opportunity to do so.

Over a period of two years (2009 – 2011) the WCSSP planning process organized and facilitated ten workshops that brought together over 65 people with varying perspectives to build this Plan. (See Appendix 13 for a full description of the Planning Process and Analyses.) The ideas for actions to protect and preserve wild salmon in the following strategies were all generated through this process. As we worked through the planning process, it became evident that to **Organize, Promote and Maintain Broad Partnerships** should serve as the overarching strategy in support of our goal of saving salmon. Every strategy within the Plan will be best served if we keep in mind that building partnerships is the most practical and powerful way to implement actions and to achieve each strategy's objectives.

Strategies and Actions

A day-long workshop in September 2010 identified the top twelve threats to salmon sustainability in the Coast Region (see Chapter 3), based on the salmon and salmon habitat viability assessment completed earlier in 2009 and 2010 in a series of workshops. These twelve threats were carried forward into a two-day workshop in November 2010 when strategies were developed that respond to each threat. This process involved:

- an original brainstorming and selection session carried out by break-out groups of experts and others particularly interested in that threat; and
- vetting and refinement by the larger workshop group.

This process resulted in twenty-four (24) specific strategies for salmon sustainability, which the larger workshop group then categorized into five strategy "themes":

EDUCATE AND INVOLVE THE COMMUNITY TO PROTECT, RESTORE AND MAINTAIN ECOSYSTEM VALUES

PROTECT AND RESTORE SALMON HABITAT FUNCTION

SUPPORT HATCHERY AND HARVEST PRACTICES CONSISTENT WITH WILD SALMON SUSTAINABILITY

USE ECONOMIC TOOLS TO PROTECT, RESTORE AND MAINTAIN ECOSYSTEM VALUES

IMPROVE REGULATORY EFFECTIVENESS TO ACHIEVE SALMON SUSTAINABILITY

In February and March 2011, five separate, full-day workshops, each centered around one of the strategy themes above, further refined and focused the original twenty four (24) strategies and identified sub-actions for WCSSP and key partners to advance the Plan's goals and objectives.

These strategies are presented in the following pages in the order listed above. Setting priorities across strategies and actions and phasing or sequencing actions will be part of next steps in implementation planning. In keeping with the overarching, broad Partnerships strategy, it is important to recognize that this Plan contains far more strategies and actions than WCSSP alone can accomplish.

A. EDUCATE AND INVOLVE THE COMMUNITY TO PROTECT, RESTORE AND MAINTAIN ECOSYSTEM VALUES

There are six strategies to Educate and Involve the Community to Protect, Restore and Maintain Ecosystem Values:

Strategy A1	**Create a WCSSP Communication and Outreach Program that Builds Salmon Awareness and Community Action**
Strategy A2	**Communicate Climate Change Tools, Research, and Information to Public Officials and Local Communities**
Strategy A3	**Work to Inform Officials, Landowners, Industry, Business, Agencies, and the Public about Invasive Species**
Strategy A4	**Inform Public Officials and Increase Public Outreach on Environmental Values to Make Shoreline Modification more Salmon-Friendly**
Strategy A5	**Reach Out to Public Officials, Landowners and Others about the Value of Preserving Marginal Land**
Strategy A6	**Educate Local Elected Officials and Residents about Stormwater and Wastewater Pollution**

STRATEGY A1: CREATE A WCSSP COMMUNICATION AND OUTREACH PROGRAM THAT BUILDS SALMON AWARENESS AND COMMUNITY ACTION

ADDRESSES ALL THREATS

The purpose of the WCSSP Communication and Outreach Program will be to increase awareness in coastal communities of the importance of salmon to their communities and to foster a legacy of commitment to salmon restoration and sustainability. The program intends to accomplish this strategy by reaching out to four groups: children, youth and schools; the general public; landowners and other individual decision makers; and official decision makers.

In all five strategy theme workshops, communication and outreach came up time and time again as an important component of and prerequisite for WCSSP's success in protecting salmon in the Coast Region. Many of those who have been deeply involved in salmon recovery have pointed to changes in fundamental human attitudes as perhaps the most important component required to preserve salmon into the future.

To accomplish this, WCSSP needs to spend some time and effort to explicitly develop an effective, creative and comprehensive Communication and Outreach Program, based on both current research as to what constitutes the most effective outreach and the on-the-ground experience of those who have worked on outreach, communication and education in the Region.

By supporting education efforts in schools and other outreach programs for youth, we can help upcoming generations understand the importance of salmon, the needs of salmon and the efforts necessary to maintain their self-sustained existence.

Through communication and outreach efforts directed at the public in general, and individual decision-makers such as landowners in particular, we can create opportunities for learning from one another, and encourage the dissemination of facts about salmon sustainability. Such outreach efforts may include forums and conferences, events like watershed festivals, public meetings, and citizen-science projects.

Finally, an effective communication program should include outreach to official decision makers, including elected and appointed government officials. The aim here will be to increase their knowledge of salmon sustainability issues, and bring both the best, latest science and a broader range of local perspectives into official decision making.

[Note: Throughout this and all later sections on strategies in this Chapter, actions are labeled "Action 1, Action 2, etc." for identification purposes only; no prioritization is implied.]

Action A1.1: Create a WCSSP communication and outreach program based on current research into the most effective outreach methods as well as the experiences of those who've been doing outreach in the Coast Region

a. Collect the most recent and credible research on effective outreach, communication and education methods.
b. Convene and staff a committee of experts within the Coast Region tasked with creating a WCSSP Communication and Outreach Program to propose to the WCSSP Board of Directors.

Action A1.2: Develop school-based curricula and youth-oriented programs for salmon sustainability

a. Work with teachers, parents, school boards and others to design and provide resources for in-school and after-school salmon education and involvement programs where such programs or activities don't already exist.

b. Find long-term funding sources for school-based salmon activities.
c. Engage young people in “citizen science” (see Glossary) projects that build active involvement in salmon sustainability.
d. Support local organizations and events such as the Marine Resource Committees (MRCs), the Chehalis Basin Partnership’s Chehalis Watershed Festival, and the Ocean Shores Interpretive Center in their work with young people, and encourage other localities to create similar organizations and activities.

Action A1.3: Use the most effective means to build community and official awareness of salmon sustainability issues and needs

a. Create and/or support campaigns that explain how many small, individual actions can make a difference in sustaining salmon in local communities.
b. Make our messages relevant to people by tailoring them to specific audiences, working with people to identify sustainability issues and solutions within their own watersheds.
c. Develop a Communication and Outreach Program component focused on informing the public about fish barrier removal.
d. Work to correct misconceptions about salmon and salmon habitat, such as “all hatcheries are bad for salmon,” “now and in the future, hatcheries are the only way to supplement salmon populations,” “salmon need deep water only,” “beaver dams block salmon movement,” and “we have to clear large wood out of streams for the salmon.”
e. Based on the best available science of outreach effectiveness, use the appropriate variety of tools to get key messages across, including established means like newspaper articles and signage at recreational sites, and newer tools like videos, website content and social networking presence.
f. Cultivate opportunities for WCSSP to “be at the table” where official decisions about salmon are made.

STRATEGY A2: COMMUNICATE CLIMATE CHANGE TOOLS, RESEARCH, AND INFORMATION TO PUBLIC OFFICIALS AND LOCAL COMMUNITIES

ADDRESSES THREAT: CLIMATE CHANGE

The purpose of this strategy is to present the highly technical subject of climate change to public officials, their staffs and members of the public in a way that encourages an understanding of its processes and effects, as well as the need for timely participation in projects and behavior that reduces its impacts on the ecosystem.

Making smart decisions about salmon and climate change depends on having good scientific and specific local information readily available to the community. While the public is aware of climate change, it is essential to reiterate how it will change the local ecosystem through temperature increases, loss of snow pack in higher elevations, flooding, erosion and storms, all of which will directly affect forestry, salmon and aquaculture.

Many leaders and residents are not fully aware of current climate change science and there are still many misconceptions about climate change. Presentations can be made to elected and appointed officials. Up-to-date information could be made accessible to a range of groups from school age youth to landowners and planners in appropriate and understandable publications, models, and Internet links. This will help bring about greater personal understanding of climate change information and a greater desire to make changes that will, in turn, bring long-term benefits to salmon.

Action A2.1: Make climate change science understandable, accessible, applicable, and specific to communities and their leaders to encourage future decisions that are informed and salmon-friendly

a. Decide on the most important messages about climate change for specific local communities and include them in the WCSSP Communication and Outreach Program. Where necessary, address the belief that climate change doesn't exist.
b. Develop and publicize a list of online climate change data and interactive programs.
c. Link climate change information to impacts on local salmon populations.
d. Disperse information to both adult and school populations about small steps that will make a difference, with a focus on what individuals can do.
e. Communicate to landowners the need to plan for changing conditions on their property.

Action A2.2: Work with organizations and agencies currently involved in climate change

a. Bring climate change information, data, and science solutions to county, city, and tribal planning processes.
b. Encourage the use of climate change data in making fish and habitat management decisions.
c. Get climate prediction modeling incorporated into land use and other planning decisions.
d. Support the dissemination of climate change information from work done by the University of Washington Climate Impact Group and the Washington State Department of Ecology.

STRATEGY A3: WORK TO INFORM OFFICIALS, LANDOWNERS, INDUSTRY, BUSINESS, AGENCIES, AND THE PUBLIC ABOUT INVASIVE SPECIES

ADDRESSES THREAT: INVASIVE SPECIES

The purpose of this strategy is to inform public officials and citizens about the way invasive species outcompete and replace native species, how and why this is important to them, and how they can help to prevent and/or eradicate invasive species, and restore native plants and animals.

There are a number of ways invasive plant and animal species spread into our river systems. These are often overlooked or not fully understood. Washing boats, equipment, tools, and shoes after use are simple, effective ways to reduce cross pollination and transfer of unwanted specimens into new areas, which would otherwise result in the spread of invasive species. As an example, sport fishermen have been known to bring non-native, invasive fish species into lakes, unaware of the impact this has on native fish. Another way invasive plants spread is by people discarding weeds or weed clippings in empty lots or dumpsites. Information about proper disposal and control methods are available from county noxious weed boards. Instructive materials intended to create awareness and clearly illustrate best practices need to be made available to boaters, farmers, landscapers, sportspersons, and citizens in general.

Combating invasive species in the Coast Region could be more effective if there was wider sharing of information about how specific invasive species affect salmon, where they are, and the best ways to remove them. Ultimately, this effort will lead to increased awareness and a legacy of improved stewardship that not only eliminates existing invasive infestations that impact salmon, but also prevents new ones.

Action A3.1: Identify the key invasive species of concern and the best existing on-the-ground efforts to prevent and/or eliminate them

a. Identify the work on invasive species that is being or has been done by county, tribal, state and federal government agencies.
b. Create a comprehensive regional inventory of invasive species, assessments of their range, best existing methods and projects for their treatment and prevention that groups in the Region have undertaken.
c. Publicize and disseminate this information to local communities through a range of accessible formats.

Action A3.2: Identify and support existing invasive species removal, prevention, education and outreach programs in the Region

a. Work with existing organizations and agencies concerned with invasive species, for example, U.S. Fish and Wildlife Service; Olympic National Park; Washington Departments of Fish & Wildlife, Natural Resources, and Agriculture; local Indian tribes; Invasive Species Council; The Nature Conservancy; Natural Resources and Conservation Service; Regional Fisheries Enhancement Groups; Northwest Natural Resources Group; Master Gardeners; county weed boards; conservation districts; and, area universities and community colleges.
b. Provide support to the existing outreach efforts of these organizations and agencies.
c. Bring these organizations and agencies together for summit meetings on invasive species to share information, support collaboration, and empower invasive species removal and prevention efforts.

d. Collect and provide information to interested parties about the necessary regulations and permits for pesticide and herbicide application.

STRATEGY A4: INFORM PUBLIC OFFICIALS AND INCREASE PUBLIC OUTREACH ON ENVIRONMENTAL VALUES TO MAKE SHORELINE MODIFICATION MORE SALMON-FRIENDLY

ADDRESSES THREAT: SHORELINE MODIFICATION INCLUDING DIKES, LEVEES, ARMORING, BULKHEADS

The purpose of this strategy is to inform government officials and landowners who live or operate along shorelines about how man-made changes to natural shorelines can adversely impact salmon while there are other techniques to protect their property and still maintain salmon-friendly habitat.

It is important to convey to government leaders and the public at large that the physical characteristics of a natural shoreline develop over a very long period. If left unaltered, they will provide sufficient vegetative structure to withstand erosion and loss of property without the use of artificial armoring. Outreach programs should describe to property owners different methods for protecting waterfront property from erosion through bioengineering and working with the shoreline through natural processes without resorting to artificial armoring.

In areas that already have extensive shoreline modifications, there is a need for presentations and informational materials for landowners to explain why and how to restore shorelines and protect their properties using alternative, salmon-friendly methods.

Action A4.1: Support and partner with other organizations and agencies working to alleviate shoreline modification problems

a. Reach out and support the efforts of agencies and organizations, such as County Shoreline Management Plans, Marine Resource Committees and the Washington Department of Ecology, who work to reduce the impacts of shoreline modification on salmon.

Action A4.2: Increase official and community awareness of successful shoreline restoration projects and promote the use of alternative, salmon-friendly shoreline modifications

a. Write articles and make presentations that showcase positive results from shoreline restoration projects that exist in the Region and around the state.
b. Provide easy-to-understand information relevant to local conditions that describe alternative, salmon-friendly shoreline modification methods.
c. Increase official and community awareness of Shoreline Management Plans and Critical Area Ordinances, including their role in salmon protection.

Action A4.3: Provide planners and decision makers with information on the science, sustainability and funding for salmon-friendly shoreline modification improvement and solutions

a. Take elected and appointed government officials on success tours.
b. Participate in town hall meetings, jurisdictional council meetings and other forums to share information about alternative shoreline protection methods.
c. Prepare and publicize lists of options that explain erosion control methods that are practical, cost effective, and salmon-friendly.

Action A4.4: Create a curriculum for K-12 youth that explains shoreline erosion

a. Create an interactive, participatory curriculum for teachers to use that explains the potential results of erosion, climate change, and steps for preventing shoreline erosion.
b. Consider obtaining funding for a physical shoreline model for use as part of this curriculum as well as at festivals and other events.

STRATEGY A5: REACH OUT TO PUBLIC OFFICIALS, LANDOWNERS AND OTHERS ABOUT THE VALUE OF PRESERVING MARGINAL LAND

ADDRESSES THREAT: AGRICULTURAL PRACTICES THAT IMPACT SALMON

The purpose of this strategy is to introduce information to the public living in either urban or rural settings about how wetted areas function in the ecosystem, the value of these areas to salmon, and how preserving/restoring them can be integrated with commercial or other development goals in a way that benefits all.

Areas that are critical for salmon are sometimes the same places that many people think of as "marginal" land for agricultural or residential purposes. These are wetlands, floodplains, and riparian areas, along potentially highly erodible shorelines, that have limited agricultural or residential importance. They can be expensive to farm or difficult to develop for other purposes. Frequently, these lands remain undeveloped and/or require constant and costly maintenance, including the payment of property taxes.

Owners of these properties can offset the cost of farming or the burden of taxes by benefiting from existing programs aimed at reducing land uses that harm salmon. Many of these programs provide incentives for agricultural practices that are good for salmon, such as rotating fields in and out of wetlands, or fencing cattle from riparian areas. Other options exist as well, such as conservation easements and purchase of development rights. Providing information, incentives and resources to landowners will help them make good decisions about potential alternatives that benefit both the landowner and the salmon.

Action A5.1: Make information available to government officials and landowners about programs that help make properties more salmon-friendly

a. Create a Region-wide clearinghouse of information that will help landowners connect with federal, state, tribal, and non-profit entities that provide incentives to make their properties salmon friendly.
b. Create and publicize an inventory of existing programs available to landowners, current programs that help preserve critical areas beneficial to salmon.[21]
c. Provide resources to property owners to help cover non-eligible costs for accessing programs such as those listed above.
d. Encourage public awareness of government-sponsored committees and volunteer programs in which all can work together to resolve land-use concerns while also benefiting salmon.

Action A5.2: Publicize and celebrate positive steps by landowners who have implemented actions to make their properties salmon friendly

a. Bring attention to properties that have reduced groundwater and surface water pollution flowing into streams and rivers.
b. Showcase properties that have implemented: efficient irrigation; water conservation measures; erosion control; integrated salmon-friendly pest management; native vegetation; and, other salmon-friendly habitat management protocols.
c. Give public recognition to property owners that do salmon-friendly riverbank restoration and/or maintain healthy riparian and instream habitat conditions.

STRATEGY A6: COMMUNICATE WITH LOCAL ELECTED OFFICIALS AND RESIDENTS ABOUT STORMWATER AND WASTEWATER POLLUTION

ADDRESSES THREAT: WATER POLLUTION FROM DEVELOPED LAND, STORMWATER AND WASTEWATER POLLUTION

The purpose of this strategy is to reduce stormwater and wastewater pollution that enters salmon habitats, primarily by explaining the need for controls, what requirements exist, and how to implement them. Runoff that is not properly managed can introduce harmful levels of sediment and toxins (such as pesticides) into salmon habitat. For that reason, it needs to be managed, both as to flow and content. Polluted water that is not discharged from a specific pipe is called nonpoint source ("NPS") pollution.

[21] Some of these programs are, for example: Certified Farm Plans, Conservation Reserve Program, Farmland Trust, Family Forest Fish Passage Program, Grassland Reserve Program, Natural Resources and Conservation Service, NW Certified Forestry Program, Transfer of Development Rights, Washington Water Trust, Wetlands Reserve Program, Washington Wildlife and Recreation Program, Sustainable Forestry (GH College), Fisheries Program (Peninsula College).

Many cities and counties already have rules about NPS pollution under federally-required stormwater plans. Similarly, there are rules about wastewater discharge, both from homes and businesses (septic) and from industry. In some cases industry must pre-treat water used in its operations before discharging it. The National Pollution Discharge Elimination System ("NPDES") gives permits for such discharge; in Washington State, these permits are issued by the Washington Department of Ecology.

Water quality and water quantity outreach aimed at local elected officials and property owners should focus on septic system maintenance, hobby farm practices, and polluted runoff from impervious surfaces flowing to aquifers and water systems. Simple practices such as maintaining on-site sewage disposal systems, creating rain gardens, and picking up pet feces will help decrease pollution entering water bodies and have a positive effect on salmon populations living near urban areas.

Action A6.1: Encourage and support organizations and programs that show property owners how to prevent water quality degradation

a. Provide information to property owners about existing water quality requirements of the state, counties and cities (e.g., stormwater and wastewater plans and permits).
b. Support educational efforts that prevent point and nonpoint pollution that degrades salmon habitat.
c. Provide educational materials about the importance of aquifer recharge areas for salmon.
d. Provide information about and encourage low-impact development techniques for individual property owners, neighborhoods and communities.

Action A6.2: Support existing agencies and organizations that encourage best property management practices

a. Support programs that teach landowners how to use natural processes to retain and filter stormwater.
b. Advise such programs about funding sources for further outreach to agricultural and residential property owners about better implementation of best management practices to prevent water pollution.
c. Support partnerships that encourage small hobby farms to understand and improve practices that would otherwise adversely impact riparian habitat and water quality (e.g., manure management).
d. Advise conservation districts and non-profit agencies on funding resources for working with small hobby farms to minimize the impacts of their activities on salmon.

B. PROTECT AND RESTORE SALMON HABITAT FUNCTION

There are six strategies to Protect and Restore Salmon Habitat Function:

Strategy B1	**Use Habitat Protection Tools & Techniques to Maintain or Restore In-channel Salmon Habitat That Is Key in Light of Climate Change**
Strategy B2	**Coordinate a Region-Wide Invasive Species Workgroup and Serve as a Hub for Regional Invasive Species Information**
Strategy B3	**Restore Buffer and Instream Channel Function By Retaining Large Trees in Riparian Zones and Landscaping with Native Plants**
Strategy B4	**Correct Existing Fish Barriers**
Strategy B5	**Encourage the Implementation of Water Quantity Planning Efforts**
Strategy B6	**Reduce Dredging and Filling of Estuaries, Rivers and Wetlands**

STRATEGY B1: USE HABITAT PROTECTION TOOLS & TECHNIQUES TO MAINTAIN OR RESTORE IN-CHANNEL SALMON HABITAT THAT IS KEY IN LIGHT OF CLIMATE CHANGE

ADDRESSES THREAT: CLIMATE CHANGE

The purpose of this strategy is to assist those involved in salmon habitat protection and restoration in planning ahead, obtaining relevant information, and designing projects with climate change impacts in mind. A unique set of tools and techniques will be essential for sustaining salmon in the Coast Region to counter the impacts of climate change. Climate change will necessitate a different approach to acquiring, maintaining, protecting, and restoring habitat.

There is growing momentum within the scientific community to study the effects of climate change on salmon. Ensuring that the Coast Region stays abreast of this growing field of study is critical. As information about climate change and salmon habitat continues to become available, it will be valuable to public officials, planning committees, and local communities. There will be a need to incorporate climate change science into local government development regulations that protect habitat, such as shoreline master programs, comprehensive plans, and development regulations. Helping citizens understand and use this data when planning for their own properties will be equally as important.

Action B1.1: Map key salmon spawning areas, rearing areas and refugia ("key habitats") using climate sensitivity analyses and advocate for their integration into local plans and regulations

a. Seek funding to map key habitats using climate sensitivity analysis.
b. Identify critical key habitats and encourage their protection.
c. Promote and accelerate habitat protection in salmon strongholds using such tools as acquisitions, conservation easements, and purchase of development rights.

d. Assist Lead Entities in incorporating climate change concepts and analyses into their strategies and projects.
e. Encourage local governments to integrate data about current and future key habitats into their plans and regulations.

Action B1.2: Make climate change information relevant to the Coast Region available to citizens

a. Create a Communication and Outreach Program component that helps citizens understand the local risks of climate change to themselves and salmon within the context of their local communities.
b. Invite University of Washington Climate Impacts Group and other experts to speak at community events.

Action B1.3: Identify funding opportunities to maintain and restore habitats ("key habitats") that are and will be important for salmon in light of climate change

a. Maintain and disperse information about funding opportunities available for protecting key habitats that are and will be important for salmon in light of climate change.
b. Develop and maintain a list of properties that, as climate change occurs, will have increasing value as future key salmon habitats, for the purpose of providing information to NGOs and others undertaking acquisition projects in the Region.

STRATEGY B2: COORDINATE A REGION-WIDE INVASIVE SPECIES WORKGROUP AND SERVE AS A HUB FOR REGIONAL INVASIVES SPECIES INFORMATION

ADDRESSES THREAT: INVASIVE SPECIES

WCSSP has the potential to act as a regional coordinating hub for invasive species information, focusing on non-native flora and fauna that negatively affect salmon. WCSSP could create a metadata source on its website about invasive plants and animals; identify and help prioritize areas important to salmon; help coordinate identification, mapping and extent of the problem; and provide support for existing groups working toward prevention and eradication.

Action B2.1: Support and establish partnerships for invasive species removal and prevention

a. Establish an annual coastal conference on invasive species to share information, serve as a coastal coordinating umbrella, showcase successful models, and prioritize invasive species efforts.
b. Identify and support invasive species workgroups and, if necessary, promote the establishment of such groups.

c. Assist in coordinating efforts to eradicate and prevent invasive species.

Action B2.2: Collect information on invasive species from all sources and make it accessible

a. Seek funding to create a clearinghouse of all invasive species information and programs within the Coast Region to bring together what are now available as separate lists and sources of information.
b. Collect information about invasive species and available resources from organizations such as Lead Entities and county noxious weed boards.
c. Where not yet done, synthesize and map invasive species across the Region to compare with NetMap's (see Glossary) Intrinsic Potential models for salmon to help prioritize invasive species eradication.
d. Create a database of existing programs and models as well as past eradication work, including information about the relative effectiveness of different treatments.
e. Identify the federal regulations, Environmental Impact Statements, protocols on federal lands (e.g., national parks/forests), and protocols from applicable state agencies (e.g., Washington Departments of Agriculture, Ecology, and Fish & Wildlife) for RCWs and WACs that concern particular plant or animal invasive species.

Action B2.3: Disseminate educational information about invasive species through websites, press releases, and article submissions

a. Develop a Communication and Outreach Program component focused on preventing, controlling and eradicating invasive species.
b. Create a metadata library on the WCSSP website for invasive species and their control.

Action B2.4: Raise funds and otherwise support existing invasive control efforts

a. Assist in identifying and writing grants aimed at funding regional efforts to identify, eradicate and prevent invasive species.
b. Where it is not already in place, encourage cross-jurisdictional cooperation in developing comprehensive regional efforts to eradicate and prevent invasive species.

STRATEGY B3: RESTORE BUFFER AND INSTREAM CHANNEL FUNCTION BY RETAINING LARGE TREES IN RIPARIAN ZONES AND LANDSCAPING WITH NATIVE PLANTS

ADDRESSES THREATS: REMOVAL AND/OR LACK OF LARGE WOODY MATERIAL;
SHORELINE MODIFICATION INCLUDING DIKES, LEVEES, ARMORING, BULKHEADS

The purpose of this strategy is to inform public officials, planners and the general public about the role that large woody material ("LWM") and other native plants plays in salmon habitat and how these resources can be effectively managed to protect/restore salmon habitat, while also preserving the rights of property owners.

Large wood is a vital and naturally occurring component of healthy stream ecosystems. It creates upstream pools, downstream plunge pools, scour pockets, shelter, and slower moving water for resting areas for fish. It provides a role both as living trees along shorelines and as fallen trees in the stream channel; both functions are critical to salmon. The living trees in the riparian buffer zone provide the shade needed to maintain the cold water temperatures required for salmon (especially bull trout) and help to secure stable banks. If a tree is cut before its time, it decays relatively quickly and ceases to provide this function and its roots do not endure to secure sediment.

Collapsing banks introduce excess sediment into streams and this can cut oxygen supply to salmon eggs and infiltrate gills. However, saturated banks can also be home to macroinvertebrates (insect larvae) that provide an excellent food source for juvenile salmon. It is important to allow bigger trees to reach maturity so when they do die and become part of the stream channel, they support optimal habitat functions. Once a mature tree collapses into the stream, it helps to create channel diversity. Large branch and root systems reduce flow velocity and prevent spawning gravel from being swept downstream after a storm. They allow pools to develop around them, creating refugia in low-water spells and shady environments within the channel.

The WCSSP Communication and Outreach Program should: include a component to reach out to landowners about the benefits of large wood both alongside and in streams; provide up-to-date information to the public about the need and availability of large wood; create incentives for people to leave wood or reposition it in streams; modify bridges and culverts to allow wood to pass during floods and function properly; support programs that currently exist, including Natural Resources and Conservation Service programs; and improve enforcement of shoreline management rules and regulations.

In addition, buffers of native plants along streams can help to filter pollutants, stabilize banks, provide shade and provide habitat for smaller creatures that are food for juvenile salmon (e.g., insects and other invertebrates). There are many sources of information on the role of landscaping stream buffers with native plants.

WCSSP can help by serving as a repository for data about the roles of native plants and LWM, serving as a clearinghouse of ideas for potential projects, and holding educational conferences.

Action B3.1: Develop partnerships, get involved, and disseminate information about the need for large wood alongside and within streams

a. Inform the public of existing Shoreline Management Plans and Critical Area Ordinances and why they exist.
b. Develop a WCSSP Communication and Outreach Program component on large wood that explains why landowners need to help protect high-functioning riparian habitat and the incentives available for them to do so.

c. Influence land managers to be consistent in using the best current forest practices, particularly along riparian corridors. Promote innovative silviculture practices that encourage large wood recruitment within riparian corridors.

Action B3.2: Promote protection and restoration of habitats that recruit large wood

a. Encourage and support projects that promote protection and restoration of forest land that contains large trees in riparian buffers along streams and rivers and lacustrine buffers around lakes.
b. Promote the conversion of alders to conifers in buffer zones.
c. Encourage the acquisition of land within watersheds for reforestation.
d. Identify opportunities to contribute trees for use in large wood placement projects.

Action B3.3: Identify funding sources for habitat protection

a. Create, maintain and disseminate an inventory of funding sources and partnerships for stream buffer and instream channel projects.

Action B3.4: Inventory and update data to help identify priority locations for action on large woody material

a. Map areas lacking large wood and integrate data into NetMap (see Glossary).
b. Prioritize areas needing large wood to improve buffer and instream channel function.
c. Collect and maintain data regarding large wood storage locations (both natural and bone-yard) that would provide the least expensive option for transportation and use of that wood in projects elsewhere in the Region.
d. Document creative ways to overcome the costs for transporting large wood to project sites.
e. Seek funding to create and maintain a large wood inventory in support of related activities in the Region.

Action B3.5: Establish a clearinghouse on riparian buffer/instream channel function research

a. Make available research papers on large wood and its importance to buffer and instream channel function restoration.
b. Inventory and document those systems with healthy buffer and instream functions and ecosystem processes.
c. Make available information on native plants (besides trees) that serve as salmon-friendly vegetation.
d. Seek funding for a native plant rescue program from new construction sites to storehouse for later replanting (similar to program of King County's Department of Natural Resources).

Action B3.6: Create a portable, physical model that demonstrates healthy versus degraded riparian and instream processes for use in education and outreach programs and events

a. Obtain funding for construction of a model that displays healthy versus degraded riparian and instream processes for use in education, communication and outreach programs and events.

STRATEGY B4: CORRECT EXISTING FISH BARRIERS

ADDRESSES THREAT: ROADS, CULVERTS, BRIDGES AND OTHER TRANSPORTATION INFRASTRUCTURE

The purpose of this strategy is to update fish barrier inventories and to find effective and efficient means of replacing or correcting non-functioning fish passages. Numerous man-made fish barriers in the Coast Region contribute to poor instream channel function and prevent fish migration. Effectively addressing these fish barriers will depend on finding sufficient funding to assess types and locations, and then prioritize and correct them.

Action B4.1: Create and maintain a Region-wide inventory of fish barriers

a. Where not already done (e.g., by the Washington Department of Transportation), catalog fish barriers into a Region-wide inventory that includes data on road culverts, bridges, tide gates, dikes and other fish barriers.
b. Integrate all Road Maintenance and Abandonment Plans ("RMAPs") for forest lands into this inventory.
c. Map and superimpose this inventory on salmon priority-use and/or Intrinsic Potential maps within NetMap (see Glossary).
d. Develop a cross-reference of the manuals, regulations, rules and guidelines that state and federal agencies use for addressing fish barrier removal.

Action B4.2: Assist public and private entities in prioritizing removal of unnecessary or malfunctioning fish barriers, and installing proper culverts or bridges as needed

a. Work with public and private forestland owners to integrate prioritization efforts in their RMAP efforts.
b. Help the responsible entities prioritize removal of fish barriers on orphan roads and railroad right-of-ways, while emphasizing that techniques and equipment for this most often requires qualified engineers; refer them to published protocols.
c. Assist diking districts in prioritizing the removal of tide gates and dikes.
d. Encourage land managers to remove barriers that may not directly bar fish passage, but do affect downstream channel function, replacing them with properly functioning structures as needed.

e. Promote the use of habitat prioritization tools (e.g., NetMap Intrinsic Potential modeling) in the decision making of both public and private entities responsible for correcting fish barriers.
f. Seek funding for needed information and designs for correcting existing fish barriers, either by removal or replacement with properly functioning culverts or bridges.

Action B4.3: Compile a Region-wide list of Washington Department of Transportation Chronic Environmental Deficiencies situations

a. In cooperation with the Washington Department of Transportation ("WSDOT"), develop an updated inventory of locations along the state highway system where chronic maintenance and repairs are negatively impacting fish and fish habitat.
b. Encourage the most effective use of mitigation funding opportunities provided by the WSDOT Chronic Environmental Deficiencies ("CED") program.

STRATEGY B5: ENCOURAGE THE IMPLEMENTATION OF WATER QUANTITY PLANNING EFFORTS

ADDRESSES THREATS: RESIDENTIAL AND COMMERCIAL DEVELOPMENT THAT IMPACTS SALMON; CLIMATE CHANGE

The purpose of this strategy is to explain how development and climate change can impact water quantity in ways that adversely impact salmon and to discuss forums or laws that work to include the needs of both people and salmon for water. Future growth and climate change will potentially alter water quantity in wetlands, streams and rivers throughout the Coast Region. Sustaining salmon in this environment may prove difficult without a better understanding of water regimes in the Region. Intensive planning will also be important for finding solutions that create an appropriate balance within the ecosystem that supports the water needs of both people and salmon.

Action B5.1: Encourage water storage projects and programs using innovative approaches and incentives

a. Compile and provide information on appropriate water storage options that both benefit salmon and meet human needs in the Coast Region from sources such as Washington Department of Ecology or from completed WRIA Watershed Plans prepared pursuant to Chapter 90.82 RCW.
b. Host a regional summit conference on water storage designed to identify interest in implementing these water storage options.
c. Support the design and implementation of water projects in coastal watersheds as appropriate.

Action B5.2: Promote the use of instream flow rules and watershed planning to ensure future water quantity for salmon in the Region

a. Encourage projects that provide the necessary data for instream flow ("ISF") rules to be developed, including but not limited to flow, channel measurements and fish species modeling, where the ISF rules are being planned.
b. Work with the Washington Department of Ecology ("Ecology") to complete Instream Flow Rules[22] for rivers in the Coast Region where applicable data exist.
c. Encourage all watersheds in the Coast Region to undertake watershed and water quality planning or plan implementation. When possible, assist in obtaining the funding to implement these plans when legislative appropriations for Ecology programs are not available.

STRATEGY B6: REDUCE DREDGING AND FILLING OF ESTUARIES, RIVERS AND WETLANDS

ADDRESSES THREAT: DREDGING AND FILLING

The purpose of this strategy is to inform public officials, planners, and the general public of the role that estuaries, rivers, and wetlands play in the salmon life cycle and how development of these areas, either by dredging or filling, needs to be managed in accordance with the law and consistent with ecosystem needs. Mitigation may be required to compensate for unavoidable impacts of essential human activities in order to maintain habitat needs for salmon and other species.

The dredging and filling of estuaries, rivers, and wetlands create short- and long-term impacts to migrating juvenile and returning adult salmon. Dredging frequently occurs in wetlands, rivers and harbors for agricultural, navigational, and flood control purposes. Filling often results from point and nonpoint activities including relocation of dredge spoils, unpermitted filling of lands for development activities, mass wasting, and erosion.

To ensure effective mitigation of these impacts, there is a need for salmon advocates to be involved during both permitting and compliance monitoring of projects. There is a role for WCSSP in identifying and advocating alternatives to dredging and filling. While other agencies (for example, the U.S. Army, Washington Departments of Ecology and Natural Resources) have regulations describing what constitutes a wetland, the actual dredging and filling of them is regulated by the Army Corps of Engineers under section 404 of the Clean Water Act and accompanying regulations and guidance. The U.S. Environmental Protection Agency ("EPA") has an oversight role and can veto permits. WCSSP can assist those involved in planning dredging/filling activities by providing information on all of these definitions and requirements in a single location.

[22] **Instream Flow Rules for Washington State: http://www.ecy.wa.gov/programs/wr/instream-flows/isfrul.html**

Action B6.1: Provide a data source on the laws and regulations regarding dredging and filling.

a. Create and maintain a database on the WCSSP website of existing federal and state definitions and requirements regarding the dredging or filling of water bodies, including links to state and federal permitting pages.

Action B6.2: "Be at the table" for projects involving dredging and filling

a. Develop a regional role for WCSSP as an interested party under the National Environmental Policy Act ("NEPA") and the State Environmental Policy Act ("SEPA") at scoping sessions for planned development or restoration activities, to ensure appropriate review and comment on dredging and filling projects.
b. Play an active role in ensuring that proper dredging/filling compliance monitoring occurs.
c. Provide information to those making decisions about development projects that involve dredging/filling to ensure that the appropriate mitigation for the impact(s) of dredging and filling on salmon is incorporated into those development plans.

Action B6.3: Gather and disseminate information on the impacts of dredging and filling on salmon and their habitat

a. Gather information and examples of the effects of dredging/filling, as well as more salmon-friendly alternatives.
b. Create NetMap (see Glossary) analysis of slide-prone slopes; add accurate vegetation layer to NetMap.
c. During the permitting process, make information available to the relevant parties about the effects of dredging and filling on salmon habitat.
d. Increase public awareness of alternatives to dredging and filling, including how to prevent nonpoint filling through proper land development practices, or how to institute Low Impact Development.

C. SUPPORT HATCHERY AND HARVEST PRACTICES CONSISTENT WITH WILD SALMON SUSTAINABILITY

The two strategies to Support Hatchery and Harvest Practices Consistent with Wild Salmon Sustainability are:

Strategy C1	**Create Opportunities that Lead to a Better Understanding of Hatchery, Harvest, and Wild Fish Policies**
Strategy C2	**Develop Partnerships for Hatchery Reform**

See Appendix 6 for an Inventory of Hatchery Programs in the Coast Region.

STRATEGY C1: CREATE OPPORTUNITIES THAT LEAD TO A BETTER UNDERSTANDING OF HATCHERY, HARVEST, AND WILD FISH POLICIES

ADDRESSES THREAT: HATCHERY AND HARVEST INTERACTION

Ultimately, wild-origin salmon are the best indicators of watershed health. When a hatchery is required to maintain harvestable levels, it can be an indication that some habitat elements are adverse to salmon, or that the population is being or has historically been overharvested.

The purpose of this strategy is to inform all sectors involved in salmon habitat protection and restoration what role the hatcheries have in this “harvest numbers” process and to assure that the several processes for salmon protection and recovery work in concert with each other to accomplish their common goals. In the Coast Region, all salmon and steelhead numbers are down from what they were only a few decades ago. Both the state and the tribes, as co-managers, want to reach and maintain a harvestable level of salmon for commercial, recreational, subsistence and ceremonial purposes, and, for now, often see hatcheries as a means of assuring such numbers. The federal government also operates hatcheries in the Region. This “harvestable level” is certainly desired by others within the larger community. For example, the recreational sport fishery is also a mainstay of the community, from which the state derives revenue and local communities receive significant economic benefit. This desired harvestable level is a much greater number than may be needed to keep a species from endangered or threatened status under the Endangered Species Act. It is important to manage hatcheries and harvest in a balanced manner in order to protect the health of both hatchery and wild fish throughout the waterways they inhabit in common, that is, streams, lakes, nearshore and ocean.

The complex socioeconomic and legal drivers of hatchery and harvest policies often make them difficult for legislators and the public to understand. Promoting a better public understanding of hatcheries and harvest is critical because public policy, along with best available science, is a driving influence in both of these "H's," harvest and hatchery.[23]

What is the relationship between hatchery and habitat? Proper management of hatchery production assures that the presence of hatchery fish do not detrimentally influence effective rearing in waterways through competition for resources or predation. The release of hatchery fish into streams is timed to minimize these interactions to the extent practicable. Hatcheries are managed to prevent pathogens and their impacts on the larger ecosystem, although, conversely, it is sometimes difficult to prevent the larger ecosystem from introducing pathogens into the hatchery. In some cases an entire brood may have be destroyed and the hatchery sanitized in response to pathogens. State and tribal pathogen experts tour the hatcheries to inspect and advise to prevent or correct problems.

While hatchery and harvest policies and programs are the responsibility of tribal, state and federal managers, and many hatcheries are operated jointly by these entities, regional planning and Lead Entity participants play an important role with their responsibility and support for improving habitat. It is important to know that a given habitat has the capacity for successfully rearing juvenile salmon, there will be sufficient food and refugia for juveniles, and the potential for sufficient spawning area when adults return, should those juveniles successfully return. WCSSP, LEGs, and their partners can help improve the overall numbers of salmon by increasing the quantity and quality of functioning natural habitat. At every point in the life cycle, the more naturally-functioning habitat that exists, the more successful rearing and spawning can occur.

In addition to the competition and fish health issues discussed above, there are a number of concerns about hatchery and wild fish interacting on the spawning grounds. These include possible influences on the genetic legacy and productivity of the wild population. The effects on wild populations of interbreeding with hatchery fish have been widely studied and discussed within the scientific community and throughout the range of those interested in the health of fish and fisheries. One generally accepted and prominent finding is that hatchery fish spawning in the wild produce fewer adult offspring than their wild counterparts (i.e., lower productivity). Furthermore, when a hatchery fish crossbreeds with a wild fish, their productivity is also depressed compared to pure wild stocks. The magnitude of that depression in productivity is not yet clear and studies have shown it varies widely within and across species from differing geographic locations. Hatchery broodstocks are managed to minimize these influences and monitoring is conducted to assess the magnitude of hatchery influence.

All aspects of fisheries management—redd surveys (escapement), hatcheries, and harvest– are conducted cooperatively among the federal, state and tribal managers. These managers meet many times a year in forums like the Pacific Salmon Commission, the Pacific Fisheries Management Council, the North of Falcon process, and a variety of other federal-state-tribal forums. They use modeling and redd counts from prior years' returning salmon, as well as exact counts of fish harvested, before figuring out what the harvest and hatchery goals for the next year should be. No one acts independently of these forums; everything is considered and planned in great detail.

[23] See "All-H" in the Glossary.

Hatchery fish have become such an integral part of fisheries operations that they often are included in counts of fish when determining endangered status. NOAA's National Marine Fisheries Service ("NMFS") may not distinguish between wild and hatchery segments of an evolutionarily significant unit when listing a salmon. The federal court case *Alsea Valley Alliance v. Evans* left confusion about when fish numbers are sustainable without hatchery assistance, and that question was left unanswered. An appeal to the 9th Circuit Court was dismissed, so the decision stands and the confusion remains.

Building public understanding of the integration of All-Hs – hatchery, harvest, and habitat (see Glossary) – is a critically important process that must be transparent and engage the public, policy makers, and co-managers.

Action C1.1: Foster an information program that promotes understanding of hatchery and harvest policies and their relationship to wild salmon sustainability

a. Support programs to synthesize existing summaries and reviews of the Region's hatchery programs (Hatchery Scientific Review Group, USFWS, etc.) and put into laymen's terms.
b. Disseminate information about the importance of maintaining wild fish stocks and how this relates to hatchery and harvest programs.
c. Disseminate information to the public about how the management of wild fish, hatcheries, and harvest interface with the Endangered Species Act.

Action C1.2: Support continued regional forums for fishery co-managers and habitat project sponsors to exchange information and better coordinate actions across all "Hs" to improve watershed and salmon population health

a. Circulate information about where harvest data are available on the web: catch records, catch locations, stocks targeted, gear used (selective or non-selective), and escapement goals set and reached. (Catch locations are often confidential, but catch limits, gear, and time of harvest are matters of publicized regulations.)
b. Provide information/web sources on hatchery operations: locations, production, and goals set and reached.
c. Inform the public and government officials that are not involved in fisheries management about the many co-manager forums (e.g., Pacific Fisheries Management Council, Pacific Salmon Commission, and North of Falcon) that exist, and their websites for scheduled meetings, staff and participants, learned papers, and data that can be downloaded.
d. Encourage study of hatchery management's relation to fish disease and impact on wild fish sustainability. This should include knowledge of the measures that are already taken to inform hatchery operators, and to control pathogens.
e. Encourage broader knowledge of ways that co-managers are working to maintain safe habitat and sustainable numbers for hatchery and wild fish, such as the Coast Regional Hatchery Action Implementation Plan.

STRATEGY C2: DEVELOP PARTNERSHIPS FOR HATCHERY REFORM

ADDRESSES THREAT: HATCHERY AND HARVEST INTERACTION

The Pacific Northwest Hatchery Reform Project was established in 2000 by Congress to fund improvement in hatcheries while recognizing their legitimate role in meeting harvest and conservation goals. Its independent scientific review panel, the Hatchery Scientific Review Group ("HSRG"), has reviewed all state, tribal and federal hatchery programs in Washington. Pacific Coast reports completed to date can be found at http://hatcheryreform.us/hrp/reports/puget/welcome_show.action. So far, projects have focused on the "low-hanging fruit"; in most cases more costly actions have been deferred. Since HSRG recommendations have not been universally accepted by all affected entities, WCSSP supports moving forward cautiously with the HSRG recommendations, in Salmon Stronghold watersheds and others, inviting full discussion before endorsing actions, while mindful that the Washington Fish and Wildlife Commission policy C3619[24] on hatchery and harvest reform directs WDFW to implement the recommendations without geographic priority and recognizing that hatchery reform is largely a responsibility of the fisheries co-managers.

Action C2.1: Promote a dialogue on hatchery reform within the Coast Region

a. Host roundtable discussions on the implementation of HSRG recommendations in the Region.
b. Assist co-managers in information exchanges, data generation, and fundraising.
c. Assist co-managers with the design and designation of Wild Salmonid Management Zones pursuant to WDFW Policy C-3619 (FWC, 2009).

[24] **http://wdfw.wa.gov/commission/policies/c3519.html**

D. USE ECONOMIC TOOLS TO PROTECT, RESTORE AND MAINTAIN ECOSYSTEM VALUES

There are six strategies to Use Economic Tools to Protect, Restore, and Maintain Ecosystem Values:

Strategy D1	**Value Ecosystem Services**
Strategy D2	**Support Incentives for Keeping Agriculture, Timber, and Residential Land Use**
Strategy D3	**Promote Coastal Wild Salmon as a Premium Market Product**
Strategy D4	**Advocate for a Barrel Transport Fee to Fund Oil Spill Response Capacity**
Strategy D5	**Explore Environmental Markets, Offset & Compensation Programs, Conservation Futures Tax, and Mitigation Funding**

STRATEGY D1: VALUE ECOSYSTEM SERVICES

ADDRESSES THREATS: SHORELINE MODIFICATION INCLUDING DIKES, LEVEES, ARMORING, BULKHEADS; RESIDENTIAL AND COMMERCIAL DEVELOPMENT THAT IMPACTS SALMON

The purpose of this strategy is to examine what the actual benefits and costs are of the natural processes necessary to sustain salmon habitat and numbers, and what the net costs are to lose those process functions if they are diminished by development, agriculture or other human activities. Economists maintain that services provided by functioning ecosystems have economic value based on their ecological processes and yield. For example, processes such as the purification of water, the natural production of wood, and the natural generation of fish and animals in an ecosystem each generate “products” that have a dollar value. The natural ecosystem is basically the “factory” producing these products.

Using this concept, ecosystem services economists can compute the annual dollar yield of a functional ecosystem, that is, the value of the functions provided by an ecosystem. Tools like this allow decision makers to evaluate the cost of the loss of ecosystem compared to perceived gains from proposed development activities.

Action D1.1: Encourage preparation of a white paper by appropriate experts that examines ecosystem services values as modeled for the entire Coast Region

a. Acquire funding to undertake an analysis of ecosystem services models for the Coast Region.
b. Encourage preparation by appropriate experts of a white paper that explores and assesses ecosystem services models already used in the Chehalis Basin (for example, Batker et al., 2010) and elsewhere.
c. Facilitate agreement within the Coast Region on which ecosystem services model(s) would be most useful.

Action D1.2: Undertake an ecosystem valuation for the Coast Region

a. Secure funding to do an ecosystem services study for the entire Coast Region, cognizant of north-south differences within the Region.
b. In this study, explore and determine a value for not having salmon species listed under ESA in a watershed, as well as other salmon-related values.
c. Encourage study of the effects on salmon of the introduction of invasive species into watersheds.

Action D1.3: Utilize ecosystem services valuations to advocate for maintaining diverse ecosystems

a. Prepare and execute a communication strategy for disseminating results of the study (see D1.2 above).
b. Encourage local and state governments to incorporate study results into public policies and regulations.
c. Encourage projects that integrate ecosystem services valuation with hazard mitigation planning to protect habitats that benefit both people and salmon – e.g., flood storage using natural floodplains, natural buffers adequate to protect development from erosion, and water supply purification and protection in natural watersheds.

STRATEGY D2: SUPPORT INCENTIVES FOR KEEPING AGRICULTURE, TIMBER, AND RESIDENTIAL LAND FROM DEVELOPMENT THAT CAN HARM SALMON HABITATS

ADDRESSES THREATS: RESIDENTIAL AND COMMERCIAL DEVELOPMENT THAT IMPACTS SALMON

The purpose of this strategy is to illustrate ways to resolve development concerns by creative incentives and alternative methods that will further both salmon habitat health and economic needs. Timely dissemination of these options is key to their implementation.

The best way to reduce the impact of more intensive development on floodplains, estuaries, riparian corridors and other natural areas important for salmon habitat is to offer incentives to property owners to keep these areas in a natural state. Options used throughout the nation for similar efforts include conservation easements and purchase of development rights, among others.

However, many landowners are either unaware that these programs exist or are unfamiliar with how to access and use them. Landowners who are interested in these programs might also need technical assistance to take advantage of these programs.

Action D2.1: Assist landowners in connecting with opportunities for conservation incentive programs

a. Collect and disseminate information about acquisition and easement opportunities available through state, federal, and non-profit programs[25] and make sources available as data on the WCSSP website.
b. Identify key salmon habitat properties in the Coast Region that face potential and more intensive development, by collecting information from LEGs, state agencies and NGOs; place this information on the WCSSP website.
c. Establish and/or support programs that could work with landowners of key habitat properties, by offering direct technical assistance in accessing conservation incentive programs, or by providing information about sources for such assistance.
d. Encourage and support use of the Voluntary Stewardship Program in lieu of additional Critical Areas restrictions.

STRATEGY D3: PROMOTE COASTAL WILD SALMON AS A PREMIUM MARKET PRODUCT

ADDRESSES THREAT: HATCHERY AND HARVEST INTERACTION

The purpose of this strategy is to enhance the commercial value of wild salmon; this would provide incentive to increase their numbers, restore their habitat, promote best management techniques, and reduce the reliance upon hatchery operations or introduction of farmed species.

There could be significant advantages if the public recognized and celebrated the differences between farm-raised, hatchery-bred and naturally-produced salmon. Wild-caught salmon in the Coast Region could be branded as a premium market product, and thus be more economically valuable.

Under this scenario, Washington fishermen would see increased market share and value for their catch as the public views wild fish as a superior, healthier product. Higher product prices in turn would provide incentives to fishermen to protect the resource through improved fishing practices and reduced reliance on hatchery fish.

Increased public demand for wild fish might also translate into greater public support and funding to restore and protect wild salmon habitat.

Action D3.1: Research steps leading to certification of particular Washington wild salmon fisheries

a. Research steps toward certification, for example through the well-respected Marine Stewardship Council[26], and prepare and circulate a summary of the certification process.

[25] For example, Conservation Reserve Enhancement Programs, and National Resource Conservation Services programs such as the Wetlands Reserve Program, etc.
[26] http://www.msc.org

b. Establish a roundtable dialogue within the Coast Region to determine interest in pursuing wild salmon certification and branding in the marketplace, given the work that is required of those seeking certification in terms of data gathering, etc.
c. Work with fish buyers who may be unaware of the differences between the health of some Pacific Coast stocks and their local (e.g., Puget Sound) ones. For example, buyers in Puget Sound are wary of buying any Washington wild fish because they don't understand these differences.
d. Seek funding for a pilot project if there is interest in certification and branding of a particular salmon fishery.

STRATEGY D4: ADVOCATE FOR OIL SPILL PREVENTION AND RESPONSE CAPACITY

ADDRESSES THREAT: OIL SPILLS

An unchecked oil spill along the outer, Pacific coast of Washington would have a significant deleterious effect on salmon and salmon habitat in our Region. Although WCSSP would not likely have a direct role in this strategy, we think it is important to include it in our Plan for two reasons. One is that if a large oil spill occurred, it could be catastrophic to salmon, and therefore we should encourage anything that can be done to lessen the consequences. Secondly, a large oil spill could be catastrophic for many coastal interests besides salmon, and this is a powerful incentive for many regional partners to work together to reduce the possibility or the effects of a large oil spill. If we work together, we will be much more likely to achieve both preventive and quick-response objectives. Finally, as was seen in the wake of the Exxon Valdez disaster, there is really no way to effectively "clean up" oil spilled in a cold, rough-water environment. Its degradation to non-toxic conditions, particularly along the rocky shorelines of the Marine Sanctuary area of the Coast Region, could take decades or longer. Therefore, the best strategy is prevention.

Action D4.1: Advocate for a barrel transport fee to fund oil spill response capacity

a. Work with interested parties to advocate for a barrel transport fee to fund oil spill response capacity.

Action D4.2: Advocate for the placement of oil-spill-response tugs in Westport and Astoria

a. Work with interested partners, including the local fish and shellfish industries, Marine Resource Committees, the Washington Department of Ecology, the U.S. Coast Guard and others in the Region to get marine rescue and oil-spill-response tugs placed in Westport and Astoria, like the one currently stationed at Neah Bay.

Action D4.3: Advocate for moving shipping lanes further offshore from the coast of Washington

a. Work with parties interested in preventing oil spills as well as the shipping industry and regulators to move shipping lanes further out from the Pacific coast of Washington State.

STRATEGY D5: EXPLORE ENVIRONMENTAL MARKETS, OFFSET & COMPENSATION PROGRAMS, CONSERVATION FUTURES TAX, AND MITIGATION FUNDING

The costs of salmon habitat restoration and sustainability efforts far outweigh currently available funding. Creative ways of bridging this funding gap will be necessary to achieve this Plan's goals and objectives. The purpose of this strategy is to research and take advantage of funding opportunities that haven't been extensively explored. These sources could not only increase funding to the Region, but also diversify funding, which is wise in the current economic and government funding atmosphere.

Action D5.1: Research how the Coast Region might best take advantage of funding opportunities such as environmental markets, offset and compensation programs, conservation futures tax, and mitigation funding

a. Track development of habitat, wetland, water quality, and carbon markets in Washington and elsewhere in the Northwest.
b. Explore ways to produce and market environmental credits from salmon restoration project sites.
c. Meet with local representatives from Washington State Department of Transportation, local road departments, local and regional utilities, and other potential buyers to discuss credit availability from salmon restoration project sites.

Action D5.2: Create a means for assuring that, with a focus on protecting its salmon, the Coast Region can effectively take advantage of these funding opportunities

a. Finance and implement pilot projects to demonstrate market viability.
b. Over time, develop policies and practices for standardizing the way we use the environmental marketplace.
c. Describe and quantify the suite of utilitarian functions (flood management, water quality improvement, aquifer recharge) of large-scale floodplain restoration.
d. Coordinate with other stakeholders in large-scale environmental initiatives such as nonpoint pollution control, water supply, stormwater treatment, floodplain management, and allied issues that are utilizing or may utilize "green infrastructure" approaches to funding.
e. Pursue pilot projects for use of a "green infrastructure" approach to address a specific and high-priority public concern (such as Chehalis River flood control).

E. IMPROVE REGULATORY EFFECTIVENESS TO ACHIEVE SALMON SUSTAINABILITY

There are five strategies to Improve Regulatory Effectiveness to Achieve Salmon Sustainability:

Strategy E1	**Improve the Effectiveness of Enforcement**
Strategy E2	**Support Water Resources Plans and Regulations that are Benign or Beneficial for Salmon and Their Habitats**
Strategy E3	**Work with Agencies to Create Effective Regulations and Policies that Restore Large Wood In Streams and on Riparian Buffers**
Strategy E4	**Work with Agencies to Strengthen the Forest Practices Act Permitting and Monitoring Process**
Strategy E5	**Work with Agencies to Change Funding Procedures for Road and Transportation Improvements to Benefit Salmon**

STRATEGY E1: IMPROVE THE EFFECTIVENESS OF ENFORCEMENT

ADDRESSES THREAT: WATER POLLUTION FROM DEVELOPED LAND, STORMWATER AND WASTEWATER POLLUTION

The purpose of this strategy is to promote compliance and improve enforcement of existing operating plans[27], laws and regulations in order to effect the protections or changes that such plans, laws and regulations were designed to create.

Protecting salmon habitat from harmful land and water uses is the objective of numerous laws and regulations enacted by federal, tribal, state, and local governments throughout the Coast Region. However, the effectiveness of any law or regulation is entirely dependent on the ability of government agencies to encourage or enforce compliance. Enforcement has proven to be a weak link in the regulatory toolbox for protecting salmon habitat. This is largely due to lack of funding for staff in the field to observe and cite violations. For example, there are sometimes only one or two federal or state fish and wildlife enforcement officers for the entire west side of the Olympic Peninsula. Effective use of volunteers might be a solution to assist these agencies until more funding is available.

In addition, when citations are issued, penalties are often not imposed, or, if levied, fail to provide sufficient incentive to obey the law. Without enough teeth in a Critical Area Ordinance, for example, it can be more profitable to harvest a shoreline tree, pay the penalty, and then keep the harvested tree. When such a violation occurs, the damage to the environment can take years to correct. Fines should be large enough to deter violations; otherwise, violators can justify and absorb the fines as a cost of doing business. Enforcement tools should also include the potential seizure and forfeiture of equipment.

A related issue is whether environmental code violations are dealt with in criminal or civil court. Many environmental codes, such as WDFW's hydraulic code for work in streams, are prosecuted in the

[27] e.g., Shoreline Management Plans and Critical Area Ordinances

criminal courts. Since the large number of drug and other criminal cases creates delays in all other matters that are on a court's docket, these hydraulic matters are not heard in a timely manner. By decriminalizing some of these environmental offenses and handling them as civil violations, the process for hearing environmental violations could be speeded up.

Action E1.1: Identify the gaps in state and local jurisdictions in regards to environmental enforcement

a. Prepare and communicate recommendations to state and local elected officials about the need to strengthen enforcement procedures. As appropriate, relate this to the previously discussed studies of the ecosystem services value of natural resources.
b. Work legislatively and through regulatory bodies to move most environmental violations from criminal to civil law as appropriate.
c. Some prosecutors, in the county forums in particular, are less familiar with wildlife and natural resources issues than with family, commercial or criminal law. Work with them as appropriate (avoiding ex parte communication) to inform them of the tenets of natural resource laws to assist them in their prosecutions.
d. Provide continuing legal education (CLE) courses in environmental law and make them available for prosecutors and judges to encourage a better understanding of the legal, socioeconomic, and technical principles behind laws and regulations that affect salmon habitat.

Action E1.2: Work with local and state legislative bodies to improve enforcement mechanisms for environmental violations

a. Encourage the adoption of penalties that accurately reflect the damage caused to the environment and are large enough to actually deter violations. At a minimum, authorized penalties should be equal to the cost of remediation and/or actual value of the commodity removed (as in the case of unauthorized removal of gravel or timber).
b. Advocate for federal, state and local governmental agencies to have the necessary funding, personnel, training and other resources available to effectively enforce environmental laws.
c. Support the expansion of efforts (such as Washington Department of Ecology's Hussman Fund) to have penalty fees returned to the enforcing agency in order to cover agency personnel costs, public outreach and education, and construction and post-construction monitoring, among other activities.
d. Work to make federal and state grants available to fund programs to correct faulty onsite sewage disposal systems. The public benefit from improving water quality should be considered in addressing any apparent prohibitions of lending public credit to private entities.

Action E1.3: Support community efforts aimed at helping to improve enforcement of environmental regulations

a. Encourage legislators and officials to enact tougher regulations and codes/ordinances that protect water resources critical for salmon habitat.
b. Support community groups that serve as surrogate "eyes" for those enforcement agencies who are short of personnel, similar to the Eyes in the Woods[28] program for hunting infractions.

STRATEGY E2: SUPPORT LAND USE AND WATER RESOURCE PLANS AND REGULATIONS THAT ARE BENIGN OR BENEFICIAL FOR SALMON AND THEIR HABITATS

ADDRESSES ALL THREATS

One of the major reasons that the Coast Region has comparatively healthy salmon runs is its low human population, about 200,000 in 2010 (U.S. Census, 2010). Even so, poorly managed residential and commercial development in the Region could eventually decrease both water quantity and water quality, and therefore salmon health. These effects on known salmon habitat require constant adjustment in land use plans and regulations to reduce deleterious impacts. Part of the solution to balancing human development with salmon habitat needs is to acquire a more complete understanding of water resources and their management in the Region. This knowledge can be used to develop more effective controls on development.

Better management of water resources goes hand in hand with a more complete knowledge of where fish habitat actually exists. The Washington Department of Natural Resources ("DNR"), along with other state, tribal, and county entities, collects data regarding those streams in the Region that bear salmon. Although DNR stream-typing (fish presence) maps are the most easily accessible database used for this purpose, their accuracy is not foolproof. Recent inventories have found mistakes in them resulting from overlooking fish presence. Because these inventories are used for logging and development permitting, these mistakes can result in a loss of healthy salmon habitat.

Action E2.1: Develop an improved understanding of water resources and rights

a. Support a study of the impact of regional water usage and rights on salmon habitat. If such a study exists, publicize it and the impacts of water usage patterns on salmon habitat.
b. Assess what actual water consumption is in the Region, for municipalities, agricultural and otherwise.
c. Encourage the development of models showing appropriate water budgets for salmon given the hydrology of basins in the Region.

[28] See www.eyesinthewoods.org

d. Encourage the legislature to develop means for funding water resources programs in the Washington Department of Ecology.
e. Identify potential regional partners for funding and monitoring water gauges in streams.

Action E2.2: Improve stream-typing (fish presence) databases for the Region

a. Work to get all streams properly identified, typed and mapped for fish presense; encourage on-the-ground stream-typing.
b. Use hydrologic modeling and tools such as LiDAR to aid in identifying potential salmon streams, while relying on ground-truthing to sample and test their validity.
c. Support the expansion of the work of organizations such as the Wild Fish Conservancy that do valid and well-accepted ground-truthing.
d. Encourage the use of improved stream-typing databases as best available science in local development regulations.

Action E2.3: Support Shoreline Master Programs (SMP), land use plans, and development regulations that protect water resources critical to salmon habitat

a. Get involved with and support counties in evaluations of their Shoreline Master Programs ("SMP"), land use plans, and development regulations for effectiveness in protecting shoreline and water resources critical to salmon habitat.
b. Identify gaps in plans and regulations that fail to protect shoreline or water resources critical to salmon habitat, and support work to amend as appropriate.
c. Evaluate development trends in each county to determine if salmon-friendly plans and development regulations are in place and implemented.
d. Collaborate with local jurisdictions to evaluate local consistency with the model FEMA ordinance to ensure compliance with National Flood Insurance Program guidelines while protecting fish habitat.

STRATEGY E3: WORK WITH AGENCIES TO CREATE EFFECTIVE REGULATIONS AND POLICIES THAT RESTORE LARGE WOOD IN STREAMS AND ON RIPARIAN BUFFERS

ADDRESSES THREAT: REMOVAL AND/OR LACK OF LARGE WOODY MATERIAL

The purpose of this strategy is to promote a wider understanding in the Region of the need for large wood in and along streams, and how this can be effectively supported and achieved through sound laws and policies.

The loss of large woody material ("LWM") in rivers often happens as a result of timber harvest or development activities, either intentionally or inadvertently. Reduced wood recruitment occurs when homeowners cut trees along shorelines to improve aesthetic views, or logging operations pay too little attention to maintaining appropriate buffers along streams. Other times, removal of instream wood occurs when property owners, worried about flooding or safety, take logjams out of streams or remove wood that is jamming culverts, or owners cut down buffer trees to create jams but secure them improperly. Such actions cause a serious loss of structural materials that would otherwise create healthy salmon habitat.

There are several reasons why this problem persists. The first is a lack of incentive within development regulations to deter such actions. While counties and cities have Critical Area Ordinances ("CAO") that prevent buffer destruction, penalties for violations are typically inadequate; the fine is often low and does not actually serve as a deterrent. However, there are opportunities to improve these situations when counties periodically update their codes.

A second reason is the public and land owner perception regarding potential liability. It is common practice for individuals to remove wood blocking a culvert and leave it in on the shoreline rather than returning it to the stream. People do this because they believe that if they return wood back into the stream and it damages property downstream, they could be liable for any damage.

Finally, there is misunderstanding about the role of logjams in a river. Most property owners and some recreational users view logjams as simply a danger to human life and property. This reflects a lack of understanding of the essential value of logjams to the overall health of streams.

Action E3.1: Assist jurisdictions in adding appropriate penalties for violations of development regulations and to deter inappropriate removal of resources (water, wood, gravel) required by salmon

a. Evaluate penalties for violation of Critical Area Ordinances ("CAOs"), Shoreline Master Programs ("SMPs"), and Hydraulic Approval Permits ("HPAs") to determine if they are commensurate with the damage caused by removal of wood from buffers, and if they are strong enough to serve as real deterrents.
b. Based on this evaluation, work to make corrections to CAO, SMP and HPA rules as necessary.

Action E3.2: Promote a better public understanding of hydrology and large woody material

a. Develop a Communication and Outreach Program component that shares information about how LWM retention and recruitment affect river movement/development and salmon habitat.
b. Develop a Communication and Outreach Program component for property owners and public road crews about how to properly manage and effectively return large wood to streams.
c. Promote the distribution of LWM educational materials at public workshops, at boat launches, within fishing license materials, and at other LWM "hot spots."

Action E3.3: Ensure that project sponsors use best available science, tools and methods in designing and constructing engineered logjams ("ELJs")

a. Ensure that property owners are aware of why man-made logjams need to be properly engineered, what preliminary studies are required, and what techniques and professional expertise are needed during the construction process.
b. Promote the use of up-to-date modeling to predict avulsion and migration potential for wood location and placement in ELJs.
c. Take the time to build stakeholder support of ELJs.
d. Encourage the use of engineers and contractors with known expertise for constructing ELJs.

Action E3.4: Support rules that maintain and increase large wood in rivers

a. Work with the Washington Department of Fish and Wildlife to promote LWM removal and relocation policies that ensure LWM retention in streams and rivers.

STRATEGY E4: WORK WITH AGENCIES TO STRENGTHEN THE FOREST PRACTICES ACT PERMITTING AND MONITORING PROCESS

ADDRESSES THREAT: LOGGING PRACTICES THAT IMPACT SALMON

The purpose of this strategy is to promote adequate permit review and compliance monitoring under the Forest Practices Act[29] ("FPA"). As timber is harvested, practical difficulties in implementing the FPA frequently affect the ability to protect salmon. Permit reviewers find little time for adequate review of applications, pre-harvest site visits, and field monitoring during harvests. In addition, there are too few personnel with the skill set necessary to effectively carry out this process.

RCW 36.70A.172(2)[30] requires Washington State and local jurisdictions to use best available science when preparing plans and development regulations, including their implementation. To better protect and benefit salmon, peer-reviewed best available science is critical for effective permit processes under the Forest Practices Act.

Action E4.1: Improve implementation of the Forest Practices Act

a. Encourage greater attendance at Timber, Fish, and Wildlife ("TFW") pre-application meetings.

[29] http://apps.leg.wa.gov/rcw/default.aspx?cite=76.09

[30] http://apps.leg.wa.gov/rcw/default.aspx?cite=36.70A.172

b. Promote effective Forest Practices Act field reviews including complete and timely notice to all affected parties.
c. Work with the FPA Board to amend the Washington Administrative Code ("WAC") to allow for adequate review periods for harvest applications.
d. Explore other possible avenues for overcoming short review periods.
e. Seek out and/or encourage greater funding to increase the number of personnel reviewing FPA harvest applications and monitoring permit compliance.

Action E4.2: Continue to update best available science within the Forest Practices Act, Growth Management plans and regulations, and Shoreline Management Act

a. Monitor opportunities to positively amend the Forest Practice Act and its regulations with best available science during adaptive management windows.
b. Work with federal, state, tribal and local government agencies to improve policies and development regulations with peer-reviewed, best available science that protect habitat for salmon.

STRATEGY E5: WORK WITH AGENCIES TO CHANGE FUNDING PROCEDURES FOR ROAD AND TRANSPORTATION IMPROVEMENTS TO BENEFIT SALMON

ADDRESSES THREAT: ROADS, CULVERTS, BRIDGES AND OTHER TRANSPORTATION INFRASTRUCTURE

Roads and other transportation infrastructure in rural areas frequently create significant barriers for salmon and/or may contribute significant sediment to the streams after storms. Unfortunately, the prioritization for upgrading or maintaining roads in state and county road plans typically reflect not their importance to salmon recovery, but instead the number of average daily trips ("ADT") by people over a road. Because the Coast Region has a much lower human population than other areas in the state, the ADT rates for the Coast Region are low, and therefore road upgrades in the region are poorly funded and given low priority. Ironically, these roads with lower priority may be much more important from the perspective of mitigating impacts on salmon habitat.

Too many local governments also defer the repair of roads, culverts, and bridges until an emergency occurs. This usually happens during periods when high-water emergency conditions exist. Repair work in high-water conditions relies on repair methods that can be detrimental to salmon habitat. Emergency rules under state law and emergency assistance programs offered through the Federal Emergency Management Agency ("FEMA") do not adequately consider the needs of salmon during or after emergency repairs are complete. In some cases repairs are deferred to the last possible date under the Forest Practices Act and rules. This allows for continued degradation of streams many years into the future.

Action E5.1: Encourage federal, state and local governments to consider salmon habitat when prioritizing transportation infrastructure improvements

a. Brainstorm ways to create incentives for consideration of salmon and salmon habitat in prioritizing and funding transportation infrastructure projects and decisions, both emergency and non-emergency.

Action E5.2: Advocate for improved emergency and non-emergency road, culvert, and bridge repair procedures that mitigate impacts to salmon habitat

a. Propose changes to federal, state and county laws to ensure effective mitigation requirements and plans whenever emergency repairs to roads, culverts, and bridges are necessary.
b. Encourage landowners and operators to make repairs in a timely fashion, where delays would have a significant adverse impact on salmon habitat.
c. Advocate changes to FEMA disaster mitigation procedures to take into account impacts on salmon.

References for Chapter 5

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CHAPTER 6
IMPLEMENTATION, MONITORING AND ADAPTIVE MANAGEMENT

Implementation of the Washington Coast Sustainable Salmon Plan will involve identifying and engaging partners, pinpointing opportunities and responsibilities, establishing schedules, and securing funding. Equally important is addressing data gaps through research, monitoring, and evaluation.

Implementation Strategy

A Logic Model (McCawley, 1997) will be used to develop a strategy defined as a sequence of objectives, each with at least one indicator to track progress toward achieving results. Having identified desired results, the model will be the basis for outlining a causal chain of inputs (such as funding, staff time) and outputs (such as an outreach program) that will create a desired outcome (changes in knowledge, behavior, or ecosystem function). Using this method, indicators will be used to track both implementation progress and effectiveness.

The Washington Coast Sustainable Salmon Partnership ("WCSSP") will facilitate implementation of the Sustainable Salmon Plan by first convening an Implementation Strategy Team. Representatives of the Coast Region's four Lead Entities, tribes, NGOs, state and federal agencies, and other interested stakeholders will be invited to serve on a dedicated team to ensure the Plan is implemented. WCSSP will provide the staff support and act as primary contact point for the Team, which will:

- Track the progress of the Sustainability Plan. As part of the sequencing of essential tasks and actions steps, the Team will identify benchmarks and measures to monitor and assess the implementation process.
- Investigate development of an implementation monitoring tool utilizing the Habitat Work Schedule and assist with its construction.
- Incorporate work from the Regional Technical Committee to help implement the monitoring and analysis actions needed to evaluate progress and effectiveness, and to ensure that data are consistent with or comparable to statewide data for salmon recovery.
- Prepare progress reports for WCSSP, GSRO, and the public, including posting all Plan implementation information to the regional web site.

Lead Entities

The Region's four Lead Entities will continue to direct implementation of habitat project lists within their own watersheds and maintain and update implementation schedules on the Habitat Work Schedule. Each Lead Entity will be asked to participate in the regional Implementation Team. The Implementation Team will be asked to recommend coordination of funding resources and implementation schedules as well as coordinating monitoring and adaptive management at the regional level.

The implementation of the regional Salmon Sustainability Plan will be most effective and likely to achieve its goals by relying on guidance and processes of the Lead Entities. The current Lead Entity process provides:

- Project Sponsors familiar with developing project goals, permitting, and legal and technical requirements.
- Local citizen committees engaged in planning prior to project development, which increases the likelihood of public support.
- Technical committees actively engaged in project identification and phasing, as well as providing support and technical advice to Project Sponsors.
- Projects refined and developed based on public input and technical review. This process offers the best opportunity for integrating Regional Plan goals and objectives into local Lead Entity Strategies.

This Lead Entity structure and process can be adapted and scaled, as necessary, to regional projects.

Public Involvement

It is essential that members of the public are provided ample opportunities to participate in partnerships with resource managers in implementation of the Plan strategies and actions. These partnerships will ensure that implementation has the greatest degree of public support and achieves the goals of healthy habitats supported by naturally functioning ecosystems, land use decisions that further protect habitat, and hatchery and harvest practices that both protect wild fish populations and support sustainable fishing economies.

The Lead Entities will remain the primary avenue for public involvement, for reviewing projects and planning activities within their own watersheds. The Implementation Team will provide information to the Lead Entities to share with local communities and investigate ways the public can participate more directly through monitoring and citizen science programs.

Regional Technical Committee

The Regional Technical Committee ("RTC") is comprised of persons with appropriate technical skills, appointed by the WCSSP Board of Directors. The Committee will continue to function under its current operating procedures, and expand its role to include regional scale project review and ranking. The RTC will expand its work to include monitoring and evaluation, and technical evaluation of Plan implementation.

Uncertainties

There are several significant unknowns that may impede implementation of the Plan, including science and data, legislation, and funding. Each of these will require a specific strategy to best address it.

DATA GAPS AND SCIENCE

Data gaps in the Coast Region that are important to salmon sustainability can be divided into three categories: those that are the result of data that exists but for a variety of reasons has been put to no useful analysis and comparisons; those that deal with unknown aspects of environmental conditions and ecosystem processes vital to salmon survival; and those that apply to the linkage and effectiveness of specific actions and their effects on habitat and salmon life history processes.

Effectiveness monitoring has been underway throughout Washington's salmon recovery community for several years and provides an important basis for understanding the effects of comparable actions in similar habitats. This information will be useful for designing and applying effectiveness monitoring to establish linkages between specific actions and resulting ecosystem impacts within coastal watersheds.

The complexity of these linkages is often poorly understood and will require input from experts from various disciplines, including fish biologists, geologists, hydrologists, forest ecologists, and other experts familiar with the Coast Region's watersheds. Filling this data gap is dependent on ongoing research and study that will test this Plan's fundamental hypothesis that highly complex and functioning ecosystems are more resilient to disturbance and will benefit salmon populations. Our first step will be collecting and analyzing all relevant research in coastal watersheds and pointing out needs for deeper understanding.

Collecting, categorizing and analyzing existing data will require the focused effort of a dedicated staff person. To date, there is no staff among WCSSP and its partners available to take on these tasks. A top priority for Plan implementation will be funding a dedicated staff position to undertake and/or coordinate these and other efforts aimed at identifying and filling data gaps important to salmon sustainability.

LEGISLATION AND POLICY

The emphasis in this Plan on improving effectiveness of regulation and legislation is inherently uncertain and largely dependent on public support for further empowering regulators and resource managers to protect salmon ecosystems with enhanced tools and authority. Outreach to support these efforts will require targeting both citizens and decision-makers with messages to increase their knowledge and understanding of the value of healthy, salmon-supporting watersheds to their lives and communities.

FUNDING

There is significant uncertainty associated with long-term funding and authorization of actions identified in this Plan. Funding through the SRFB from the Pacific Coastal Salmon Recovery Fund has been declining and may continue to do so. Tribes bring invaluable resources to this work but funding continues to be a challenge for their efforts as well. Habitat Conservation Plans ("HCPs") and Road Maintenance and Abandonment Plans ("RMAPs") provide important management and restoration resources on state and private forest lands. All of these and others are insufficient for the large-scale actions required for full implementation of this Plan.

A key step toward addressing funding uncertainties will be the Identification of the goals and objectives of state and federal agency land, fish and wildlife plans, and how our strategies and actions align with theirs. In some cases, actions and strategies in our Plan are already underway. It is critical to effective and efficient implementation for us to know and coordinate as much as possible with our partners, to know what they are doing so our efforts complement and enhance theirs, fill gaps, and provide critical support. And to know what we need to ask from them.

Monitoring and Adaptive Management

Monitoring will be necessary to understand if the actions recommended in the Plan are achieving their intended results. The risk that these actions may not be appropriate or adequate is real, and must be managed by built-in monitoring and evaluation to determine if the actions are having the predicted results. Further monitoring will be required to assess the biological conditions of the watersheds and status of their salmon species.

As an ecosystem-based sustainability strategy, this Plan is based on the assumption that the Coast Region's watersheds will support and sustain more salmon, with the greatest life history diversity, if management actions lead to more *natural* conditions favoring maximum bio-diversity and connectedness in and between habitats at multiple spatial and temporal scales. Still, success must be measured by the status of salmon populations over time.

A detailed monitoring and evaluation program will be designed as a part of implementation of the Plan. This program will be incorporated into an adaptive management framework based on the principles and concepts presented in *The Scientific Basis of Validation Monitoring of Salmon for Conservation and Restoration Plans (*Botkin et al., 2000) and also, to a degree, on the 2007 NMFS guidance document, *Adaptive Management for ESA-listed Salmon and Steelhead Recovery: Decision Framework and Monitoring Guidance* (NMFS, 2007).

The absence of ESA-listed salmon in much of the Region means we are not required to follow NMFS guidance, but monitoring and evaluation program design will be informed by ESA program guidance in order that our monitoring data has relevance across the state and to state and federal agencies involved in salmon recovery and sustainability.

IMPLEMENTATION MONITORING

Actions implemented under the Plan will be monitored to determine if the actions were carried out as planned. This will be an administrative review, potentially tracked within the regional portal in the Habitat Work Schedule.

Implementation monitoring will look at the types of actions taken, how many and where. For habitat actions the monitoring will include the area or length of stream or other habitat affected. Indicators for implementation monitoring will include field observations for habitat projects, and notes and project reports and other materials for outreach and other projects.

STATUS AND TRENDS MONITORING

The status and trends of most salmon ESU/DPS populations will be monitored by the tribes and WDFW, usually as escapement estimates based upon redd counts in index areas. These data are limited and, for over one third of the Region's populations, they are not adequate for estimating status. Limitations of the modeling methodology used to estimate escapement – where that has been possible – is in part balanced by the trends suggested in up to 35 years of data.

Washington Department of Ecology's Environmental Assessment Program initiated Status and Trends Monitoring for Watershed Health and Salmon Recovery in the Washington Coast Region in 2010. The purpose is to develop and use a sampling plan that reports on the status of Watershed Health and Salmon Recovery Efforts at the Water Resource Inventory Area ("WRIA") and Regional scale. The program uses a Quality Assurance Monitoring Plan ("MP") for implementing a probability-based sampling effort to inform on the condition of streams and rivers. http://www.ecy.wa.gov/programs/eap/stsmf/index.html

The goal of status and trends monitoring is to provide quantitative, statistically valid estimates of habitat and water quality, which are important for policy and management decisions. The objectives of the status and trends monitoring plan are to:

- Provide a probability-based sampling framework that can be used at the state, salmon recovery region, and WRIA scales by all levels of government and volunteers to assess the conditions of the state's aquatic resources.
- Determine a sampling site selection process that provides a minimum of 80% confidence in the estimated status of wadeable and non-wadeable streams.
- Identify specific metrics or indicators that will be monitored and the protocols used to measure them.
- Incorporate existing information and monitoring data, where possible, into the status and trends assessment.
- Develop partnerships with other agencies, local governments, and volunteer groups to implement the monitoring plan or share data.

Additional monitoring programs, at various spatial scales, will be identified and evaluated for their applicability to providing valuable data. Tribal, WDFW, Ecology, and other monitoring programs will be incorporated into a regional monitoring strategy that will be regularly updated and evaluated for its sufficiency to measure the status of attributes and indicators of species and habitats.

EFFECTIVENESS MONITORING

Effectiveness monitoring of habitat projects is robust in Washington's other salmon recovery regions, providing a wealth of data we can draw on to inform project design, sequencing, and implementation in the Coast Region. A thorough compilation of existing effectiveness monitoring studies, focused on watersheds similar to those in the Coast (Lower Columbia and Puget Sound), will be the first step in developing an effectiveness monitoring program for this Plan. The program will include a detailed approach, indicators, and protocols to be used in assessment of habitat restoration.

Other strategy themes will require somewhat different approaches. Whereas habitat strategies/actions can be assessed in terms of habitat quality parameters, fish abundance and productivity measures, outreach and regulatory effectiveness strategies are more challenging to measure in terms of their impact on fish and fish habitat. These elements of effectiveness monitoring will require measures of landowners and decision-makers behaviors that affect habitat, and measures of voluntary participation in habitat protection and restoration as well as analysis of regulatory influence on land use decisions over time.

RESEARCH

Unknown aspects and relationships between environmental conditions and salmon life histories will be increasingly important to evaluate the effectiveness of the strategies and actions of this Plan. The Regional Technical Committee will be central to identifying and supporting important research in support of Plan implementation and effectiveness monitoring. Once a clearer understanding has been reached on current data and what it can tell us, filling data gaps will drive the identification and prioritization of research.

WCSSP will work with relevant partners to encourage research be undertaken to better understand, for instance: effects of past restoration projects on habitat and ecosystem processes; innovative harvest techniques that reduce negative impacts on wild fish while improving economic returns for fishers; interactions between hatchery fish and wild populations; invasive species impacts on salmon; the interaction between bull trout and other Coast salmon populations. These are but a few of the many ideas for research discussed in the planning process.

DATA MANAGEMENT

As mentioned above, one of the key elements required in Plan implementation and adaptive management is a robust data management program. It represents the single most significant gap in WCSSP capacity at this time and is among the first that needs to be addressed.

Dedicated funding will be sought for staffing to evaluate existing data, identify data gaps, and develop and implement a data management system. Multiple systems exist around the state that can provide important insights and improve the efficiency and lower the cost of the Coast's efforts dramatically. A data management tool is needed that can provide a comprehensive conceptual framework based on monitoring indicators and data collection protocols. This process will be directed by the Implementation Team in consultation with the Regional Technical Committee, and will include a geo-database that can be used to support and direct data collection in the field as well as analysis through the NetMap Tools system.

The data management system, indicators and protocols will be developed as much as possible to coordinate with state and other regional systems to limit costs and allow data to be rolled up for inclusion and evaluation, and for regional and statewide assessments.

Likewise, successful implementation, monitoring and adaptive management will rely on existing monitoring programs of the tribes, WDFW, Ecology, DNR, NOAA and others. The development of a Coast Region Monitoring Program and Data Management system will strive to be consistent with these other programs.

Adaptive Management

Adaptive Management is defined in the Washington State Forest Practices Law (RCW 76.09.020) as "reliance on scientific methods to test the results of actions taken so that the management and related policy can be changed promptly and appropriately." The uncertainties that accompany implementation of this Plan require monitoring on multiple levels to supply data with which to analyze whether the strategies and actions being implemented are achieving the intended results. Adaptive Management of this Plan will proceed through four steps:

> **Analyzing**. This first step involves converting raw data into useful information. This will be conducted on a regular cycle to be determined by the Implementation Team, likely each year or two at the outset and perhaps longer intervals as implementation progresses. The analysis will be based on clearly defined questions articulated by the Implementation Team, and summarized raw data will be used to answer these questions. The larger questions to be answered through this analysis are: 1) What did we intend to accomplish through our actions? 2) What actually happened? 3) What were the likely causes of the results we observed? 4) What actions should we continue to take and how can we improve our actions? 5) What opportunities are coming up to test our thinking about improving our actions and how do we test and review this thinking?

Learning. This second step is the active process of using the experiences and information obtained through the above analysis to confirm, modify or change future actions. This is a critical step and is an important stage in which to re-engage the entire Planning Team. This will enable the original team to analyze the underlying causes of how and why results were achieved, or not, and to seek practical ways to improve results. A broader team is important at this stage to bring a range of perspectives, knowledge and experience to bear on issues and find solutions. This step is also critical for clearly articulating a solid rationale to stakeholders – and funders – as to what changes are needed and why.

Adapting. This third step involves simply using the lessons learned through analyses to change and improve the strategies and actions in this Plan. In this step WCSSP will be asked to approve specific updates to the Plan recommended by the Implementation Team. It will specifically look at strategic actions, implementation and monitoring plans, and may include updates to status indicators. It may also include updates and revisions to the basic planning documents including the viability charts and threats identification and ranking, or even a formal iteration of all steps in the Open Standards planning process.

Sharing. It is important to share not only our successes, but also what does not work. There is much to learn from failures and these lessons can provide the most compelling ways of communicating targeted messages to different audiences. Sharing the results of analyses with the entire Planning Team will help bring a broader understanding of the Plan as well as what changes are needed and why. This will also help to ensure continued commitment to the Plan as well as buy-in for changes to it.

Consistency and Coordination with Other Plans

A key component of successful implementation of the Plan will be the identification of partners actively engaged or seeking to be engaged in actions that advance or complement the goals and objectives of the Plan. In some cases, the specific actions called for in the Plan are already being taken by others, and it is important for the Implementation Team to engage with those groups to support them and ensure greater efficiency and likelihood of success for all partners.

As part of developing the Implementation Strategy, this will involve a comprehensive analysis of other planning and management actions underway or contemplated by natural resource managers in the Coast Region to identify congruities and potential conflicts. Some of these plans are identified and briefly described in Appendix 1. Others may be identified as part of the analysis.

Funding Strategy

A primary goal of this Plan was articulated during the formation of the Washington Coast Sustainable Salmon Partnership in 2007:

> ***Avoid additional ESA listings and further diminished [salmon] populations in the Washington Coast Region through sustainability instead of ESA recovery planning*** (Triangle, 2007).

As has been articulated by many, it is far easier and less costly to protect and enhance existing high quality habitat than it is to restore habitat that has already been degraded. By the same token, it is a better use of limited resources to prevent additional salmon ESA listings than to try to achieve recovery after listing.

There is as yet no detailed analysis of the costs of implementing this Plan and ensuring the sustainability of Washington Coast salmon. A list of medium and high priority habitat restoration projects identified across the Region, and ready for implementation in the next two to five years, totals over $41 million, and concludes this chapter.

Likewise, strategic acquisitions of critical habitat are also expensive, but opportunities to protect extensive areas are extraordinary. The Hoh River Trust has acquired and protected nearly 7,000 acres of riparian and upland forest in the Hoh valley at a cost of over $12 million (http://www.hohrivertrust.org/about-the-trust). The Nature Conservancy recently purchased 3,000 acres of riparian floodplain habitat on the Clearwater, one of the region's most productive watersheds, at a cost of nearly $6 million (http://www.nature.org/ourinitiatives/regions/northamerica/unitedstates/washington/conservancy-buys-3088-acres-on-the-coast.xml) .

Many existing programs and funding sources have and will continue to pay for efforts directly or indirectly in support of the Plan strategies. Private timber companies' Road Maintenance and Abandonment Plans ("RMAPs") and Habitat Conservation Plans ("HCPs") help to ensure a minimum of further habitat degradation on their lands. Management of a large percentage of the Coast Region by federal and state landowners – the National Park Service ("NPS"), the Forest Service ("USFS"), US Fish and Wildlife Service ("USFWS"), Washington Department of Natural Resources ("WDNR"), and Washington Department of Fish and Wildlife ("WDFW") – are largely complementary with salmon habitat protection and restoration. Unfortunately, funding for many of these agencies is currently inadequate, and critical protection and restoration work could easily be deferred indefinitely at great cost to ecosystem function and salmon habitat.

The costs associated with implementation of many other strategies and actions, such as outreach and regulatory effectiveness, are lower. Significant progress will be made through staff or stakeholder participation in public meetings and planning forums – just making certain salmon, habitat, and ecosystem interests are well represented. Much of these costs require long-term programmatic funding to coordinate, facilitate, and implement strategies and actions.

Implementation of this Plan will be dependent in part on the following funding sources:

- The Pacific Coastal Salmon Recovery Fund and the Washington Salmon Recovery Funding Board;
- Appropriations from the Washington State Legislature for state agency budgets (WDFW, Ecology, WDNR, Conservation Districts);
- Grant funds to Washington State Agencies administered through the Washington Recreation and Conservation Office and other Federal Grant Programs administered through the Department of the Interior (USFWS) and others;
- Appropriations from the US Congress for federal agency budgets (USACE, USFWS, USFS, NPS, and NRCS);
- Other nongovernmental organizations such as The Nature Conservancy, The Wild Salmon Center, the National Fish and Wildlife Foundation, EcoTrust, and Regional Fishery Enhancement Groups; and
- Voluntary projects funded through public and private partnerships.

The overall uncertainty of future funding, including the Pacific Coastal Salmon Recovery Funds on which this program has almost exclusively depended thus far, prompted the WCSSP to authorize the creation of the Washington Coast Sustainable Salmon Foundation, which will be organized specifically to secure funding and provide fiscal services for the implementation of the Washington Coast Sustainable Salmon Plan. The Foundation will become active on July 1, 2013.

A key task of the Implementation Team will be the creation of a specific funding strategy. Utilizing the completed Plan, Implementation Plans for each strategy theme, and real and compelling stories of the measurable value and benefit of restoration and protection work already accomplished, a financial model will be developed illustrating the total cost and benefit of full Plan implementation. This model will be the primary tool with which the Foundation will secure long-term investment in the salmon populations of the Washington Coast Region and the ecosystems they depend on.

On the following pages is a draft list of habitat projects compiled by the Lead Entities and other salmon restoration partners which address strategies listed under "Protect and Restore Salmon Habitat Function." This list is preliminary and does not necessarily represent the highest priority projects in a given basin. Rather, it is partial list of priority projects which, with adequate funding, can be accomplished in the next two to three years. Projects which are developed to implement the Plan's non-habitat strategies (such as Outreach, Economic Tools, etc.) will be identified and described in the Plan Implementation Strategy. The Implementation Strategy is on track to be completed by the end of 2013.

PRELIMINARY 2013 – 2015 REGIONAL HABITAT PROJECT LIST

[Note: These are on-the-ground habitat projects and do not include projects addressing the other strategies in this Plan.]

WRIA 20 SOL DUC – HOH

HOH BASIN

Upper Hoh Road Realignment
Location: Approx milepost (MP) 4 to MP 6, MP 9.5 to MP 10, MP 12 to 12.5, plus short distances within ONP
Action to be taken: Relocation of certain road sections will eliminate the need to protect during high flow emergencies. Depending on the site, upgrade inadequate stream crossings to pass 100 yr flows, remove many fish passage barriers, eliminate and stabilize many sections of bank armoring and old fills.
Issue/Limiting Factor being addressed: Lack of functional riparian forest, lack of buffers, lack of shade, fish passage barriers, lack of 100 year flood passage
Cost: *$*20,000,000
Salmon stocks benefited: Chinook, coho, steelhead, coastal cutthroat, bull trout

Allen's Marsh
Location: Hoh River mile 14.5 (East of HWY 101, south of H-1000 Rd.).
Action to be taken: Culvert repair/replace, riparian and bank stabilization
Issue/Limiting Factor being addressed: Consolidation of flow and off-channel habitat access
Cost: $29,000
Salmon stocks benefited: Chinook, coho, coastal cutthroat

Noxious Weed Control
Location: Entire length of Hoh River
Action to be taken: Annually eliminate or control state listed noxious weeds including knotweed, herb robert, scotch broom, tansy, etc. Cost is yearly for as long as the will is there.
Issue/Limiting Factor being addressed: Symptom of poor riparian habitat, may prevent/delay normal forest succession on river bars
Cost: $110,000
Salmon stocks benefited: Chinook, coho, steelhead, coastal cutthroat, bull trout

Hoh Springs weirs/Dismal Pond (old SSHEAR projects)
Location: T27N, R11W, sec 34, 35
Action to be taken: Repair/remove barriers, replace with roughened channels that allow both beaver usage and fish passage without excessive maintenance. Includes designs for deeper back water ponds to cool water temps.
Issue/Limiting Factor being addressed: Passage barriers to both beavers and man-made devices. High warm water temps in man-made off-channel sites.
Cost: $125,000
Salmon stocks benefited: Coho, steelhead, coastal cutthroat

37X Road (Rayonier Bar)

Location: T26N, R13W, sec 14

Action to be taken: Remove culverts to allow fish passage to stream and wetland, stabilize /replant slopes where slides have occurred and stabilize road bed to prevent further slides. Also, stabilize an old crossing on Hoh side channel and remove large culvert that has already washed out. Includes designs for new off channel rearing ponds.

Issue/Limiting Factor being addressed: Mass wasting, sedimentation into wetlands and stream that feed directly into the Hoh R., fish passage barriers

***Cost*:** $120,000

Salmon stocks benefited: Coho, steelhead, coastal cutthroat

QUILLAYUTE/ CALAWAH BASIN

Sitkum R.2900-072 Road Decommissioning

(Note: This project was determined to be priority after the Quileute Reach Assessment used in the NPCLE strategy had been completed.)

Location: In the Sitkum drainage of the S Fork Calawah River Basin, T28N, R12W, Sec 11 and 12. USFS landowner. Quileute U&A.

Action to be taken: Forest Service has ongoing HPA through MOU with state. Remove culverts and decommission road segment in accordance with USFS guidelines and policies.

Issue/Limiting Factor being addressed: Deteriorating culvert and lack of usage of road in that area. Eliminates potential mass wasting in response to undersized and non-maintained culverts and road segment.

Cost: $220,000

Salmon stocks benefited: Chinook, coho, steelhead, coastal cutthroat

FS 2912 and 2912-060 Road Decommissioning

(Note: Top 8 priority in Quileute/stakeholder assessment of restoration needs)

Location: In the Sitkum sub-watershed of the Calawah River Basin, T29N, R11W, Sec 32. USFS landowner. Quileute U&A.

Action to be taken: USFS has ongoing MOU with state, for HPA work. Remove culverts, pullback and/or outslope areas of unstable soils; restore natural drainage and decommission road segment in accordance with USFS guidelines and policies.

Issue/Limiting Factor being addressed: Deteriorating and undersized culverts, and side cast constructed roads on unstable geology, and a lack of funding for adequate road maintenance and culvert upgrades, increase the likelihood of road related mass wasting events which was identified as a limiting factor in the Sitkum drainage. Road decommissioning reduces the potential for massive inputs of fine and coarse sediment from road related mass wasting, which has a significant impact on fish habitat and productivity.

Cost: $180,000

Salmon stocks benefited: Chinook, coho, steelhead, coastal cutthroat

FS 2923-015 Road Decommissioning

Location: FS 2923 road, in the Rainbow Creek drainage, Sitkum River sub watershed

Action to be taken: Remove culverts, pullback and/or outslope areas of unstable soils; restore natural drainage and decommission road segment in accordance with USFS guidelines

Issue/Limiting Factor being addressed: Deteriorating and undersized culverts, and side cast constructed roads on unstable geology, and a lack of funding for adequate road maintenance and

culvert upgrades, increase the likelihood of road related mass wasting events which was identified as a limiting factor in the Sitkum drainage
Cost: $170,000
Salmon stocks benefited: Chinook, coho, steelhead, coastal cutthroat

QUILLAYUTE/SOL DUC BASIN

Gunderson Creek Culvert Replacement T29R
Location: Tributary of Sol Duc River, where creek passes under D 2000 Road. T29N, R13W Sec. 20. Land ownership: Rayonier; Quileute U&A
Action to be taken: HPA for instream work. Design and construction bids for culvert work (including removal of old and installing new). Monitor fish presence per SRFB requirements.
Issue/Limiting Factor being addressed: Fish passage, access to habitat. Originally Medium Priority project ranked high by NPCLE Technical Committee in 2011.
Cost: $120,000
Salmon stocks benefited: Coho, steelhead, coastal cutthroat

Sol Duc Trib # 20.0335 Culvert Replacement
Location: River mile 4 of tributary 20.00335
Action to be taken: HPA for instream work. Design and construction bids for culvert work (including removal of old and installing new). Monitor fish presence per SRFB requirements.
Issue/Limiting Factor being addressed: Fish passage
Cost: $120,000
Salmon stocks benefited: Chinook, coho, steelhead, coastal cutthroat

Gunderson Off-Channel Restoration
Location: Off-channel ponds at Gunderson Creek 20 0304
Action to be taken: Reconnect ponds and wetlands with Gunderson Creek
Issue/Limiting Factor being addressed: Juvenile access, hydrologic storage and lack of overwintering habitat
Cost: $90,000
Salmon stocks benefited: Coho, steelhead, coastal cutthroat

Gunderson Culvert Repair
Location: River Mile 0.5 at East Fork of Gunderson Creek # 20 0304a
Action to be taken: HPA for instream work. Design and construction bids for culvert work (including removal of old and installing new). Monitor fish presence per SRFB requirements.
Issue/Limiting Factor being addressed: Fish passage
Cost: $100,000
Salmon stocks benefited: Coho, steelhead, coastal cutthroat

QUILLAYUTE/ DICKEY BASIN

Sands Creek Drainage Culvert Replacement
Location: Mile 14.5 on the FS 9000 Road on the middle fork of Sands Creek
Action to be taken: Culvert replacement with a bridge
Issue/Limiting Factor being addressed: Partial barrier and failing culvert leading to an imminent sediment dump into productive spawning and rearing habitat

Cost: *$407,000*
Salmon stocks benefited: Chinook, coho, steelhead

<u>**OZETTE BASIN**</u>

<u>**Noxious Weed Control**</u>
Location: Entire upper Lake Ozette Basin
Action to be taken: Annually eliminate or control state listed noxious weeds especially knotweed. Cost listed is annual for several years.
Issue/Limiting Factor being addressed: Symptom of poor riparian habitat, may prevent/delay normal forest succession on river bars
Cost: $175,000
Salmon stocks benefited: Sockeye, Chinook, coho, steelhead, coastal cutthroat

<u>**NEARSHORE**</u>

<u>**WRIA 20 Nearshore Assessment of Salmonid presence**</u>
Location: Makah Bay, mouth of the Quillayute River and mouth of the Hoh River
Action to be taken: Beach seine sampling for salmonid adult and juvenile presence
Issue/Limiting Factor being addressed: Salmonid habitat use of nearshore estuaries and accompanying foraging resources
Cost: $200,000
Salmon stocks benefited: All anadromous stocks in WRIA 20 and any migrating adults or juveniles from adjacent (or beyond) systems

<u>**Nearshore Assessment of Salmonid genetic stocks**</u>
Location: Makah Bay, mouth of the Quillayute River and mouth of the Hoh River
Action to be taken: Sub-sample salmonid tissue from beach seines for genetic stock identification
Issue/Limiting Factor being addressed: Identification of salmonid stock ESUs utilizing the nearshore for migration and foraging
Cost: $120,000
Salmon stocks benefited: All anadromous stocks in WRIA 20 and any migrating adults or juveniles from adjacent (or beyond) systems

<u>WRIA 21 QUINAULT</u>

<u>**QUINAULT BASIN**</u>

<u>**Upper Quinault River Restoration**</u>
Location: Upper Quinault River
Action to be taken: Install Engineered Logjams over 5 mile stretch of river
Issue/Limiting Factor being addressed: Habitat restoration
Cost: $5,000,000
Salmon stocks benefited: Chinook, coho, chum, steelhead, coastal cutthroat, sockeye

<u>**QUEETS/CLEARWATER AND QUINAULT BASINS**</u>

<u>Knotweed Control and Riparian Enhancement</u>
Location: Quinault, Queets, and Clearwater Rivers
Action to be taken: Control of knotweed within entire basin and riparian plantings
Issue/Limiting Factor being addressed: Riparian habitat restoration
Cost: $250,000
Salmon stocks benefited: Chinook, coho, chum, coastal cutthroat

WRIA 22 LOWER CHEHALIS

GRAYS HARBOR/NORTH BAY BASIN

<u>West Fork Chenois Creek Fish Barrier Correction</u>
Location: Ocean Beach Road at West Fork Chenois Creek, MP 4.5
Action to be taken: Replace barrier culvert with bridge
Issue/Limiting Factor being addressed: Fish passage
Cost: $350,000
Salmon stocks benefited: Chinook, coho, chum, steelhead, coastal cutthroat

<u>Chenois Creek Barrier Corrections</u>
Location: Rayonier Timber Co. lands in upper West Fork Chenois Creek watershed
Action to be taken: Correct 10 fish barrier culverts
Issue/Limiting Factor being addressed: Fish passage
Cost: $350,000
Salmon stocks benefited: Chinook, coho, chum, steelhead, coastal cutthroat

<u>Campbell Slough Fish Barrier Correction</u>
Location: Rayonier Timber Co. lands in upper Campbell Slough watershed
Action to be taken: Correct 5 fish passage barrier culverts, including 3 crossing abandonments
Issue/Limiting Factor being addressed: Fish passage
Cost: $100,000
Salmon stocks benefited: Chinook, coho, chum, steelhead, coastal cutthroat

GRAYS HARBOR/SOUTH BAY BASIN

<u>Redmond Slough</u>
Location: Redmond Slough adjacent to Bottle Beach State Park
Action to be taken: Removal of a dike/tidegate and installation of new tide gates at the Highway 105 crossings of Redmond Slough tidal channels. Restoring up to 58 acres of tidal rearing habitat and emergent salt marsh.
Issue/Limiting Factor being addressed: Estuarine floodplain habitat restoration, natural tidal inundation, juvenile salmon rearing
Cost: $350,000
Salmon stocks benefited: Chinook, coho, chum, coastal cutthroat

<u>John's River Dike Removal</u>
Location: John's River Wildlife Area
Action to be taken: Removal of remnant failed dikes in the John's River Wildlife Area, improving tidal inundation and access to tidal rearing habitat

Issue/Limiting Factor being addressed: Estuarine floodplain habitat restoration, natural tidal inundation, juvenile salmon rearing
Cost: $270,000
Salmon stocks benefited: Chinook, coho, chum, coastal cutthroat

WRIAs 22/23 ENTIRE CHEHALIS

ENTIRE CHEHALIS BASIN

Chehalis Basin Knotweed Control
Location: Basin wide
Action to be taken: Control of knotweed within targeted sub basins and riparian plantings
Issue/Limiting Factor being addressed: Riparian habitat restoration
Cost: $415,000
Salmon stocks benefited: Chinook, coho, chum, steelhead, coastal cutthroat

WRIA 23 UPPER CHEHALIS

BLACK RIVER BASIN

Allen Creek Restoration
Location: Case Road between Littlerock and Maytown
Action to be taken: Design and construct restoration of 2100 ft. long reach of Allen Creek, tributary to Beaver Creek in Thurston County. Abandon 1600 ft. long ditched section of Allen Creek adjacent to Case Road and restore flow to its historical location in sinuous channel.
Issue/Limiting Factor being addressed: Channel reconnection and connectivity, Riparian habitat restoration
Cost: $120,000
Salmon stocks benefited: Chinook, coho, chum, steelhead, coastal cutthroat

LINCOLN MANAGEMENT UNIT/BUNKER CREEK BASIN

Culvert 1404W15A
Location: Bunker Creek - Deverueaux
Action to be taken: Replace barrier culvert with bridge
Issue/Limiting Factor being addressed: Fish passage
Cost: $100,000
Salmon stocks benefited: coho, steelhead, coastal cutthroat

Bunker Creek Barrier Removal Project
Location: Bunker Creek Road, MP 2.386
Action to be taken: Replace barrier culvert with larger culvert or bridge
Issue/Limiting Factor being addressed: Fish passage
Cost: $50,000
Salmon stocks benefited: coho, steelhead, coastal cutthroat

Bunker Creek Barrier Removal Project
Location: Bunker Creek Road, MP 5.678
Action to be taken: Replace barrier culvert with larger culvert or bridge
Issue/Limiting Factor being addressed: Fish passage
Cost: $150,000
Salmon stocks benefited: coho, steelhead, coastal cutthroat

Ceres Hill Road Barrier Removal Project
Location: Ceres Hill Road, MP 5.816, unnamed tributary to Bunker Creek
Action to be taken: Replace barrier culvert with larger culvert or bridge
Issue/Limiting Factor being addressed: Fish passage
Cost: $150,000
Salmon stocks benefited: coho, steelhead, coastal cutthroat

Bunker Creek Barrier Removal Project
Location: Bunker Creek off Bunker Creek Road
Action to be taken: Replace barrier culvert with bridge
Issue/Limiting Factor being addressed: Fish passage
Cost: $130,000
Salmon stocks benefited: coho, steelhead, coastal cutthroat

LINCOLN MANAGEMENT UNIT/LINCOLN CREEK BASIN

Culvert 1504W15A
Location: Harris Creek at Independence Road
Action to be taken: Replace barrier culvert with larger culvert or bridge
Issue/Limiting Factor being addressed: Fish passage
Cost: $85,000
Salmon stocks benefited: coho, steelhead, coastal cutthroat

SKOOKUMCHUCK BASIN

Culvert 1501W27D
Location: Field Crossing on Snyder Creek
Action to be taken: Replace barrier culvert with larger culvert or bridge
Issue/Limiting Factor being addressed: Fish passage
Cost: $80,000
Salmon stocks benefited: coho, steelhead, coastal cutthroat

Culvert 1501W33A
Location: Packwood Creek off Mine Road
Action to be taken: Replace barrier culvert with larger culvert or bridge
Issue/Limiting Factor being addressed: Fish passage
Cost: $80,000
Salmon stocks benefited: coho, steelhead, coastal cutthroat

Culvert 1501W33C
Location: Packwood Creek off Mine Road

***Action to be taken*:** Replace barrier culvert with larger culvert or bridge
***Issue/Limiting Factor being addressed*:** Fish passage
***Cost*:** $80,000
***Salmon stocks benefited*:** coho, steelhead, coastal cutthroat

NEWAUKUM BASIN

Culvert 1301W23D
***Location*:** Middle Fork Newaukum Private Drive
***Action to be taken*:** Replace barrier culvert with bridge
***Issue/Limiting Factor being addressed*:** Fish passage
***Cost*:** $120,000
***Salmon stocks benefited*:** coho, steelhead, coastal cutthroat

WRIA 24 WILLAPA

WILLAPA BASIN

Lower Forks Creek Restoration
***Location*:** Forks Creek Hatchery and upstream to the hatchery intake
***Action to be taken*:** Remove hardened in-channel structures, reconstruct stream channel and bank, add large wood/engineered logjams, replant/restore riparian habitats. Remove Hatchery intake dam, install roughened channel with step pool configuration.
***Issue/Limiting Factor being addressed*:** Fish passage, lack of large woody material, excess sediment input, lack of riparian vegetation, channel diversity and structure
***Cost*:** $2,000,000
***Salmon stocks benefited*:** Chinook, coho, chum, steelhead, coastal cutthroat

Stringer Creek Dam Removal
***Location*:** Tributary to the Willapa, Hyland Stringer Road, Menlo
***Action to be taken*:** Remove 100% passage barrier, install meandering roughened channel, install large woody material, replant/restore riparian habitat
***Issue/Limiting Factor being addressed*:** Fish passage, lack of large woody material, excess sediment input, lack of riparian vegetation, lack of spawning gravels in lower reaches
***Cost*:** $250,000
***Salmon stocks benefited*:** Chinook, coho, chum, steelhead, coastal cutthroat

Mill Creek Meander Reconnection
***Location*:** Tributary to the Willapa, Mile 1 on Mill Creek Road
***Action to be taken*:** Replace blocked upstream inlet and downstream outlet to large historic meander bend of Mill Creek with two bridges. Install large woody material and replant/restore riparian habitat.
***Issue/Limiting Factor being addressed*:** Floodplain function and connectivity, fish forage, spawning, rearing and refugia. Lack of large wood and riparian buffers.
***Cost*:** $800,000
***Salmon stocks benefited*:** Chinook, coho, chum, steelhead, coastal cutthroat

NASELLE BASIN

Clearwater Creek Fish Passage
Location: Government Road and Clearwater Creek, Pac Cons Dist Field ID 136-137
Action to be taken: Replace barrier culverts with bridge
Issue/Limiting Factor being addressed: Estuarine floodplain habitat restoration, natural tidal inundation, juvenile salmon rearing
Cost: $1,400,000
Salmon stocks benefited: coho, chum

Smith Creek
Location: Parpala Road Site ID 144-145
Action to be taken: Replace barrier culverts with bridge
Issue/Limiting Factor being addressed: Estuarine floodplain habitat restoration, natural tidal inundation, juvenile salmon rearing
Cost: $700,000
Salmon stocks benefited: coho, chum

Unnamed Tributary to Naselle Estuary
Location: Government Road and Clearwater Creek, Pac Cons Dist Field ID 139
Action to be taken: Replace barrier culverts with bridge
Issue/Limiting Factor being addressed: Estuarine floodplain habitat restoration, natural tidal inundation, juvenile salmon rearing
Cost: $1,070,000
Salmon stocks benefited: coho, chum

Unnamed Tributary to Naselle Estuary
Location: Parpala Road, Pac Cons Dist Field ID 142
Action to be taken: Replace barrier culverts with bridge
Issue/Limiting Factor being addressed: Estuarine floodplain habitat restoration, natural tidal inundation, juvenile salmon rearing
Cost: $900,000
Salmon stocks benefited: coho, chum

Unnamed Tributary to Naselle Estuary
Location: Parpala Road, Pac Cons Dist Field ID 143
Action to be taken: Replace barrier culverts with bridge
Issue/Limiting Factor being addressed: Estuarine floodplain habitat restoration, natural tidal inundation, juvenile salmon rearing
Cost: $1,300,000
Salmon stocks benefited: coho, chum

Parpala Ranch Dike Removal
Location: Adjacent to Naselle Estuary, 348 Parpala Road
Action to be taken: Remove 13 failing tidegates and several miles of dike, restore 200 acres of estuarine wetland
Issue/Limiting Factor being addressed: Estuarine floodplain habitat restoration, natural tidal inundation, juvenile salmon rearing
Cost: $750,000

Salmon stocks benefited: coho, chum

Roaring Slough Culvert Replacements
Location: Naselle River estuary, west and north of Johnson Landing on SR 101
Action to be taken: Replace two failing and undersized culverts with bridges
Issue/Limiting Factor being addressed: Estuarine floodplain habitat restoration, natural tidal inundation, juvenile salmon rearing
Cost: $1,000,000
Salmon stocks benefited: coho, chum

BEAR BASIN

Pickering Slough Culvert and Tide Gate Replacement
Location: Bear River Estuary east of SR 101
Action to be taken: Replace undersized culvert and tidegate with 70' bridge to open access to four restored streams in 3.74 square mile watershed
Issue/Limiting Factor being addressed: Fish passage, estuarine floodplain habitat restoration, natural tidal inundation, juvenile salmon rearing
Cost: $350,000
Salmon stocks benefited: coho, chum

Porter Point Dike Removal
Location: Bear River Estuary, South End of Willapa Bay
Action to be taken: Remove 1.85 miles of dikes, reconnect 7 tidal channels to historic conditions, assist in removal of fish ladder. Restore 140 acres of historic estuarine salt marsh habitat. Final phase of 500 acre estuarine wetland restoration.
Issue/Limiting Factor being addressed: Fish passage, estuarine floodplain habitat restoration, natural tidal inundation, juvenile salmon rearing
Cost: $30,000
Salmon stocks benefited: coho, chum

References for Chapter 6

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APPENDIX 1
EXISTING SALMON AND HABITAT PROTECTION PLANS IN THE COAST REGION

Overview

At the first Scoping Meeting in January 2009, one of the key concepts identified early and agreed upon was to build on other existing plans in the Region. In addition, the approach and structure for this regional Plan is to strengthen local efforts and emphasize collaboration among the four coastal Lead Entity Groups ("LEGs"). The WCSSP Plan does not supplant or supersede individual Lead Entity Strategies (see below).

The design of the planning process from the beginning has been to ensure that LEGs maintain control of setting goals and priorities for salmon sustainability within their respective Water Resource Inventory Areas ("WRIAs"). The process built on existing local strategies and emphasizes regional approaches that complement them. The use of common, regional assessment and analysis tools used in this planning process has already led one or two Lead Entities to propose amending their strategies. Such planning process decisions will continue to be made at the Lead Entity level.

Not only does the WCSSP Plan share common goals with the Lead Entity Strategies, there are also several other coastal plans and management strategies designed and in place to protect salmon, salmon habitat, and broader ecosystem functions. In addition, there are plans that outline management of the harvest and hatcheries. It is the aim of the WCSSP Plan to integrate our efforts with these other entities and plans, wherever appropriate and feasible.

Extending beyond the regional scope, there are also several statewide, national, and international steps that have been taken and are helping to protect salmon populations in the Coast Region. The Forest and Fish Agreement (1999) became state law to ensure that forest practices minimize salmon habitat degradation. The Hatchery Scientific Review Group ("HSRG") was created by Congress to encourage reform of hatchery practices to better protect wild salmon populations. The Pacific Salmon Treaty was signed by the United States and Canada to preserve salmon by preventing overharvest in the ocean.

Two ESA recovery plans are in place or nearing completion in the Coast Region. The National Marine Fisheries Service ("NMFS") completed the *Lake Ozette Sockeye Salmon Recovery Plan* in May 2009 (see below) and the USFWS is currently working toward completion of the *Draft Recovery Plan for the Coastal-Puget Sound Distinct Population Segment of Bull Trout* (see below). Its critical habitat analysis was published in the Federal Register on October 18, 2010. WCSSP will endeavor to support and integrate management objectives and strategies of these ESA recovery plans into the broader strategies and actions of the WCSSP Plan.

In keeping with our overarching strategy to **Organize, Promote and Maintain Broad Partnerships***,* the following planning documents have been identified as the primary management efforts with which we need to integrate our efforts with – when appropriate – as we move from Plan completion to implementation. This list is intended to be a comprehensive overview, rather than an exhaustive summary.

ENDANGERED SPECIES ACT RECOVERY PLANS

Lake Ozette Sockeye Salmon Recovery Plan Summary

National Marine Fisheries Service, National Oceanic and Atmospheric Administration
Available at: http://www.nwr.noaa.gov/Salmon-Recovery-Planning/Recovery-Domains/Puget-Sound/upload/Ozette-summary.pdf

The Lake Ozette watershed is home to the Lake Ozette Sockeye salmon, which are listed as a threatened species under the Endangered Species Act ("ESA"). With their threatened listing in 1999 came the responsibility to recover the species to the point that they are again self-sustaining and contributing members of their own ecosystems. There are five known subpopulations or aggregations of Lake Ozette Sockeye, defined in terms of where they spawn—on beaches around the lake or in the tributaries. The goal of this recovery plan is to ensure that the naturally spawning Lake Ozette Sockeye population is sufficiently abundant, productive, and diverse (in terms of life histories and geographic distribution) to provide significant ecological, cultural, social, and economic benefits. Community livability, economic well-being, and treaty-reserved fishing rights have benefited by balancing salmon recovery with management of local land use and fishery economies.

Draft Recovery Plan for the Coastal-Puget Sound Distinct Population Segment of Bull Trout (*Salvelinus confluentus*) (May 2004)

U.S. Fish and Wildlife Service
Available at: http://ecos.fws.gov/speciesProfile/profile/speciesProfile.action?spcode=E065

The Puget Sound Management Unit is one of two management units comprising the Coastal-Puget Sound Distinct Population Segment of Bull Trout (*Salvelinus confluentus*). The overall recovery implementation strategy is to integrate with ongoing tribal, state, local, and federal management and partnership efforts at the watershed or regional scales. This coordination will maximize the opportunities for complementary actions, eliminating redundancy, and making the best use of available resources for bull trout and salmon recovery.

LEAD ENTITY STRATEGIES

WRIA 20 North Pacific Coast – Salmon Restoration Strategy (2010 Edition)

North Pacific Coast Lead Entity Group ("NPCLE")
Available at: http://www.wcssp.org/Documents/NPCWRIA20salmonstrategy2010sml.pdf

The primary goal of the *North Pacific Coast Lead Entity Strategy* is to maintain and improve ecosystem productivity and genetic diversity for all WRIA 20 salmon species by protecting the highly productive habitats and populations, and restoring impaired habitat and populations where the potential to recover exists. Only two salmon stocks in WRIA 20 have been listed for federal protection; Lake Ozette Sockeye and bull trout are listed as threatened under the Endangered Species Act. The NPCLE Strategy focuses on four distinct areas: Hoh River Basin, Quillayute River Complex, Lake Ozette Basin, and North Pacific Coastal "Independent" Drainages.

WRIA 21 Queets/Quinault Salmon Habitat Recovery Strategy (January 2010)

Quinault Indian Nation Lead Entity Group
Available at: http://www.wcssp.org/Documents/Quinault_LE_Strategy.pdf

The vision of this strategic plan is: "All of the watersheds in WRIA 21 will contain healthy, diverse populations of salmon sustained by healthy ecosystems that are supported by undisrupted physical and biological processes, and contain abundant, contiguous aquatic and riparian habitats utilized by diverse, species-rich biological communities that support and service the cultural and other value-based needs of local stakeholders" (p. 1). There are no threatened or endangered salmon species in WRIA 21. Bull trout, a listed salmon species, is considered present, and a considerable amount of habitat suitable for bull trout is found in the upper Queets and Quinault systems. The watersheds in WRIA 21 are prioritized into three categories; two large systems that dominate the area (Queets and Quinault Watersheds), three intermediate size rivers with characteristics in common (Moclips, Raft, and Copalis Rivers), and several small streams with independent entry into the Pacific Ocean.

WRIAs 22 and 23 Chehalis Basin Salmon Habitat Restoration and Preservation Work Plan (2010 Update)

Grays Harbor County Lead Entity Group, also known as the Chehalis Basin Lead Entity Group
Available at: http://www.co.grays-harbor.wa.us/info/pub_svcs/ChehalisBasin/Docs/WRIA20080922-23.pdf

The Chehalis Basin strategy sets out specific strategies for restoring habitat for each of the thirteen subbasins in WRIA 22-23, noting recovery issues and identifying general recovery actions. In addition it outlines basin-wide strategies for invasive species and barrier projects. This plan addresses eleven subbasins: the Black, Boistfort, Cloquallum, Hoquiam-Wishkah, Humptulips, Lincoln, Newaukum, Satsop, Skookumchuck, South Harbor, and Wynoochee, as well as the Grays Harbor Estuary.

WRIA 24 Pacific County Strategic Plan for Salmon Recovery (June 2001)

Pacific County Lead Entity Group
Available at: http://www.wcssp.org/Documents/Pacific%20LE%20Strategy.pdf

The overall goal of the *Pacific County Strategic Salmon Recovery Plan* is to re-establish the connection between fish and their habitat through the identification of deleterious human actions and their effects on salmon survival. The majority of the streams in the Willapa Basin support salmon, while only a portion cannot. The Willapa Basin consists of seven watersheds that produce salmon: the North, Willapa, Palix, Nemah, Naselle, Bear, and Long Beach Watersheds.

WATERSHED MANAGEMENT AND RESTORATION PLANS

WRIA 20 Watershed Management Plan (2009) and Detailed Implementation Plan (2010)

Available at: http://www.ecy.wa.gov/programs/eap/wrias/Planning/20.html

WRIA 20's Detailed Implementation Plan ("DIP"), premised on the Management Plan, includes strategies to provide sufficient water for both out-of-stream uses and instream flows. Actions to achieve these strategies including interim milestones to measure progress are listed in the DIP in anticipated chronological order. Coordination and oversight responsibilities and specific funding mechanisms are described within the actions and sub-actions themselves whenever possible. Throughout the plan, partnerships are acknowledged and proposed.

Watershed Restoration Plan for National Forest System Lands within the Calawah River Watershed

U.S. Forest Service
Available at: http://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb5374314.pdf

The Forest Service's Pacific Northwest Region Aquatic Restoration Strategy is a region-wide effort to protect and restore aquatic habitat across Washington and Oregon. The strategy relies on a collaborative approach to restoration and on focusing available resources in selected high priority watersheds to accomplish needed restoration activities on national forest system lands as well as other ownerships. In 2010 the Olympic National Forest selected the Calawah River watershed as its "Focus Watershed" for the Washington Coast basin. Over the next several years the Forest Service will emphasize restoration within the Calawah River watershed and will work with partners to complete high priority needs to protect and restore salmon and steelhead habitat. This action plan, developed within the collaborative group framework, identifies the high priority work which is needed to protect and restore watershed health, water quality, and fish habitat on National Forest System lands within the Calawah watershed.

WRIAs 22 and 23 – The Chehalis Basin Partnership Watershed Management Plan 2007-2008 Detailed Implementation Plan

Available at: http://www.co.grays-harbor.wa.us/info/pub_svcs/Lead_Entity/library/DIP%202007%20Amendment[1].pdf

The Chehalis Basin Detailed Implementation Plan contains implementation strategies to achieve goals that will lead to providing sufficient water for agricultural, commercial, industrial, and residential needs, as well as meeting minimum instream flow requirements. The strategies focus on water quantity, water quality, habitat, exempt wells, and water conservation.

Upper Quinault Restoration Plan

Quinault Indian Nation

The purpose of this plan is to describe scientific foundations, preferred methods, general procedures, and a framework for scheduling actions that will ultimately increase the quantity and quality of natural sockeye salmon spawning habitats on the Upper Quinault River floodplain. Initial actions will be directed toward preservation of the limited sockeye spawning habitat area remaining. Immediate action is necessary to halt the ongoing deterioration of habitats and the declining trend of sockeye abundance. The short-term objective is to restore and maintain sockeye production at recent levels. In the longer term, the actions described in this plan aim to re-establish a floodplain dominated by mature forest and more natural physical and biological processes.

FISHERIES MANAGEMENT

Pacific Coast Salmon Plan Fishery Management Plan for Commercial and Recreational Salmon Fisheries off the Coasts Of Washington, Oregon And California as Revised Through Amendment 14 (Adopted March 1999)

Pacific Fisheries Management Council
Available at: http://www.pcouncil.org/wp-content/uploads/fmpthrua14.pdf

This document guides management of commercial and recreational salmon fisheries off the coasts of Washington, Oregon, and California. Since 1977, salmon fisheries in the exclusive economic zone ("EEZ") off Washington, Oregon, and California (from three to 200 miles offshore) have been managed under salmon fishery management plans ("FMPs") of the Pacific Fisheries Management Council. This FMP covers the coast-wide aggregate of natural and hatchery salmon species; in addition, the plan contains requirements and recommendations with regard to essential fish habitat for the managed stocks. While all species of salmon fall under the jurisdiction of this plan, it currently only contains fishery management objectives for chinook, coho, pink (odd-numbered years only), and any salmon species listed under the Endangered Species Act that is measurably impacted by Council fisheries.

HATCHERY MANAGEMENT

Hatchery Reform Principles and Recommendations of the Hatchery Scientific Review Group (April 2004)

Hatchery Scientific Review Group
Available at:
http://www.lltk.org/hrp-archive/pdf/hsrg/HSRG_Princ_Recs_Report_Full_Apr04.pdf

In 2005, the Hatchery Scientific Review Team ("HSRG") completed a review of coastal hatcheries that examined the hatcheries' capacity to conserve naturally spawning salmon while supporting sustainable fisheries. The outcomes from this effort were a series of recommendations for hatchery reform outlined in three reports that focused on the North Coast (WRIAs 20 and 21), Grays Harbor (WRIAs 22 and 23), and Willapa Bay (WRIA 24).

WASHINGTON STATE AGENCY PLANS

Forest Practices Habitat Conservation Plan (FPHCP)

Washington Department of Natural Resources
FPA available at http://apps.leg.wa.gov/rcs/default.aspx?cite=76.09)

Forest practices in Washington State are regulated through the Washington Department of Natural Resources ("DNR") Forest Practices program by means of the Forest Practices Act, Chapter 76.09 RCW, and Title 222 WAC. The Forest Practices program and rules require the maintenance and restoration of aquatic and riparian habitat. The State of Washington seeks to provide long-term conservation of covered species, to support an economically viable timber industry, and to create regulatory stability for landowners. The FPHCP provides measures to minimize and mitigate the incidental take of five ESA-listed fish species that comprise 17 separate aggregations of populations of "evolutionarily significant units" ("ESUs") for anadromous fish species and the United States Fish and Wildlife Service designation of "distinct population segment" ("DPS") for resident fish species.

Forest Land Plan for the Olympic Experimental Forest Habitat Conservation Plan Planning Unit; Draft Environmental Impact Statement (June 2010)

Washington Department of Natural Resources
Available at: http://www.dnr.wa.gov/ResearchScience/Topics/SEPANonProject/Pages/amp_sepa_nonpro_oesf_flp.aspx

The Washington Department of Natural Resources ("DNR") manages 270,000 acres of forested state trust lands within the Olympic Experimental State Forest ("OESF") Habitat Conservation Plan Planning Unit. For this unit, DNR has been carrying out forest land planning to customize the guidance from broader agency forest policies and plans to meet agency goals and address related issues. The focus of this Draft Environmental Impact Statement is to provide analysis of potential impacts to the environment from the proposed management alternatives and describe proposed changes to DNR's landscape management strategies for the OESF. While other strategies are important elements of the plan, the key management strategy being examined in this process is the implementation of the OESF riparian conservation strategy.

Wildlife Areas October 2010 Update Environmental Impact Statement for the Proposed Wildlife Area Habitat Conservation Plan

Washington Department of Fish and Wildlife
Available at: http://wdfw.wa.gov/lands/wildlife_areas/hcp/

The Washington Department of Fish and Wildlife ("WDFW") is developing a habitat conservation plan ("HCP") for activities on state owned and managed Wildlife Areas. The HCP will be a long-term management plan for the conservation and protection of species and their habitats in Wildlife Areas. The goals of the Wildlife Areas HCP are to provide federal Endangered Species Act assurances for management, operational and recreational activities occurring in state Wildlife Areas, and to thereby contribute to the conservation and recovery of approximately 60 species listed under the ESA.

Ocean Acidification: From Knowledge to Action, November 2012

Washington Department of Ecology
Available at: https://fortress.wa.gov/ecy/publications/publications/1201015.pdf

Recognizing the threat to Washington's shellfish industry, its tribal communities, and its broader marine environment, Governor Gregoire created the Washington State Blue Ribbon Panel on Ocean Acidification, which first convened in February 2012. The panel's charge was to:

- Review and summarize the current state of scientific knowledge about ocean acidification;
- Identify the research and monitoring needed to increase scientific understanding and improve resource management;
- Develop recommendations to respond to ocean acidification and reduce its harmful causes and effects; and,

- Identify opportunities to improve coordination and partnerships and to enhance public awareness and understanding of ocean acidification and how to address it.

This report, and the accompanying technical document, *Scientific Summary of Ocean Acidification in Washington State Marine Waters*, constitute the Panel's report of its findings and recommendations for action.

Road Maintenance and Abandonment Plans ("RMAPs") – Large Forest Owners

Available at: **RMAPS, Olympic Region**, 411 Tillicum Lane, Forks, WA 98331, 360-374-2800

Washington State forest management laws require most private forest landowners to prepare and submit a Road Maintenance and Abandonment Plan ("RMAP"). An RMAP is a forest road inventory and schedule for any repair work that is needed to bring roads up to state standards. RMAPs are prepared by the landowners and approved by the Washington Department of Natural Resources. Implementation of these plans in the Coast Region has brought a huge benefit to salmon through replacement of blocking culverts and reduction of sediment input into streams. Large forest landowners who harvest more than 2 million board feet from their own lands are required to submit an RMAP. Only some small forest landowners are required to submit an RMAP. All forest roads have been required to be covered under an approved RMAP since December 31st, 2005.

The following Large Forest Landowners in the Coast Region have RMAPs approved by DNR in place:

Anderson & Middleton
Bloedell Timberlands Development
Campbell Group (2 RMAPs)
Wa. Dept. of Natural Resources
Fruit Growers Supply Co.
Grays Harbor County
Green Crow Corporation
Green Crow Timber
Green Diamond
Hancock Forest Management
Hawthorne Timberlands Co.
Hope Resources
Hoquiam, City of
Makah Forest Enterprises
Manke Lumber
Merrill & Ring
Olympic Range Tree Farm
Port Blakely Tree Farm
Rayonier
Weyerhaeuser
Wa. Dept. of Fish & Wildlife

FEDERAL LANDS MANAGEMENT

Olympic National Park, General Management Plan

National Park Service
Available at: http://parkplanning.nps.gov/documentsList.cfm?projectID=10233

This General Management Plan for the Olympic National Park ("ONP") represents a commitment by the National Park Service to the public and explains how ONP will be managed for the next 15 to 20 years. The plan presents the type of actions that are required for the preservation of the park's resources; defines the types and general intensities of development associated with public enjoyment and use of the area; discusses visitor-carrying capacities for the Park; and, outlines potential modifications to the external boundaries of the park.

Olympic National Forest Land and Resource Management Plan 1990

Amended 1994 by: Record of decision for amendments to Forest Service and Bureau of Land Management Planning Documents within the range of the Northern Spotted Owl (Northwest Forest Plan)

U.S. Forest Service
Available at:
http://www.fs.usda.gov/wps/portal/fsinternet/!ut/p/c4/04_SB8K8xLLM9MSSzPy8xBz9CP0os3gjAwhwtDDw9_AI8zPwhQoY6BdkOyoCAPkATlA!/?ss=110609&navtype=BROWSEBYSUBJECT&cid=FSE_003853&navid=091000000000000&pnavid=null&position=BROWSEBYSUBJECT&ttype=main&pname=Olympic%20National%20Forest-%20Home

The Forest Plan guides all natural resource management activities in and establishes management standards and guidelines for the Olympic National Forest. It describes resource management practices; levels of resource production and management; and, the availability and suitability of lands for resource management. These management actions include forest-wide multiple uses, standards for future activities, allowable sale quantity for timber, and monitoring and evaluation requirements.

The 1994 Amendment contained the following changes: it established late-successional reserves; established the Olympic Adaptive Management Area; identified Congressionally Reserved Areas; established riparian reserves; designated key watersheds; and, established standards and guidelines to govern land management activities with these designations. In addition, the amendment eliminated the Spotted Owl Habitat Areas in the Olympic Plan, which was fulfilled by the late-successional reserves habitat. The three principal effects on the management of the Olympic National Forest were to provide for long-term maintenance of late-successional forest habitat, expand emphasis on riparian habitat, fish habitat and water quality; and, reduce levels of forest management activities such as ground disturbance and vegetation manipulation.

Olympic Coast National Marine Sanctuary Draft Management Plan

National Oceanic and Atmospheric Administration
Available at: http://olympiccoast.noaa.gov/protection/mpr/welcome.html

Based on several years of scientific assessment and public input, the *Olympic Coast National Marine Sanctuary Draft Management Plan* includes recommendations for revised goals and objectives, action plans, a plan for implementation based on different funding levels, and recommended performance measures. The draft plan includes action plans to address six priority topics: fulfill treaty trust responsibility; achieve collaborative and coordinated management; conduct collaborative research, assessments and monitoring to support ecosystem-based management; improve ocean literacy; conserve natural resources; and, understand the sanctuary's cultural, historical and socioeconomic significance. Some minor regulatory clarifications are also included in the revision.

APPENDIX 2
WDFW SALMON STOCK DELINEATIONS

ALL SPECIES

Table 13. COAST STOCK STATUS SUMMARY 1992 AND 2002

Source: Washington Dept. of Fish and Wildlife (WDFW) 1992 SASSI and 2002 SaSI

COAST STOCK STATUS SUMMARY – 1992 and 2002				
	1992		**2002**	
North Coast	**No. of stocks**	**Percent of stocks**	**No. of stocks**	**Percent of stocks**
Healthy stocks	35	49%	31	45%
Depressed stocks	4	6%	3	4%
Critical stocks	0	0%	1	2%
Extinct stocks	0	0%	0	0%
Not Rated stocks	Not applicable		0	0%
Unknown stocks	33	46%	34	49%
Total	72		69	
	1992		**2002**	
South Coast	**No. of stocks**	**Percent of stocks**	**No. of stocks**	**Percent of stocks**
Healthy stocks	30	70%	32	65%
Depressed stocks	4	9%	10	20%
Critical stocks	0	0%	0	0%
Extinct stocks	0	0%	0	0%
Not Rated stocks	Not applicable		0	0%
Unknown stocks	9	21%	7	14%
Total	43		49	
	1992		**2002**	
Coast Total	**No. of stocks**	**Percent of stocks**	**No. of stocks**	**Percent of stocks**
Healthy stocks	65	57%	63	53%
Depressed stocks	8	7%	13	11%
Critical stocks	0	0%	1	<1%
Extinct stocks	0	0%	0	0%
Not Rated stocks	Not applicable		0	0%
Unknown stocks	42	37%	41	35%
Total	115		118	

Table 14. SALMON AND STEELHEAD STOCK LIST PRESENTED BY RIVER BASIN

Source: Washington Dept. of Fish and Wildlife (WDFW)

SALMON AND STEELHEAD STOCK LIST PRESENTED BY RIVER BASIN				
Stock	**1992 Status**	**2002 Status**	**Origin**	**Production Type**
SOOES/OZETTE	**1992 STOCK STATUS**	**2002 STOCK STATUS**	**STOCK ORIGIN**	**PRODUCTION TYPE**
CHINOOK – FALL				
Sooes	Unknown	Unknown	Native	Composite
CHUM – FALL				
Sooes	Unknown	Unknown	Unresolved	Unresolved
Ozette	Unknown	Unknown	Native	Wild
COHO				
Sooes/Waatch	Unknown	Unknown	Mixed	Composite
Ozette	Unknown	Unknown	Native	Wild
SOCKEYE				
Ozette	Depressed	Unknown	Native	Composite
STEELHEAD – WINTER				
Sooes/Waatch	Unknown	Unknown	Native	Wild
Ozette	Unknown	Unknown	Native	Wild
QUILLAYUTE	**1992 STOCK STATUS**	**2002 STOCK STATUS**	**STOCK ORIGIN**	**PRODUCTION TYPE**
CHINOOK – SPRING				
Sol Duc	Healthy	Healthy	Mixed	Composite
CHINOOK – SUMMER				
Quillayute/Bogachiel	Unknown	Healthy	Native	Wild
Sol Duc	Healthy	Unknown	Mixed	Composite
Calawah	Unknown	Healthy	Native	Wild
CHINOOK – FALL				
Quillayute/Bogachiel	Healthy	Healthy	Native	Wild
Dickey	Healthy	Unknown	Native	Wild
Sol Duc	Healthy	Healthy	Native	Wild
Calawah	Healthy	Healthy	Native	Wild
CHUM – FALL				
Quillayute	Unknown	Unknown	Native	Wild
COHO – SUMMER				
Sol Duc	Healthy	Healthy	Native	Composite
COHO – FALL				
Dickey	Healthy	Healthy	Native	Wild
Sol Duc	Healthy	Healthy	Native	Composite
Bogachiel	Healthy	Healthy	Native	Wild
Calawah	Healthy	Healthy	Native	Wild

SALMON AND STEELHEAD STOCK LIST PRESENTED BY RIVER BASIN				
Stock	1992 Status	2002 Status	Origin	Production Type
SOCKEYE				
Lake Pleasant	Unknown	Healthy	Native	Wild
STEELHEAD – SUMMER				
Sol Duc Quillayute/Bogachiel Calawah	Unknown Unknown Unknown	Unknown Unknown Unknown	Unresolved Unresolved Unresolved	Wild Wild Wild
STEELHEAD – WINTER				
Quillayute/Bogachiel Dickey Sol Duc Calawah	Healthy Healthy Healthy Healthy	Healthy Healthy Healthy Healthy	Native Native Native Native	Wild Wild Wild Wild
HOH	**1992 STOCK STATUS**	**2002 STOCK STATUS**	**STOCK ORIGIN**	**PRODUCTION TYPE**
CHINOOK – SPRING/SUMMER				
Hoh	Healthy	Healthy	Native	Wild
CHINOOK – FALL				
Hoh	Healthy	Healthy	Native	Wild
CHUM – FALL				
Hoh	Unknown	Unknown	Unknown	Wild
COHO				
Goodman /Mosquito Creeks Hoh	Unknown Healthy	Unknown Healthy	Native Native	Wild Wild
STEELHEAD – SUMMER				
Hoh	Unknown	Unknown	Native	Wild
STEELHEAD – WINTER				
Goodman Creek Mosquito Creek Hoh	Unknown Unknown Healthy	Healthy Unknown Healthy	Native Native Native	Wild Wild Wild
KALALOCH	**1992 STOCK STATUS**	**2002 STOCK STATUS**	**STOCK ORIGIN**	**PRODUCTION TYPE**
COHO				
Kalaloch Creek	Unknown	Unknown	Native	Wild
STEELHEAD – WINTER				
Kalaloch Creek	Unknown	Unknown	Native	Wild
QUEETS	**1992 STOCK STATUS**	**2002 STOCK STATUS**	**STOCK ORIGIN**	**PRODUCTION TYPE**
CHINOOK – SPRING/SUMMER				
Queets Clearwater	Depressed Depressed	Depressed Critical	Native Native	Wild Wild

SALMON AND STEELHEAD STOCK LIST PRESENTED BY RIVER BASIN				
Stock	**1992 Status**	**2002 Status**	**Origin**	**Production Type**
CHINOOK – FALL				
Queets Clearwater	Healthy Healthy	Healthy Healthy	Native Native	Wild Wild
CHUM – FALL				
Queets	Unknown	Unknown	Unresolved	Unresolved
COHO				
Queets Clearwater Salmon River	Healthy Healthy Healthy	Healthy Healthy Healthy	Native Native Mixed	Composite Composite Composite
STEELHEAD – SUMMER				
Queets Clearwater	Healthy Unknown	Unknown Unknown	Native Native	Wild Wild
STEELHEAD – WINTER				
Queets Clearwater	Healthy Healthy	Healthy Healthy	Native Native	Wild Wild
RAFT	**1992 STOCK STATUS**	**2002 STOCK STATUS**	**STOCK ORIGIN**	**PRODUCTION TYPE**
COHO				
Raft	Unknown	Unknown	Mixed	Wild
STEELHEAD –WINTER				
Raft	Unknown	Unknown	Mixed	Composite
QUINAULT	**1992 STOCK STATUS**	**2002 STOCK STATUS**	**STOCK ORIGIN**	**PRODUCTION TYPE**
CHINOOK – SPRING/SUMMER				
Quinault	Depressed	Depressed	Native	Wild
CHINOOK – FALL				
Quinault Cook Creek	Healthy Healthy	Healthy Unknown	Native Mixed	Wild Composite
CHUM – FALL				
Quinault	Healthy	Unknown	Mixed	Composite
COHO				
Quinault Cook Creek	Unknown Healthy	Unknown Unknown	Mixed Mixed	Composite Composite
SOCKEYE				
Quinault	Healthy	Healthy	Native	Wild
STEELHEAD – SUMMER				
Quinault	Unknown	Unknown	Native	Wild
STEELHEAD – WINTER				

SALMON AND STEELHEAD STOCK LIST PRESENTED BY RIVER BASIN				
Stock	**1992 Status**	**2002 Status**	**Origin**	**Production Type**
Quinault/ Quinault	Healthy	Depressed	Mixed	Wild
Lake Quinault	Healthy	Healthy	Native	Wild
MOCLIPS/COPALIS				
COHO				
Moclips	Unknown	Unknown	Mixed	Composite
Copalis	Unknown	Unknown	Mixed	Wild
STEELHEAD – WINTER				
Moclips	Healthy	Unknown	Native	Wild
Copalis	Unknown	Unknown	Native	Wild
GRAYS HARBOR	**1992 STOCK STATUS**	**2002 STOCK STATUS**	**STOCK ORIGIN**	**PRODUCTION TYPE**
CHINOOK – SPRING				
Chehalis	Healthy	Healthy	Native	Wild
CHINOOK – SUMMER				
Satsop	Depressed	Depressed	Mixed	Wild
CHINOOK – FALL				
Humptulips	Healthy	Depressed	Native	Wild
Hoquiam	Healthy	Depressed	Native	Wild
Wishkah	Healthy	Healthy	Native	Wild
Wynoochee	Healthy	Depressed	Native	Wild
Satsop	Healthy	Healthy	Native	Composite
Chehalis	Healthy	Healthy	Native	Wild
South Bay	Unknown	Unknown	Non-Native	Wild
CHUM – FALL				
Humptulips	Healthy	Healthy	Native	Wild
Chehalis	Healthy	Healthy	Native	Wild
COHO				
Humptulips	Healthy	Healthy	Mixed	Composite
Hoquiam	Healthy	Healthy	Mixed	Composite
Wishkah	Healthy	Depressed	Mixed	Composite
Wynoochee	Healthy	Healthy	Mixed	Composite
Satsop	Healthy	Healthy	Mixed	Composite
Chehalis	Healthy	Healthy	Mixed	Composite
South Bay	Healthy	Healthy	Mixed	Composite
STEELHEAD – SUMMER				
Humptulips	Unknown	Unknown	Native	Wild
Chehalis	Unknown	Unknown	Unknown	Wild
STEELHEAD – WINTER				
Humptulips	Healthy	Depressed	Native	Wild
Hoquiam	Healthy	Depressed	Native	Wild

SALMON AND STEELHEAD STOCK LIST PRESENTED BY RIVER BASIN				
Stock	**1992 Status**	**2002 Status**	**Origin**	**Production Type**
Wishkah	Healthy	Healthy	Native	Wild
Wynoochee	Healthy	Healthy	Mixed	Composite
Satsop	Depressed	Depressed	Native	Wild
Chehalis	Healthy	Healthy	Native	Wild
Skookumchuck/Newaukum	Depressed	Healthy	Native	Composite
South Bay	Unknown	Unknown	Native	Wild
WILLAPA BAY	**1992 STOCK STATUS**	**2002 STOCK STATUS**	**STOCK ORIGIN**	**PRODUCTION TYPE**
CHINOOK – FALL				
North River/Smith Creek	Depressed	Depressed	Native	Wild
Willapa	Not Rated	Healthy	Mixed	Composite
Naselle	Not Rated	Depressed	Mixed	Composite
CHUM – FALL				
North River	Healthy	Healthy	Native	Wild
Willapa	Healthy	Unknown	Native	Wild
Palix	Healthy	Healthy	Native	Wild
Nemah	Healthy	Unknown	Native	Wild
Naselle	Healthy	Healthy	Mixed	Wild
Bear River	Healthy	Unknown	Native	Wild
COHO				
North River/Smith Creek	Not Rated	Healthy	Mixed	Composite
Willapa	Not Rated	Healthy	Mixed	Composite
Palix/Niawiakum	Not Rated	Healthy	Mixed	Composite
Nemah	Not Rated	Healthy	Mixed	Composite
Naselle	Not Rated	Healthy	Mixed	Composite
Bear River	Not Rated	Healthy	Mixed	Composite
STEELHEAD – WINTER				
North River/Smith Creek	Unknown	Healthy	Native	Wild
Willapa	Healthy	Healthy	Native	Wild
Palix	Unknown	Healthy	Native	Wild
Nemah	Unknown	Healthy	Native	Wild
Naselle	Healthy	Healthy	Native	Wild
Bear River	Unknown	Healthy	Native	Wild

APPENDIX 3
NORTH AMERICAN SALMON STRONGHOLD PARTNERSHIP ("NASSP") RATINGS

CHINOOK, COHO, STEELHEAD, SOCKEYE, CHUM

North American Salmon Stronghold Partnership Expert Ratings (2011)

What is a Stronghold? The North American Salmon Stronghold Partnership ("NASSP")[31] Charter[32] defines a Stronghold as:

> *Status conferred to a defined geographical unit which meets biological criteria for abundance, productivity, diversity (life history and run timing), habitat quality, or other biological attributes important to sustaining viable populations of wild Pacific salmon throughout their range. The term stronghold refers to a watershed, multiple watersheds or other defined spatial units where populations are strong, diverse, and the habitat has a high intrinsic potential to support a particular species, or suite of species.*

How are Strongholds Identified? Although the process of identifying Salmon Strongholds varies slightly by region, state, and country to accommodate for the variety of data sources and experts available, the methodology is standardized. At the most basic level, the process includes the following analytical steps:

- Local and regional experts rate population units within salmon ecoregions[33] based upon biological criteria (abundance, productivity, life history diversity, and percent natural origin spawners).
- Experts provide a rating of their certainty associated with each population unit rating;
- Ratings undergo confidence testing using a Decision Support Model to identify population units that are strong (weak, research, and unknown units are also identified).

[31] Information available at: http://www.wildsalmoncenter.org/programs/north_america/strongholds.php
[32] NASSP Charter, Article 2.6 (2009): http://www.wildsalmoncenter.org/programs/north_america/strongholds.php
[33] X. Augerot, Atlas of Pacific Salmon: The First Map-Based Status Assessment of Salmon in the North Pacific (Berkeley: University of California Press, 2005), 7.

- Strong population units undergo MARXAN[34] mapping analysis to identify habitat areas of high integrity, high terrestrial and hydrologic connectivity, and high future security using data derived from the Conservation Success Index.[35]
- MARXAN outputs and strong population units are superimposed for optimization testing, which experts use to delineate one to two Strongholds per ecoregion. Not all strong population units qualify for Stronghold status due to poor habitat conditions or future security.

For the Washington Coast, a total of 118 population units, also known as SaSI[36] stocks, were evaluated within the Seasonal Upwelling Cline ecoregion. Experts recognized a total of 121 population units; however, three[37] of the population units are not yet formally recognized by the co-managers[38] and were not included in further analysis. The following tables summarize results.

Table 15. Washington Coast Salmon Stronghold ratings and status

Source: NASSP/WSC

WASHINGTON COAST STRONGHOLD POPULATION UNIT RATING – 2011				
Population Unit Rating	**No. of Units**	**Percent of Units**	**No. of Units Associated to Stronghold**	**Percent of Units Associated to Stronghold**
Strong	49	41%	29	25%
Research	47	39%	-	-
Weak	22	19%	-	-
TOTAL Population Units	118	-	-	-

Rating Definitions:

Strong: A population unit that exhibits relatively little influence from hatchery fish on spawning grounds (> 75% natural origin spawners), expresses most of its life history diversity traits, and has relatively high wild abundance and productivity, relative to its ecoregion or ESU. Expert certainty (within and across reviewers) is high.

Research: A population unit that requires additional scientific analysis and/or improved expert certainty to qualify as either strong or weak.

Weak: A population unit that exhibits relatively high influence from hatchery fish on spawning grounds (>25%), does not express most of its life history diversity traits, and has relatively low abundance and productivity. The category includes extirpated population units. Expert certainty (within and across reviewers) is high.

Following page: Figure 10: MAP OF NASSP WASHINGTON COAST STRONGHOLDS: MAY 2011 ASSESSMENT

[34] Information available at: http://gg.usm.edu/pat/files/PAT_v3_Tutorial.pdf
[35] Information available at: http://www.tu.org/science/conservation-success-index
[36] Washington Department of Fish and Wildlife online at http://wdfw.wa.gov/conservation/fisheries/sasi/
[37] Black River Coho, Black River Steelhead and Cloquallum Coho.
[38] Boldt decision of 1974, online document available at: http://www.ccrh.org/comm/river/legal/boldt.htm

SOURCE: WSC ON BEHALF OF NAASP

Table 16. Washington Coast Salmon Stronghold ratings and status listed by SaSI stock and by river basin

Source: WSC on behalf of NASSP

Washington Coast Salmon Stronghold ratings and status listed by SaSI stock and by river basin.			
Stock	**2011 Population Rating**	**Percent Natural Origin Spawners**	**Stronghold Status**
SOOES/OZETTE	**2011 POPULATION UNIT RATING**	**EST. PERCENT NATURAL ORIGIN SPAWNERS**	**STRONGHOLD STATUS**
CHINOOK – Fall			
Sooes	Research	95% - 100%	No
CHUM – Fall			
Sooes	Research	Unknown	No
Ozette	Weak	95% - 100%	No
COHO			
Sooes/Waatch	Weak	95% - 100%	No
Ozette	Weak	50% - 74%	No
SOCKEYE			
Ozette	Weak	75% - 94%	No
STEELHEAD – Winter			
Sooes/Waatch	Weak	50% - 74%	No
Ozette	Weak	75% - 94%	No
QUILLAYUTE	**2011 POPULATION UNIT RATING**	**EST. PERCENT NATURAL ORIGIN SPAWNERS**	**STRONGHOLD STATUS**
CHINOOK – Spring			
Sol Duc	Research	50% - 74%	No
CHINOOK – Summer		50% - 74%	No
Quillayute/Bogachiel	Strong	75% - 94%	Yes
Sol Duc	Research	50% - 74%	
Calawah	Strong	75% - 94%	Yes
CHINOOK – Fall			
Quillayute/Bogachiel	Strong	95% - 100%	Yes
Dickey	Strong	95% - 100%	Yes
Sol Duc	Strong	95% - 100%	Yes
Calawah	Strong	95% - 100%	Yes
CHUM – Fall			
Quillayute	Research	Unknown	No
COHO – Summer			
Sol Duc	Strong	75% - 94%	Yes
COHO – Fall			
Dickey	Strong	75% - 94%	Yes
Sol Duc	Strong	75% - 94%	Yes
Bogachiel	Strong	75% - 94%	Yes
Calawah	Strong	75% - 94%	Yes
SOCKEYE			
Lake Pleasant	Strong	75% - 94%	Yes
STEELHEAD – Summer			
Sol Duc	Research	Unknown	No

Washington Coast Salmon Stronghold ratings and status listed by SaSI stock and by river basin.			
Stock	**2011 Population Rating**	**Percent Natural Origin Spawners**	**Stronghold Status**
Quillayute/Bogachiel	Research	Unknown	No
Calawah	Research	Unknown	No
STEELHEAD – Winter			
Quillayute/Bogachiel	Strong	75% - 94%	Yes
Dickey	Strong	95% - 100%	Yes
Sol Duc	Strong	75% - 94%	Yes
Calawah	Strong	75% - 94%	Yes
HOH	**2011 POPULATION UNIT RATING**	**EST. PERCENT NATURAL ORIGIN SPAWNERS**	**STRONGHOLD STATUS**
CHINOOK – Spring/Summer			
Hoh	Strong	75% - 94%	Yes
CHINOOK – Fall			
Hoh	Strong	95% - 100%	Yes
CHUM – Fall			
Hoh	Weak	95% - 100%	No
COHO			
Goodman /Mosquito Creeks	Research	Unknown	No
Hoh	Strong	95% - 100%	Yes
STEELHEAD – Summer			
Hoh	Research	Unknown	No
STEELHEAD – Winter			
Goodman Creek	Research	50% - 74%	No
Mosquito Creek	Research	75% - 94%	No
Hoh	Strong	75% - 94%	Yes
KALALOCH	**2011 POPULATION UNIT RATING**	**EST. PERCENT NATURAL ORIGIN SPAWNERS**	**STRONGHOLD STATUS**
COHO			
Kalaloch Creek	Strong	95% - 100%	Yes
STEELHEAD – Winter			
Kalaloch Creek	Strong	95% - 100%	Yes
QUEETS	**2011 POPULATION UNIT RATING**	**EST. PERCENT NATURAL ORIGIN SPAWNERS**	**STRONGHOLD STATUS**
CHINOOK – Spring/Summer			
Queets	Weak	95% - 100%	No
Clearwater	Weak	95% - 100%	No
CHINOOK – Fall			
Queets	Strong	75% - 94%	Yes
Clearwater	Strong	95% - 100%	Yes
CHUM – Fall			
Queets	Weak	95% - 100%	No
COHO			
Queets	Strong	75% - 94%	Yes
Clearwater	Strong	95% - 100%	Yes
Salmon River	Weak	50% - 74%	No

Washington Coast Salmon Stronghold ratings and status listed by SaSI stock and by river basin.			
Stock	**2011 Population Rating**	**Percent Natural Origin Spawners**	**Stronghold Status**
STEELHEAD – Summer			
Queets	Research	Unknown	No
Clearwater	Research	95% - 100%	No
STEELHEAD – Winter			
Queets	Strong	75% - 94%	Yes
Clearwater	Strong	95% - 100%	Yes
RAFT	**2011 POPULATION UNIT RATING**	**EST. PERCENT NATURAL ORIGIN SPAWNERS**	**STRONGHOLD STATUS**
COHO			
Raft	Research	95% - 100%	No
STEELHEAD –Winter			
Raft	Research	75% - 94%	No
QUINAULT	**2011 POPULATION UNIT RATING**	**EST. PERCENT NATURAL ORIGIN SPAWNERS**	**STRONGHOLD STATUS**
CHINOOK – Spring/Summer			
Quinault	Research	95% - 100%	No
CHINOOK – Fall			
Quinault	Research	50% - 74%	No
Cook Creek	Research	Unknown	No
CHUM – Fall			
Quinault	Research	25% - 49%	No
COHO			
Quinault	Research	50% - 74%	No
Cook Creek	Research	0% – 24%	No
SOCKEYE			
Quinault	Weak	95% - 100%	No
STEELHEAD – Summer			
Quinault	Research	Unknown	No
STEELHEAD – Winter			
Quinault/ Quinault Lake	Strong	75% - 94%	Yes
Quinault	Research	50% - 74%	No
MOCLIPS/COPALIS	**2011 POPULATION UNIT RATING**	**EST. PERCENT NATURAL ORIGIN SPAWNERS**	**STRONGHOLD STATUS**
COHO			
Moclips	Research	95% - 100%	No
Copalis	Strong	95% - 100%	No
STEELHEAD – Winter			
Moclips	Research	95% - 100%	No
Copalis	Research	95% - 100%	No
GRAYS HARBOR	**2011 POPULATION UNIT RATING**	**EST. PERCENT NATURAL ORIGIN SPAWNERS**	**STRONGHOLD STATUS**
CHINOOK – Spring			
Chehalis	Research	95% - 100%	No
CHINOOK – Summer			

Washington Coast Salmon Stronghold ratings and status listed by SaSI stock and by river basin.			
Stock	**2011 Population Rating**	**Percent Natural Origin Spawners**	**Stronghold Status**
Satsop	Research	75% - 94%	No
CHINOOK – Fall			
Humptulips	Research	50% - 74%	No
Hoquiam	Research	95% - 100%	No
Wishkah	Strong	75% - 94%	No
Wynoochee	Strong	95% - 100%	No
Satsop	Research	75% - 94%	No
Chehalis	Weak	75% - 94%	No
South Bay	Research	95% - 100%	No
CHUM – Fall			
Humptulips	Weak	95% - 100%	No
Chehalis	Weak	95% - 100%	No
COHO			
Humptulips	Research	25% - 49%	No
Hoquiam	Strong	75% - 94%	No
Wishkah	Strong	75% - 94%	No
Wynoochee	Strong	95% - 100%	No
Satsop	Research	50% - 74%	No
Chehalis	Research	50% - 74%	No
South Bay	Strong	75% - 94%	No
STEELHEAD - Summer			
Humptulips	Research	75% - 94%	No
Chehalis	Research	50% - 74%	No
STEELHEAD - Winter			
Humptulips	Strong	75% - 94%	No
Hoquiam	Strong	75% - 94%	No
Wishkah	Strong	75% - 94%	No
Wynoochee	Research	75% - 94%	No
Satsop	Strong	75% - 94%	No
Chehalis	Strong	75% - 94%	No
Skookumchuck/Newaukum	Research	75% - 94%	No
South Bay	Strong	95% - 100%	No
WILLAPA BAY	**2011 POPULATION UNIT RATING**	**EST. PERCENT NATURAL ORIGIN SPAWNERS**	**STRONGHOLD STATUS**
CHINOOK – Fall			
North River/Smith Creek	Research	95% - 100%	No
Willapa	Weak	25% - 49%	No
Naselle	Weak	25% - 49%	No
CHUM – Fall			
North River	Research	95% - 100%	No
Willapa	Research	75% - 94%	No
Palix	Research	95% - 100%	No
Nemah	Weak	75% - 94%	No
Naselle	Research	75% - 94%	No
Bear River	Weak	95% - 100%	No

Washington Coast Salmon Stronghold ratings and status listed by SaSI stock and by river basin.			
Stock	**2011 Population Rating**	**Percent Natural Origin Spawners**	**Stronghold Status**
COHO – Fall			
North River/Smith Creek	Weak	50% - 74%	No
Willapa	Research	50% - 74%	No
Palix/Niawiakum	Strong	95% - 100%	No
Nemah	Weak	25% - 49%	No
Naselle	Weak	50% - 74%	No
Bear River	Strong	95% - 100%	No
STEELHEAD – Winter			
North River/Smith Creek	Strong	75% - 94%	No
Willapa	Strong	75% - 94%	No
Palix	Research	75% - 94%	No
Nemah	Strong	75% - 94%	No
Naselle	Strong	75% - 94%	No
Bear River	Strong	75% - 94%	No

APPENDIX 4
PACIFIC FISHERY MANAGEMENT COUNCIL ("PFMC") STOCK ASSESSMENT AND FISHERY EVALUATION

CHINOOK and COHO

The following pages include Washington Coast salmon stocks data excerpted directly from the Pacific Fishery Management Council's ("PFMC") *Review of 2010 Ocean Salmon Fisheries, Appendix B: Historical Record of Escapements to Inland Fisheries and Spawning Areas,* tables B-23 through B-37. The data are estimates of in-river or terminal run size, catch, and escapement in numbers of fish for nine chinook and seven coho fisheries.

Also included are graphs depicting escapement and terminal run size which are derived directly from the data presented. Wherever possible, these graphs are based on natural escapement and natural terminal run size. For Willapa Bay, where escapement goals are set for both natural and hatchery fish, both sets of numbers are included. For Quinault Coho, natural and hatchery fish are combined. The PFMC evaluation does not include data on Quinault Chinook escapement but does include treaty gillnet catch of chinook, chum, and sockeye in the Quinault River in numbers of fish. These data are included and graphed as well.

In most cases, total escapement numbers in the following graphs are derived from a formula based upon redd counts in index areas. Any conclusions drawn from these data should be considered tentative only.

The lack of data has long been considered one of our greatest challenges. It is our objective through implementation of this Plan to work toward correcting this problem.

On the following pages:

Tables/Graphs 17: HISTORICAL RECORD OF ESCAPEMENTS TO INLAND FISHERIES AND SPAWNING AREAS

Source: Pacific Fishery Management Council, *Review of 2010 Ocean Salmon Fisheries, Appendix B*

TABLE B-23. Willapa Bay fall Chinook terminal run size, catch, and spawning escapement in numbers of fish.

	Non-local Stocks	Terminal Catch		Spawning Escapement		
Year or Average	Gillnet Catch[a/]	Gillnet	Sport[b/]	Natural[c/]	Hatchery	Terminal Run Size[d/]
1976-1980	8,660	14,496	419	1,995	4,529	21,439
1981-1985	1,011	7,331	589	1,588	5,398	14,906
1986-1990	2,521	18,173	1,578	5,596	22,458	47,805
1991-1995	1,162	28,082	2,823	2,818	17,086	50,809
1996	-	37,065	3,024	2,153	12,079	54,321
1997	-	12,311	2,404	3,852	13,729	32,296
1998	-	6,765	2,178	3,114	8,658	20,715
1999	-	265	1,906	1,360	6,966	10,497
2000	-	5,902	1,399	2,303	10,455	20,059
2001	-	5,444	2,121	2,161	10,099	19,825
2002	36	9,452	2,537	1,729	13,680	27,398
2003	220	7,488	3,242	2,732	14,628	28,090
2004[e/]	-	4,349	3,851	2,838	21,444	32,482
2005[e/]	-	6,523	6,630	1,978	18,514	33,645
2006[e/]	-	12,334	6,442	3,739	24,569	47,084
2007[e/]	-	4,112	2,579	1,907	13,839	22,437
2008[e/]	-	3,595	2,904	1,507	15,241	23,247
2009[e/]	-	6,868	4,552	2,251	20,333	34,004
2010[e/]	-	6,903	NA	NA	NA	NA
GOAL				4,350[f/]	9,800[f/]	

a/ Non-local gillnet is catch in Area 2G prior to Aug. 16.

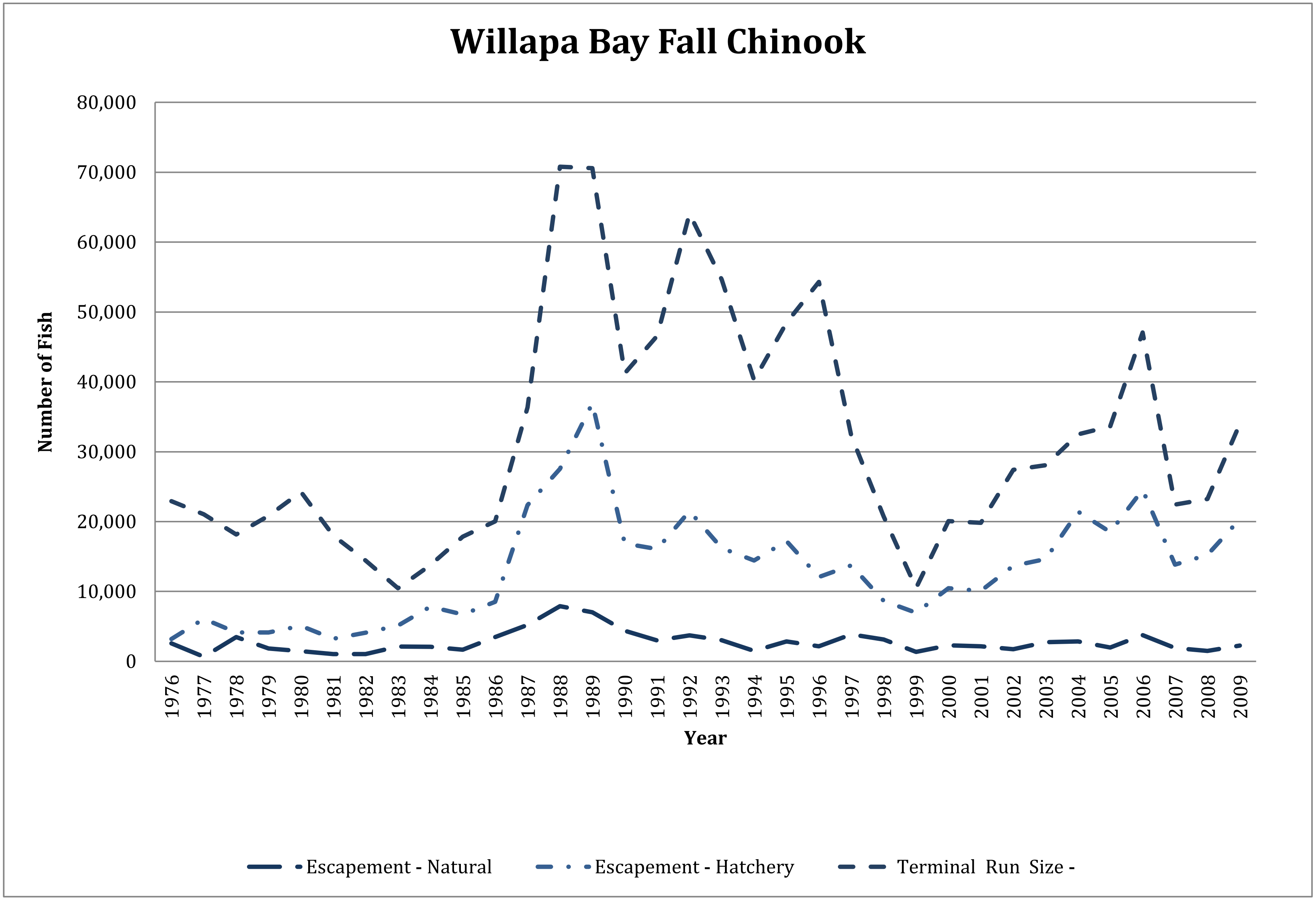
b/ Adults. Sport catch since 1991 includes marine areas within Willapa Bay (e.g., Washaway Beach).

c/ Escapement estimates after 1984 are based on revised spawning habitat estimates. Natural = adult returns assumed to be from natural origin parents.

d/ Does not include catch of non-local stocks.

e/ Preliminary.

f/ WDFW goal; not an FMP goal.



Willapa Bay Fall Chinook
80,000
70,000
60,000
50,000
40,000
30,000
20,000
10,000
0
Number of Fish
1976
1977
1978
1979
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
Year
Escapement - Natural
Escapement - Hatchery
Terminal Run Size -

TABLE B-24. Willapa Bay coho terminal run size, catch, and spawning escapement in numbers of fish.

	Terminal Catch		Spawning Escapement		
Year or Average	Gillnet	Sport[a]	Natural[b]	Hatchery[c]	Terminal Run Size[d]
1976-1980	15,011	2,842	5,800	14,328	37,981
1981-1985	39,007	2,181	3,567	26,640	69,968
1986-1990	69,199	2,591	NA	35,811	107,601
1991-1995	34,287	2,802	4,582	27,205	65,211
1996	38,316	4,052	15,711	48,854	106,933
1997	1,550	806	4,934	6,691	13,981
1998	13,140	852	13,807	6,902	34,701
1999	5,467	2,836	9,628	22,823	40,754
2000	10,193	1,780	23,031	29,387	64,391
2001	31,837	5,689	48,414	54,359	140,299
2002	59,435	5,683	58,703	48,871	172,692
2003	66,460	5,881	49,398	66,115	187,854
2004[e]	16,533	2,325	38,672	19,216	76,746
2005[e]	50,031	3,867	26,493	40,679	121,070
2006[e]	19,948	811	12,563	7,831	41,153
2007[e]	8,218	955	13,723	9,002	31,898
2008[e]	16,699	1,221	18,474	9,743	46,137
2009[e]	75,417	6,257	48,774	20,306	150,754
2010[e]	28,568	NA	NA	NA	NA
GOAL			13,090[f]	6,100[g]	

a/ Adults. Sport catch since 1991 includes marine areas within Williapa Bay (e.g., Washaway Beach).

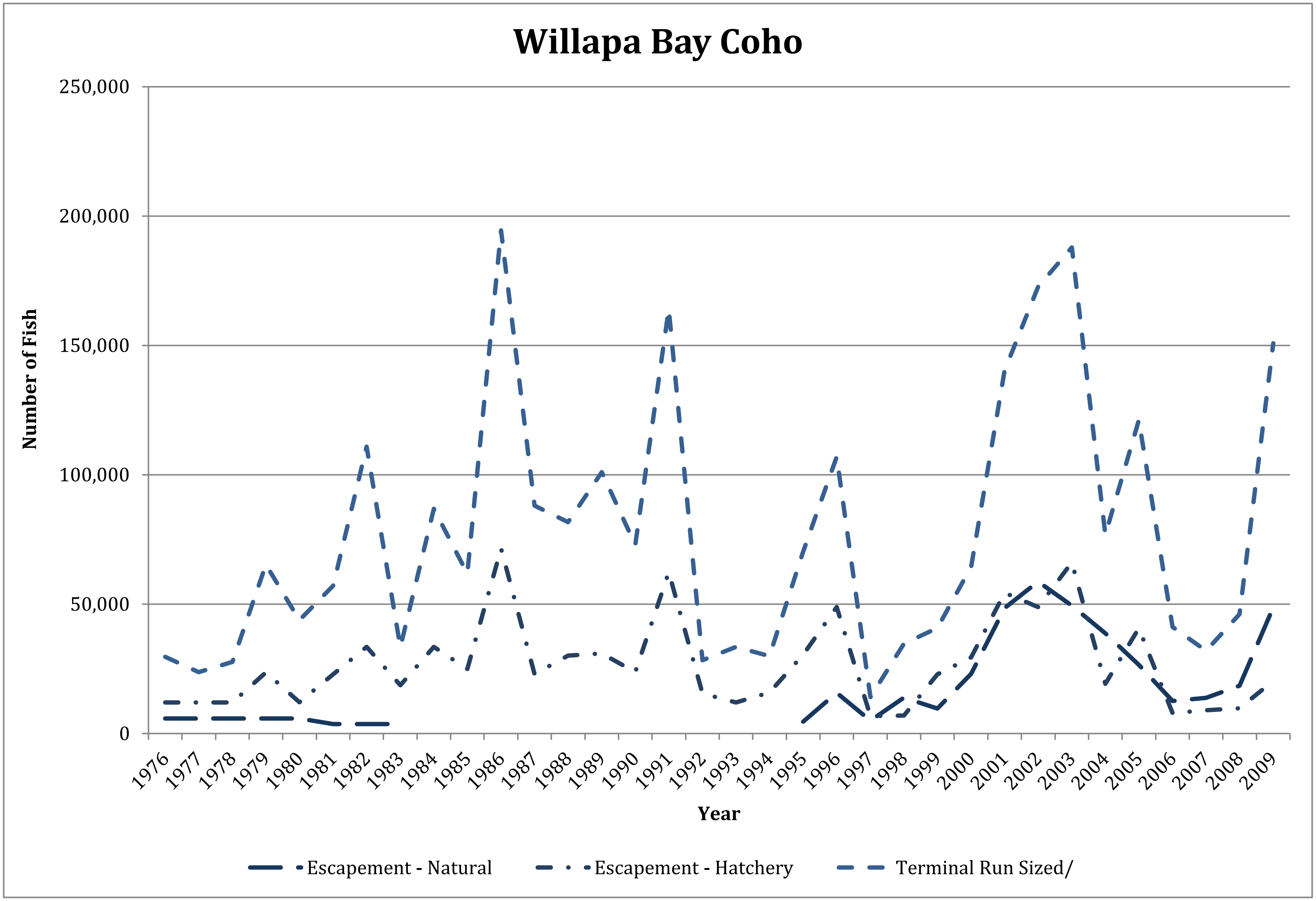
b/ Natural spawning escapement estimates were not made in 1984-1994; estimates in 1996, 1997, and 1998 do not include adult fish released upstream of

c/ Hatchery rack number includes fish released upstream.

d/ Does not include natural spawning escapement between 1984 and 1994.

e/ Preliminary.

f/ WDFW goal; not an FMP goal.



Willapa Bay Coho
250,000
200,000
150,000
100,000
50,000
0
Number of Fish
1976
1977
1978
1979
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
Year
Escapement - Natural
Escapement - Hatchery
Terminal Run Sized/

TABLE B-25. Grays Harbor Chinook terminal catch, spawning escapement, and run size in numbers of fish. (Page 1 of 2)

Year or Average	Early Non-local Catch	Terminal Catch: Non-Indian Gillnet	Treaty Indian Gillnet	Chehalis Tribal Gillnet	Sport[a/]	Spawning Escapement: Natural[b/]	Hatchery[c/]	Terminal Run Size[d/]
				SPRING Chinook				
1976-1980	-	-	-	587	e/	600	-	1,187
1981-1985	-	-	-	57	5	924	-	963
1986-1990	-	-	e/	143	6	1,875	-	2,024
1991-1995	-	-	0	94	15	1,566	-	1,675
1996	-	-	104	127	52	4,462 [f/]	-	4,745
1997	-	-	52	172	160	4,460 [f/]	-	4,844
1998	-	-	6	164	121	2,388	-	2,679
1999	-	-	3	187	76	1,285	-	1,551
2000	-	-	17	174	91	3,135	-	3,417
2001	-	-	4	210	252	2,860	-	3,326
2002	-	-	76	419	124	2,598	-	3,217
2003	-	-	68	0	131	1,904	-	2,103
2004	-	-	54	177	65	5,034	-	5,330
2005	-	-	26	439	88	2,129	-	2,682
2006	-	-	5	249	128	2,481	-	2,863
2007[g/]	-	-	5	205	54	651	-	915
2008[g/]	-	-	2	0	0	995	-	997
2009[g/]	-	-	18	0	0	1,132	-	1,150
2010[g/]	-	-	0	0	NA	NA	-	NA
GOAL						1,400		

TABLE B-25. Grays Harbor Chinook terminal catch, spawning escapement, and run size in numbers of fish. (Page 2 of 2)

Year or Average	Early Non-local Catch	Terminal Catch: Non-Indian Gillnet	Treaty Indian Gillnet	Chehalis Tribal Gillnet	Sport[a/]	Spawning Escapement: Natural[b/]	Hatchery[c/]	Terminal Run Size[d/]
FALL Chinook								
1976-1980	4,433	3,642	3,108	1,006	1,128	7	413	9,303
1981-1985	602	964	3,524	465	268	10	742	5,973
1986-1990	694	4,122	10,414	597	1,340	20,474	1,319	38,266 h/
1991-1995	206	5,000	7,750	901	3,794	12,044	3,006	32,496 h/
1996	148	1,441	4,068	49	7,456	16,988	4,307	34,309 h/
1997	24	2,796	6,630	311	2,687	16,342	2,416	31,183 h/
1998	5	267	4,135	0	2,912	11,476	1,921	20,711 h/
1999	0	87	1,926	1	114	9,196	1,990	13,315 h/
2000	671	647	3,289	0	1,714	8,081	1,450	15,182
2001	0	2,523	3,885	0	3,210	8,340	1,121	19,079
2002	40	26	963	0	2,955	10,621	2,006	16,570
2003	0	295	851	0	1,031	17,808	2,858	22,842
2004	0	183	3,498	476	6,158	29,461	3,584	43,360
2005	0	379	2,260	3	465	17,040	3,536	23,683
2006	0	195	3,738	0	1,635	15,955	2,845	24,368
2007[g/]	0	514	2,472	19	1,719	11,264	1,072	17,060
2008[g/]	0	717	1,878	72	313	13,570	1,631	18,181
2009[g/]	0	1,193	2,485	0	0	7,215	1,125	12,018
2010[g/]	0	1,495	3,403	0	NA	NA	NA	NA
GOAL						14,600		

a/ Age-3 and older.

b/ Age-3 and older, including hatchery fish spawning naturally.

c/ Includes naturally spawning fish taken for broodstock.

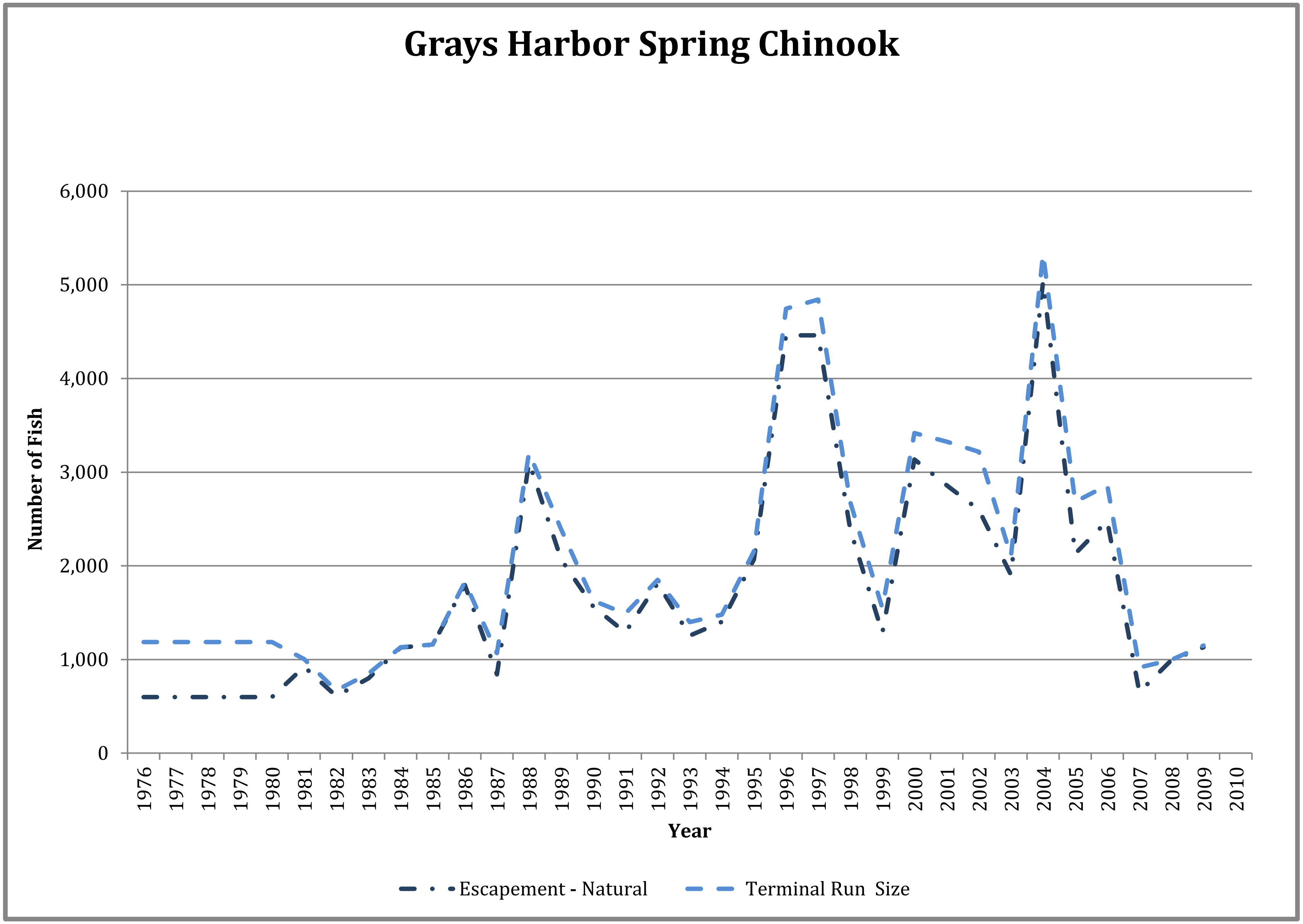
d/ Minimum estimate due to incomplete estimates of river recreational catch. Does not include non-local catch.

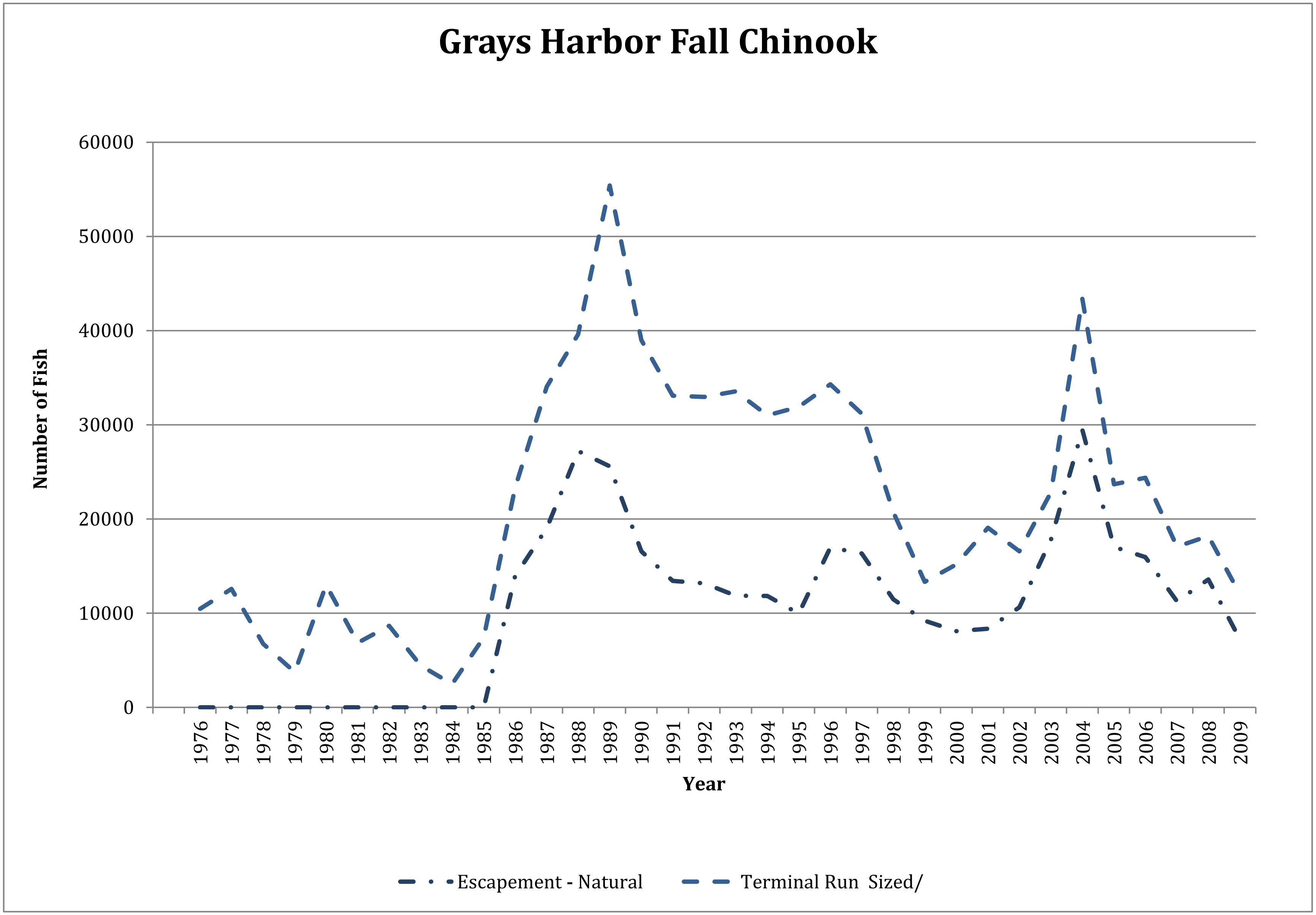
e/ Fewer than 50 fish.

f/ WDFW is not able to differentiate spawning time and believes this includes fall Chinook.

g/ Preliminary.

h/ Recreational catch estimates by WDFW reflect application of catch record card bias correction factor of 0.833. Quinault Indian Nation does not believe this factor is appropriate for this fishery. Unadjusted catch estimates are 1,000 for 1987; 2,400 for 1988; 2,500 for 1989; 2,400 for 1990; 4,500 for 1991; 2,600 for 1992; 4,200 for 1993; 4,300 for 1994; 6,500 for 1995; 6,800 for 1996; 3,400 for 1997; 3,500 for 1998; and 100 for 1999; terminal run sizes would be adjusted accordingly.


Grays Harbor Spring Chinook
6,000
5,000
4,000
3,000
2,000
1,000
0
Number of Fish
1976
1977
1978
1979
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
Year
Escapement - Natural
Terminal Run Size



Grays Harbor Fall Chinook
60000
50000
40000
30000
20000
10000
0
Number of Fish
1976
1977
1978
1979
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
Year
Escapement - Natural
Terminal Run Sized/

TABLE B-26. Grays Harbor coho terminal catch, spawning escapement, and run size estimates in numbers of fish.

	Terminal Catch				Spawning Escapement[b/]		Terminal Run Size[c/]		
Year or Average	Non-Indian Gillnet	Treaty Indian Gillnet	Chehalis Tribal Gillnet	Sport[a/]	Natural	Hatchery	Natural	Hatchery	Total[d/]
1976-1980	5,231	9,675	3,500	2,021	29,510	10,207	44,430	17,933	61,088
1981-1985	5,299	15,614	2,863	5,012	36,847	17,565	40,374	42,013	82,388
1986-1990	7,715	30,109	1,817	5,355	44,836	30,767	51,553	69,041	120,595
1991-1995	12,502	29,745	2,716	10,503	36,516	31,654	51,384	72,082	123,466
1996	10,096	51,812	2,915	20,846	63,572	49,378	87,869	110,161	198,030
1997	115	5,548	125	1,547	22,469	12,710	19,258	22,958	42,216
1998	795	13,586	361	2,123	35,551	16,228	40,398	28,702	69,100
1999	1,674	12,212	797	4,507	33,346	29,655	37,987	44,342	82,329
2000	4,995	10,947	331	5,122	38,054	29,127	43,355	40,268	83,623
2001	3,152	15,671	533	20,868	80,100	90,411	76,401	118,595	194,996
2002	6,853	14,518	666	13,083	110,066	45,300	110,969	76,108	187,077
2003	6,623	12,041	1,000	12,026	84,952	65,114	94,759	87,383	182,142
2004	5,231	17,431	4,483	9,847	60,690	47,418	64,371	80,736	145,107
2005	3,073	23,232	2,286	11,043	38,585	47,784	43,665	82,716	126,381
2006[e/]	649	8,680	127	2,185	17,767	16,729	20,440	24,902	45,342
2007[e/]	1,687	8,922	1,108	4,456	25,121	14,345	32,472	23,284	55,756
2008[e/]	7,783	10,204	385	3,210	34,054	12,774	47,060	19,990	67,050
2009[e/]	561	28,513	858	16,053	69,733	45,174	88,405	56,792	145,197
2010[e/]	3,990	25,314	2,519	NA	NA	NA	NA	NA	NA
GOAL					35,400				

a/ Beginning in 1987, estimates provided by WDFW for recreational catch reflect punch card bias correction factor.

b/ "Natural" includes hatchery fish spawning in wild. "Hatchery" includes wild fish taken for broodstock.

c/ Terminal run size numbers from 1981 to present are under co-manager review.

d/ The combined natural and hatchery run size total may not add to the sum of the catch and escapements due to hatchery total run size including on-station and off-station escapements.

e/ Preliminary.

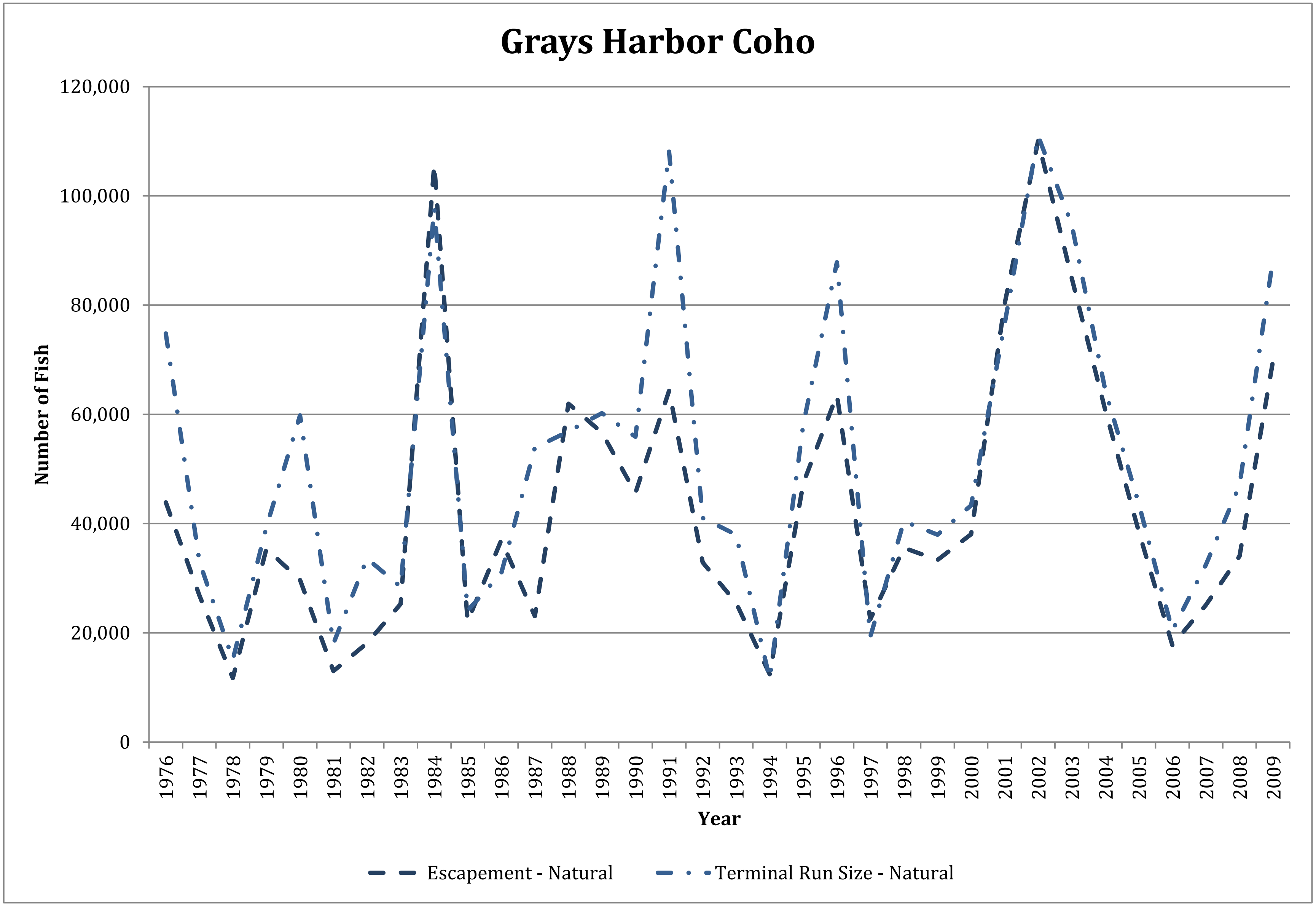

Grays Harbor Coho
120,000
100,000
80,000
60,000
40,000
20,000
0
Number of Fish
1976
1977
1978
1979
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
Year
Escapement - Natural
Terminal Run Size - Natural

TABLE B-27. Treaty Indian gillnet catch of Chinook, chum, and sockeye salmon in the Quinault River in numbers of fish.

Year or Average	Spring/Summer Chinook[a/]	Fall Chinook[a/]	Chum	Sockeye
1976-1980	149	4,320	7,960	17,560
1981-1985	114	5,100	4,720	12,600
1986-1990	338	8,822	4,686	11,218
1991-1995	98	6,293	2,505	9,523
1996	41	5,221	594	1,244
1997	19	2,625	1,033	2,532
1998	75	6,124	4,699	3,440
1999	10	4,840	599	73
2000	0	3,421	755	0
2001	5	4,047	2,009	0
2002	36	4,542	1,151	16,939
2003	92	7,343	3,742	37,130
2004	142	10,662	2,916	6,990
2005	24	7,648	1,283	116
2006	16	7,044	862	8
2007	<20	2,126	1,173	1
2008	10	3,682	1,171	0
2009[b/]	43	5,455	1,156	1,441
2010[b/]	8	4,521	2,037	1,856

a/ Stock separation under review.

b/ Preliminary.

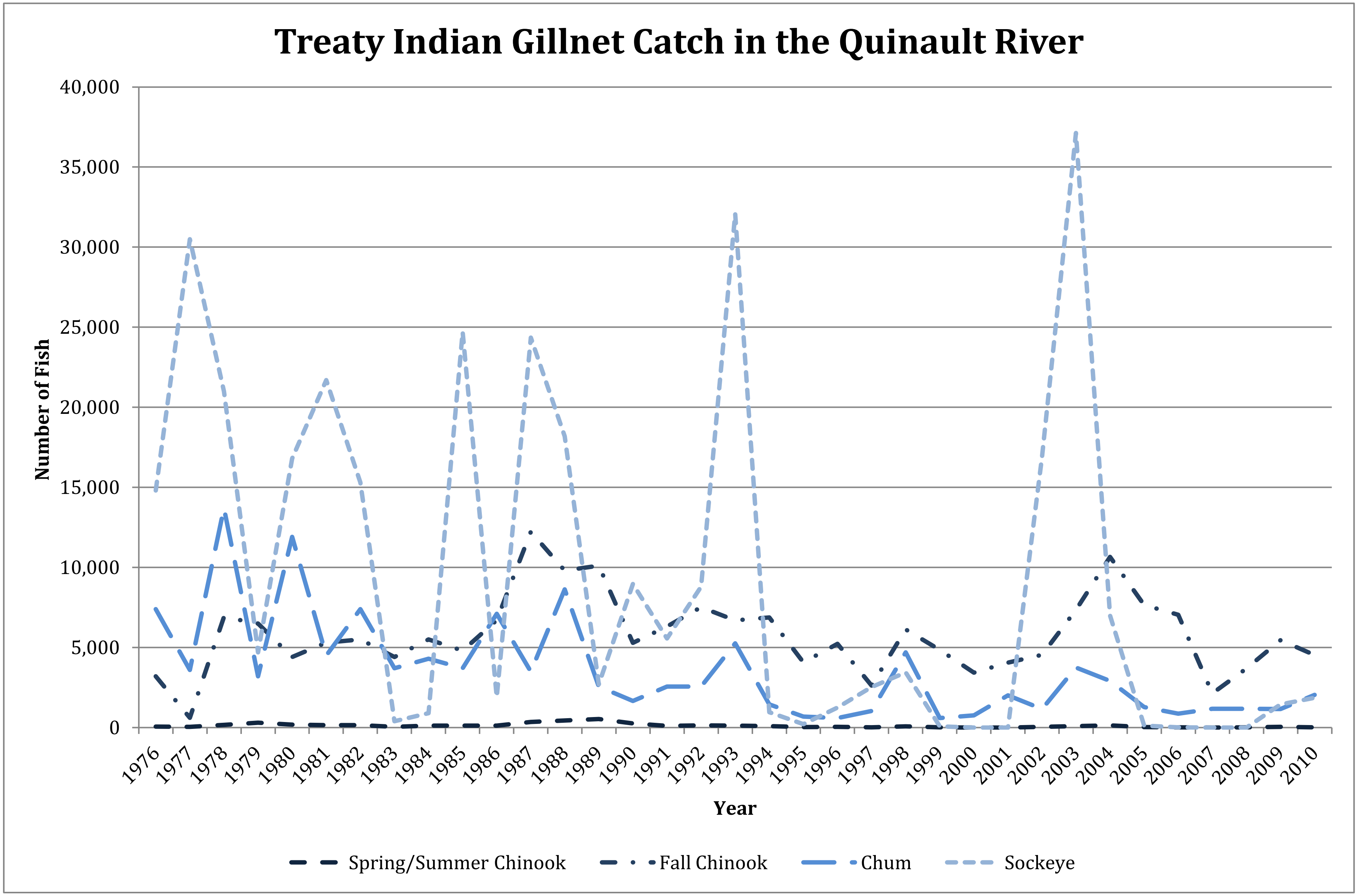

Treaty Indian Gillnet Catch in the Quinault River
Number of Fish
40,000
35,000
30,000
25,000
20,000
15,000
10,000
5,000
0
1976
1977
1978
1979
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
Year
Spring/Summer Chinook
Fall Chinook
Chum
Sockeye

TABLE B-28. Estimated inriver run size, catch and escapement for Quinault River coho in numbers of fish.

Year or Average	Terminal Catch[a/] Gillnet	Ceremonial & Subsistence	River Sport	Escapement Natural	Hatchery	Terminal Run Size Natural	Hatchery	Total
1977-1980	9,750	–	–	3,425	3,107	8,465	7,750	16,215
1981-1985	10,700	–	–	3,237	6,239	7,809	12,657	20,466
1986-1990	13,777	–	–	3,185	4,239	8,024	13,200	21,224
1991-1995	7,963	–	–	4,319	8,046	6,205	13,472	19,678
1996	10,087	–	–	13,327	9,521	18,849	13,865	32,714
1997	365	–	–	3,150	1,054	3,339	1,118	4,457
1998	5,946	–	–	3,770	3,158	7,156	5,581	12,737
1999	15,491	–	–	12,666	14,617	19,138	23,101	42,239
2000	16,194	–	–	7,421	9,481	14,559	18,099	32,658
2001	25,348	–	–	21,565	30,689	30,016	47,115	77,131
2002	19,197	–	–	12,213	16,841	16,847	30,196	47,043
2003	22,546	–	–	4,710	16,841	9,546	34,132	43,678
2004	17,055	–	–	1,404	10,321	3,377	24,821	28,198
2005	23,852	–	–	6,418	10,034	15,951	25,574	41,525
2006	9,785	336	325	1,110	3,207	3,432	11,032	14,464
2007	11,770	578	650	6,193	15,069	9,778	24,395	34,173
2008	25,227	961	978	14,920	14,959	26,544	29,774	56,318
2009[b/]	54,882	2,036	2,047	33,140	23,353	48,324	66,095	114,419
2010[b/]	41,806	NA	NA	NA	NA	NA	NA	NA
GOAL					Hatchery Production			

a/ Includes dip-in fish destined for other river systems.

b/ Preliminary.

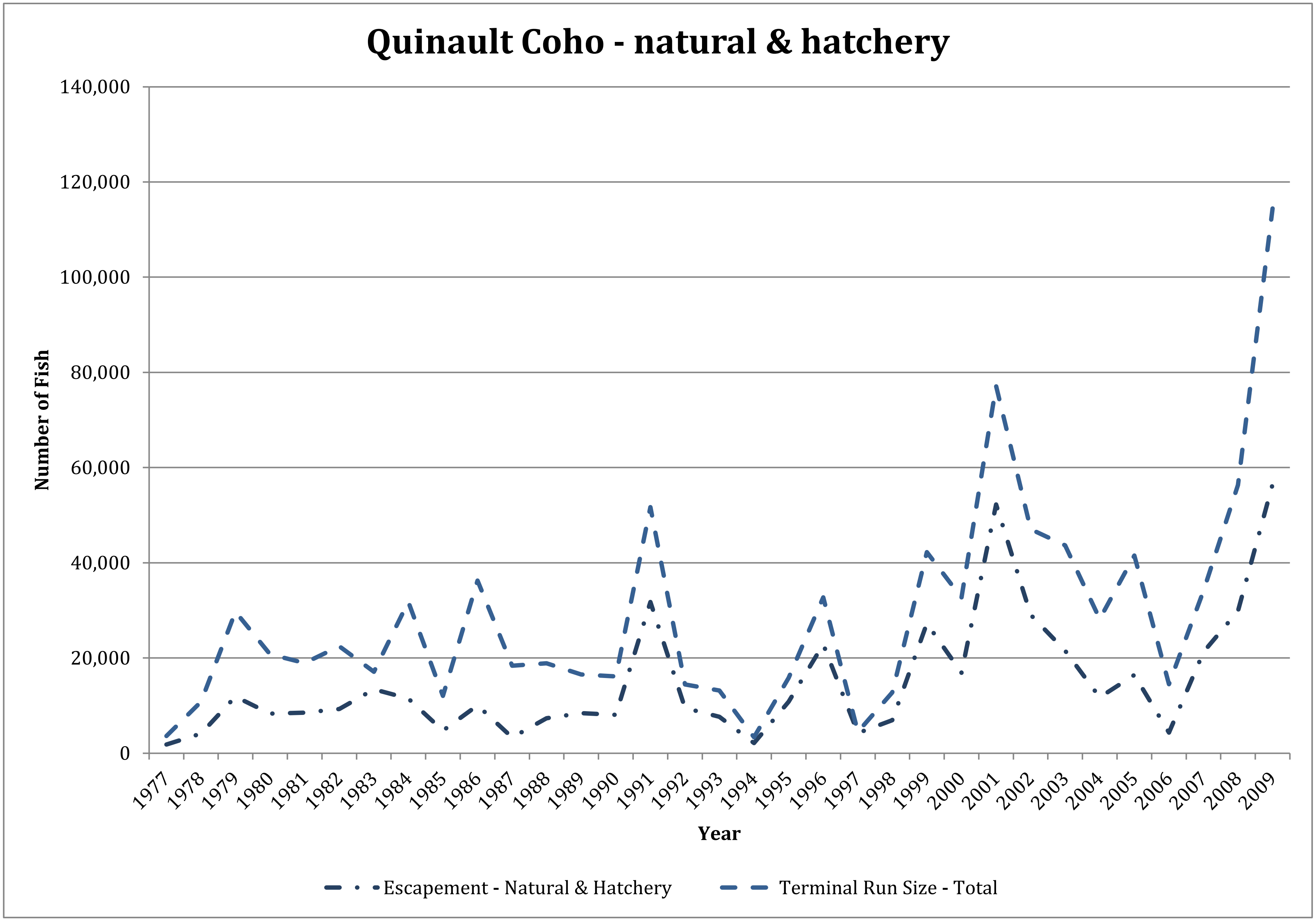

Quinault Coho - natural & hatchery
140,000
120,000
100,000
80,000
60,000
40,000
20,000
0
Number of Fish
1977
1978
1979
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
Year
Escapement - Natural & Hatchery
Terminal Run Size - Total

TABLE B-29. Estimated inriver run size, catch, and escapement of Queets River spring/summer Chinook in numbers of fish.

Year or Average	Terminal Catch: Gillnet	Terminal Catch: Ceremonial & Subsistence	Terminal Catch: River Sport[a/]	Escapement: Natural[b/]	Escapement: Hatchery	Terminal Run Size: Natural	Terminal Run Size: Hatchery	Terminal Run Size: Total
1976-1980	267	18	53	851	24	1,176	37	1,078
1981-1985	243	20	27	890	52	956	74	1,209
1986-1990	646	46	67	1,527	-	2,287	-	2,287
1991-1995	64	5	10	610	-	689	-	688
1996	43	3	69	776	-	891	-	891
1997	72	10	71	540	-	693	-	693
1998	18	27	-	492	-	537	-	537
1999	12	41	-	373	-	426	-	426
2000	-	2	-	248	-	250	-	250
2001	-	17	-	548	-	565	-	565
2002	-	17	-	738	-	755	-	755
2003	-	6	-	189	-	195	-	195
2004	-	15	-	604	-	619	-	619
2005	-	8	-	298	-	306	-	306
2006	-	6	-	330	-	336	-	336
2007	-	6	-	352	-	358	-	358
2008	-	3	-	305	-	305	-	305
2009[c/]	-	0	-	495	-	495	-	495
2010[c/]	-	0	-	N/A	-	N/A	-	N/A
GOAL				700[d/]				

a/ River catch of adults.

b/ Natural escapement includes hatchery strays.

c/ Preliminary.

d/ Minimum. Terminal run managed at 30 percent exploitation rate of inriver run size.

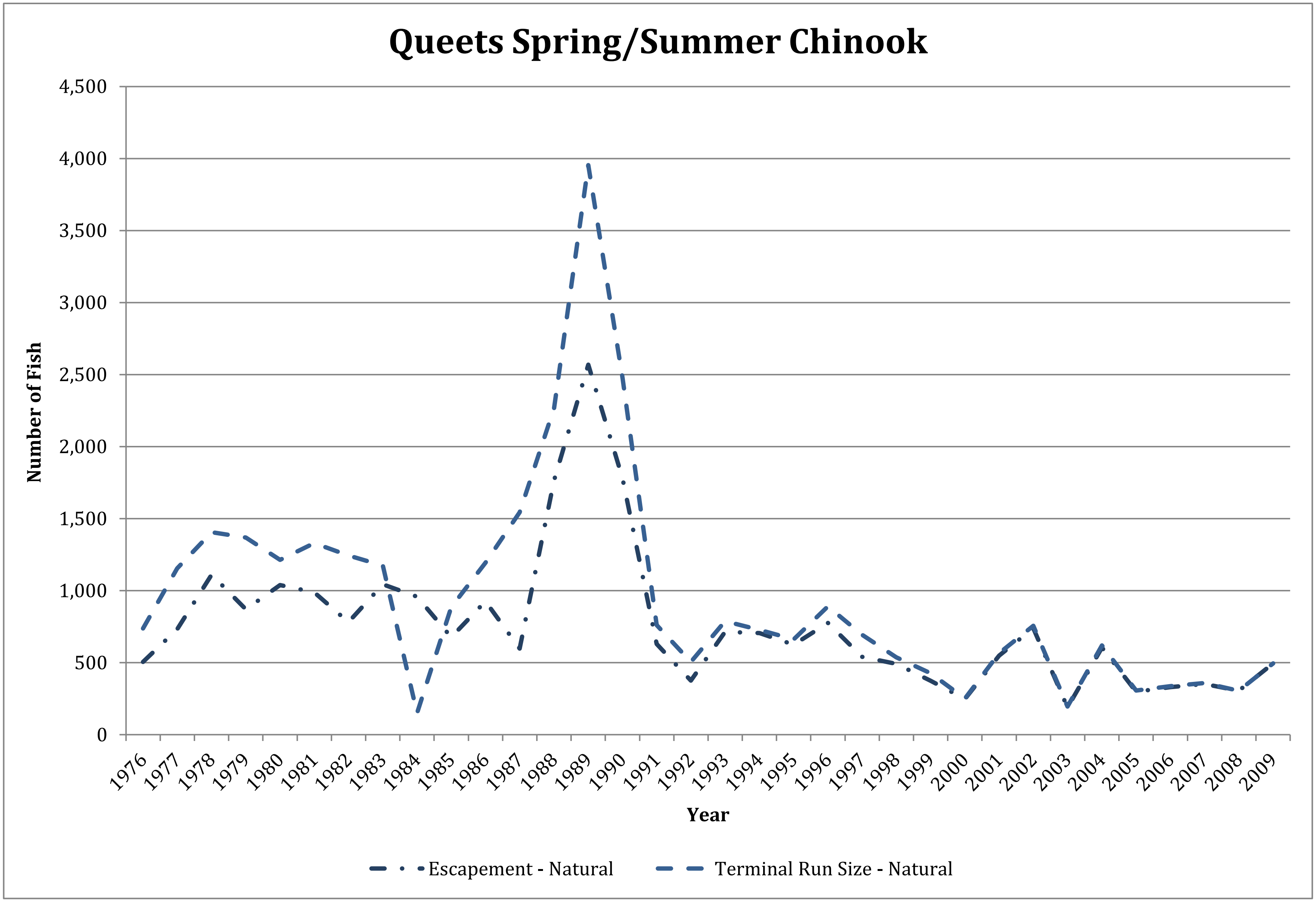

Queets Spring/Summer Chinook
4,500
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
Number of Fish
1976 1977 1978 1979 1980 1981 1982 1983 1984 1985 1986 1987 1988 1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009
Year
Escapement - Natural
Terminal Run Size - Natural

TABLE B-30. Estimated inriver run size, catch, and escapement of Queets River fall Chinook in numbers of fish.

Average	Terminal Catch			Escapement	Terminal Run Size		
	Gillnet	Ceremonial & Subsistence	River Sport[a/]	Natural[b/]	Natural[c/]	Indicator[d/]	Total
1976-1980	1,540	100	36	2,820	4,320	-	4,320
1981-1985	2,104	20	135	3,930	5,691	591	6,282
1986-1990	2,430	20	214	8,768	10,677	861	11,538
1991-1995	1,860	20	109	4,106	5,511	708	6,219
1996	1,307	20	238	4,218	4,693	1,234	5,927
1997	1,708	20	210	2,872	4,122	823	4,945
1998	804	20	347	3,859	5,009	164	5,173
1999	947	20	93	1,918	2,885	220	3,105
2000	262	20	50	3,755	3,752	395	4,147
2001	1,366	64	285	3,099	3,604	1,204	4,808
2002	2,887	69	20	2,589	4,377	1,184	5,561
2003	1,322	93	278	4,979	5,203	1,415	6,618
2004	1,228	93	370	5,105	4,778	2,019	6,797
2005	1,648	90	441	4,557	4,521	2,213	6,734
2006	1,079	57	71	3,051	3,255	1,003	4,258
2007	634	20	74	878	1,293	307	1,600
2008	1,020	41	0	3,082	3,465	692	4,157
2009[e/]	1,522	65	209	NA	NA	NA	NA
2010[e/]	1,723	NA	NA	NA	NA	NA	NA
GOAL				2,500[f/]			

a/ River sport catch of age-3 and older fish. The 2000 sport fishery was closed to retention of unmarked Chinook. The 2002 sport fishery was closed to Chinook retention on October 18 due to unusually low water conditions. The 2008 sport fishery was closed to the retention of Chinook. The 2009 sport fishery was closed to retention of unmarked Chinook in Queets and Salmon Rivers within Olympic National Park.

b/ Includes Indicator Stock. Estimates for years prior to 2001 assume a broodstock take of 150 as a placeholder until individual run reconstructions are complete.

c/ Includes from 100 to 200 wild Chinook captured each season near spawning grounds to be used as Indicator broodstock.

d/ This is an integrated wild/hatchery program. Broodstock are unmarked wild fish collected from river.

e/ Preliminary.

f/ Minimum. Terminal run managed at 40 percent exploitation rate of terminal run size.

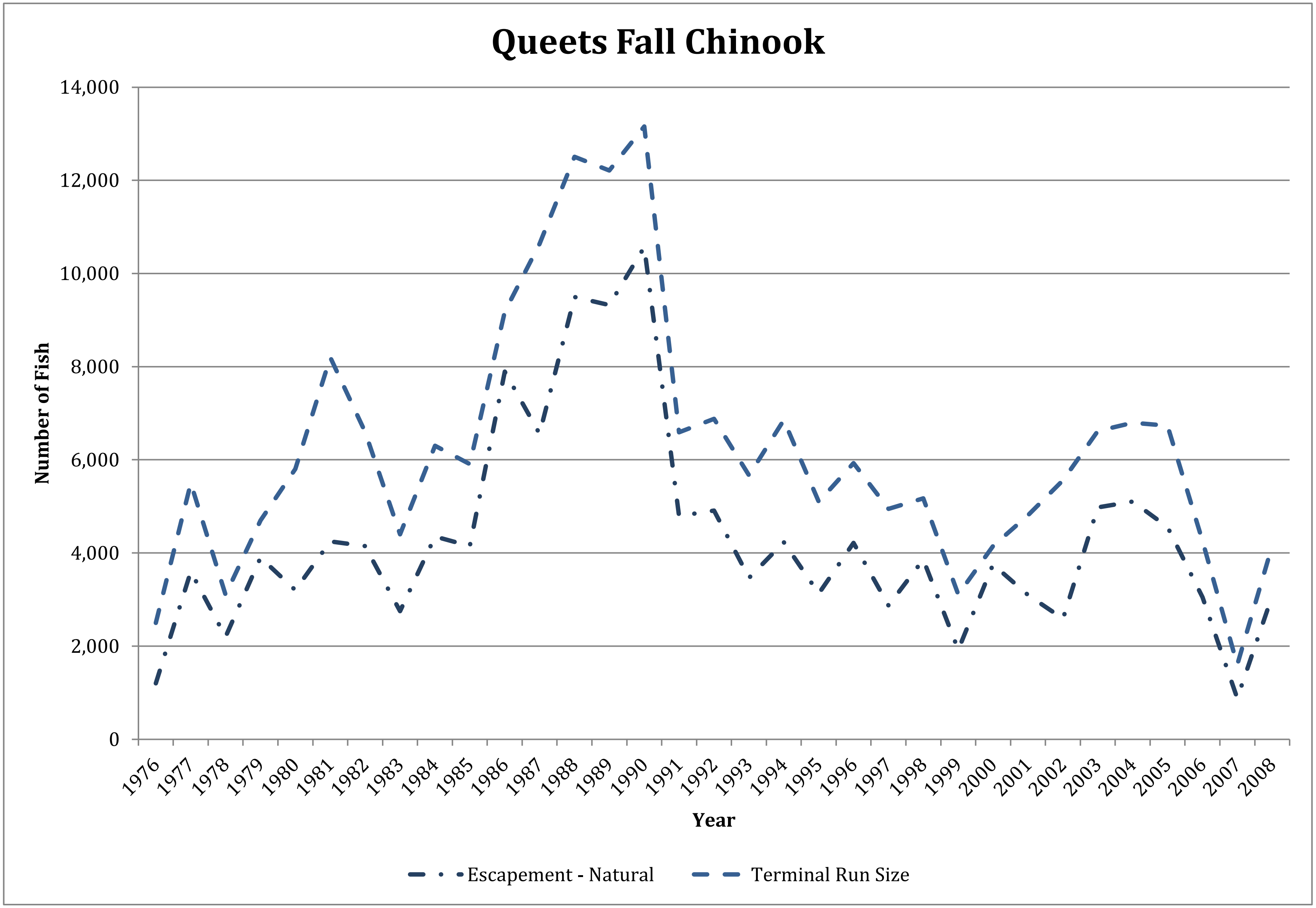

Queets Fall Chinook
14,000
12,000
10,000
8,000
6,000
4,000
2,000
0
Number of Fish
1976
1977
1978
1979
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
Year
Escapement - Natural
Terminal Run Size

TABLE B-31. Estimated terminal run size, catch, and escapement for Queets River coho in numbers of fish.

	Terminal Catch[a]				Escapement[c]			Terminal Run Size[c]		
Year or Average	Gillnet	Ceremonial & Subsistence	River Sport[b]	Natural	Supplemental	Hatchery	Natural	Supplemental	Hatchery	Total[d]
1976-1980	2,440	60	140	3,460	-	1,000	5,100	-	1,640	6,740
1981-1985	2,385	20	104	5,397	-	2,654	6,411	-	3,794	10,205
1986-1990	8,455	18	241	4,826	996	3,700	6,343	1,825	9,685	17,123
1991-1995[e]	4,423	285	273	4,943	1,024	3,455	5,967	1,167	6,927	13,828
1996	16,035	920	279	8,926	3,575	5,189	10,722	4,502	13,078	28,302
1997	3,087	222	106	1,712	e/	2,137	1,970	e/	5,029	6,999
1998	7,411	452	135	4,134	1,387	3,503	4,661	1,536	9,545	15,742
1999	3,974	381	119	4,799	519	3,551	5,054	529	7,388	12,971
2000	5,066	479	223	8,104	682	2,032	8,715	701	5,366	14,782
2001	13,722	1,287	1,554	23,871	1,082	6,508	28,368	2,293	14,193	44,854
2002	23,712	1,009	399	13,968	1,065	2,240	16,123	1,311	21,514	38,948
2003	12,693	921	743	9,846	1,081	7,002	13,224	1,343	15,544	30,111
2004[f]	8,189	657	1,287	7,484	1,225	3,985	10,030	1,673	10,395	22,098
2005[f]	20,810	989	873	6,539	432	7,843	9,658	542	26,304	36,504
2006[f]	6,190	353	52	5,626	0	2,931	6,400	0	7,101	13,501
2007	2,261	304	153	4,680	0	1,874	6,066	0	2,779	8,845
2008	4,671	356	562	4,629	0	3,461	6,221	0	5,667	11,888
2009[g]	25,003	1,697	865	9,200	0	NA	NA	0	NA	NA
2010[g]	21,107	NA	NA	NA	0	NA	NA	0	NA	NA
GOAL				5,800-14,500						

a/ Includes dip-in fish from other river systems.

b/ Recreational catch of adults (coho over 20 inches).

c/ Natural escapement and run size estimates include fish taken for hatchery brood stock.

d/ Queets stock only; does not include non-local, dip-in fish.

e/ 1991 and 1997 supplemental was included in natural escapement and run size.

f/ Poor conditions during the coho spawner survey season precluded conduct of an independent spawner escapement estimate.

g/ Preliminary. In-season effort model used to scale run size to observed catch and effort, natural escapement, and actual hatchery rack escapement.

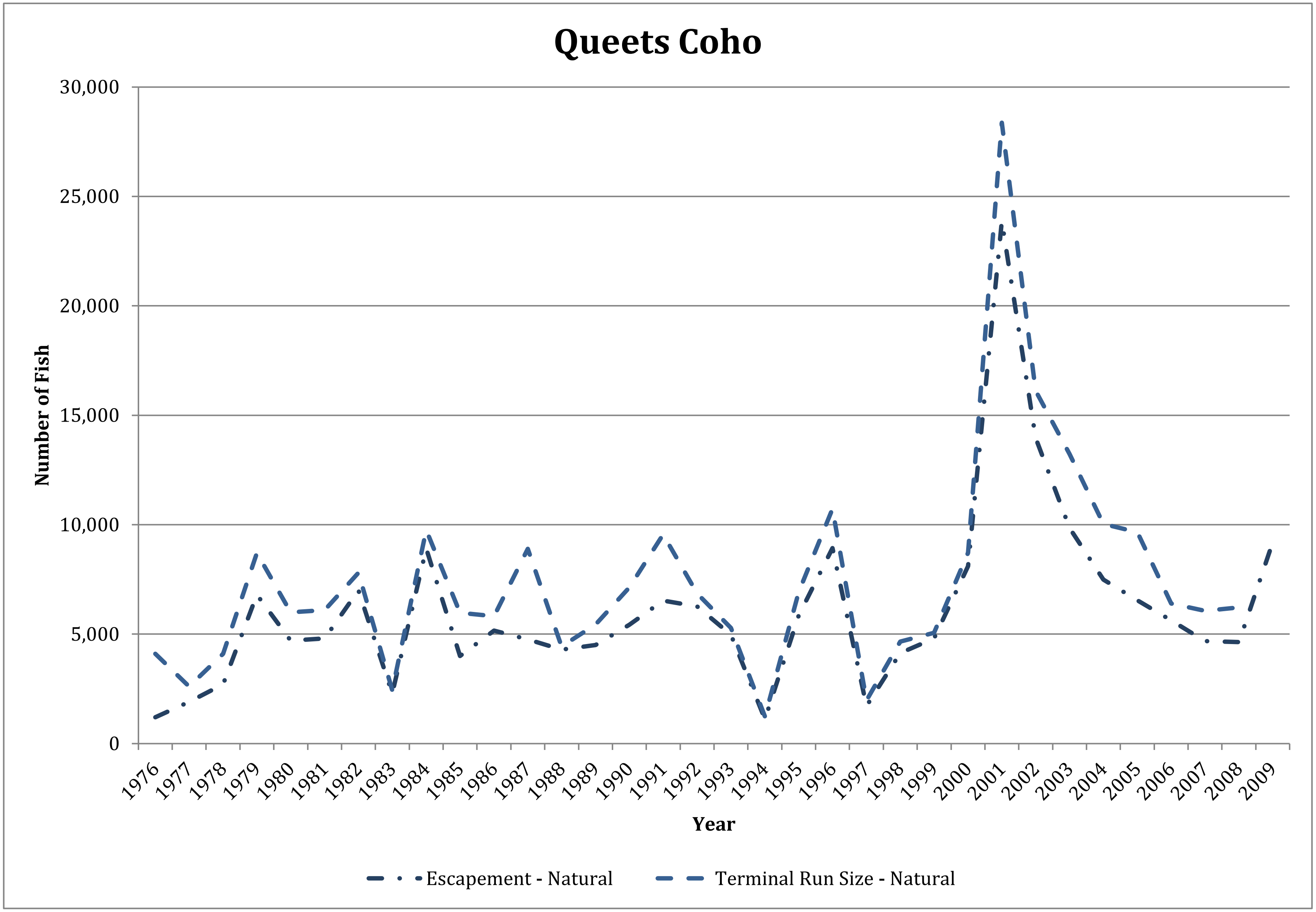

Queets Coho
Number of Fish
30,000
25,000
20,000
15,000
10,000
5,000
0
1976
1977
1978
1979
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
Year
Escapement - Natural
Terminal Run Size - Natural

TABLE B-32. Estimated inriver run size, catch, and escapement for Hoh River spring/summer Chinook in numbers of fish.

	Terminal Catch[a/]											
Year or	Gillnet			Ceremonial & Subsistence				Escapement		Terminal Run Size		
Average	Natural	Hatchery	Total	Natural	Hatchery	Total	River Sport[b/]	Natural	Hatchery	Natural	Hatchery	Total
1976-1980	NA	NA	640	--	--	52	84	1,040	0	1,835	0	1,835
1981-1985	NA	NA	448	--	--	30	124	1,431	50	1,944	128	2,073
1986-1990	NA	NA	1,072	--	--	33	315	2,829	34	4,043	257	4,300
1991-1995	NA	NA	432	--	--	22	273	1,268	0	1,852	156	2,008
1996	NA	NA	471	--	--	30	267	1,371	16	2,083	114	2,197
1997	NA	NA	416	--	--	57	331	1,826	0	2,582	53	2,635
1998	NA	NA	294	--	--	20	288	1,287	0	1,880	28	1,908
1999[c/]	NA	NA	155	--	--	20	52	928	99	1,081	171	1,252
2000[d/]	NA	NA	87	--	--	38	21	492	0	529	116	645
2001[d/]	NA	NA	134	--	--	39	43	1,159	0	1,231	101	1,332
2002[e/]	NA	NA	587	--	--	37	372	2,464	0	3,375	85	3,460
2003[e/]	NA	NA	296	--	--	20	206	1,228	0	1,646	104	1,750
2004[e/]	NA	NA	401	--	--	20	102	1,786	0	2,239	70	2,309
2005[e/]	NA	NA	323	--	--	36	73	1,193	0	1,389	217	1,606
2006[e/]	NA	NA	576	--	--	37	109	904	0	1,061	571	1,632
2007[e/]	NA	NA	760	--	--	68	136	810	0	1,023	592	1,615
2008[d/e/]	22	227	249	10	40	50	7	671	0	717	274	991
2009[d/e/f/]	30	106	136	3	2	5	12	880	2	913	110	1,023
2010[d/e/f/]	24	83	107	0	0	0	NA	NA	0	NA	83	NA
GOAL								900[g/]				

a/ Beginning in 1981, catch breakouts recalculated to account for Solduc hatchery yearling release dip-in fish.

b/ Recreational catch of adults (at least 24 inches total length); beginning in 2008, all Chinook must be marked with a healed adipose fin clip.

c/ Sport fishery closed until July 14.

d/ Sport fishery closed through August 31 to retention of wild adult spring/summer Chinook.

e/ Sport fishery open May 16 through August 31 from mouth to Willoughby Creek.

f/ Preliminary.

g/ Minimum. Terminal run managed at 31 percent harvest rate of inriver run size.

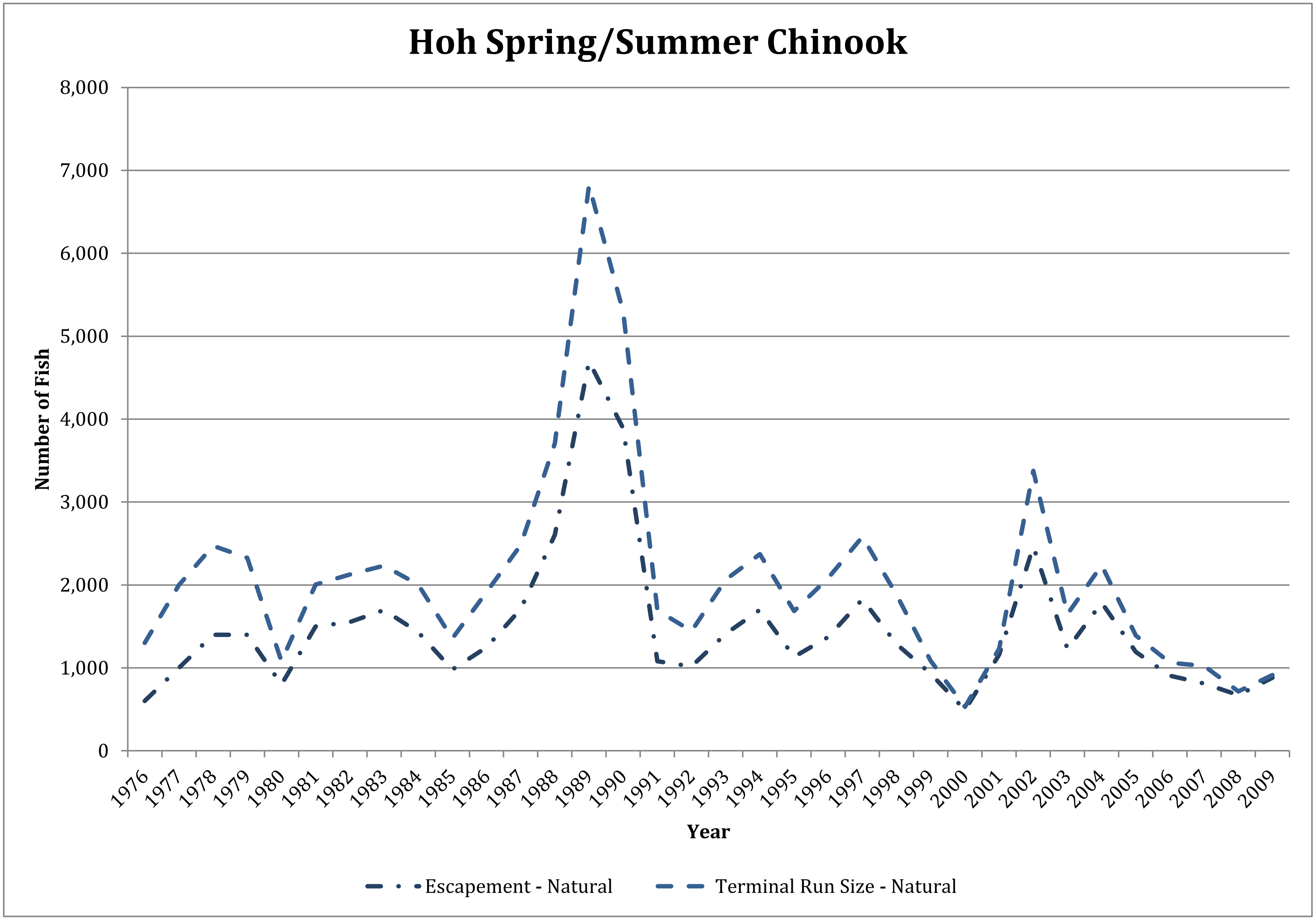

Hoh Spring/Summer Chinook
Number of Fish
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
1976
1977
1978
1979
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
Year
Escapement - Natural
Terminal Run Size - Natural

TABLE B-33. Estimated inriver run size, catch, and escapement for Hoh River fall Chinook in numbers of fish.

Year or Average	Terminal Catch			Escapement		Terminal Run Size		
	Gillnet	Ceremonial & Subsistence	River Sport[a]	Natural[b]	Hatchery	Natural[b]	Hatchery	Total
1976-1980	760	36	37	2,080	-	2,960	-	2,960
1981-1985	849	36	59	2,745	20	3,684	100	3,764
1986-1990	2,000	32	213	4,500	33	6,819	88	6,907
1991-1995	871	27	233	2,774	0	3,590	65	3,655
1996	836	30	192	3,022	0	4,061	19	4,080
1997	1,114	35	164	1,773	0	3,034	52	3,086
1998	846	30	268	4,257	0	5,388	13	5,401
1999	596	30	413	1,924	0	2,941	22	2,963
2000	404	20	479	1,749	0	2,632	20	2,652
2001	946	40	600	2,560	0	4,116	120	4,236
2002[c]	1,461	30	134	4,415	82	5,716	406	6,122
2003	517	30	216	1,649	32	2,345	99	2,444
2004	815	30	400	3,211	26	4,410	72	4,482
2005	970	21	229	4,180	14	5,337	77	5,414
2006	586	30	204	1,535	0	2,324	19	2,343
2007[d]	660	30	192	1,556	0	2,427	11	2,438
2008[d]	659	0	278	2,849	0	3,761	25	3,786
2009[d]	651	0	140	2,081	0	2,851	21	2,872
2010[d]	342	0	NA	2,347	0	NA	0	NA
GOAL				1,200[e]				

a/ Recreational catch of age-3 and older fish.

b/ Includes fish taken for hatchery brood stock.

c/ Low water in October and early November delayed upstream migration, prompting closure of the sport fishery to Chinook retention on October 19 for the remainder of season. Tribal gillnet fishery closed weeks 44 and 45.

d/ Preliminary.

e/ Minimum. Terminal run managed for a maximum 40 percent harvest rate of inriver run size.

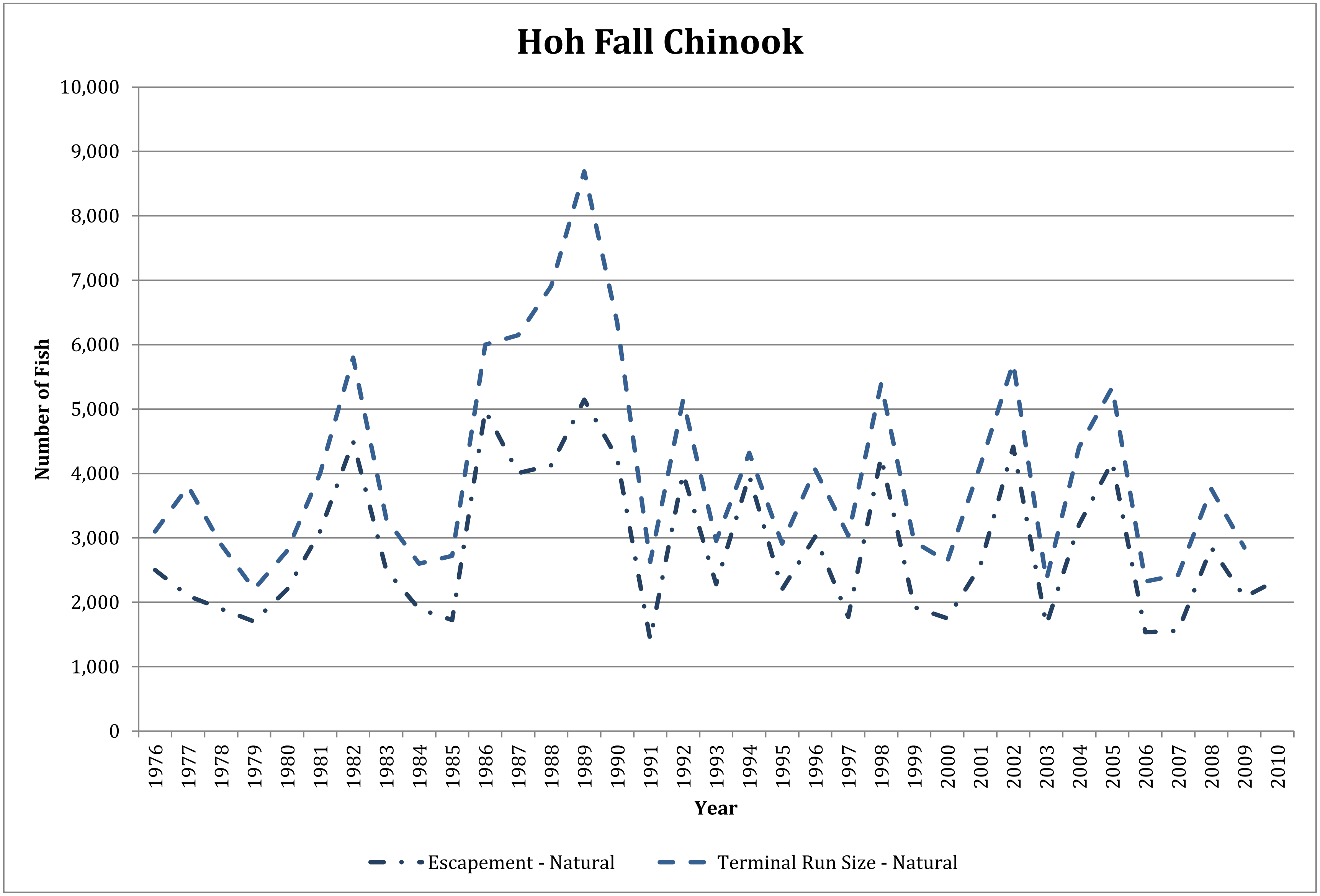

Hoh Fall Chinook
Number of Fish
10,000
9,000
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
1976
1977
1978
1979
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
Year
Escapement - Natural
Terminal Run Size - Natural

TABLE B-34. Estimated inriver run size, catch, and escapement for Hoh River coho in numbers of fish.

Year or Average	Terminal Catch[a/] Gillnet	Ceremonial & Subsistence	River Sport[b/]	Escapement Natural[c/]	Hatchery	Terminal Run Size Natural[c/]	Hatchery	Total
1976-1980	1,960	74	28	2,700	39	4,683	259	4,942
1981-1985	1,604	48	22	3,371	92	4,655	452	5,107
1986-1990	2,507	30	165	3,145	238	5,221	760	5,981
1991-1995	801	26	168	3,078	122	3,816	379	4,195
1996	972	50	101	4,858	0	5,835	146	5,981
1997[d/]	85	25	4	1,386	0	1,449	51	1,500
1998	650	20	213	4,418	0	5,184	118	5,302
1999	1,706	25	256	4,594	0	6,293	308	6,601
2000	1,932	20	280	6,772	0	8,831	173	9,004
2001	3,909	40	786	10,773	840	14,801	1,547	16,348
2002[e/]	3,114	30	401	9,009	1,922	11,254	3,222	14,476
2003	1,872	20	350	6,273	645	8,118	1,021	9,139
2004	1,255	20	437	4,702	14	6,291	137	6,428
2005	3,830	30	280	4,711	732	8,294	1,259	9,553
2006	1,313	30	108	1,282	0	2,267	466	2,733
2007[f/]	1,764	30	305	3,072	0	5,120	51	5,171
2008[f/]	1,788	4	204	2,461	67	4,308	220	4,528
2009[f/]	4,294	0	505	4,615	0	8,224	685	8,909
2010[f/]	2,638	0	NA	NA	0	NA	468	NA
GOAL				2,000 to 5,000				

a/ Includes dip-in fish from other river systems.

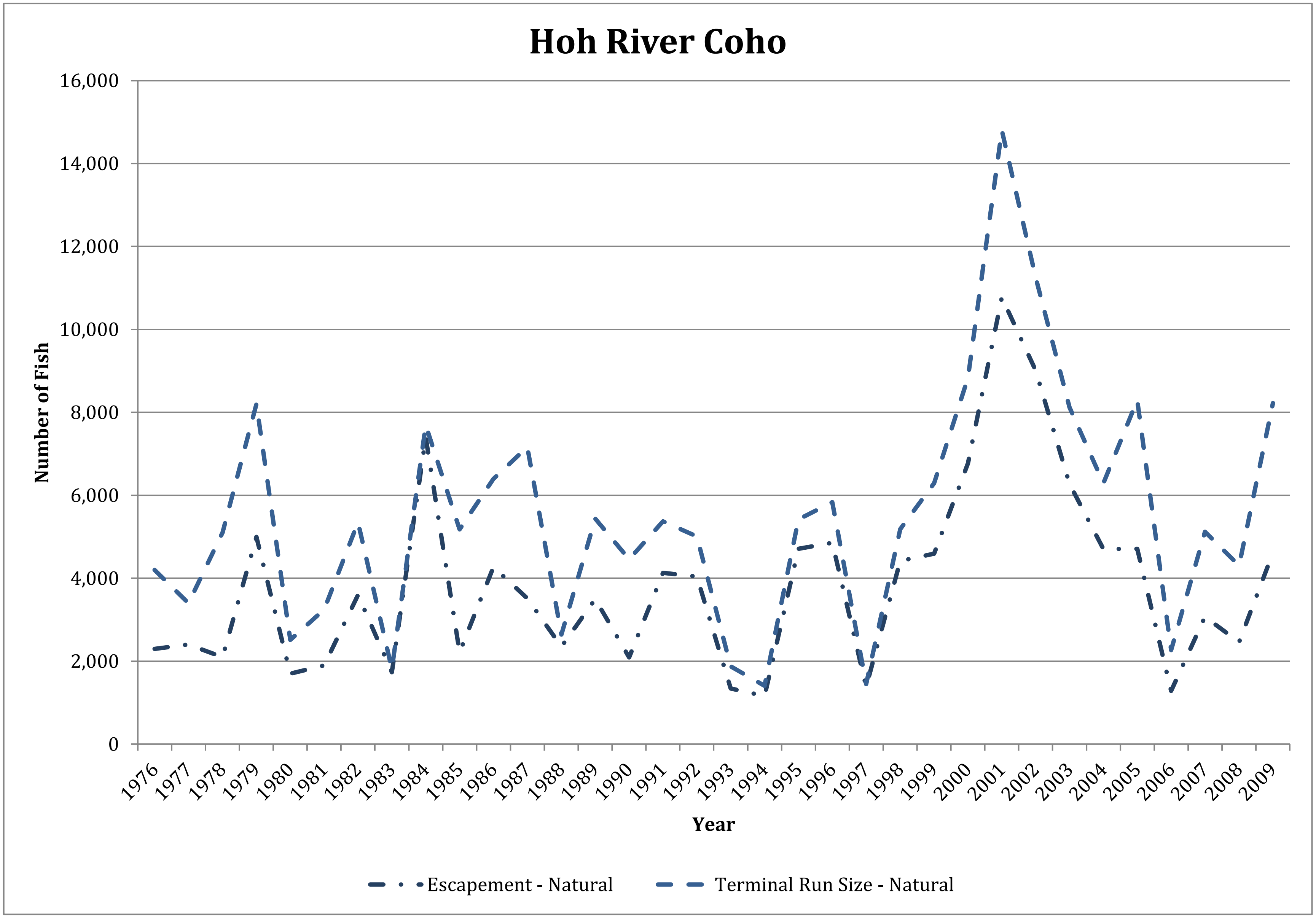
b/ Recreational catch of adults (coho over 20 inches).

c/ Natural escapement and run sizes estimates include fish taken for hatchery brood stock.

d/ Recreational fishermen were limited to Chinook only. Release of adult coho required. Tribal net fishery used large mesh to minimize coho impacts.

e/ Sport and tribal gillnet seasons reduced inseason in response to delayed upriver movement of coho caused by extreme low water conditions in October and early November. Closures were for two weeks.

f/ Preliminary.



Hoh River Coho
16,000
14,000
12,000
10,000
8,000
6,000
4,000
2,000
0
Number of Fish
1976 1977 1978 1979 1980 1981 1982 1983 1984 1985 1986 1987 1988 1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009
Year
Escapement - Natural
Terminal Run Size - Natural

TABLE B-35. Estimated inriver run size, catch, and escapement for Quillayute River spring/summer Chinook in numbers of fish.

Year or Average	Terminal Catch			Escapement		Terminal Run Size		
	Gillnet	Ceremonial & Subsistence[a/]	River Sport[b/]	Natural[c/]	Hatchery[d/]	Natural[c/]	Hatchery[d/]	Total
1976-1980	2,520	20	380	2,093	800	-	-	3,698
1981-1985	700	20	48	731	260	-	-	1,164
1986-1990	1,631	22	258	1,602	1,003	3,085	2,503	4,341
1991-1995	893	25	293	1,159	832	1,444	1,758	3,202
1996	136	50	257	1,170	226	1,388	426	1,814
1997	106	50	263	890	198	1,177	305	1,482
1998	199	50	128	1,599	247	1,829	369	2,198
1999	368	50	238	713	596	818	1,147	1,965
2000	254	50	307	989	227	1,149	678	1,827
2001	330	50	353	1,225	973	1,399	1,515	2,914
2002	419	50	367	1,002	836	1,100	1,573	2,673
2003	184	50	343	1,219	1,250	1,308	1,738	3,046
2004	217	50	341	1,093	763	1,259	1,195	2,454
2005	332	3	479	876	801	1,033	1,467	2,500
2006	688	0	318	553	1,032	604	1,987	2,591
2007	800	0	180	502	1,007	568	1,921	2,489
2008	993	40	223	949	796	1,081	1,920	3,001
2009[e/]	483	30	192	555	722	682	1,300	1,982
2010[e/f/]	564	0	NA	702	880	828	1,318	2,146
GOAL				1,200[g/]				

a/ Beginning in 2005, ceremonial and subsistence catch taken during scheduled gillnet fishery is reported as gillnet catch. Catch during designated ceremonial and subsistence fisheries is listed sepatately.

b/ Recreational catch of adults; mark selective for adipose fin clipped coho beginning in 2003.

c/ Natural escapement includes hatchery strays and broodstock fish.

d/ Hatchery escapement and terminal run size exclude hatchery strays.

e/ Preliminary.

f/ Terminal run size estimates incomplete because inriver sport catch estimates are unavailable.

g/ FMP goal is adults; WDFW goal of 1,200 includes age-3 males (jacks).

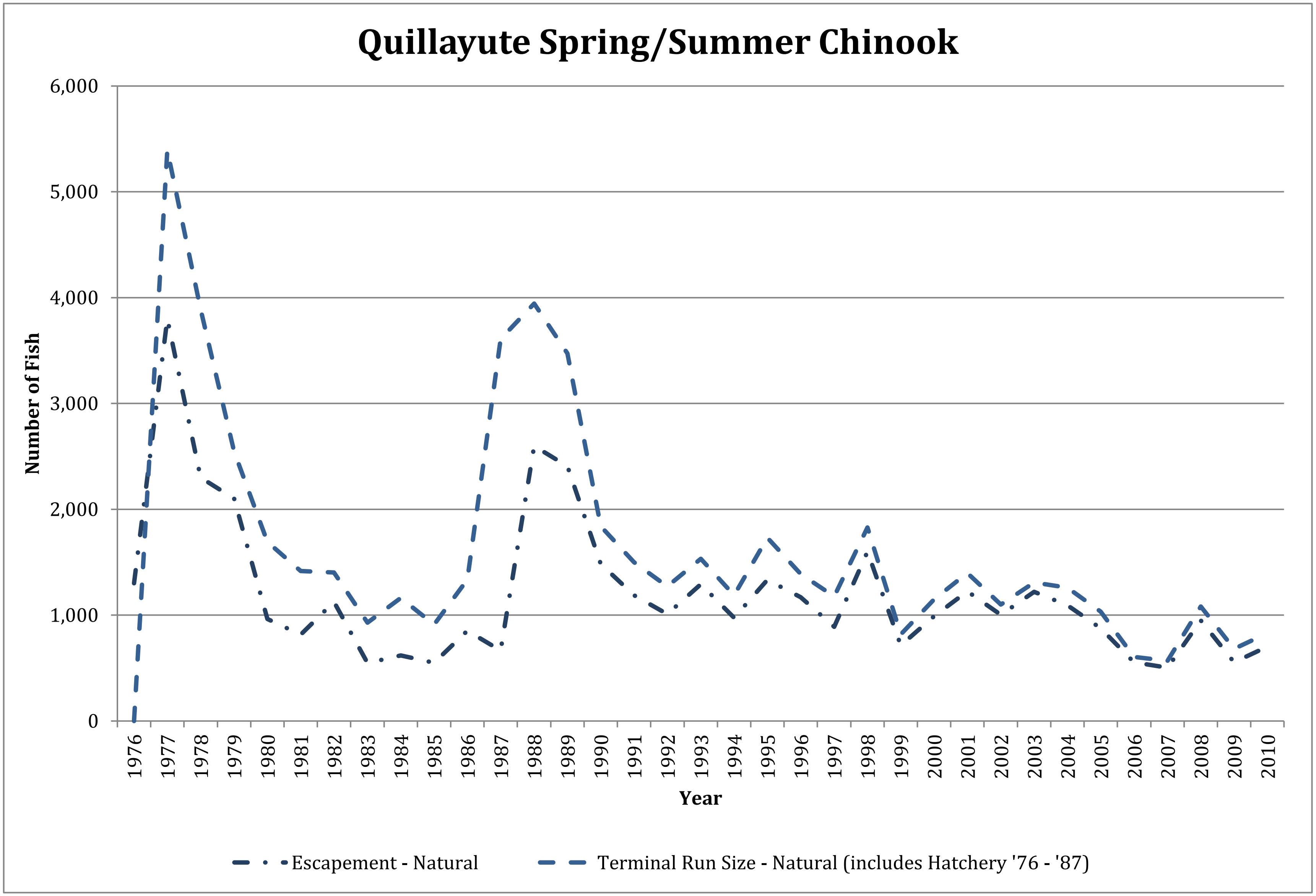

Quillayute Spring/Summer Chinook
6,000
5,000
4,000
3,000
2,000
1,000
0
Number of Fish
1976
1977
1978
1979
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
Year
Escapement - Natural
Terminal Run Size - Natural (includes Hatchery '76 - '87)

TABLE B-36. Estimated inriver run size, catch, and escapement for Quillayute River fall Chinook in numbers of fish.

Year or Average	Terminal Catch: Gillnet	Terminal Catch: Ceremonial & Subsistence[a/]	Terminal Catch: River Sport[b/]	Escapement: Natural[c/]	Escapement: Hatchery[d/]	Terminal Run Size: Natural[c/]	Terminal Run Size: Hatchery[d/]	Terminal Run Size: Total
1976-1980	2,640	20	220	4,220	144	6,540	640	7,180
1981-1985	2,075	50	131	6,282	77	8,219	305	8,525
1986-1990	5,475	50	564	12,238	112	18,004	379	18,383
1991-1995	713	50	289	5,670	11	6,705	29	6,733
1996	1,377	100	500	7,316	0	9,293	0	9,293
1997	282	50	310	5,405	0	6,047	0	6,047
1998	762	100	326	6,752	0	7,940	0	7,940
1999	1,129	100	195	3,334	0	4,758	0	4,758
2000	604	100	360	3,730	0	4,794	0	4,794
2001	1,650	100	659	5,136	0	7,545	0	7,545
2002	3,074	100	271	6,067	0	9,512	0	9,512
2003	1,345	100	626	7,398	0	9,469	23	9,492
2004	527	100	681	3,831	0	6,133	12	6,145
2005	1,414	0	499	6,406	0	8,319	32	8,351
2006	1,969	0	35	5,642	0	7,656	15	7,671
2007	905	0	166	3,066	0	4,137	0	4,137
2008	1,426	0	217	3,612	0	5,250	5	5,255
2009[e/]	2,434	0	352	3,130	0	5,874	42	5,916
2010[e/f/]	1,814	0	NA	4,386	0	6,182	18	6,200
GOAL				3,000[g/]				

a/ Beginning in 2005, ceremonial and subsistence catch taken during scheduled gillnet fishery is reported as gillnet catch.

b/ River recreational catch of age-3 and older fish.

c/ Includes fish taken for hatchery brood stock and hatchery strays.

d/ Hatchery escapement and terminal run size exclude hatchery strays.

e/ Preliminary.

f/ Terminal run size estimates incomplete since inriver sport catch estimates are unavailable.

g/ Minimum. Terminal run managed at 40 percent harvest rate.

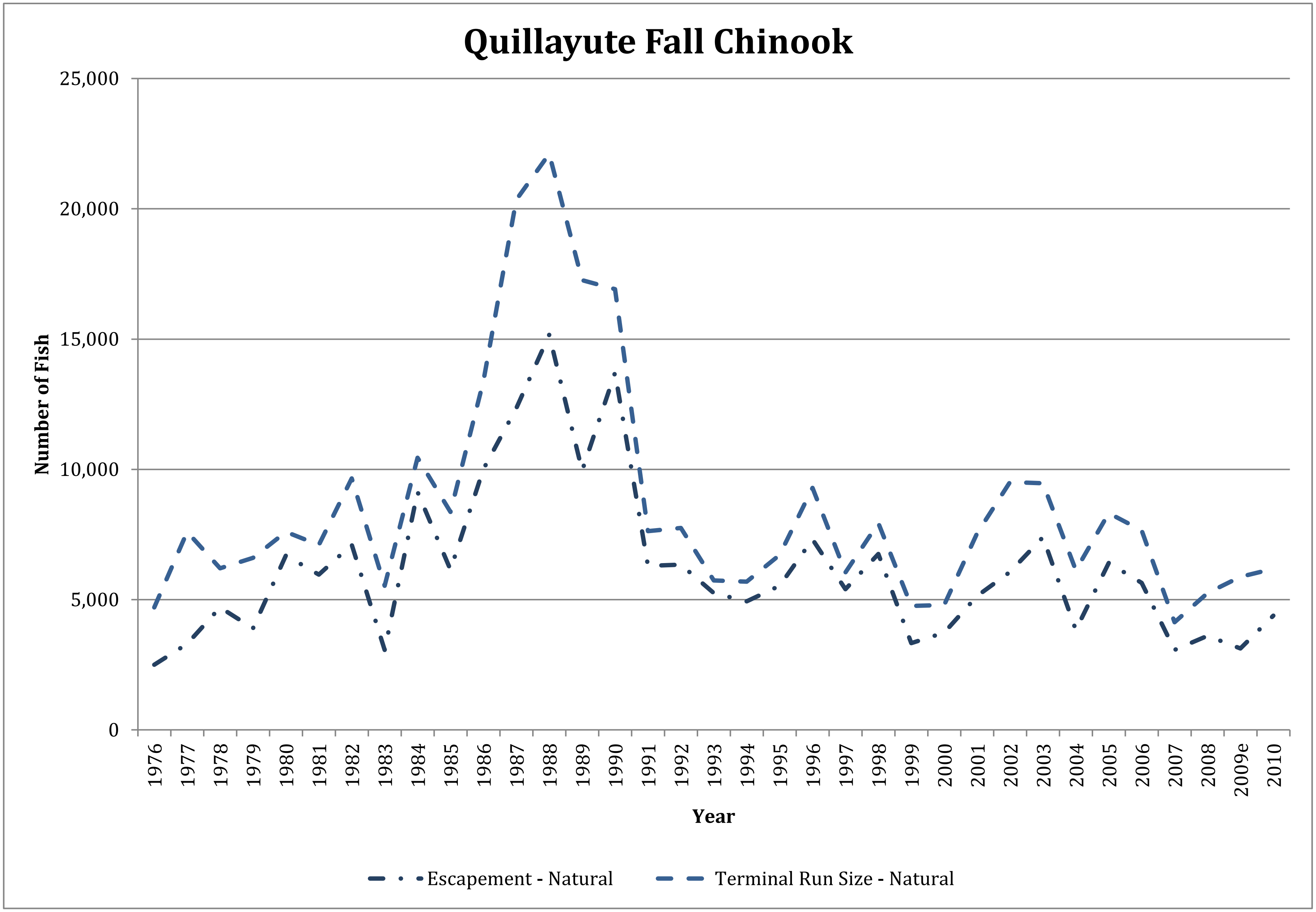

Quillayute Fall Chinook
25,000
20,000
15,000
10,000
5,000
0
Number of Fish
1976
1977
1978
1979
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009e
2010
Year
Escapement - Natural
Terminal Run Size - Natural

TABLE B-37. Estimated inriver run size, catch, and escapement for Quillayute River coho stocks in numbers of fish. (Page 1 of 2)

Year or Average	Terminal Catch[a/] Gillnet	Ceremonial & Subsistence[b/]	River Sport[c/]	Escapement Natural[d/]	Escapement Hatchery[e/]	Terminal Run Size Natural[d/]	Terminal Run Size Hatchery[e/]	Total
				SUMMER COHO				
1976-1980	5,038	56	266	1,192	4,565	1,962	9,154	11,116
1981-1985	4,062	50	105	946	2,744	2,106	5,802	7,908
1986-1990	3,204	50	94	723	4,001	1,643	6,430	8,072
1991-1995	1,286	50	191	784	6,501	989	7,823	8,812
1996	2,552	50	189	465	3,400	801	5,855	6,656
1997	70	50	14	753	1,509	798	1,598	2,396
1998	1,310	50	93	346	1,688	593	2,894	3,487
1999	945	50	292	624	7,527	723	8,715	9,438
2000	1,188	50	278	1,001	3,745	1,237	5,025	6,262
2001	2,196	50	590	961	12,993	1,841	14,949	16,790
2002	3,982	50	150	1,012	3,939	2,099	7,034	9,133
2003	2,412	50	326	505	6,539	1,472	8,360	9,832
2004	1,337	50	343	1,269	6,527	1,874	7,652	9,526
2005	10,273	0	487	1,218	7,182	2,197	16,963	19,160
2006	2,413	0	141	604	1,832	1,620	3,222	4,842
2007	645	0	200	792	4,778	1,029	5,399	6,428
2008[f/]	1,376	0	198	706	6,419	1,010	7,689	8,699
2009[f/]	3,645	0	233	1,337	8,085	2,355	10,945	13,300
2010[f/g/]	1,378	0	NA	276	1,644	737	2,561	3,298
GOAL					Hatchery Production			

TABLE B-37. Estimated inriver run size, catch, and escapement for Quillayute River coho stocks in numbers of fish. (Page 2 of 2)

Year or Average	Terminal Catch[a]			Escapement		Terminal Run Size		
	Gillnet	Ceremonial & Subsistence[b]	River Sport[c]	Natural[d]	Hatchery[e]	Natural[d]	Hatchery[e]	Total
				FALL COHO				
1976-1980	5,985	53	70	9,002	2,435	13,959	3,587	17,546
1981-1985	3,789	49	164	7,464	2,102	10,988	2,580	13,568
1986-1990	5,794	100	385	8,766	1,771	14,119	2,695	16,815
1991-1995	3,598	100	565	7,357	4,736	9,930	6,426	16,356
1996	8,419	100	1,336	11,009	11,515	14,596	17,783	32,379
1997	456	50	38 [h]	4,623	2,645	5,021	2,791	7,812
1998	4,606	50	1,340	13,866	12,834	16,980	15,716	32,696
1999	22,946	50	1,054	9,365	13,528	19,524	27,515	47,039
2000	5,606	50	1,059	13,343	13,118	17,706	15,470	33,176
2001	23,991	50	2,620	18,876	23,892	36,714	32,715	69,429
2002	22,214	50	2,002	23,016	30,656	34,695	43,243	77,938
2003	13,949	50	2,533	14,756	13,799	25,188	19,899	45,087
2004	19,321	50	2,831	13,354	21,248	25,118	31,687	56,805
2005	29,530	0	3,420	11,501	24,137	22,125	46,463	68,588
2006	9,643	0	291	5,210	4,450	12,195	7,433	19,628
2007	10,152	0	826	6,232	5,423	10,942	11,711	22,653
2008[f]	15,659	10	478	6,947	12,098	12,866	22,326	35,192
2009[f]	36,693	0	4,620	7,863	23,373	24,508	48,041	72,549
2010[f/g]	26,639	10	NA	9,322	23,325	21,699	37,597	59,296
GOAL				6,300-15,800				

a/ Includes dip-in fish from other systems.

b/ Beginning in 2005, ceremonial and subsistence catch taken during scheduled gillnet fishery is reported as gillnet catch. Catch during designated ceremonial and subsistence fisheries is listed separately.

c/ Recreational catch of adults (coho over 20 inches).

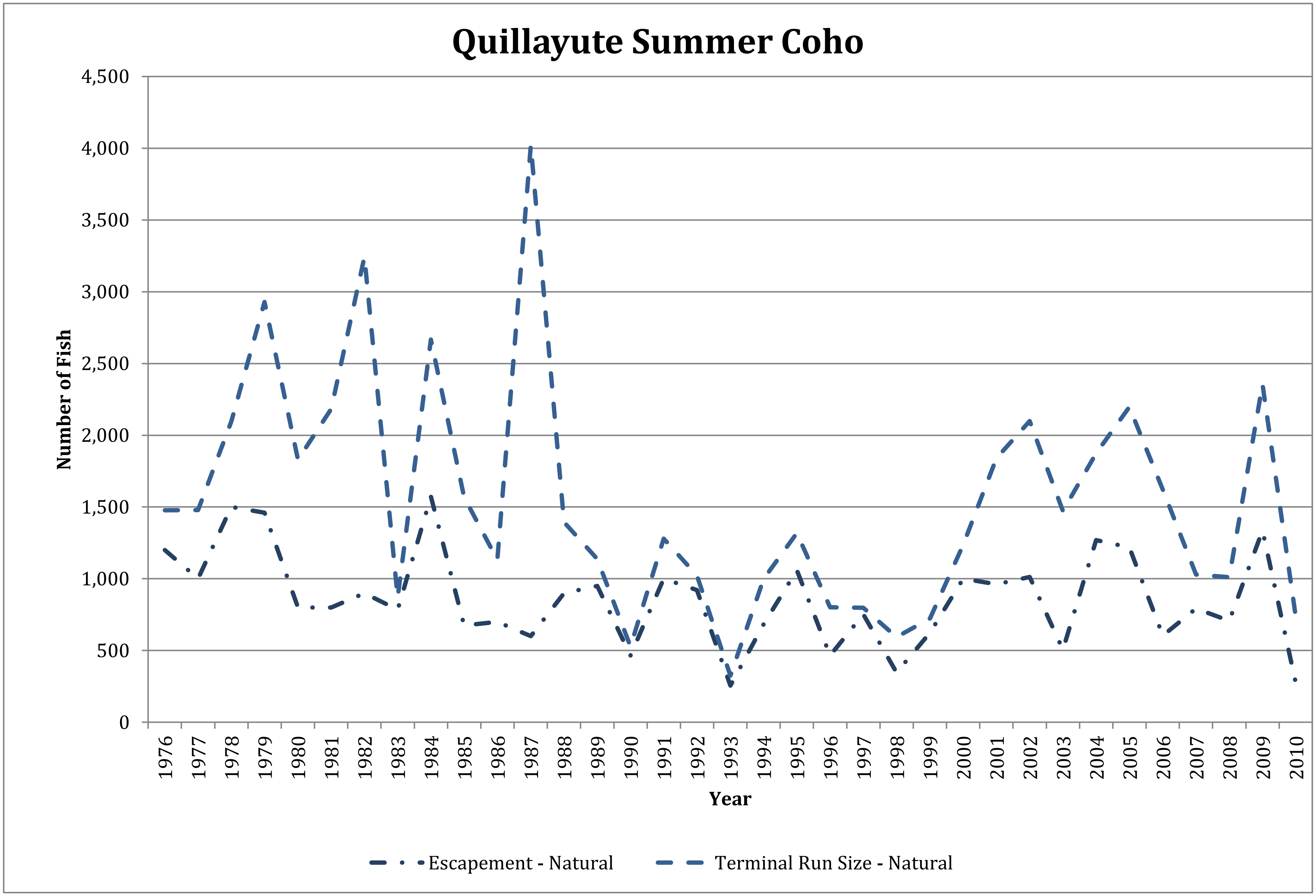
d/ Natural escapement and run size estimates include fish taken for hatchery brood stock.

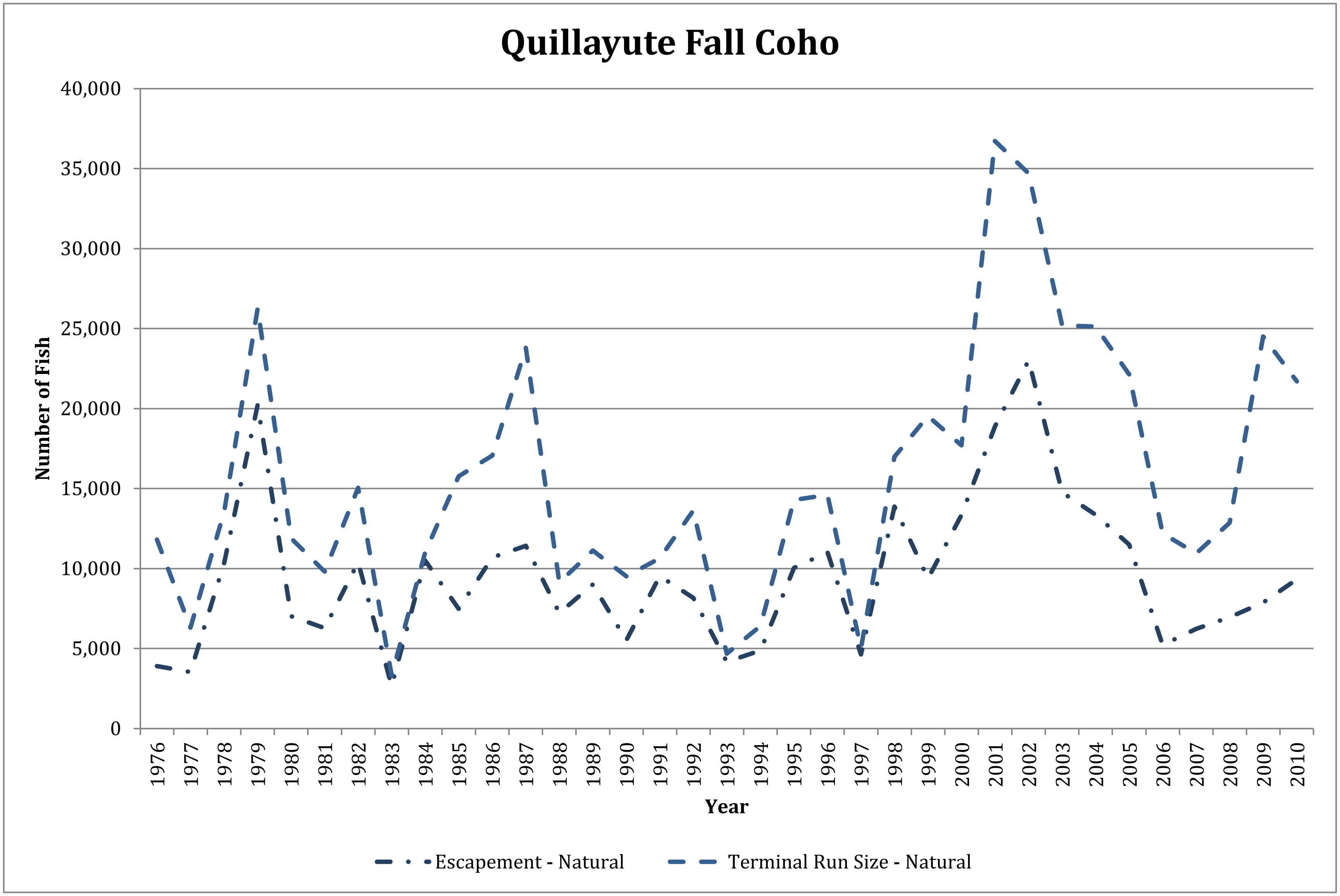
e/ Hatchery escapement and terminal run size exclude hatchery strays.

f/ Preliminary.

g/ Terminal run size estimates incomplete since inriver sport catch estimates are unavailable.

h/ Regulations required nonretention of coho.


Quillayute Summer Coho
Number of Fish
4,500
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
1976
1977
1978
1979
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
Year
Escapement - Natural
Terminal Run Size - Natural



Quillayute Fall Coho
40,000
35,000
30,000
25,000
20,000
15,000
10,000
5,000
0
Number of Fish
1976
1977
1978
1979
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
Year
Escapement - Natural
Terminal Run Size - Natural

APPENDIX 5
WDFW STOCK ASSESSMENTS

WINTER STEELHEAD and CHUM

The following charts are derived from the Washington Department of Fish and Wildlife ("WDFW") escapement data (Online at: http://wdfw.wa.gov/mapping/salmonscape/index.html). Budgetary limitations have historically made the collection and processing of this data difficult for the agency and that problem has recently gotten much worse. Much of the field data is collected by the Tribes and provided to WDFW. Even still, recent staffing cuts to the agency have made it difficult to update databases.

The Pacific Fisheries Management Council data presented in Appendix 4 is limited to chinook and coho, the two most commercially important species in the Coast Region. The following data covers only winter steelhead and chum. Escapement data is not collected for most of the chum populations in the northern WRIAs. Sockeye data is not included.

In most cases, total escapement numbers in the following graphs are derived from a formula based upon redd counts in index areas. Any conclusions drawn from these data should be considered tentative only.

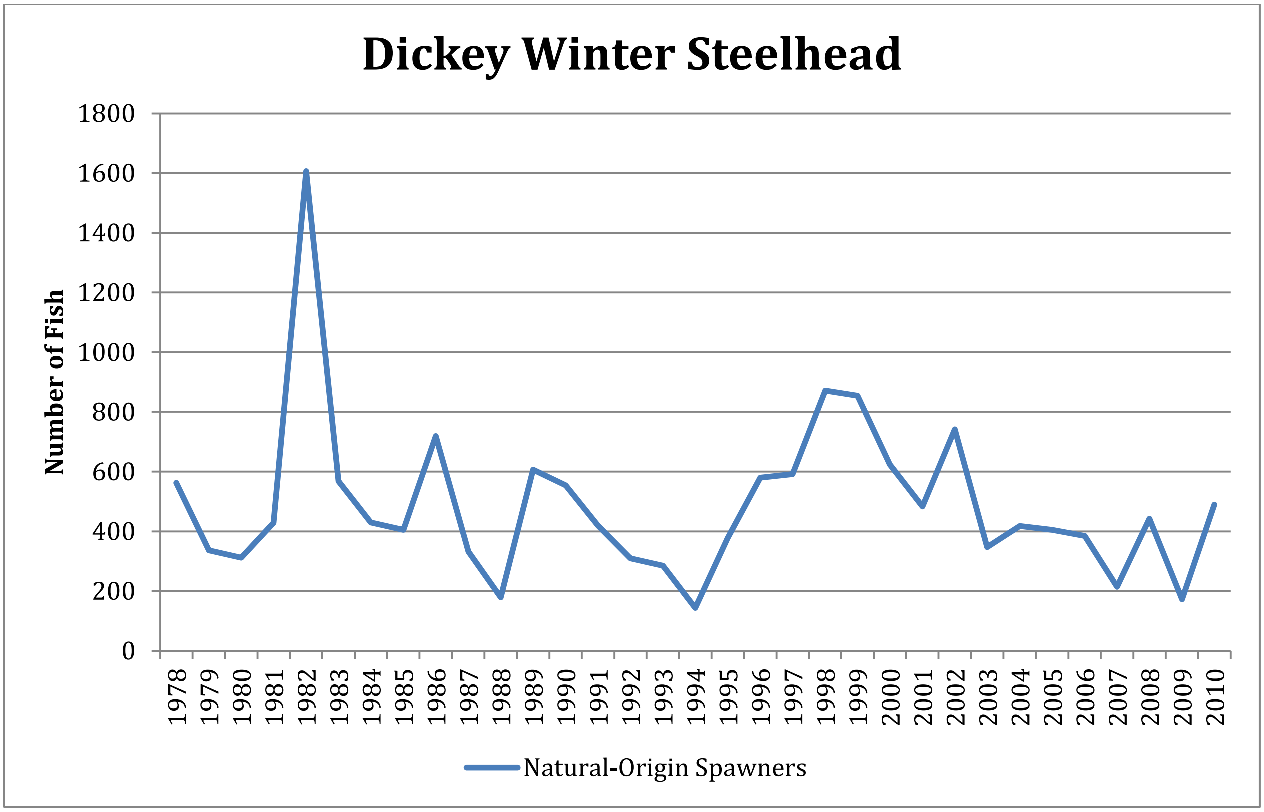
The lack of data has long been considered one of our greatest challenges. It is our objective through implementation of this Plan to work hard at correcting this problem.

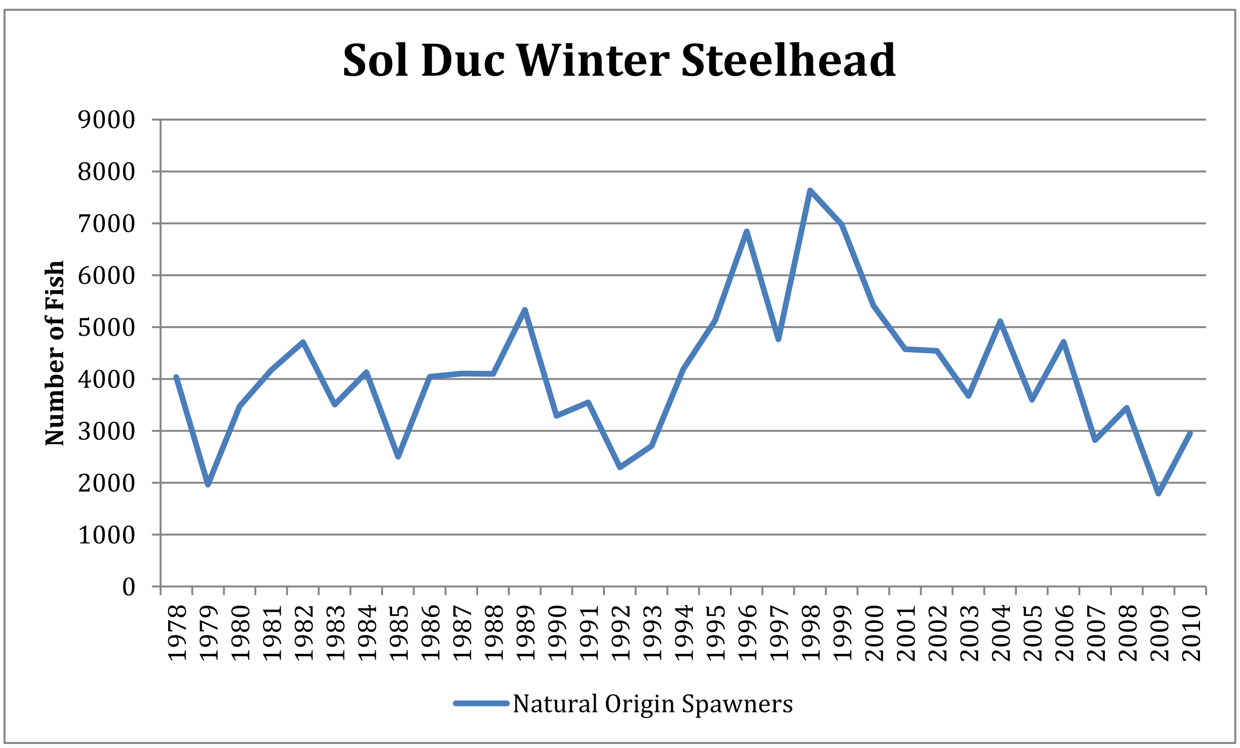
On the following pages:

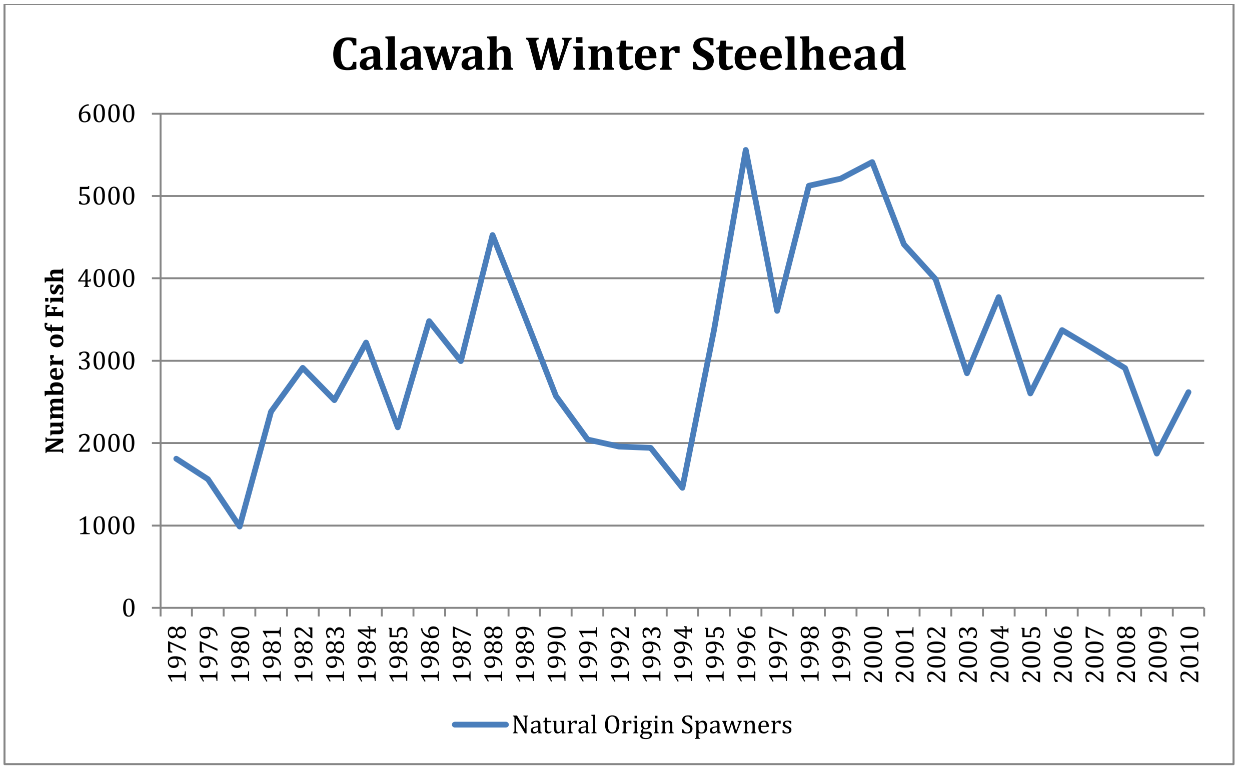
Figures 11: WDFW STOCK ASSESSMENTS AND TRENDS (WINTER STEELHEAD AND CHUM)

Source/Courtesy of Washington Department of Fish & Wildlife (WDFW)

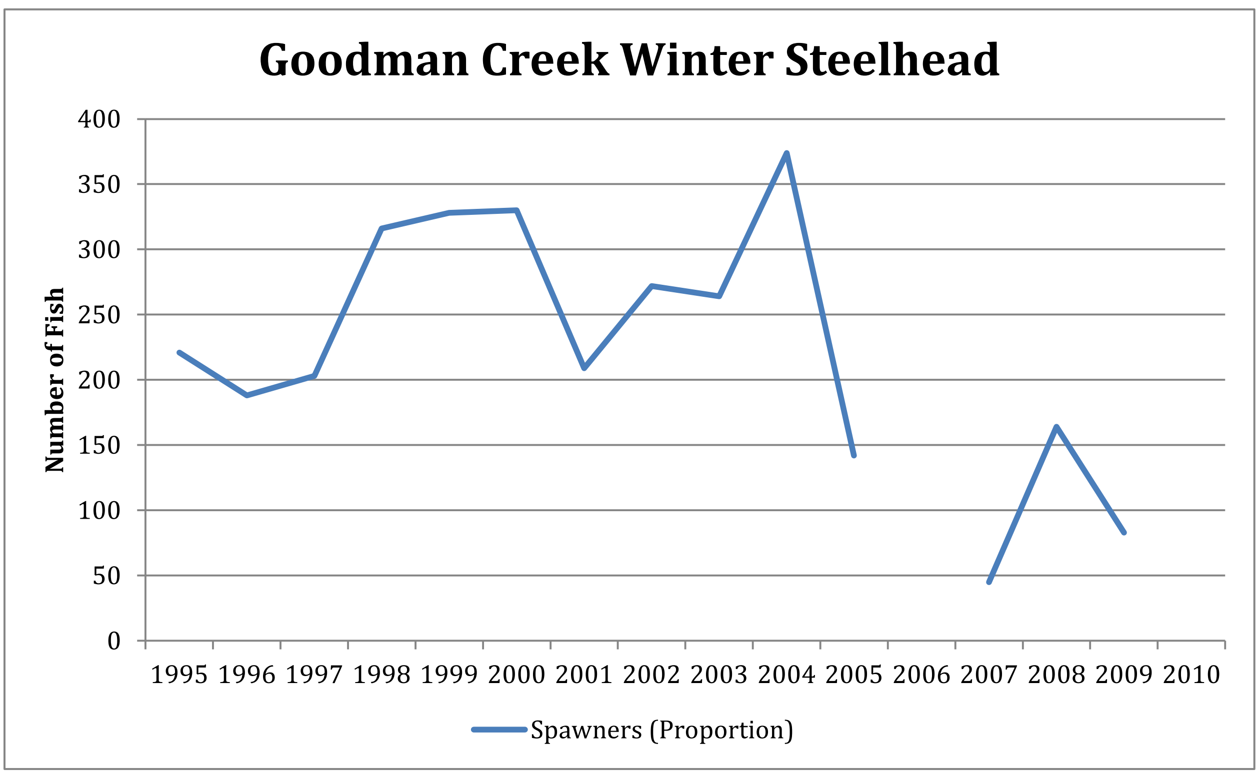
Notes pertaining to specific data sets are included after the graphs at the end of this Appendix.

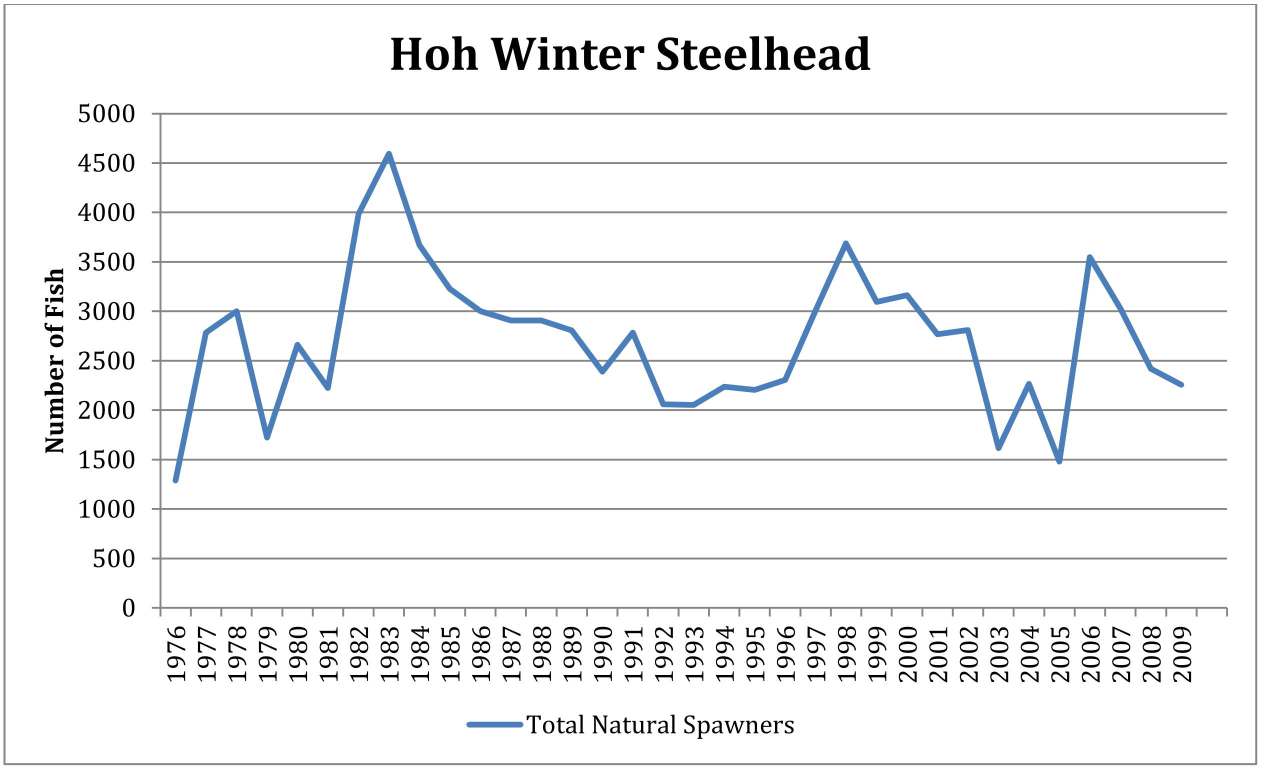

Dickey Winter Steelhead
Number of Fish
1800
1600
1400
1200
1000
800
600
400
200
0
1978
1979
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
Natural-Origin Spawners

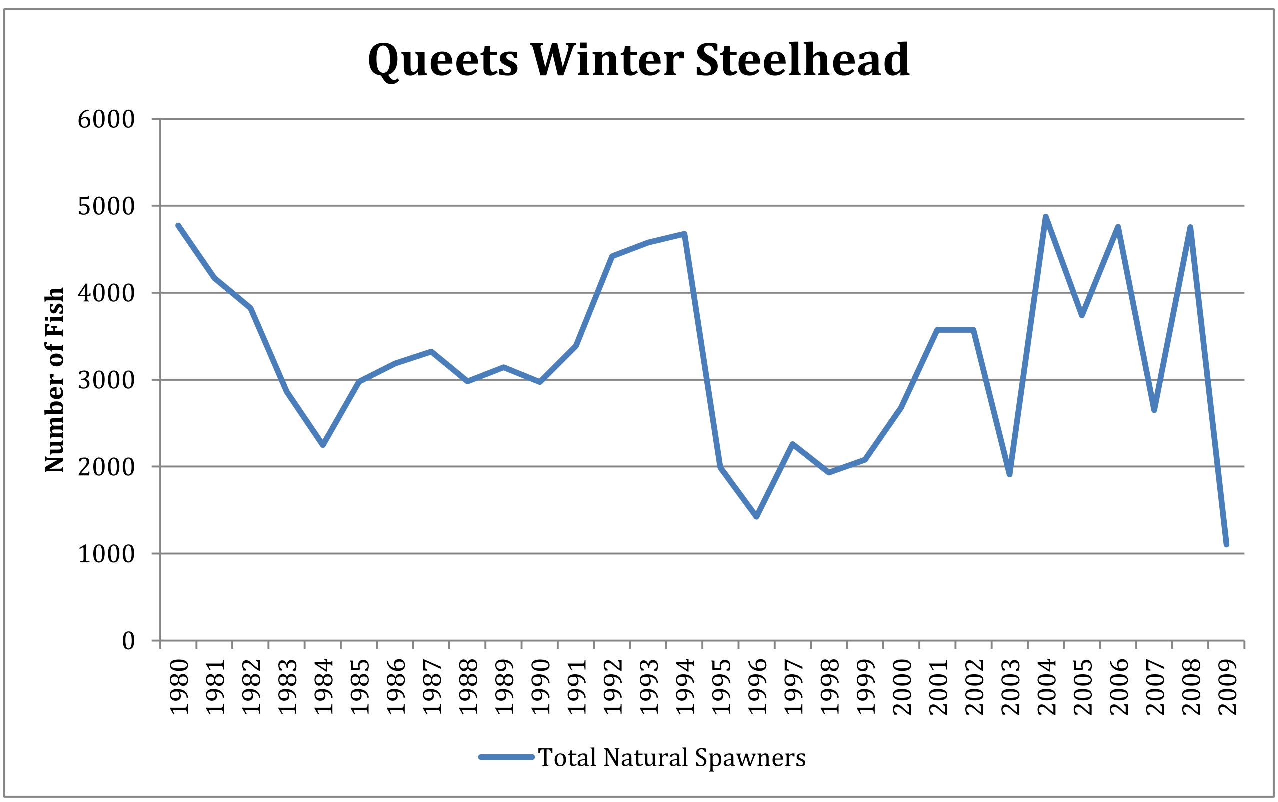

Sol Duc Winter Steelhead
Number of Fish
9000
8000
7000
6000
5000
4000
3000
2000
1000
0
1978
1979
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
Natural Origin Spawners

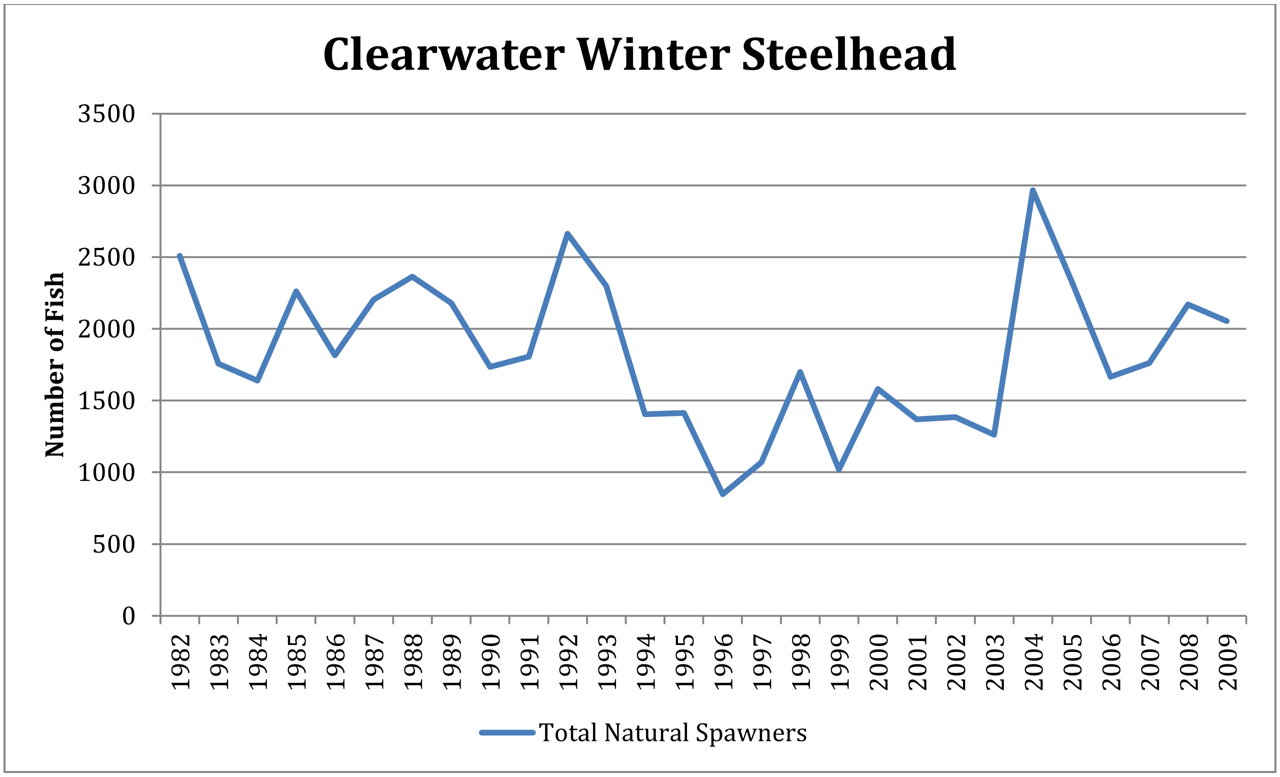

Calawah Winter Steelhead
Number of Fish
6000
5000
4000
3000
2000
1000
0
1978 1979 1980 1981 1982 1983 1984 1985 1986 1987 1988 1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010
Natural Origin Spawners

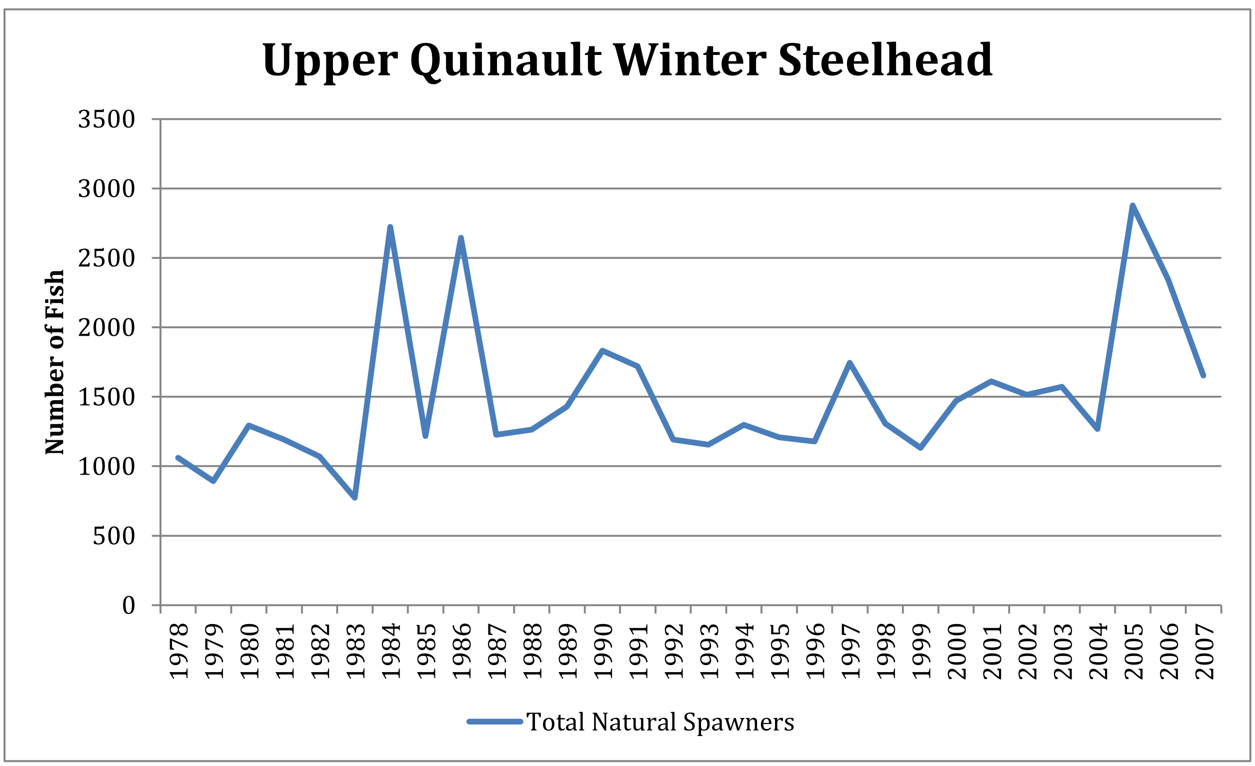
s

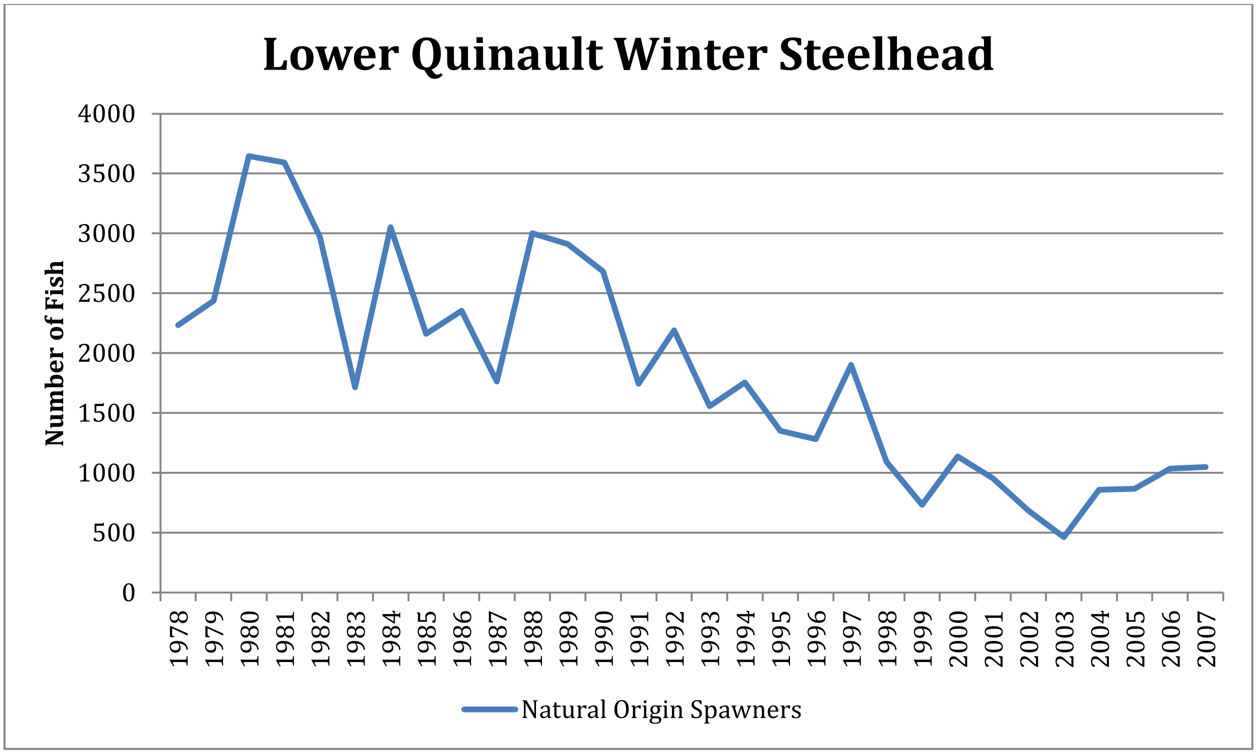

Goodman Creek Winter Steelhead
Number of Fish
400
350
300
250
200
150
100
50
0
1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010
Spawners (Proportion)


Hoh Winter Steelhead
Number of Fish
5000
4500
4000
3500
3000
2500
2000
1500
1000
500
0
1976
1977
1978
1979
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
Total Natural Spawners

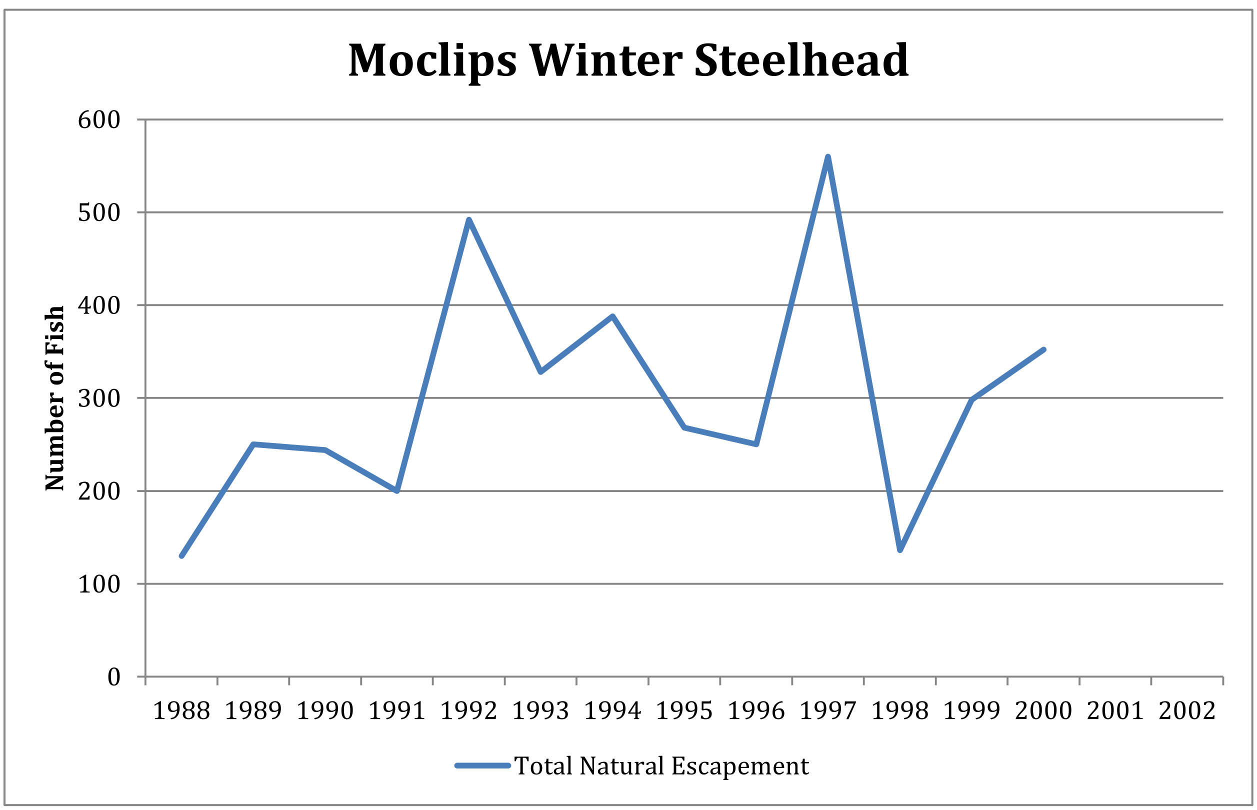

Queets Winter Steelhead
Number of Fish
6000
5000
4000
3000
2000
1000
0
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
Total Natural Spawners


Clearwater Winter Steelhead
Number of Fish
3500
3000
2500
2000
1500
1000
500
0
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
Total Natural Spawners

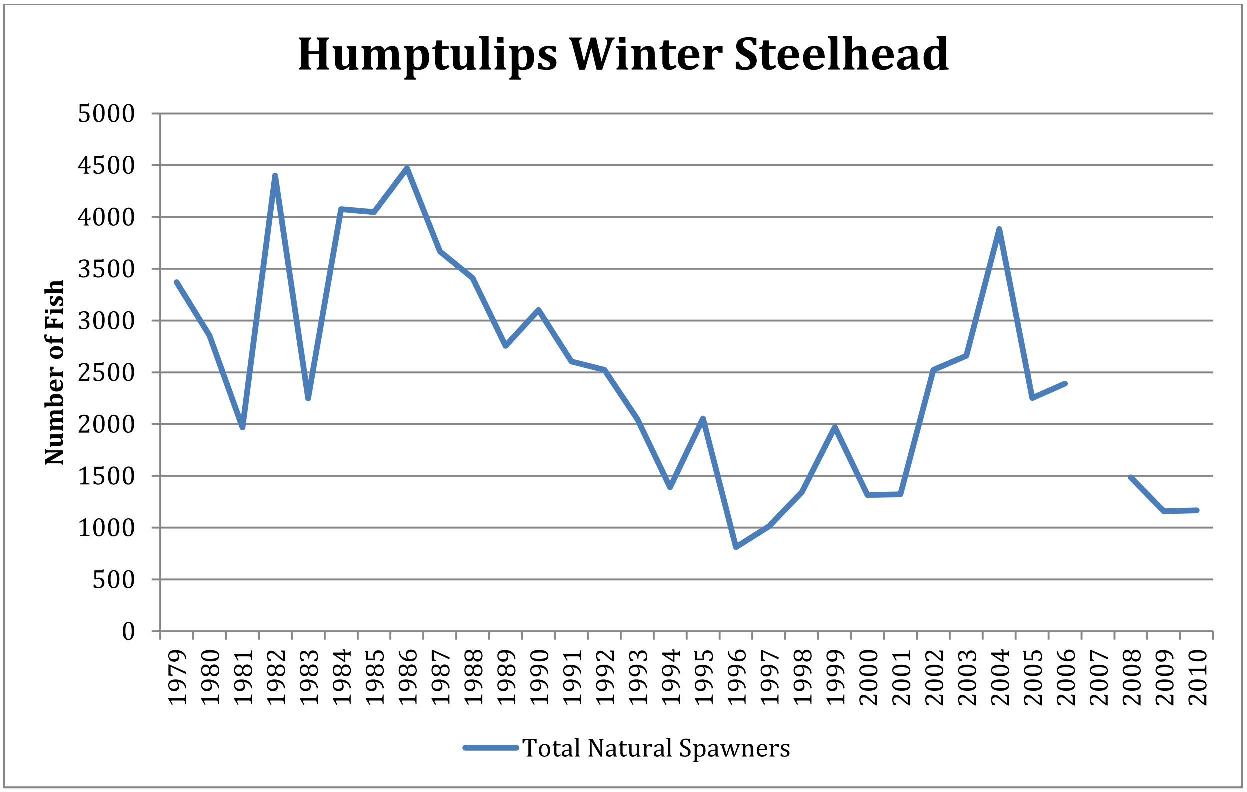

Upper Quinault Winter Steelhead
Number of Fish
3500
3000
2500
2000
1500
1000
500
0
1978
1979
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
Total Natural Spawners

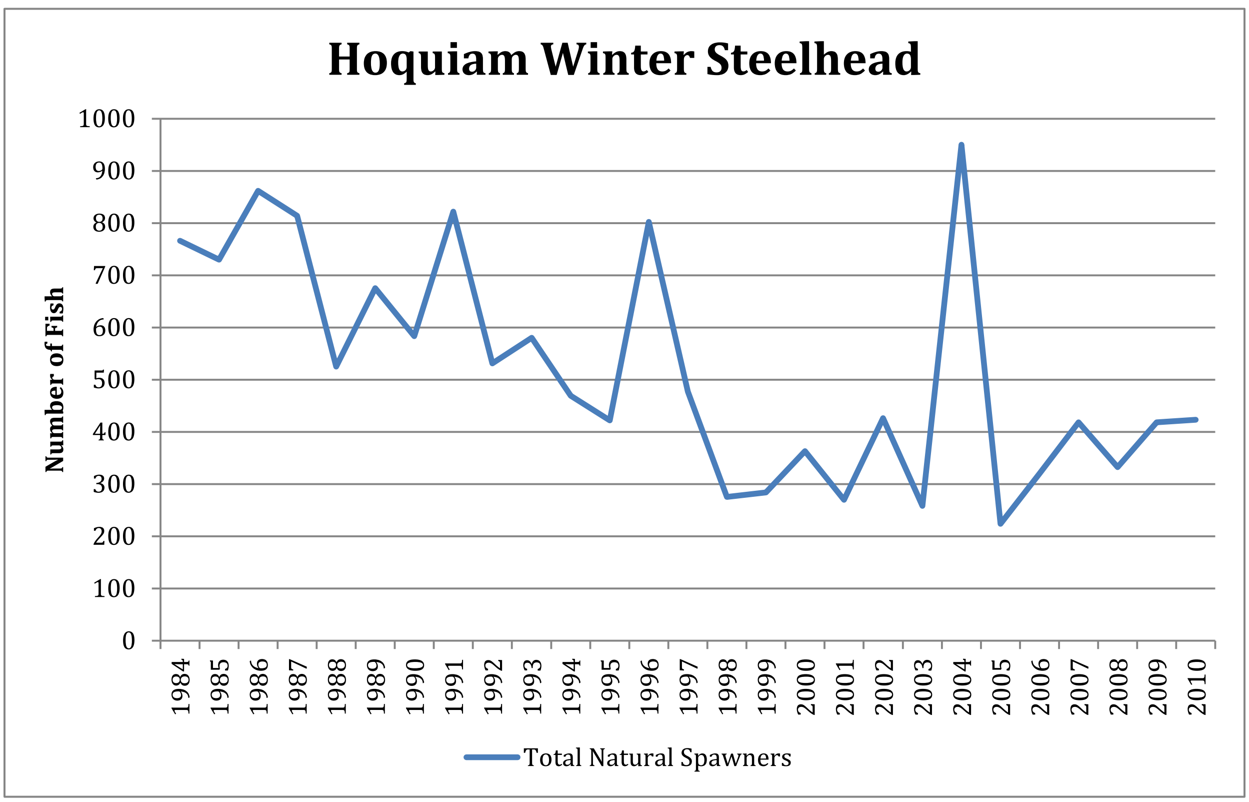


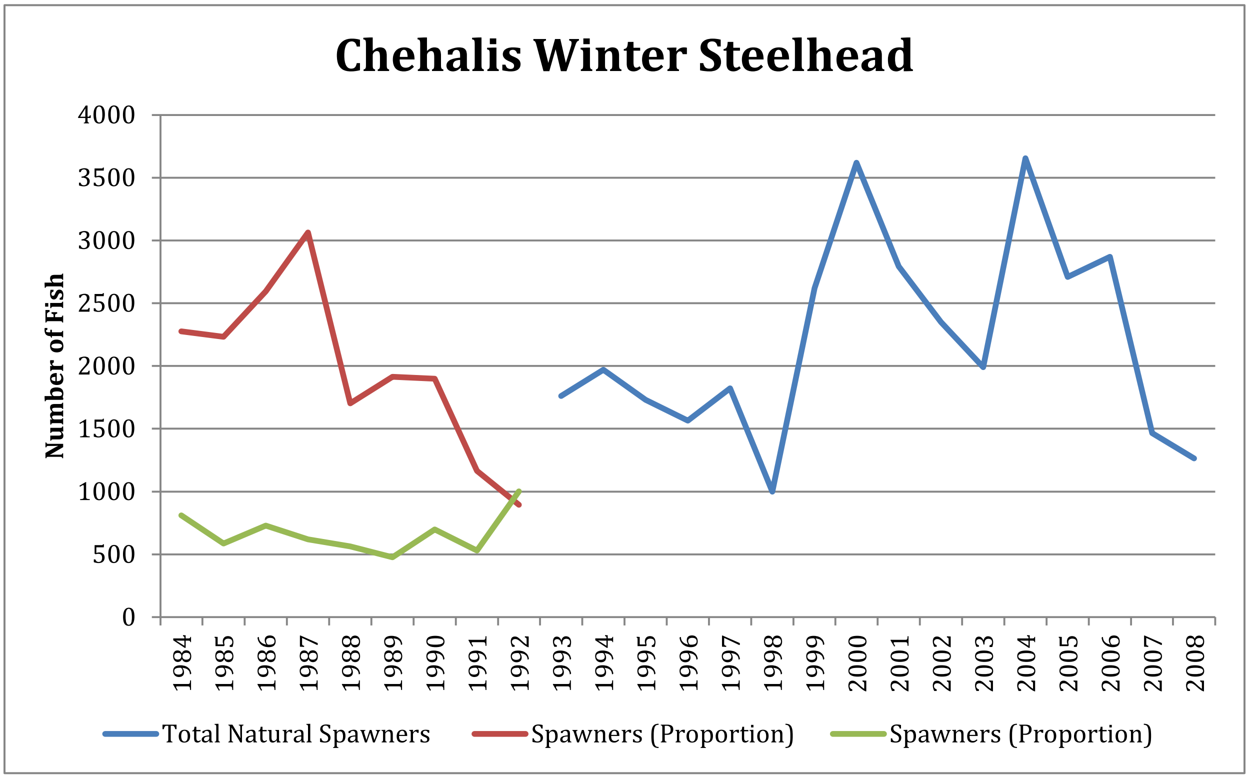
Lower Quinault Winter Steelhead
Number of Fish
4000
3500
3000
2500
2000
1500
1000
500
0
1978
1979
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
Natural Origin Spawners



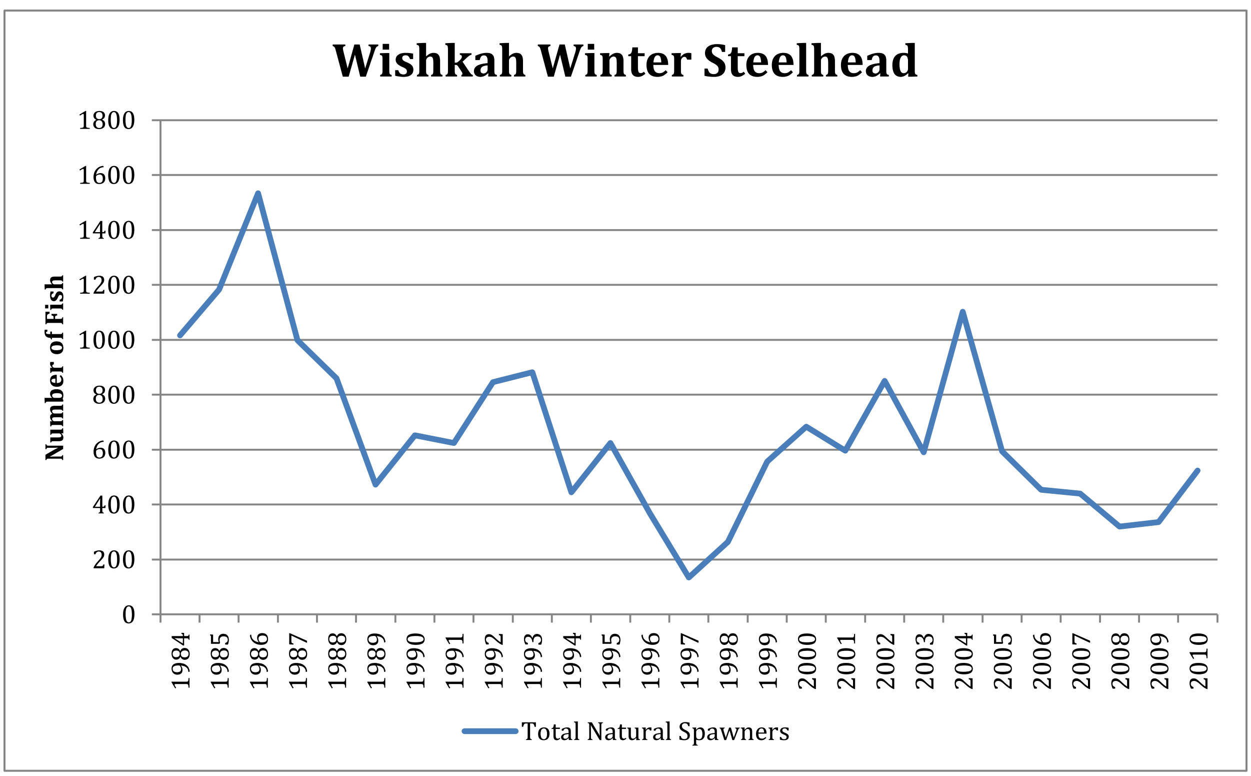
Moclips Winter Steelhead
Number of Fish
600
500
400
300
200
100
0
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
Total Natural Escapement


Humptulips Winter Steelhead
Number of Fish
5000
4500
4000
3500
3000
2500
2000
1500
1000
500
0
1979
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
Total Natural Spawners

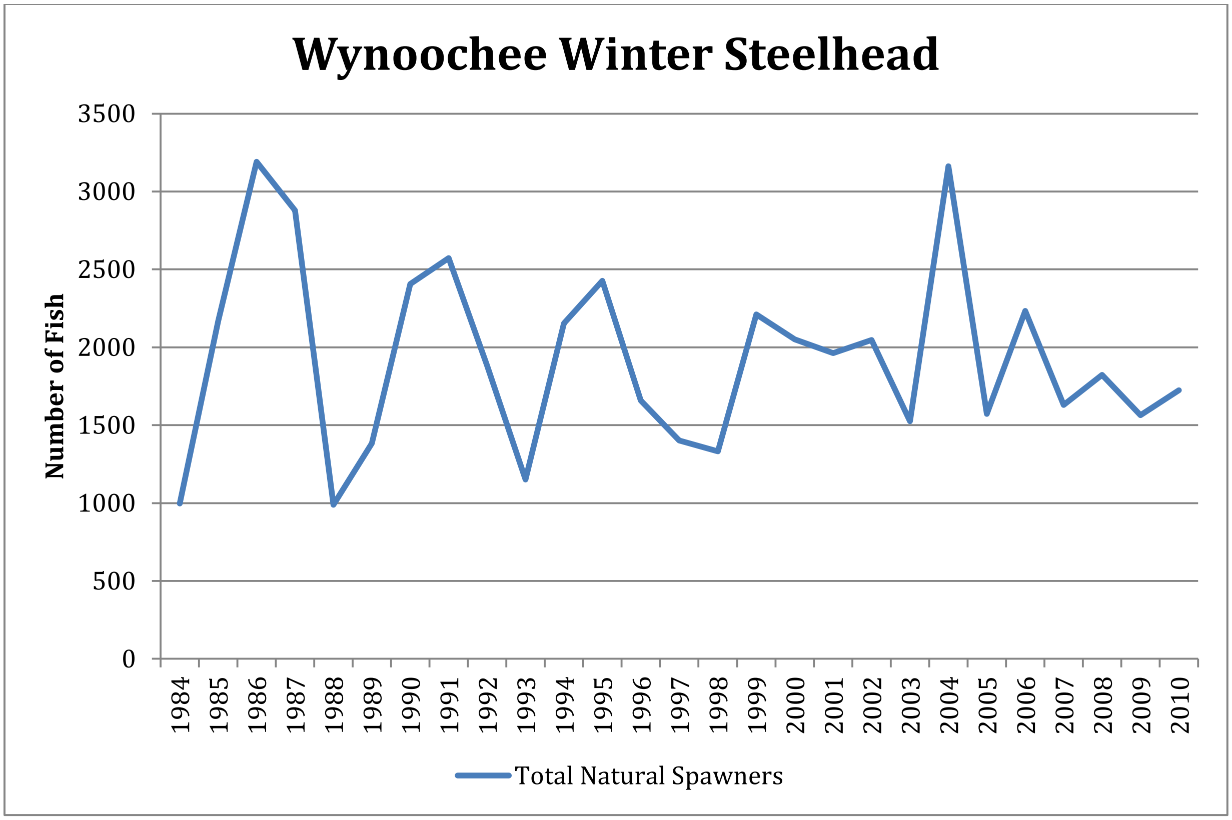

Hoquiam Winter Steelhead
Number of Fish
1000
900
800
700
600
500
400
300
200
100
0
1984
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
Total Natural Spawners

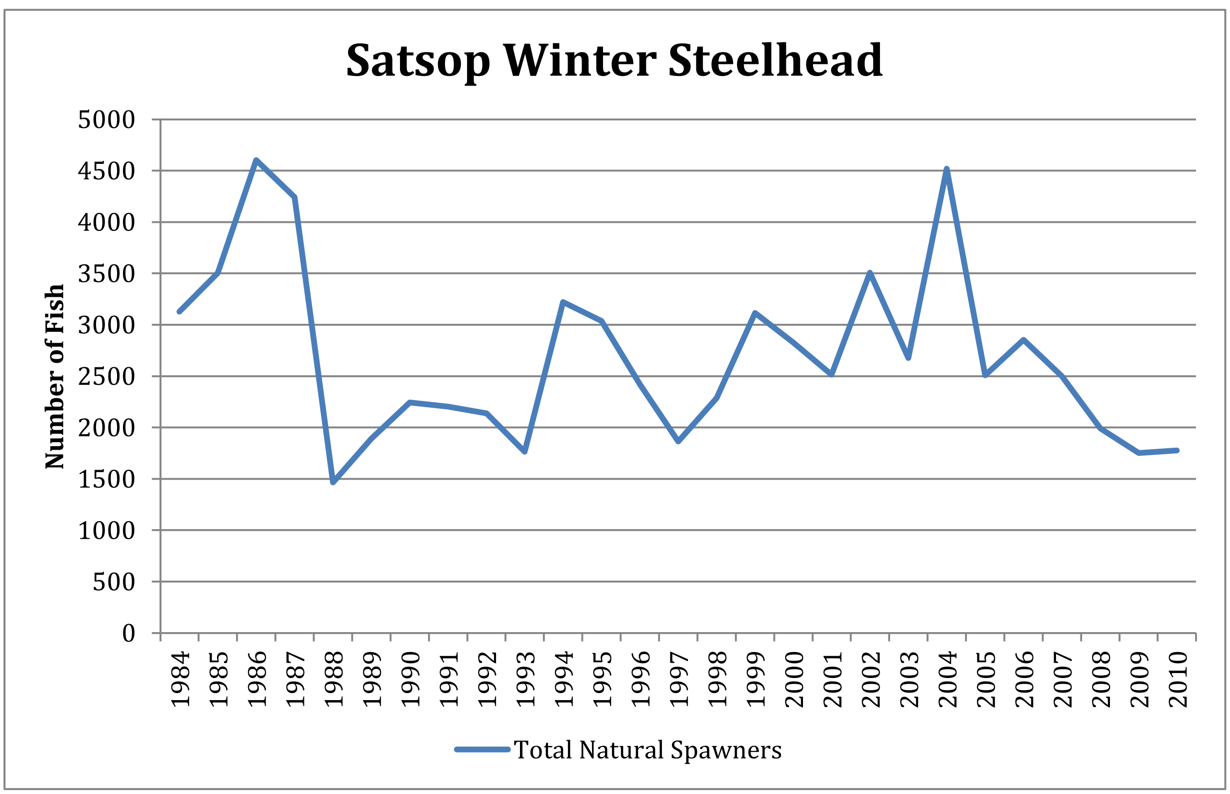


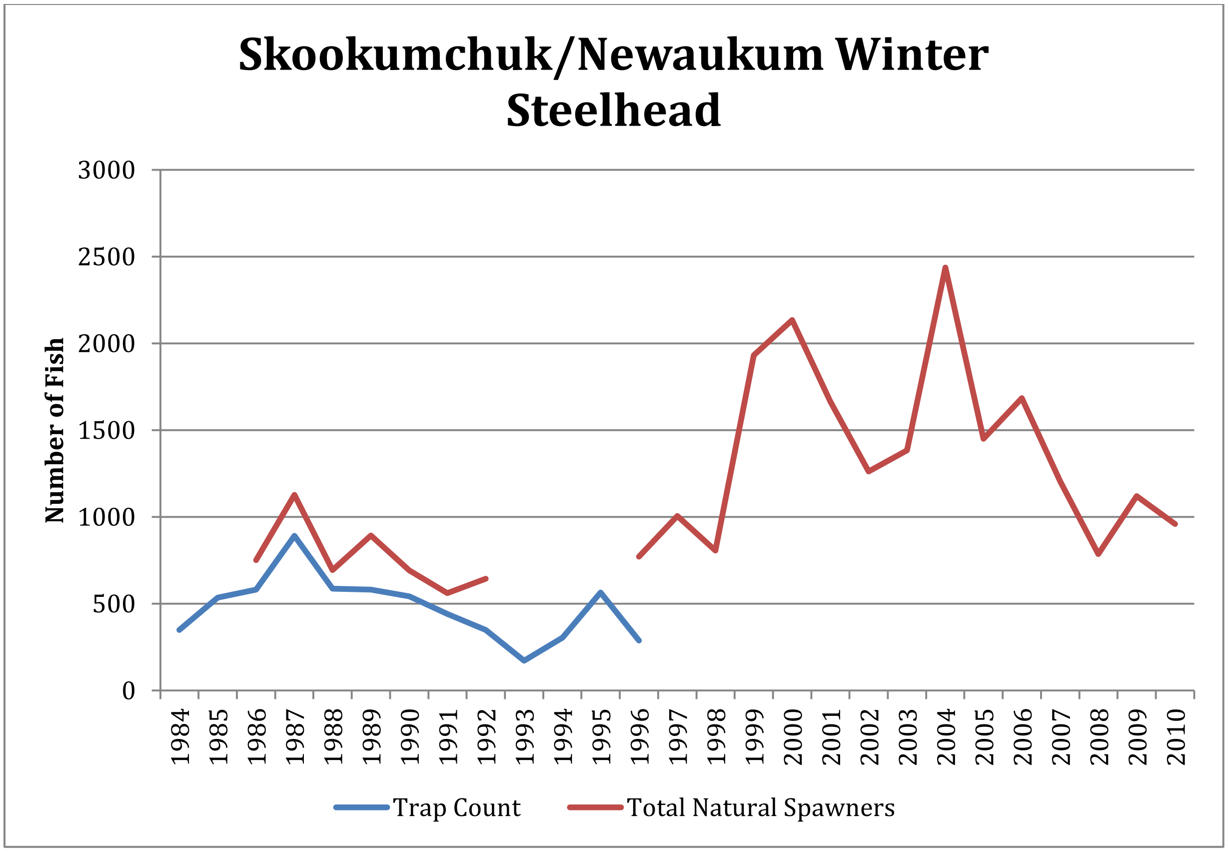
Chehalis Winter Steelhead
Number of Fish
4000
3500
3000
2500
2000
1500
1000
500
0
1984 1985 1986 1987 1988 1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008
Total Natural Spawners
Spawners (Proportion)
Spawners (Proportion)

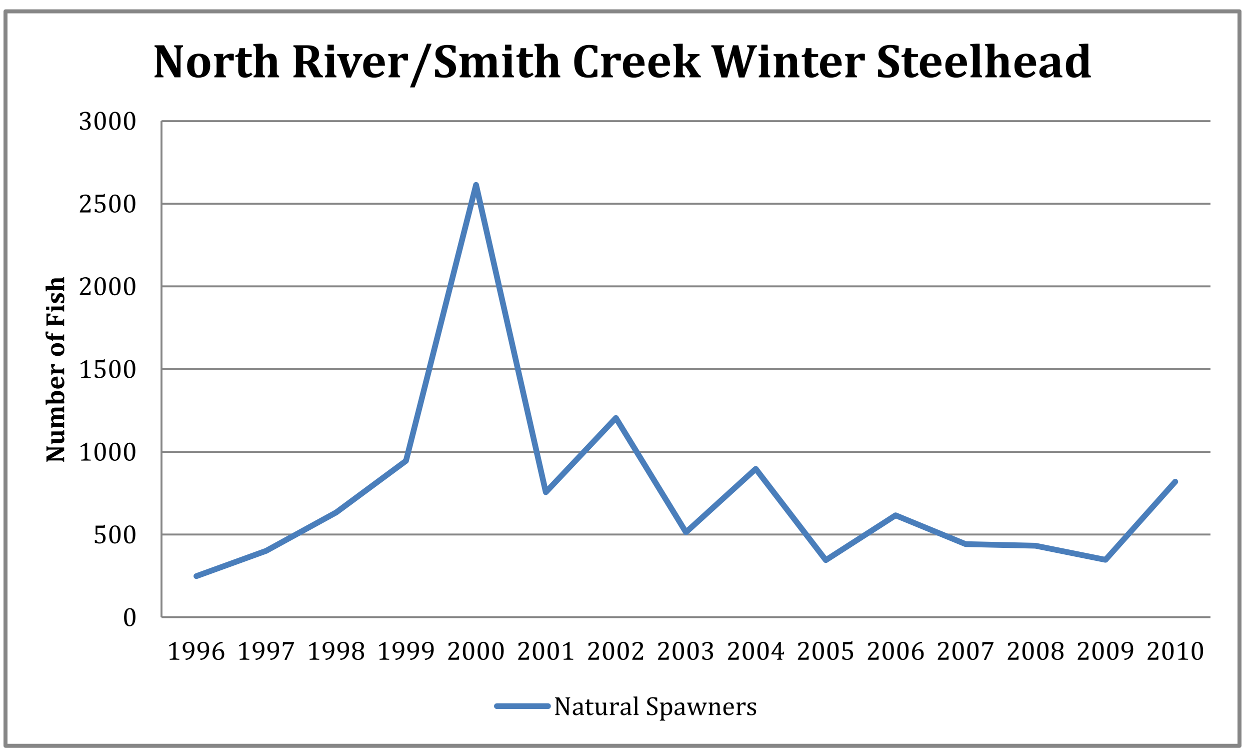


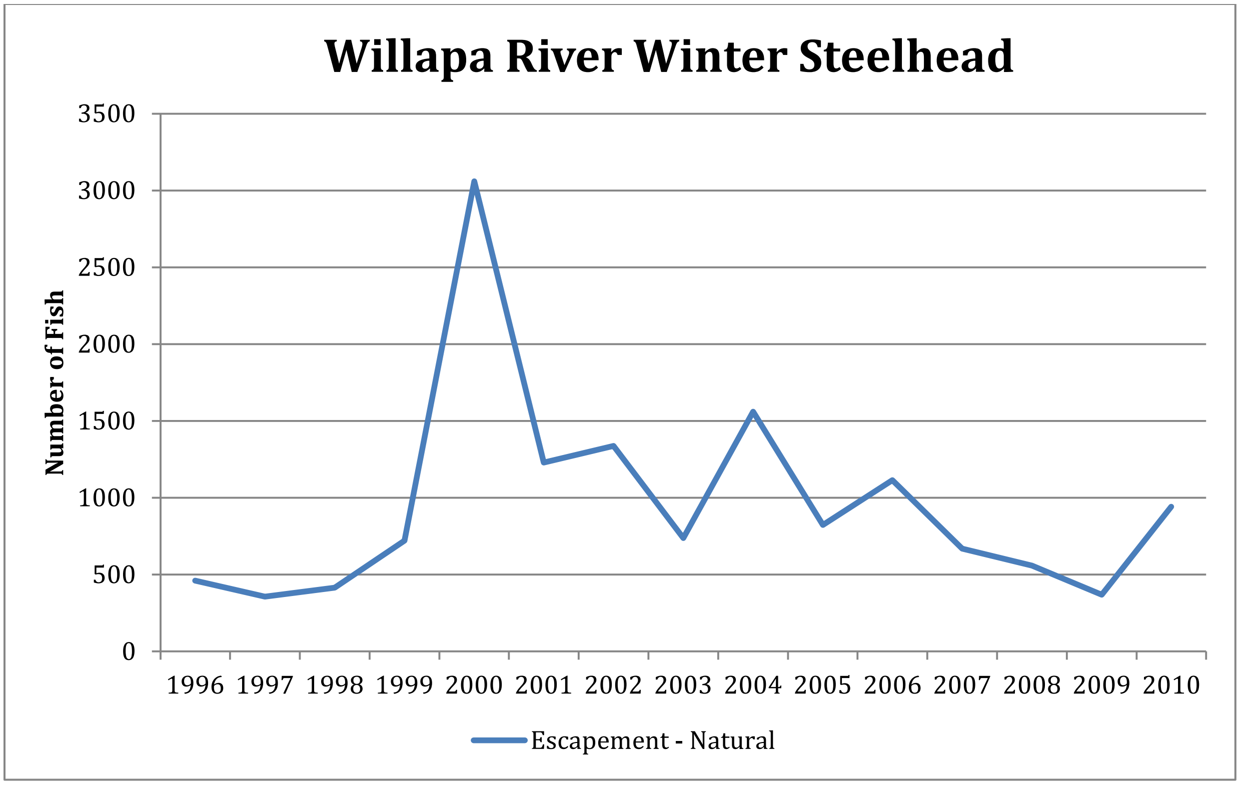
Wishkah Winter Steelhead
Number of Fish
1800
1600
1400
1200
1000
800
600
400
200
0
1984 1985 1986 1987 1988 1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010
Total Natural Spawners

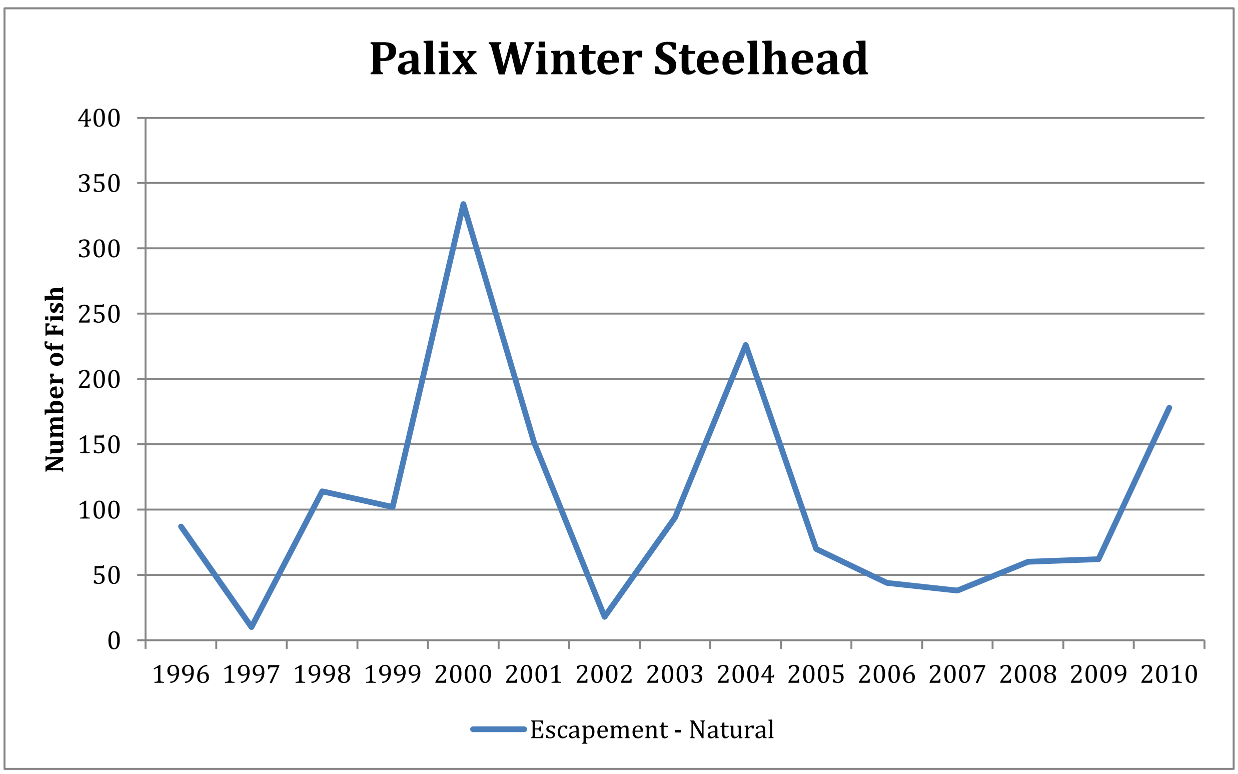

Wynoochee Winter Steelhead
Number of Fish
3500
3000
2500
2000
1500
1000
500
0
1984
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
Total Natural Spawners

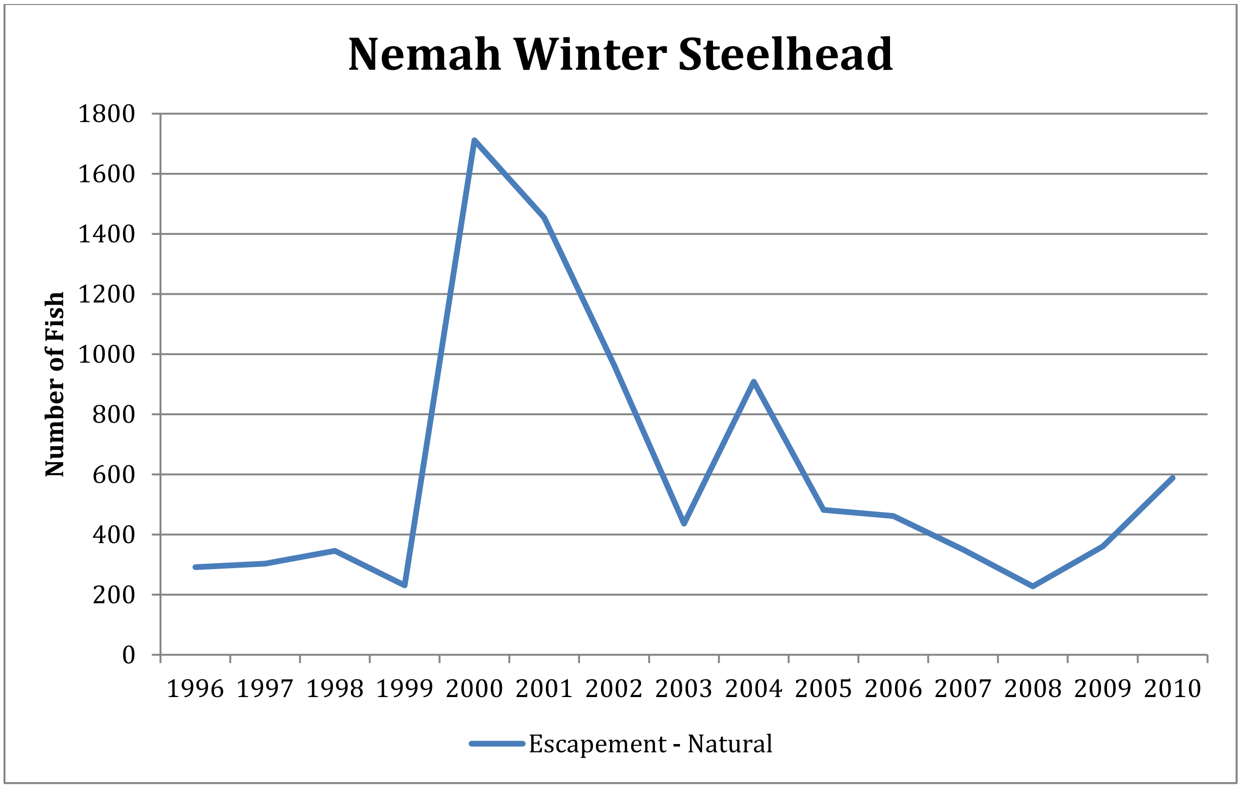

Satsop Winter Steelhead
Number of Fish
5000
4500
4000
3500
3000
2500
2000
1500
1000
500
0
1984
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
Total Natural Spawners

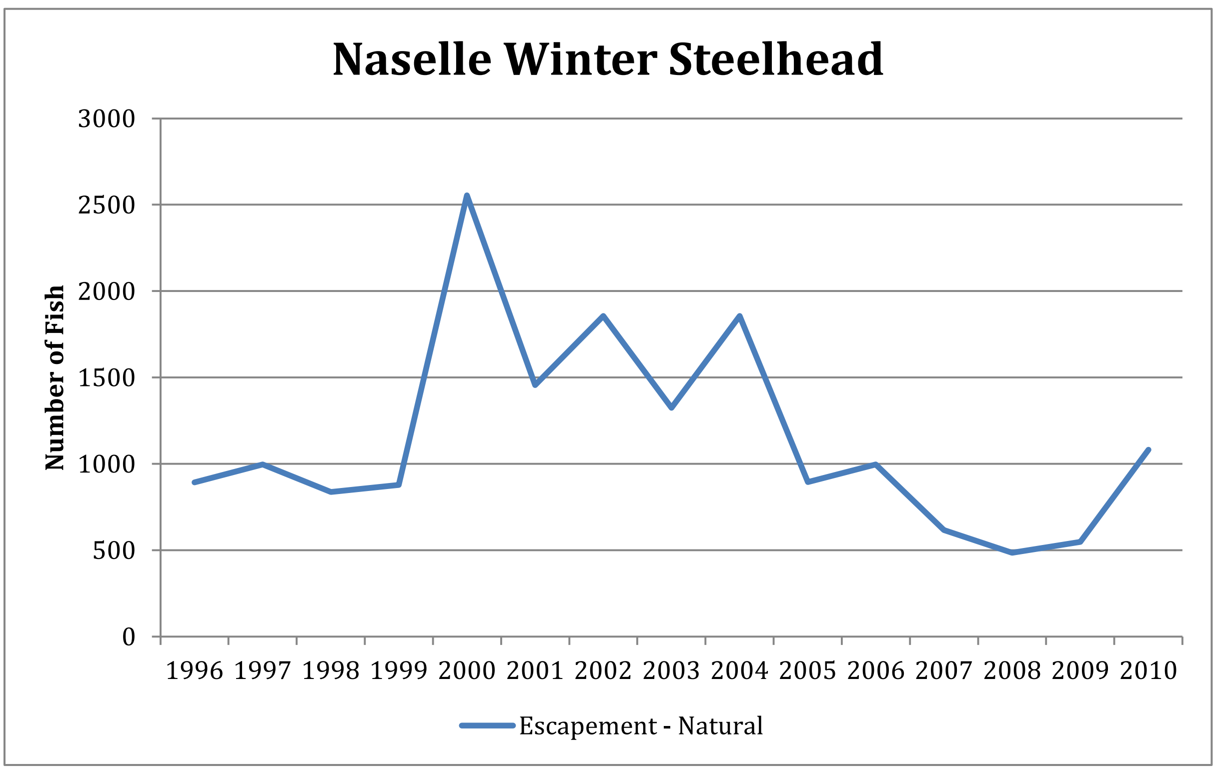

Skookumchuk/Newaukum Winter Steelhead
Number of Fish
3000
2500
2000
1500
1000
500
0
1984
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
Trap Count
Total Natural Spawners

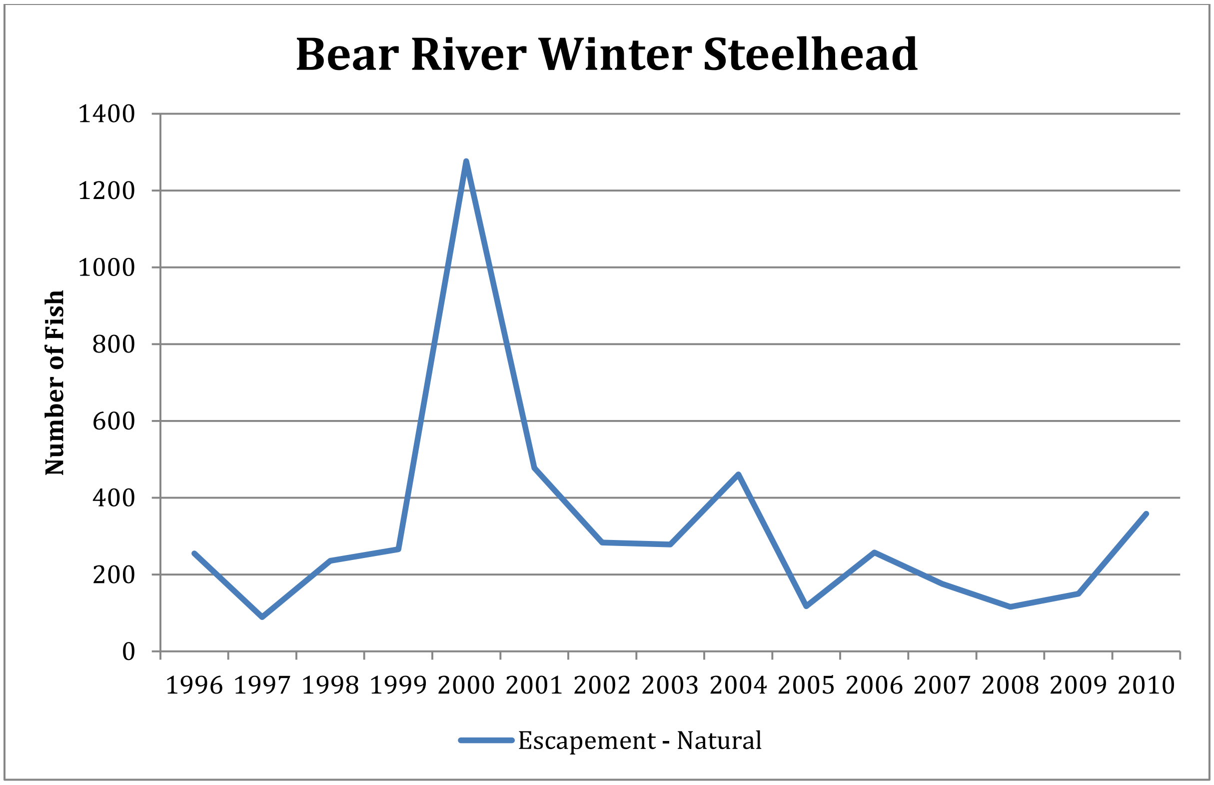

North River/Smith Creek Winter Steelhead
Number of Fish
3000
2500
2000
1500
1000
500
0
1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010
Natural Spawners


Willapa River Winter Steelhead
Number of Fish
0
500
1000
1500
2000
2500
3000
3500
1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010
Escapement - Natural

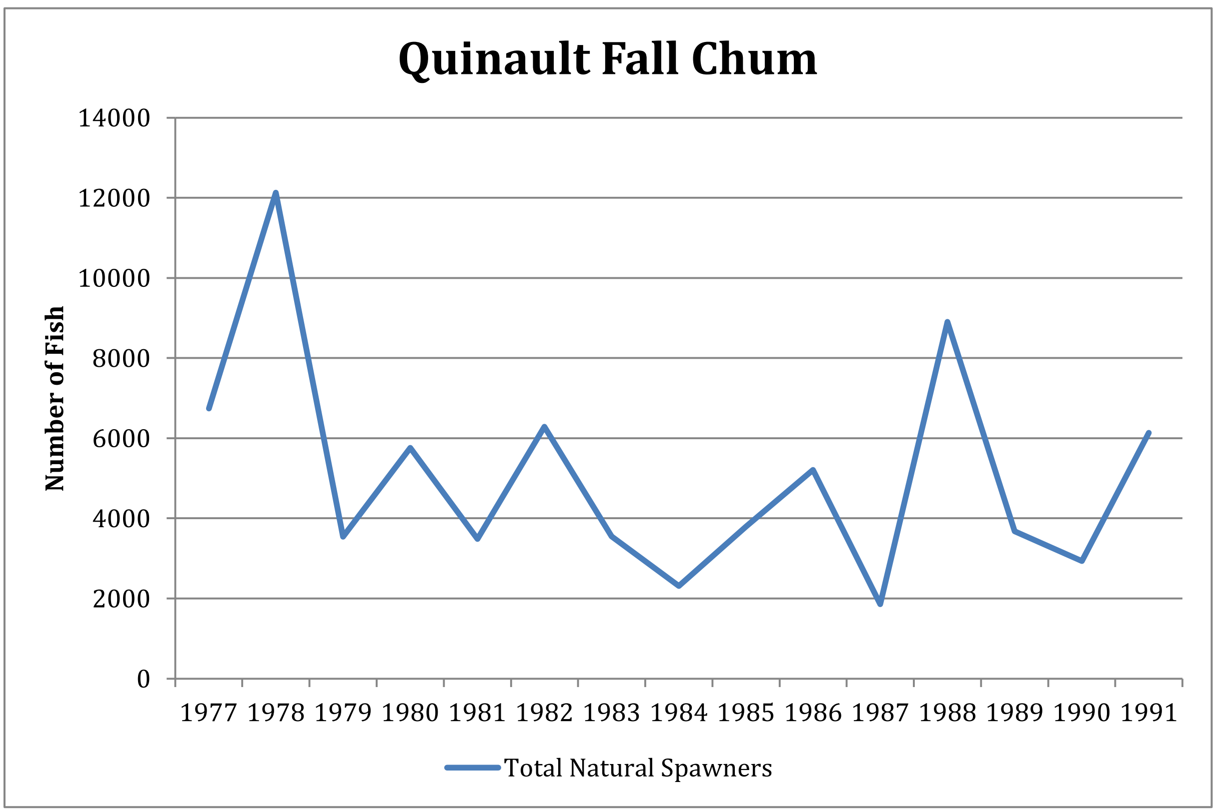

Palix Winter Steelhead
Number of Fish
0
50
100
150
200
250
300
350
400
1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010
Escapement - Natural


Nemah Winter Steelhead
Number of Fish
1800
1600
1400
1200
1000
800
600
400
200
0
1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010
Escapement - Natural

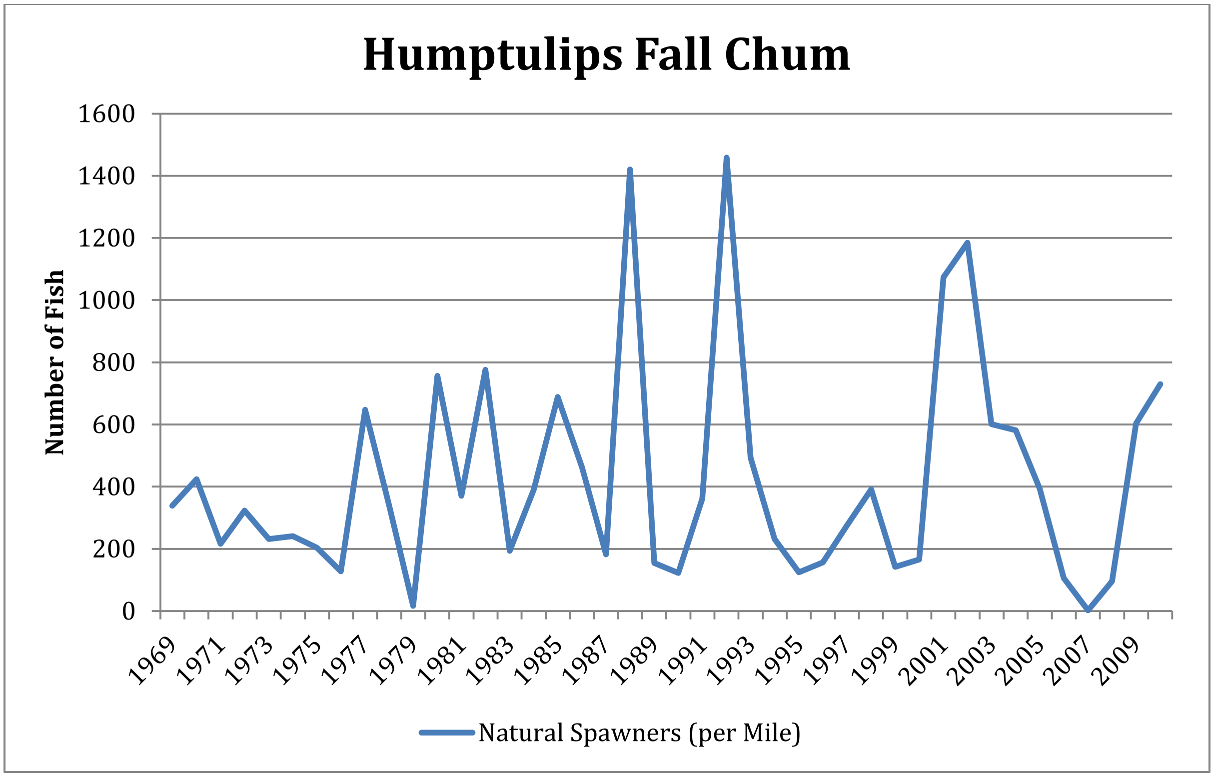

Naselle Winter Steelhead
Number of Fish
3000
2500
2000
1500
1000
500
0
1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010
Escapement - Natural

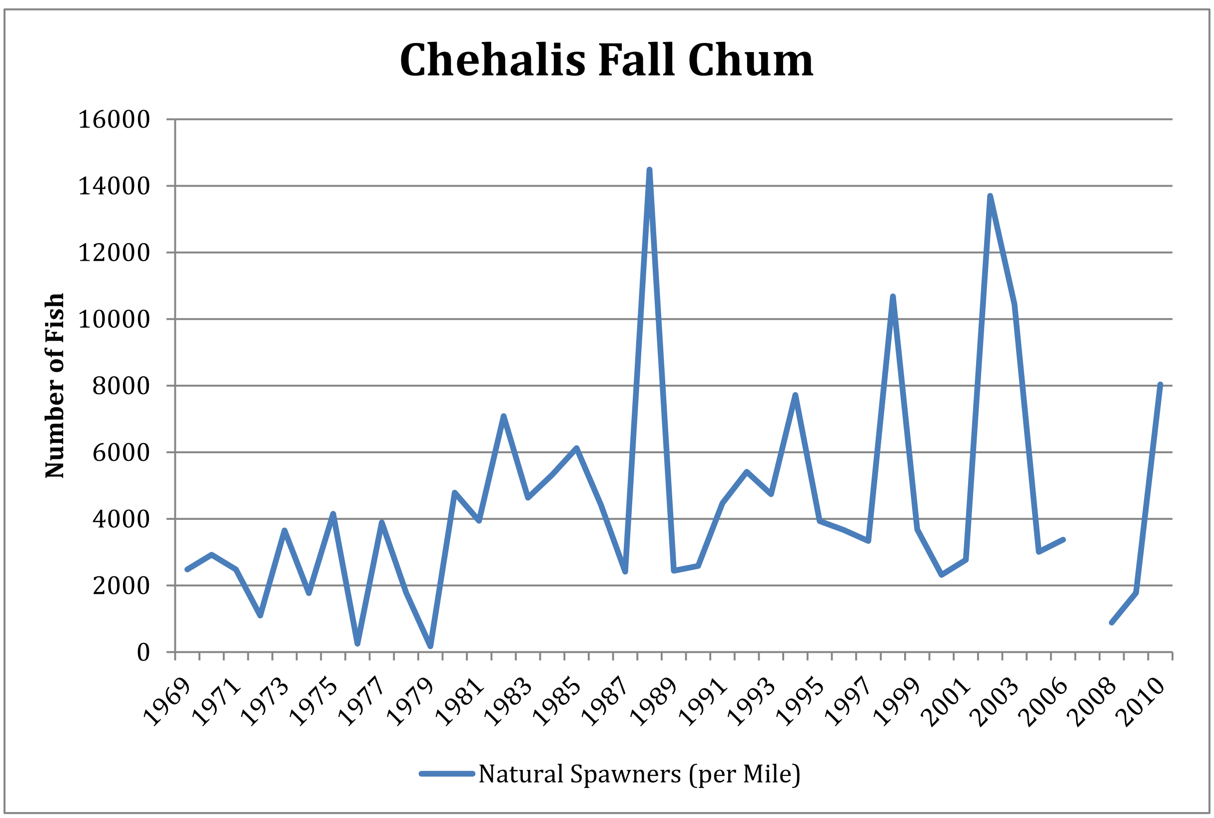


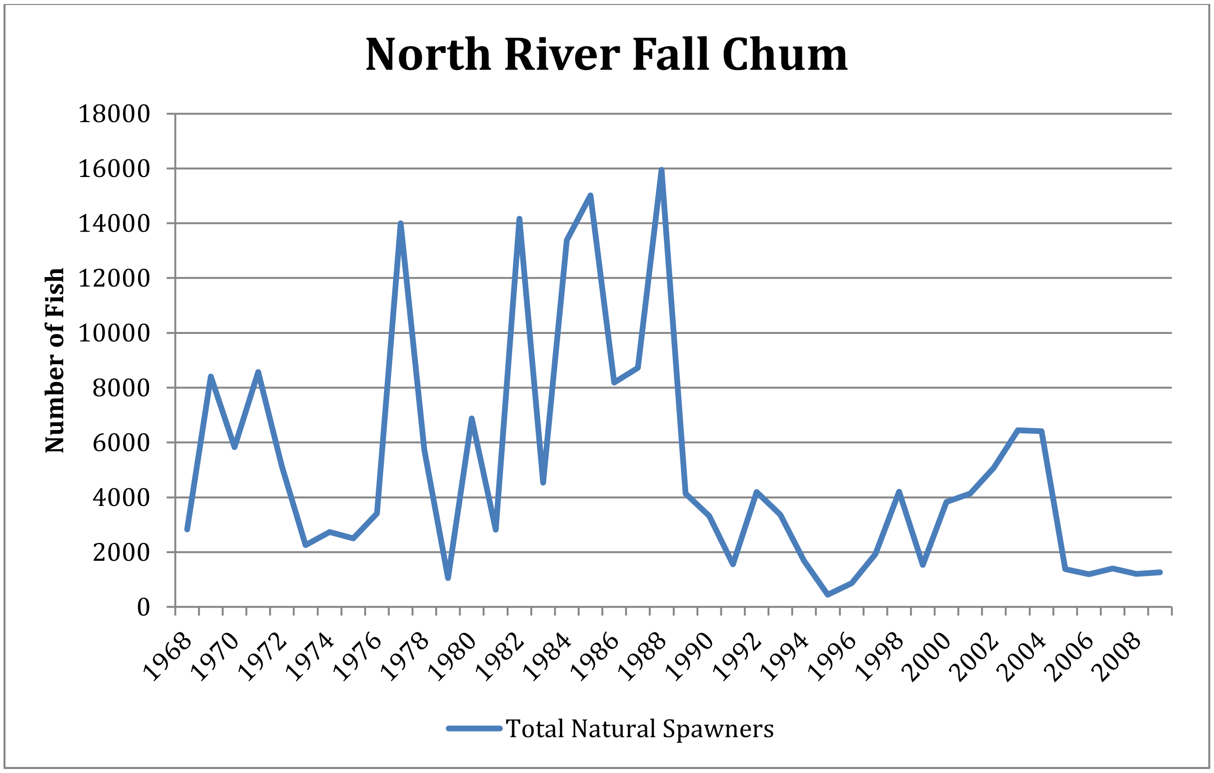
Bear River Winter Steelhead
Number of Fish
1400
1200
1000
800
600
400
200
0
1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010
Escapement - Natural

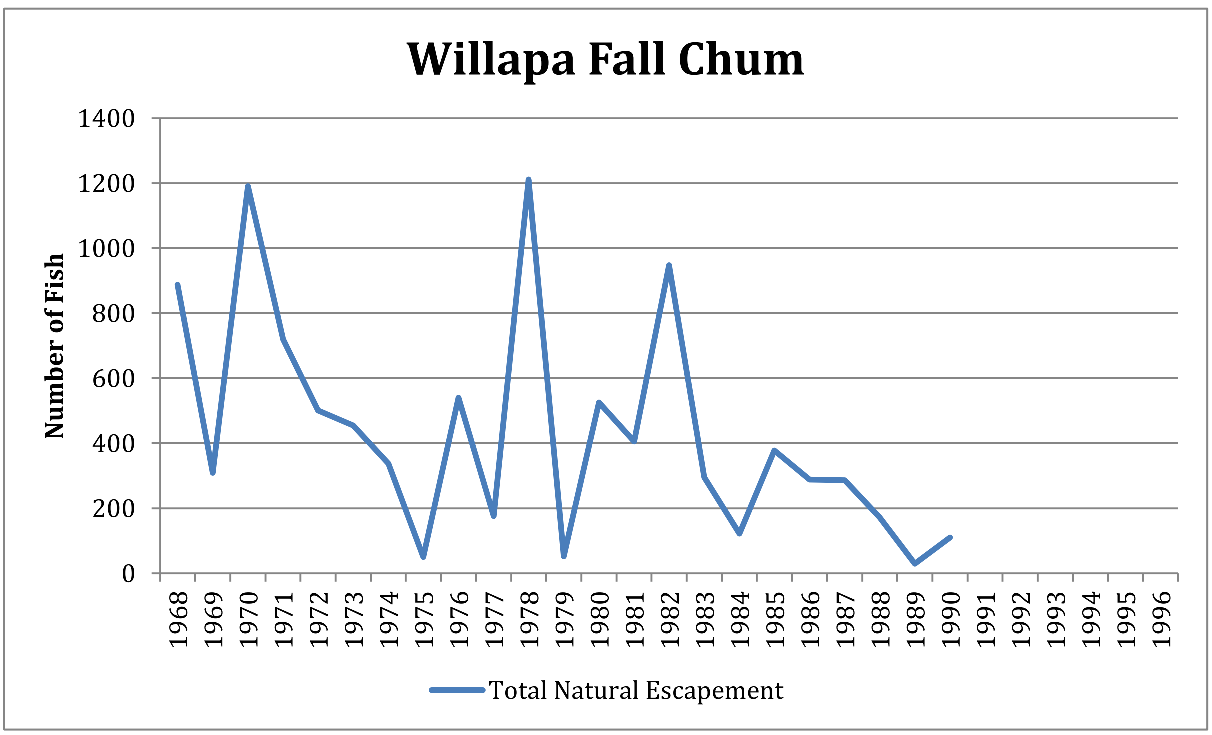


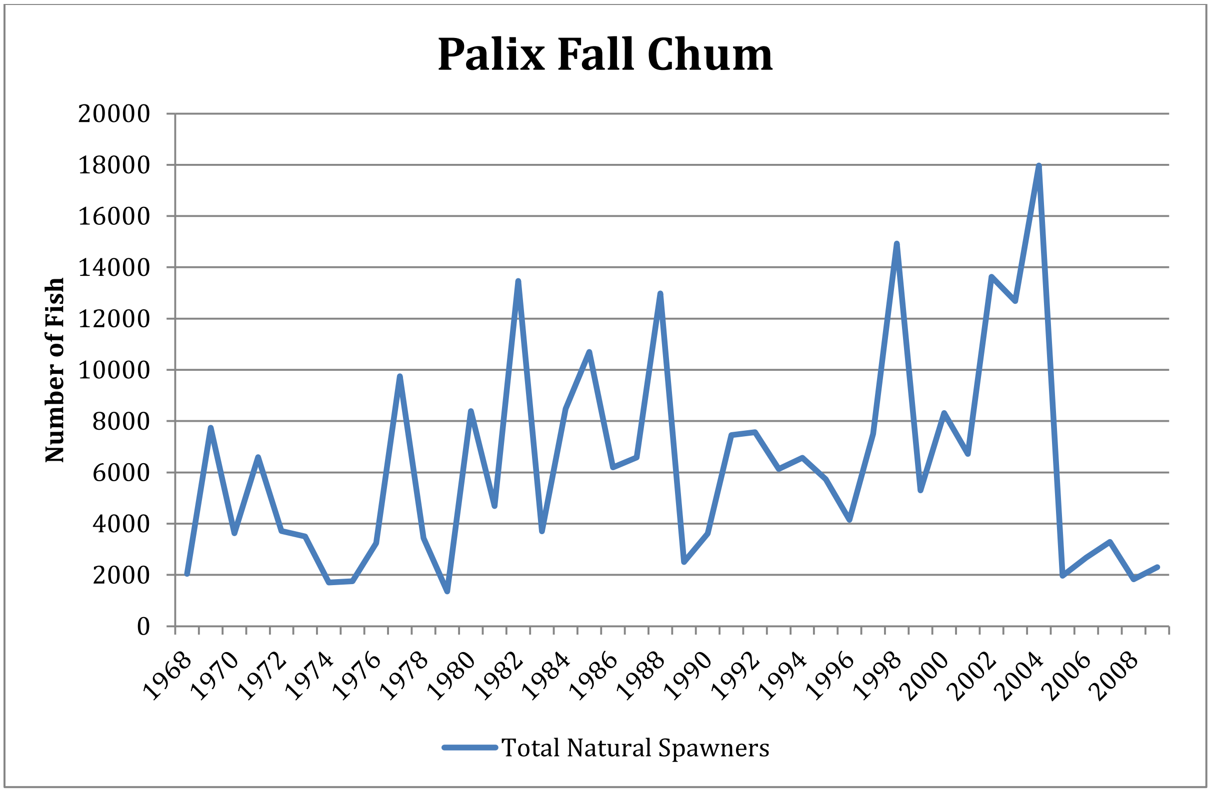
Quinault Fall Chum
Number of Fish
14000
12000
10000
8000
6000
4000
2000
0
1977 1978 1979 1980 1981 1982 1983 1984 1985 1986 1987 1988 1989 1990 1991
Total Natural Spawners

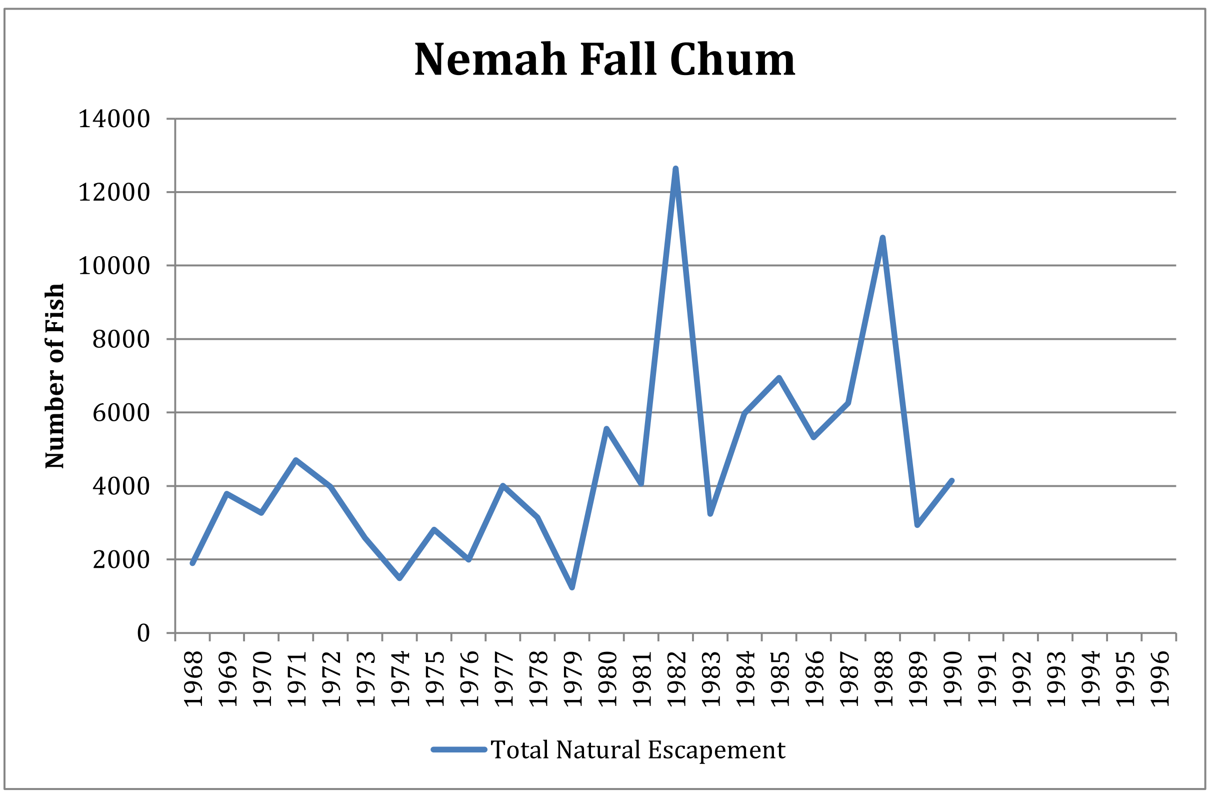

Humptulips Fall Chum
1600
1400
1200
1000
800
600
400
200
0
Number of Fish
1969
1971
1973
1975
1977
1979
1981
1983
1985
1987
1989
1991
1993
1995
1997
1999
2001
2003
2005
2007
2009
Natural Spawners (per Mile)

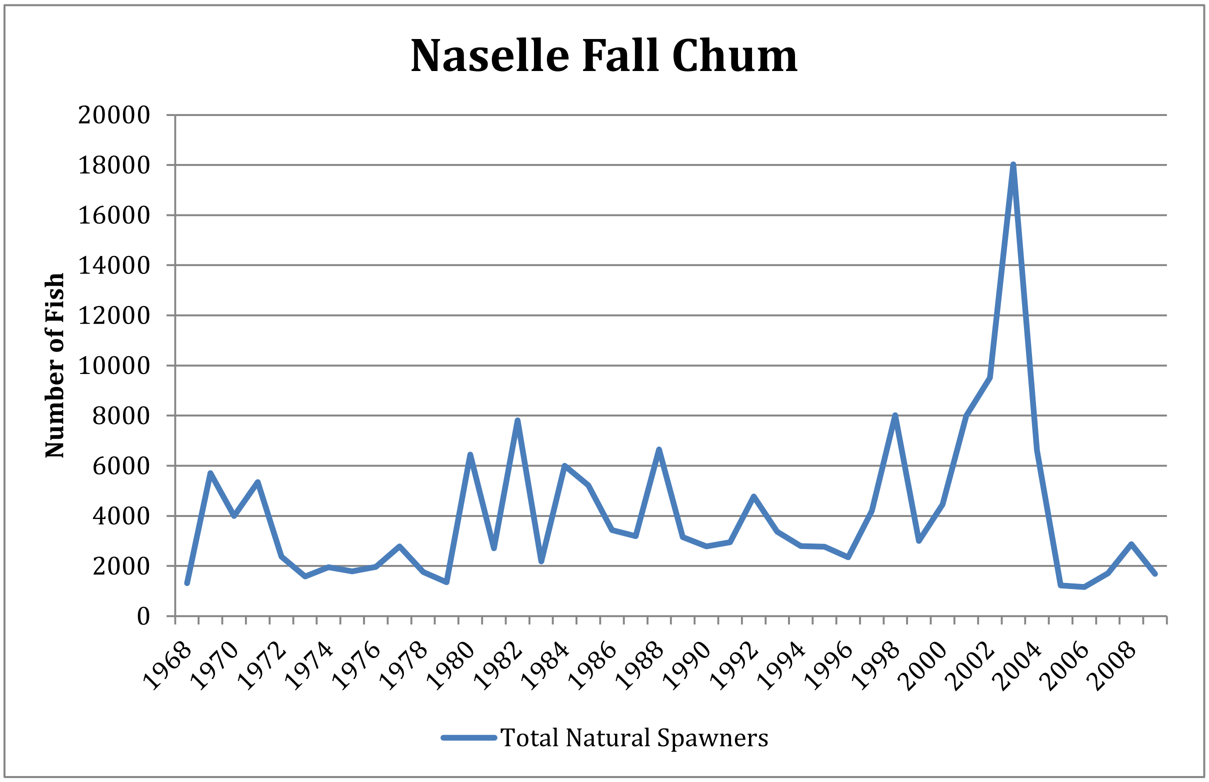

Chehalis Fall Chum
16000
14000
12000
10000
8000
6000
4000
2000
0
Number of Fish
1969
1971
1973
1975
1977
1979
1981
1983
1985
1987
1989
1991
1993
1995
1997
1999
2001
2003
2006
2008
2010
Natural Spawners (per Mile)

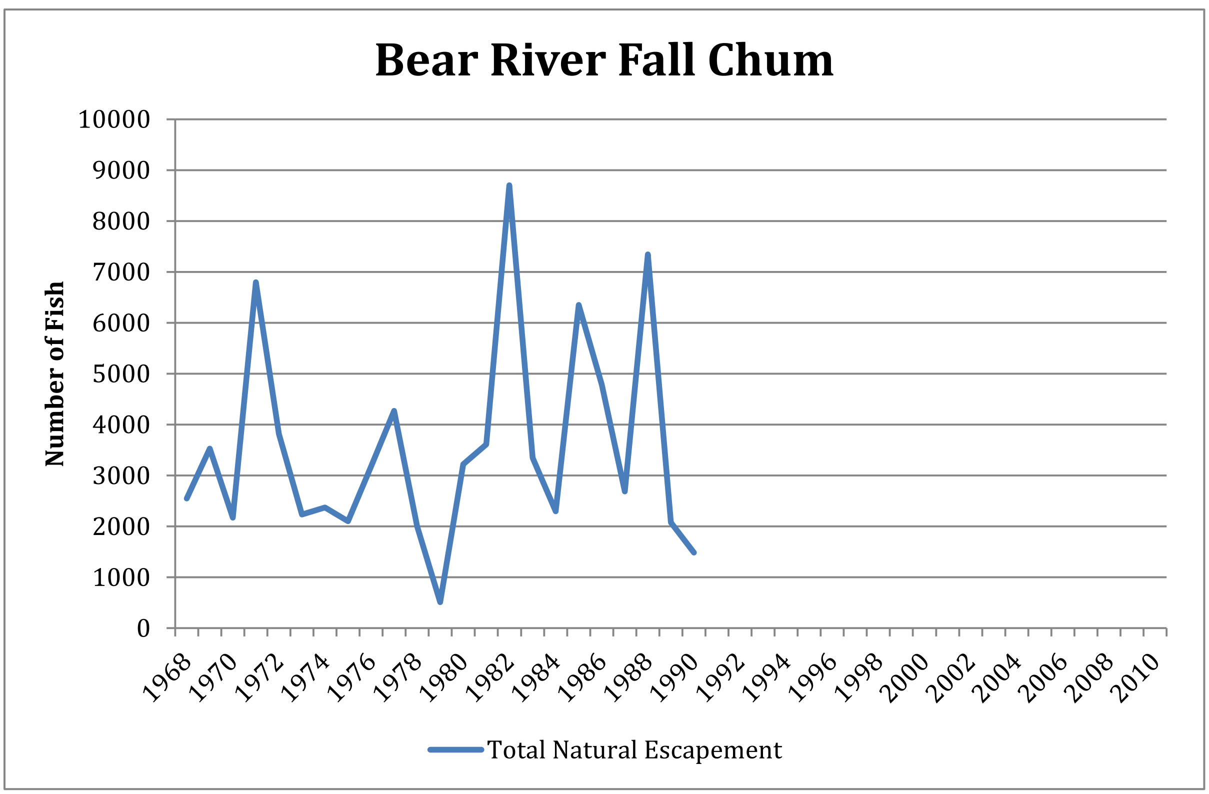

North River Fall Chum
Number of Fish
18000
16000
14000
12000
10000
8000
6000
4000
2000
0
1968
1970
1972
1974
1976
1978
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
Total Natural Spawners


Willapa Fall Chum
Number of Fish
1400
1200
1000
800
600
400
200
0
1968
1969
1970
1971
1972
1973
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
Total Natural Escapement


Palix Fall Chum
20000
18000
16000
14000
12000
10000
8000
6000
4000
2000
0
Number of Fish
1968
1970
1972
1974
1976
1978
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
Total Natural Spawners


Nemah Fall Chum
14000
12000
10000
8000
6000
4000
2000
0
Number of Fish
1968
1969
1970
1971
1972
1973
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
Total Natural Escapement


Naselle Fall Chum
Number of Fish
20000
18000
16000
14000
12000
10000
8000
6000
4000
2000
0
1968
1970
1972
1974
1976
1978
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
Total Natural Spawners


Bear River Fall Chum
Number of Fish
10000
9000
8000
7000
6000
5000
4000
3000
2000
1000
0
1968
1970
1972
1974
1976
1978
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
Total Natural Escapement

Notes on WRIA 20 winter steelhead data

Quillayute River System - Winter steelhead spawner escapement has been monitored for the Quillayute River system, which includes the Sol Duc, Quillayute/Bogachiel, Calawah and Dickey steelhead stocks, since 1978. In 1985, WDFW and the Quileute Tribe agreed to a wild steelhead spawner escapement goal of 5,900 for the entire Quillayute River system. The goal for the Quillayute/Bogachiel River(s) is 1,127 wild steelhead spawners.

Dickey River - Winter steelhead spawner escapement has been monitored for the Quillayute River system, which includes the Sol Duc, Quillayute/Bogachiel, Calawah and Dickey steelhead stocks, since 1978. In 1985, WDFW and the Quileute Tribe agreed to a wild steelhead spawner escapement goal of 5,900 for the entire Quillayute River system. The goal for the Dickey River is 123 wild steelhead spawners.

Sol Duc River - Winter steelhead spawner escapement has been monitored for the Quillayute River system, which includes the Sol Duc, Quillayute/Bogachiel, Calawah and Dickey steelhead stocks, since 1978. In 1985, WDFW and the Quileute Tribe agreed to a wild steelhead spawner escapement goal of 5,900 for the entire Quillayute River system. The goal for the Sol Duc River is 2,910 wild steelhead spawners.

Calawah River - Natural-Origin Spawners - Winter steelhead spawner escapement has been monitored for the Quillayute River system, which includes the Sol Duc, Quillayute/Bogachiel, Calawah and Dickey steelhead stocks, since 1978. In 1985, WDFW and the Quileute Tribe agreed to a wild steelhead spawner escapement goal of 5,900 for the entire Quillayute River system. The goal for the Calawah River is 1,740 wild steelhead spawners.

Goodman Creek - Data are escapement estimates based on redd counts in an index area located on mainstem of Goodman Creek (River Mile [RM) 0.3 to 12.0].

Hoh River - Total Natural Spawners - Data are total escapement estimates based on redd counts on the Hoh River and South Fork Hoh River.

Notes on WRIA 21 winter steelhead data

Queets River - Data are total escapement estimates based on redd counts in index areas in the Queets basin. Index areas include the mainstem Queets River (RM 23.5 to 25.8) and tributaries such as Salmon River (RM 3.7 to 4.7 and RM 10.8 to 11.9), Matheny Creek (RM 0.5 to 2.7), and Sams River (RM 1.9 to 3.0).

Clearwater River - Data are total escapement estimates based on redd counts in index areas in the Clearwater basin. Index areas include the mainstem Clearwater River (RM 0.5 to 2.7, RM 15.5 to 17.0 and RM 22.3 to 23.0) and tributaries such as Shale Creek (RM 0.0 to 2.0), Miller Creek (RM 0.0 to 1.0 and

RM 2.3 to 2.9), East Fork Miller Creek (RM 0.0 to 0.5), Christmas Creek (RM 0.0 to 1.3), Snahapish River (RM 0.0 to 1.6 and RM 2.3 to 5.2), Stequaleho River (RM 0.0 to 1.8), and Sollecks River (RM 0.0 to 1.2 and RM 6.1 to 7.1).

Upper Quinault River - Data are total escapement estimates based on redd counts in the Quinault basin.

Lower Quinault River - Data are wild spawner total escapement estimates based on redd counts in index areas of the Quinault basin.

Moclips River - Escapement has not been monitored by WDFW since 1996. Quinault tribal fisheries staff collect spawning ground survey data and have estimated escapements from 1998 to the present. In 2001 and 2002 spawner survey data was collected by Quinault fisheries staff - however, no basin escapement was estimated.

Notes on WRIA 22 and 23 winter steelhead

Humptulips River - Data are total escapement estimates based on redd counts in index areas within the Humptulips basin.

Hoquiam River - Data are total escapement estimates based on redd counts in index areas within the Hoquiam River.

Chehalis River - Data are total escapement estimates based on redd counts in index areas within the Chehalis River basin.

Wishkah River - Data are total escapement estimates based on redd counts in index areas within the Wishkah River.

Wynoochee River - Data are total escapement estimates based on redd counts in index areas within the Wynoochee River.

Satsop River - Data are total escapement estimates based on redd counts in index areas within the Satsop River basin.

Skookumchuk and Newaukum Rivers - Trap Count data are dam counts for the upper Skookumchuck River. Total Natural Spawners data are total escapement estimates based on redd counts in index areas within the Newaukum and lower Skookumchuck Rivers.

Notes on WRIA 24 winter steelhead data

North River/Smith Creek - Data are total escapement estimates based on redd counts in index areas within North River and Smith Creek.

Willapa River - Data are total escapement estimates based on redd counts in index areas within the Willapa River basin.

Palix River - Data are total escapement estimates based on redd counts in index areas within Palix River basin.

Nemah River - Data are total escapement estimates based on redd counts in index areas within the Nemah River.

Naselle River - Data are total escapement estimates based on redd counts in index areas within the Naselle River.

Bear River - Data are total escapement estimates based on redd counts in index areas within the Bear River.

Notes on fall chum data

Quinault River - Data are results of spawning ground surveys. Escapement is no longer monitored by WDFW. The Quinault Fisheries collects spawning ground survey data but has not generated escapements based on these counts.

Humptulips River - Data are spawners per mile observed in an index area within Stevens Creek. Data usefulness is poor because a single index area is used to produce a basin-wide estimate.

Chehalis River - Data are spawners per mile observed in three index areas of the Satsop River. Data usefulness is poor because only three index areas are used to produce a basin-wide estimate.

Palix River - Data are total escapement estimates based on redd counts in index areas within the Palix River.

Nemah River - Escapement estimates have not been generated since 1996.

Naselle River - Data are total escapement estimates based on redd counts in index areas within the Naselle River.

Bear River - Total escapement estimates. There is limited recent abundance trend data with which to rate stock status. After 1990, escapement has been monitored infrequently.

APPENDIX 6
INVENTORY OF COASTAL HATCHERY PROGRAMS

Regional Overview

The Coast Region has an extensive array of hatchery facilities and artificial propagation programs for chum, coho, chinook, sockeye, and steelhead. The primary hatchery managers in the region include the Washington Department of Fish and Wildlife ("WDFW"), U.S. Fish and Wildlife Service ("USFWS"), the Hoh Tribe, the Makah Tribe, the Quileute Tribe, and the Quinault Indian Nation. In addition, there are numerous small volunteer programs supported by WDFW through both technical and logistical support.

Major Hatchery Agreements, Policies, Reviews, and Documents

An assortment of agreements, policies, reviews, and documents provide an extensive overview of hatchery programs within the Coast Region. Preparers include the state and treaty tribes, individually and as co-managers, the U.S. Fish and Wildlife Service, and the Hatchery Scientific Review Group ("HSRG").[39]

State of Washington Policies and Documents

WDFW adopted a ***Hatchery and Fishery Reform Policy*** (C-3619) in 2009 that promotes the conservation and recovery of wild salmon and steelhead. The policy designates artificial production programs as either serving conservation objectives or harvest opportunities that meet specific and clear goals.

The major points of this policy include: adhering to the guidance set by the Hatchery Scientific Review Group; improving broodstock management; commitment to mass marking all hatchery chinook, coho, and steelhead intended for harvest; securing adequate funding for needed hatchery improvements; implementing hatchery reforms outlined in the 21st Century Salmon and Steelhead Framework (WDFW, 2009); and working with the co-managers to establish a network of Wild Salmonid Management Zones.

WDFW also publishes its ***Hatchery Escapement Reports*** annually to enumerate the total number of adult fish returning to WDFW facilities and cooperative projects within Washington State.

[39] See Chapter 5, Strategy C2, p. 90

Co-Manager Agreements

The State of Washington and Western Washington's treaty tribes (see Chapter 1 section, The Role of Native American Tribes) have concluded several agreements that relate to hatchery management.

> The *Salmonid Disease Control Policy* requires testing of fish and eggs to prevent the spread of diseases before transferring them to another hatchery or planting in streams outside of native waters.
> The *Policy of Washington Department of Fish and Wildlife and Western Washington Treaty Tribes Concerning Wild Salmonids* calls for assurance that hatcheries will provide significant fishery benefits without adverse impacts on the long-term productivity of naturally-spawning salmon and their ecosystems. There are five performance measures that relate to: maintaining genetic diversity; meeting criteria in the Salmonid Disease Control Policy; completing hatchery operation plans; using appropriate artificial production techniques; and, developing agreements on mass marking of salmon. All WDFW hatchery fish will have markings.

In addition, each tribe may have individual agreements with the state regarding cooperative management actions and facility operations.

USFWS

The long-term conservation of natural salmon populations and their inherent genetic resources was the focus of the USFWS Olympic Peninsula Hatchery Review Team in 2009 when it reviewed federally owned fish hatcheries in the region. To meet this goal, the ***Quilcene, Quinault, and Makah National Fish Hatcheries Assessments and Recommendations*** set short- and long-term strategies for both hatchery-propagated and naturally spawning populations.

Hatchery Scientific Review Group

In 2005, the Hatchery Scientific Review Group completed a review of hatcheries in the Coast Region that examined their capacity to conserve naturally spawning salmon while supporting sustainable fisheries. The outcomes from this effort were a series of recommendations for hatchery reform outlined in three reports that focused on the North Coast (WRIAs 20 and 21), Grays Harbor (WRIAs 22 and 23), and Willapa Bay (WRIA 24).

Future Brood Document

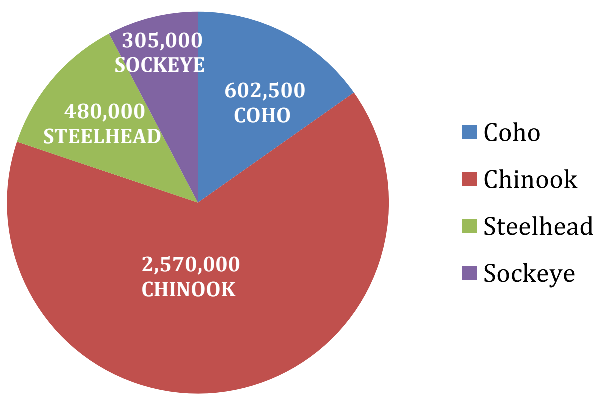
The ***Future Brood Document*** is a pre-season planning document for fish hatchery production in the state. WDFW, the Northwest Indian Fisheries Commission ("NWIFC"), treaty tribes, and USFWS develop the document annually to set production goals and plans for hatcheries. The document must consider legal constraints, mitigation objectives, WDFW goals and objectives, HSRG recommendations, hatchery genetic management plans (when applicable), benefit risk assessments, Salmonid Disease Control Policy, and the Final Joint WDFW/Tribal Wild Salmonid Policy. This document tracks broodstock transfers between programs and facilities as well as site releases.

The hatchery release sites listed under each WRIA Hatchery Program profile is from the ***2010 Future Brood Document***.

WRIA 20 Hatchery Programs

WDFW, the Quileute Tribe, the Makah Tribe, USFWS, and one volunteer organization operate hatchery and rearing operations for coho, chinook, steelhead, and sockeye in WRIA 20. These hatcheries produce and release approximately 4 million, coho, chinook, steelhead, and sockeye juveniles into WRIA waters annually for augmentation and conservation purposes.

Figure 12: Annual Hatchery Releases in WRIA 20



WRIA 20 Hatchery and Rearing Facilities

<u>Bear Springs Pond</u>

The Quileute Tribe operates the Bear Bring Springs Pond, a single pond for rearing 50,000 chinook for later release in the Sol Duc River. Juvenile chinook for the facility comes from the Lonesome Creek Hatchery.

<u>Bogachiel Hatchery</u>

The WDFW Bogachiel Hatchery has facilities for egg-take, spawning, incubation, and rearing of summer and winter steelhead. Each year, the hatchery releases approximately 30,000 summer steelhead in the Calawah River, 20,000 summer steelhead in the Sol Duc River, and 130,000 winter steelhead in the Bogachiel River.

Chalaat Creek Hatchery

This acclimation facility operated by the Hoh Tribe works in conjunction with the Quinault National Fish Hatchery to prepare 50,000 winter steelhead juveniles for release in the Hoh River. In addition to a rearing tanks and a fenced portion of Chalaat Creek, the hatchery has a small incubation facility.

Makah National Fish Hatchery

The U.S. Fish and Wildlife Service owns and operates this hatchery located along the Sooes/Tsoo-Yess River on the Makah Indian Reservation. This large hatchery has facilities for egg-take, spawning, incubation, and rearing for chinook, coho, winter steelhead, and sockeye.

This facility ships chinook juveniles to the Educket Creek Hatchery and sockeye juveniles to the Umbrella Creek and Stony Creek Hatcheries. Site releases into the Sooes/Tsoo-Yess River include approximately 2,200,000 fall chinook, 200,000 coho, and 158,000 winter steelhead.

http://www.fws.gov/Pacific/fisheries/hatcheryreview/Reports/olypen/Olympic_PeninsulaNFHReview_AppendixA_May09_FINAL.pdf

Snider Creek Pond

The Olympic Guides Association raises 50,000 winter steelhead at Snider Creek Pond for release in the Sol Duc River. The project harvests wild adults in the Sol Duc River and transports them to the Sol Duc Hatchery for egg take and spawning. After incubation at the hatchery, parr return to the ponds until ready for release.

http://www.olympicpeninsulaguidesassociation.com/snider.htm

Sol Duc Hatchery

The Sol Duc Hatchery, owned and operated by WDFW, is located on the Sol Duc River north of Forks. The hatchery has facilities for egg-take, spawning, incubation, and rearing for chinook, coho, and winter steelhead. The facility works closely with the Elwha, Hurd, Lonesome, and Morse Creek Hatcheries as well as the Snider Creek Rearing Ponds.

The facility annually plants 320,000 summer chinook and 350,000 coho on site in the Sol Duc River.

Umbrella Creek and Stony Creek Hatcheries

Umbrella Creek Hatchery is a sockeye facility owned by the Makah Tribe. The facility traps adults and holds them until ripe. The staging facility in Neah Bay Ripe spawns sockeye adults and returns eyed eggs to both the Umbrella Creek and Stony Creek Hatcheries. The Umbrella Creek facility plants 122,000 juveniles and the Stony Creek facility plants 183,000 juveniles.

HSRG Regional Recommendations for WRIA 20

Implement system-wide recommendations regarding establishing a regional system of wild steelhead management zones, where streams are not planted with hatchery fish, but are instead managed for native stocks. Fishing for steelhead in these zones would not be incompatible with this approach, but no hatchery-produced steelhead should be introduced. Such zones would reduce the risk of naturally spawning fish interbreeding with hatchery fish, and provide native stocks for future fisheries programs. To meet harvest goals, hatchery releases may be increased in those streams selected for hatchery production.

Select both wild and hatchery streams based on stock status and a balance of large and small streams and habitat types.

Use locally-adapted hatchery stock for those streams. Decrease reliance on other facilities to backfill shortages in locally adapting hatchery stock. Actions such as harvest restrictions should be implemented to achieve 100% local broodstock if necessary.

Manage the hatchery stock to maintain its early spawn timing and reduce the likelihood of interaction with naturally spawning steelhead.

Include adult collection capability wherever steelhead are released, to capture as many adults from the returning segregated population as possible. Discontinue releases where adults cannot be collected at return.

- Adipose mark releases to maximize harvest opportunity and monitor stray rates.
- Size the hatchery program in a manner that achieves harvest goals with minimal impact on wild populations.
- Release hatchery yearling steelhead smolts between April 15 and May 15 at target size of six fish to the pound, and a condition factor of less than 1.0.
- Conduct a workshop to implement this wild steelhead management zones concept.
- Implement monitoring and evaluation as a basic component of both wild steelhead management zones and hatchery harvest streams.
- Increase volitional release time period prior to forced release.

WRIA 20 Hatchery Release Sites

Ten rivers and creeks in WRIA 20 receive hatchery fish from hatcheries in WRIA 20 and 21. All plants are from stocks within the WRIA with the exception of Hoko winter steelhead planted in the Bogachiel River.

The table on the following pages identifies release sites by species.

Table 18. WRIA 20 Hatchery Releases

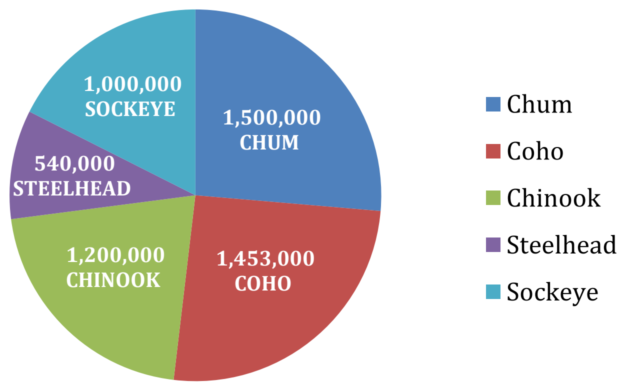
Release site	Species	Run type	Stock	Brood origin	Broodstock count	Start plant date	End plant date	Mark type	CWT	Facility of origin	Program type
Bogachiel 20.0162	Steelhead	Winter	Hoko 19.0148	Hatchery	130,000	April '11	Apr '11		No	Bogachiel Hatchery	
Bogachiel 20.0162	Steelhead				130,000						
Bogachiel Tribs	Coho	NA	Bogachiel 20.0162	Hatchery	12,500	Mar '11	Mar '11		No	RFEG 8 North Coast	
Bogachiel r Tribs	Coho				12,500						
Calawah 20.0175	Steelhead	Summer	Quillayute 20.0096	Hatchery	30,000	Apr '11	Apr '11	AD	No	Bogachiel Hatchery	Segregated
Calawah 20.0175	Steelhead				30,000						
Educket 20.0010	Coho	NA	Sooes 20.0015	Hatchery	40,000	Apr '11	Apr '11	AD	No	Educket Cr Hatchery	Integrated
Educket 0.0010	Coho				40,000						
Educket 20.0010	Steelhead	Winter	Sooes 20.0015	Hatchery	22,000	May '11	May '11	AD	No	Educket Cr Hatchery	Segregated
Educket 20.0010	Steelhead				22,000						
Hoh 20.0422	Steelhead	Winter	Quinault 21.0398	Hatchery	5,000	Apr '11	Apr '11	AD	Yes	Chalaat Cr Hatchery	Segregated
Hoh 20.0422	Steelhead	Winter	Quinault 21.0398	Hatchery	45,000	Apr '11	May '11	AD	No	Chalaat Cr Hatchery	Segregated
Hoh 20.0422	Steelhead				50,000						
Hoh 20.0422	Steelhead	Winter	Quinault 21.0398	Hatchery	40,000	May '11	May '11	AD	No	Quinault NFH -Cook C	Segregated
Hoh 20.0422	Steelhead	Winter	Quinault 21.0398	Hatchery	10,000	May '11	May '11	AD	Yes	Quinault NFH -Cook C	Segregated
Hoh 20.0422	Steelhead				50,000						
Sol Duc 20.0096	Chinook	Summer	Sol Duc 20.0096	Mixed	170,000	Apr '11	Apr '11	AD	No	Sol Duc Hatchery	Integrated
Sol Duc 20.0096	Chinook	Summer	Sol Duc 20.0096	Mixed	50,000	Apr '11	Apr '11		Yes	Bear Springs 2 (20)	Integrated
Sol Duc 20.0096	Chinook	Summer	Sol Duc 20.0096	Mixed	50,000	Apr '11	Apr '11	AD	Yes	Sol Duc Hatchery	Integrated
Sol Duc 20.0096	Chinook	Summer	Sol Duc 20.0096	Mixed	30,000	Apr '11	Apr '11	AD	Yes	Sol Duc Hatchery	Integrated
Sol Duc 20.0096	Chinook				300,000						
Sol Duc 20.0096	Coho	NA	Sol Duc 20.0096	Mixed	100,000	Apr '11	Apr '11	AD	No	Sol Duc Hatchery	Integrated
Sol Duc 20.0096	Coho	Summer	Sol Duc 20.0096	Mixed	100,000	Apr '11	Apr '11	AD	No	Sol Duc Hatchery	Integrated
Sol Duc 20.0096	Coho	NA	Sol Duc 20.0096	Mixed	75,000	Apr '11	Apr '11	AD	Yes	Sol Duc Hatchery	Integrated
Sol Duc 20.0096	Coho	NA	Sol Duc 20.0096	Mixed	75,000	Apr '11	Apr '11		Yes	Sol Duc Hatchery	Integrated
Sol Duc 20.0096	Coho				350,000						

Release site	Species	Run type	Stock	Brood origin	Broodstock count	Start plant date	End plant date	Mark type	CWT	Facility of origin	Program type
Sol Duc 20.0096	Steelhead	Summer	Quillayute 20.0096	Hatchery	20,000	Apr '11	Apr '11	AD	No	Bogachiel Hatchery	Segregated
Sol Duc 20.0096	Steelhead	Winter	Sol Duc 20.0096	Mixed	20,000	Apr '11	Apr '11	LV	No	Snider Cr Rearing Pd	Integrated
Sol Duc 20.0096	Steelhead				40,000						
Sol Duc 20.0096	Chinook	Summer	Sol Duc 20.0096	Mixed	70,000	July '11	July '11		Yes	Sol Duc Hatchery	Integrated
Sol Duc 20.0096	Chinook				70,000						
Sooes 20.0015	Chinook	Fall	Sooes 20.0015	Hatchery	1,940,000	May '11	May '11	AD	No	Makah NFH	Integrated
Sooes 20.0015	Chinook	Fall	Sooes 20.0015	Hatchery	260,000	May '11	May '11	AD	Yes	Makah NFH	Integrated
Sooes 20.0015	Chinook				2,200,000						
Sooes 20.0015	Coho	NA	Sooes 20.0015	Hatchery	120,000	May '11	May '11	AD	No	Makah NFH	Integrated
Sooes 20.0015	Coho	NA	Sooes 20.0015	Hatchery	40,000	May '11	May '11	AD	Yes	Makah NFH	Integrated
Sooes 20.0015	Coho	NA	Sooes 20.0015	Hatchery	40,000	May '11	May '11		Yes	Makah NFH	Integrated
Sooes 20.0015	Coho				200,000						
Sooes 20.0015	Steelhead	Winter	Sooes 20.0015	Hatchery	158,000	May '11	May '11		No	Makah NFH	Segregated
Sooes 20.0015	Steelhead				158,000						
Stony 20.0058a	Sockeye	NA	Ozette (20)	Hatchery	91,500	Apr '11	Apr '11	OT	No	Stony Cr Hatchery	Integrated
Stony 20.0058a	Sockeye	NA	Ozette (20)	Hatchery	45,750	June '11	June '11	OT	No	Stony Cr Hatchery	Integrated
Stony 20.0058a	Sockeye	NA	Ozette (20)	Hatchery	45,750	June '11	June '11	AD+OT	No	Stony Cr Hatchery	Integrated
Stony 20.0058a	Sockeye				183,000						
Umbrella 20.0052	Sockeye	NA	Ozette (20)	Hatchery	122,000	June '11	June '11		No	Umbrella Cr Hatchery	Integrated
Umbrella 20.0052	Sockeye				122,000						

WRIA 21 Hatchery Programs

The Quinault Indian Nation and the U.S. Fish and Wildlife Service operate hatchery and rearing operations for chum, coho, chinook, steelhead, and sockeye in WRIA 21. These hatcheries produce and release approximately 5.7 million into Cook Creek, Quinault Lake, and the Salmon River waters annually for augmentation purposes.

Figure 13: Annual Hatchery Releases in WRIA 21



WRIA 21 Hatchery and Rearing Facilities

<u>Lake Quinault Tribal Hatchery</u>

The Quinault Indian Nation owns and operates the Lake Quinault Tribal Hatchery along the southwest shore of Lake Quinault. The facility is comprised of net pens for raising chinook, winter steelhead, and sockeye juveniles for release in Lake Quinault. The tribe also conducts egg takes and incubation for each species at the facility.

<u>Quinault National Fish Hatchery</u>

This U.S. Fish and Wildlife Service hatchery is located on the Quinault Indian Reservation along Cook Creek, a tributary of the Quinault River. This large federal hatchery has facilities for egg-take, spawning, incubation, and rearing of chum, coho, chinook, and winter steelhead. The facility also ships juveniles to the Lake Quinault Tribal and the Chalaat Creek Hatcheries.

The facility annually releases into Cook Creek 1,500,000 chum, 600,000 chinook, 803,000 coho, and 190,000 winter steelhead. The hatchery also releases 50,000 winter steelhead into the Hoh River.

Salmon River Hatchery

The Salmon River Hatchery borders the Salmon River, a tributary of the lower Queets River. This facility has facilities for egg-take, spawning, incubation, and rearing of coho, chinook, and winter steelhead. The facility plants on site 450,000 chinook, 650,000 coho, and 150,000 winter steelhead.

HSRG Regional Recommendations for WRIA 21

The HSRG made the same recommendations for WRIA 21 hatcheries as those in WRIA 20 (see previous section).

WRIA 21 Hatchery Release Sites

Cook Creek, the Salmon River, and Quinault Lake are the main release sites for hatchery fish in WRIA 21. The table on the following pages identifies release sites by species.

Table 19. WRIA 21 Hatchery Releases

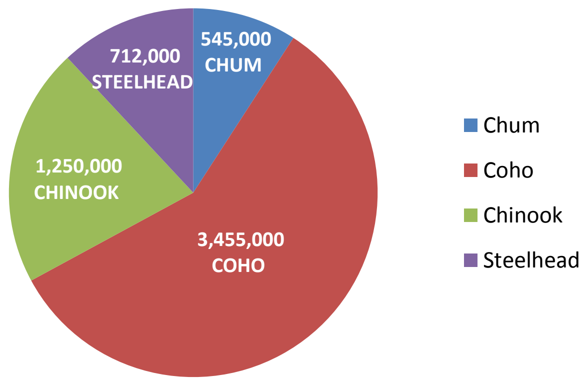
Release site	Species	Run type	Stock	Brood origin	broodstock count	Start plant date	End plant date	Mark type	CWT	Facility of origin	Program type
Cook 21.0429	Coho	NA	Cook 21.0429	Hatchery	500,000	May '11	May '11	AD	No	Quinault NFH	Segregated
Cook 21.0429	Coho	NA	Cook 21.0429	Hatchery	80,000	May '11	May '11	AD	Yes	Quinault NFH	Segregated
Cook 21.0429	Coho	NA	Cook 21.0429	Hatchery	80,000	May '11	May '11		Yes	Quinault NFH	Segregated
Cook 21.0429	Coho				660,000						
Cook 21.0429	Chinook	Fall	Cook 21.0429	Hatchery	400,000	July '11	July '11	AD	No	Quinault NFH	Integrated
Cook 21.0429	Chinook	Fall	Cook 21.0429	Hatchery	200,000	July '11	July '11	AD	Yes	Quinault NFH	Integrated
Cook 21.0429	Chinook				600,000						
Cook 21.0429	Chum	NA	Cook 21.0429	Hatchery	1,500,000	April '11	April '11		No	Quinault NFH	Segregated
Cook 21.0429	Chum				1,500,000						
Cook 21.0429	Coho	NA	Cook 21.0429	Hatchery	143,000	Mar '11	Mar '11		No	Quinault NFH	Segregated
Cook 21.0429	Coho				143,000						
Cook 21.0429	Steelhead	Winter	Quinault 21.0398	Hatchery	170,000	May '11	May '11		No	Quinault NFH	Segregated
Cook 21.0429	Steelhead	Winter	Quinault 21.0398	Hatchery	20,000	May '11	May '11	AD	Yes	Quinault NFH	Segregated
Cook 21.0429	Steelhead				190,000						
Quinault Lake	Chinook	Fall	Quinault 21.0398	Hatchery	200,000	Sep '11	Sep '11	AD	Yes	Quinault NFH	Integrated
Quinault Lake	Chinook	Fall	Quinault 21.0398	Hatchery	200,000	Sep '11	Sep '11		Yes	Quinault NFH	Integrated
Quinault Lake	Chinook				400,000						
Quinault Lake	Sockeye	NA	Quinault 21.0398	Wild	1,000,000	April '11	April '11		No	Quinault NFH	Integrated
Quinault Lake	Sockeye				1,000,000						
Quinault Lake	Steelhead	Winter	Quinault 21.0398	Mixed	165,000	April '11	April '11		No	Quinault NFH	Integrated
Quinault Lake	Steelhead	Winter	Quinault 21.0398	Mixed	35,000	April '11	April '11	AD	Yes	Quinault NFH	Integrated
Quinault Lake	Steelhead				200,000						
Salmon 21.0139	Coho	NA	Salmon 21.0139	Hatchery	500,000	April '11	April '11	AD	No	Salmon R Hatchery	Segregated
Salmon 21.0139	Coho	NA	Salmon 21.0139	Hatchery	75,000	April '11	April '11		Yes	Salmon R Hatchery	Segregated

Release site	Species	Run type	Stock	Brood origin	broodstock count	Start plant date	End plant date	Mark type	CWT	Facility of origin	Program type
Salmon 21.0139	Coho	NA	Salmon 21.0139	Hatchery	75,000	April '11	April '11	AD	Yes	Salmon R Hatchery	Segregated
Salmon 21.0139	Coho				650,000						
Salmon 21.0139	Chinook	Fall	Queets 21.0016	Hatchery	200,000	Aug-11	Aug-11	AD	Yes	Salmon R Hatchery	Integrated
Salmon 21.0139	Chinook				200,000						
Salmon 21.0139	Steelhead	Winter	Salmon 21.0139	Hatchery	115,000	April '11	April '11		No	Salmon R Hatchery	Segregated
Salmon 21.0139	Steelhead	Winter	Salmon 21.0139	Hatchery	35,000	April '11	April '11	AD	Yes	Salmon R Hatchery	Segregated
Salmon 21.0139	Steelhead				150,000						

WRIAs 22-23 Hatchery and Rearing Programs

The Washington Department of Fish and Wildlife, cooperative volunteer projects, and the Gray Harbor College Aquaculture Center operate 16 hatchery and rearing programs in WRIA 22-23. These programs produce and release approximately 5.6 million chum, coho, chinook, and steelhead juveniles into the system annually for augmentation and mitigation purposes.

Figure 14: Annual Hatchery Releases in WRIAs 22-23



WRIAs 22-23 Facilities and Projects Inventory

Bingham Creek Hatchery

The Bingham Creek Hatchery is a full-spectrum facility located on the East Fork Satsop River at RM 17.5. WDFW owns and operates the hatchery with partial funding support from Skookumchuck mitigation funds. The facility has been in operation since 1948.

The hatchery has facilities for egg-take, incubation, and rearing. The hatchery produces chum, coho, chinook, and winter steelhead juvenile from Satsop River stocks. While the chum program, coordinated with the Satsop Springs Hatchery, consists of a segregated broodstock, the hatchery manages all other species as integrated broodstock.

Bingham Creek supplies coho eyed-eggs and juveniles to a variety of rearing programs operated by schools and conservation groups throughout the region. These juveniles end up in Still, Sylvia, and Cook Creeks and the Elk and Johns Rivers. All other salmon produced by the hatchery are released into the Satsop River.

Carlisle Lake

The Carlisle Lake incubation and rearing facility is an educational program operated by the Onalaska Future Farmers of America ("FFA") in conjunction with Onalaska School District. The Skookumchuck Dam Mitigation Program and the Onalaska FFA funds the facility while WDFW provides technical supervision and support.

The Carlisle Lake facility consists of covered buildings for egg-take and incubation as well as net pens located at nearby Carlisle Lake. The program hatches winter-run steelhead, chum, and coho and raises coho in the net pens. The facility receives juvenile coho and steelhead eyed eggs from the Skookumchuck Hatchery. The Carlisle facility releases fish into tributaries of the Upper Chehalis.

Eight Creek Pond

The Upper Chehalis Fishery Enhancement Association operates Eight Creek Pond near the town of Doty on Weyerhaeuser land. The pond serves as a rearing facility for coho and steelhead. Juveniles raised at the pond eventually are released into Elk Creek, a tributary of the Chehalis River.

Coho raised at the ponds is Skookumchuck hatchery stock while the steelhead is Chehalis hatchery stock. In addition, green steelhead eggs are collected at Eight Creek and shipped to the Skookumchuck Hatchery for incubation and rearing.

Elma High School FFA

Elma High School operates an aquaculture program that raises approximately 2,000 Satsop stock coho juveniles. The educational program receives eyed eggs from Bingham Creek Hatchery for eventual return and release into the Satsop River. The facility consists of eight 800-gallon and two 250-gallon tanks.

Grays Harbor 4-H Fricke Project

This is a small coho-rearing project managed by the Saron Lutheran Church 4-H club. Located along Blazer Creek, a tributary of the Little Hoquiam River, the program receives approximately 30,000 eyed eggs annually from the Bingham Creek Hatchery. Juveniles raised at the project eventually are released into Still, Sylvia, and Cook Creeks.

Grays Harbor College Aquaculture Center

The Grays Harbor College Natural Resources Programs operates a hatchery program for coho and chum. The facility incubates and rears coho and chum for release into Alder Creek, which empties directly into the Grays Harbor Estuary. Broodstock consists of returning coho and chum adults and the Lake Aberdeen Hatchery supplements the facility with approximately 50,000 green chum eggs.

Grays Harbor Gill Nets

This private facility, located on the East Hoquiam River, rears 200,000 juveniles supplied by the Mayr Brothers Hatchery.

Humptulips Hatchery

The Humptulips Hatchery is a WDFW facility located on Stevens Creek that it has been operating since 1976. The hatchery has facilities for egg-take, incubation, and rearing. It annually releases 1,200,000 coho, 500,000 chinook, and 155,000 steelhead. All fish produced at this facility are released in Stevens Creek.

Lake Aberdeen Hatchery

The Lake Aberdeen Hatchery is another WDFW hatchery that has facilities for egg-take, incubation, and rearing. The hatchery annually releases 230,000 steelhead in the Wynoochee River, and 30,000 coho and 50,000 chinook into Van Winkle Creek. The hatchery also supplies coho eggs and juveniles to the Aberdeen School District and the Region 6 Educational Cooperatives, as well as chum eggs to Grays Harbor College.

Lyle Heimbigner Project

This private facility annually raises and eventually releases 45,000 coho in Stearns Creek. The Skookumchuck Hatchery supplies eyed eggs to the project.

Satsop Springs Hatchery

Satsop Springs is a WDFW facility located on the East Fork Satsop River operated by the Chehalis Basin Fisheries Task Force. The facility focuses on chum, coho, and chinook production.

The facility collects chum eggs for incubation at the Bingham Creek Hatchery, which return as fry to Satsop Springs for rearing and release (200,000) on site. Satsop Springs supplies 600,000 green chinook eggs to the Bingham Creek Hatchery. Bingham Creek Hatchery in turn supplies Satsop Springs with coho juveniles, which it releases 330,000 into the Satsop River.

Skookumchuck Dam

The Skookumchuck Dam facility is a mitigation project to compensate for habitat loss created by the Skookumchuck Dam. Oregon-based dam owner Pacificorp mitigates the loss by providing adequate flow downstream for chinook as well as rearing facilities for steelhead. The facility rears and plants 75,000 steelhead that it receives from the Skookumchuck Hatchery. The dam has a fish trap for capturing adult broodstock taken to other facilities.

Skookumchuck Hatchery

WDFW recently expanded the Skookumchuck Hatchery to include new and upgraded facilities for egg-take, incubation, and rearing. The facility emphasizes coho and steelhead production. In addition to planting 100,000 coho in the Skookumchuck River, the facility provides Skookumchuck coho juveniles and eyed eggs to the Carlisle Lake, Centralia High School, Deep Creek, Dillenbaugh, Eight Creek, Heimbigner, Pedersen, Region 6 Educational Cooperative, and Rochester FFA Projects. The Skookumchuck Hatchery also incubates and rears Skykomish eyed eggs from the Marblemount Hatchery for export to the Squaxin Island net pens.

Westport Net Pens

The City of Westport owns the Westport Net Pens, with assistance from Ocosta High School, the local Kiwanis Club, and the Port of Grays Harbor. The net pens annually plant 100,000 coho juveniles into the Westport Boat Basin. The Bingham Creek Hatchery supplies the net pens with the Satsop River broodstock used in the project.

Mayr Brothers Hatchery

WDFW owns and currently manages the Mayr Brothers Hatchery located RM 25 on the Wishkah River. This hatchery facility does egg-take, incubation, and rearing for chum, coho, and chinook. The facility plants 100,000 chum, 150,000 coho, and 200,000 chinook in the Wishkah River. The hatchery receives 35,000 coho eyed eggs from the Buzzard Creek project and ships back 25,000 juveniles for further rearing and release. Juvenile coho also go to the Aberdeen Net Pens and eyed eggs to the Grays Harbor Gillnet Project.

Rochester FFA

The Rochester Future Farmers of America aquaculture program receives and rears 25,000 coho for release in Prairie Creek. The program receives eyed eggs of Skookumchuck broodstock from the Skookumchuck Hatchery.

HSRG Regional Recommendations for WRIAs 22-23

Chinook

- Identify fall, spring and summer chinook stocks; determine their status; minimize impacts on other natural-spawning stocks during adult collection.
- Mark and tag hatchery chinook and coho to determine their contribution to harvest and the proportion of hatchery-origin versus wild-origin fish on the spawning grounds.

Coho

- Maintain and encourage regional diversity in this large, geographically diverse region. DNA analysis has shown that coho are more genetically diverse than was previously assumed. This will require further analysis of regional stock structure and suggests the use of locally-adapted broodstocks.

- Size coho programs consistent with goals for coho and other regional stocks.

- Include 10% jacks in broodstocks.

Chum

It was unclear to the HSRG that there was a need for conservation programs for chum. Regional chum stocks appeared at the time of their report to be in reasonably good shape.

Steelhead

- Dedicate WRIA 23 to steelhead harvest programs, using integrated, native winter stocks.

- Dedicate the Wishkah River to natural production.

WRIA 22-23 Hatchery Release Sites

Hatchery programs in WRIA 22-23 plant fish at 24 sites. The table on the following page identifies release sites by species.

Table 20: WRIAs 22-23 Hatchery Releases

Release site	Species	Run type	Stock	Brood origin	Broodstock count	Start plant date	End plant date	Mark type	CWT	Facility of origin	Program type
Alder 22.1215	Chum	NA	Van winkle 22.0240	Mixed	45,000	April '11	April '11		No	Grays Harbor College	Integrated
Alder 22.1215	Chum				45,000						
Bingham 22.0465	Chum	NA	Satsop 22.0360	Hatchery	200,000	Mar '11	April '11		No	Bingham Cr Hatchery	Segregated
Bingham 22.0465	Chum				200,000						
Chehalis 22.0190	Coho	NA	Wishkah 22.0191	Mixed	25,000	May '11	May '11	AD	No	Buzzard Cr Coop	Integrated
Chehalis 22.0190	Coho				25,000						
Cook 22.0410	Coho	NA	Satsop 22.0360	Mixed	9,500	May '11	May '11		No	Grays Harbor 4-F	Integrated
Cook 22.0410	Coho				9,500						
Deep 23.0957	Coho	NA	Skookumchuck 23.0761	Mixed	100,000	Jan '11	Jan '11		No	Skookumchuck Hatchry	Integrated
Deep 23.0957	Coho				100,000						
Dillenbaugh 23.0880	Coho	NA	Skookumchuck 23.0761	Mixed	50,000	April '11	April '11		No	Dillenbaugh Cr Project	Integrated
Dillenbaugh 23.0880	Coho				50,000						
Eight 23.1117	Coho	Late	Skookumchuck 23.0761	Mixed	100,000	April '11	May '11	AD	No	Eight Ck/Upr Chehalis	Integrated
Eight 23.1117	Coho				100,000						
Eight 23.1117	Steelhead	Winter	Chehalis 22.0190	Mixed	32,000	April '11	April '11	AD	No	Eight Ck/Upr Chehalis	Integrated

Release site	Species	Run type	Stock	Brood origin	Broodstock count	Start plant date	End plant date	Mark type	CWT	Facility of origin	Program type
Eight 23.1117	Steelhead				32,000						
Elk 22.1333	Coho	NA	Satsop 22.0360	Mixed	25,000	Jan '11	Jan '11		No	Ocosta High Project - RSI	Integrated
Elk 22.1333	Coho				25,000						
Gable 23.0959	Coho	NA	Skookumchuck 23.0761	Mixed	45,000	Mar '11	Mar '11		No	Deep Cr 23.0957	Integrated
Gable 23.0959	Coho				45,000						
Grays Harbor Estuary	Coho	NA	Wishkah 22.0191	Mixed	100,000	April '11	April '11	AD	No	Aberdeen net pens	Integrated
Grays Harbor Estuary	Coho	NA	Wishkah 22.0191	Mixed	50,000	April '11	April '11	AD	No	Aberdeen net pens	Integrated
Grays Harbor Estuary	Coho				150,000						
Hoquiam EF 22.0138	Coho	NA	Wishkah 22.0191	Mixed	190,000	May '11	May '11		No	Grays Harbor Gillnet	Integrated
Hoquiam EF 22.0138	Coho				190,000						
Johns 22.1270	Coho	NA	Satsop 22.0360	Mixed	25,000	May '11	May '11		No	Ocosta High Project - RSI	Integrated
Johns 22.1270	Coho				25,000						
Newaukum NF 23.0887	Coho	NA	Skookumchuck 23.0761	Mixed	45,000	April '11	April '11		No	Pedersen Project	Integrated
Newaukum NF 23.0887	Coho				45,000						
Newaukum NF 23.0909	Steelhead	Winter	Skookumchuck 23.0761	Mixed	10,000	April '11	April '11	AD	No	Noel Cole Pond (23)	Integrated

Release site	Species	Run type	Stock	Brood origin	Broodstock count	Start plant date	End plant date	Mark type	CWT	Facility of origin	Program type
Newaukum-NF 23.0909	Steelhead				10,000						
Prairie 23.0729	Coho	NA	Skookumchuck 23.0761	Mixed	25,000	Mar '11	Mar '11		No	Rochester FFA	Integrated
Prairie cr 23.0729	Coho				25,000						
Quigg lake (gray)	Coho	NA	Satsop 22.0360	Mixed	25,000	April '11	April '11	AD	No	Friends Landing	Integrated
Quigg lake (gray)	Coho				25,000						
Satsop 22.0360	Coho	NA	Satsop 22.0360	Mixed	290,000	May '11	May '11	AD	No	Satsop Springs Ponds	Integrated
Satsop 22.0360	Coho	NA	Satsop 22.0360	Mixed	40,000	May '11	May '11	AD	Yes	Satsop Springs Ponds	Integrated
Satsop 22.0360	Coho	NA	Satsop 22.0360	Mixed	1,000	June '11	June '11	AD	No	Elma FFA	Integrated
Satsop 22.0360	Coho				331,000						
Satsop 22.0360	Chum	NA	Satsop 22.0360	Mixed	200,000	Mar '11	April '11		No	Satsop Springs Ponds	Integrated
Satsop 22.0360	Chum				200,000						
Satsop EF 22.0360	Coho	Late	Satsop 22.0360	Mixed	150,000	Mar '11	May '11	AD	No	Bingham Cr Hatchery	Integrated
Satsop EF 22.0360	Coho	NA	Satsop 22.0360	Mixed	75,000	Mar '11	May '11	AD	Yes	Bingham Cr Hatchery	Integrated
Satsop EF 22.0360	Coho	NA	Satsop 22.0360	Mixed	75,000	Mar '11	May '11		Yes	Bingham Cr Hatchery	Integrated
Satsop EF 22.0360	Coho				300,000						
Satsop EF 22.0360	Chinook	Fall	Satsop 22.0360	Mixed	200,000	June '11	June '11	AD	Yes	Bingham Cr Hatchery	Integrated
Satsop EF 22.0360	Chinook	Fall	Satsop 22.0360	Mixed	300,000	June '11	June '11		Yes	Bingham Cr Hatchery	Integrated
Satsop EF 22.0360	Chinook				500,000						
Satsop EF 22.0360	Steelhead	Winter	Satsop 22.0360	Mixed	55,000	April '11	April '11	AD	No	Bingham Cr Hatchery	Integrated

Release site	Species	Run type	Stock	Brood origin	Broodstock count	Start plant date	End plant date	Mark type	CWT	Facility of origin	Program type
Satsop EF 22.0360	Steelhead				55,000						
Stevens 22.0064	Chinook	Fall	Humptulips 22.0004	Mixed	200,000	June '11	June '11	AD	Yes	Humptulips Hatchery	Integrated
Stevens 22.0064	Chinook	Fall	Humptulips 22.0004	Mixed	300,000	June '11	June '11	AD	No	Humptulips Hatchery	Integrated
Stevens 22.0064	Chinook				500,000						
Stevens 22.0064	Coho	NA	Humptulips 22.0004	Mixed	550,000	March '11	May '11	AD	No	Humptulips Hatchery	Integrated
Stevens 22.0064	Coho	NA	Humptulips 22.0004	Mixed	50,000	March '11	May '11	AD	Yes	Humptulips Hatchery	Integrated
Stevens 22.0064	Coho	Late	Humptulips 22.0004	Mixed	370,000	March '11	May '11	AD	No	Humptulips Hatchery	Integrated
Stevens 22.0064	Coho				970,000						
Stevens 22.0064	Steelhead	Winter	Humptulips 22.0004	Hatchery	125,000	April '11	May '11	AD	No	Humptulips Hatchery	Segregated
Stevens 22.0064	Steelhead	Summer	Humptulips 22.0004	Hatchery	30,000	April '11	May '11	AD	No	Humptulips Hatchery	Segregated
Stevens 22.0064	Steelhead				155,000						
Skookumchuck 23.0761	Coho	Late	Skookumchuck 23.0761	Mixed	50,000	April '11	May '11	AD	No	Skookumchuck Hatchery	Integrated
Skookumchuck 23.0761	Coho	NA	Skookumchuck 23.0761	Mixed	50,000	April '11	May '11	AD	Yes	Skookumchuck Hatchery	Integrated
Skookumchuck 23.0761	Coho				100,000						
Skookumchuck 23.0761	Steelhead	Winter	Skookumchuck 23.0761	Mixed	75,000	April '11	May '11	AD	No	Skookumchuck Dam	Integrated
Skookumchuck 23.0761	Steelhead				75,000						
Stearns 23.0934	Coho	NA	Skookumchuck 23.0761	Mixed	30,000	April '11	April '11	AD	No	Heimbigner Project	Integrated
Stearns 23.0934	Coho	NA	Skookumchuck 23.0761	Mixed	15,000	May '11	May '11	AD	No	Heimbigner Project	Integrated

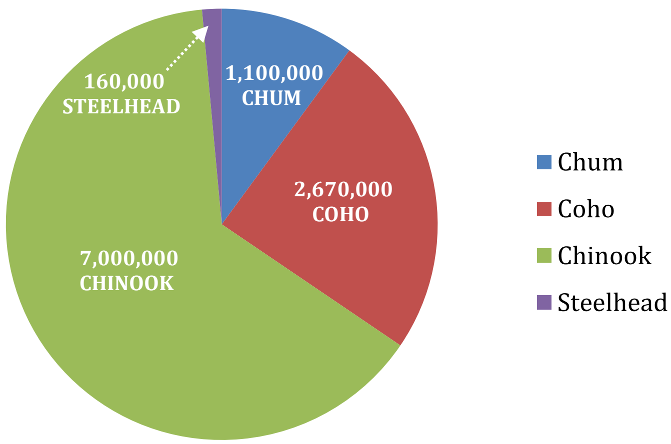
Release site	Species	Run type	Stock	Brood origin	Broodstock count	Start plant date	End plant date	Mark type	CWT	Facility of origin	Program type
Stearns 23.0934	Coho				45,000						
Still 22.0366	Coho	NA	Satsop 22.0360	Mixed	9,500	April '11	April '11		No	Grays Harbor 4-F	Integrated
Still 22.0366	Coho				9,500						
Sylvia 22.0261	Coho	NA	Satsop 22.0360	Mixed	9,500	April '11	April '11		No	Grays Harbor 4-F	Integrated
Sylvia 22.0261	Coho				9,500						
Tapp 23.0958	Coho	NA	Skookumchuck 23.0761	Mixed	45,000	Mar '11	Mar '11		No	Deep Cr 23.0957	Integrated
Tapp 23.0958	Coho				45,000						
Van winkle 22.0240	Coho	NA	Van winkle 22.0240	Mixed	30,000	Mar '11	May '11	AD	Yes	Lake Aberdeen Hatchery	Integrated
Van winkle 22.0240	Coho				30,000						
Van winkle 22.0240	Chinook	Fall	Van winkle 22.0240	Mixed	50,000	June '11	June '11	AD	No	Lake Aberdeen Hatchery	Integrated
Van winkle 22.0240	Chinook				50,000						
Wishkah 22.0191	Coho	NA	Wishkah 22.0191	Mixed	150,000	Mar '11	May '11	AD	No	Mayr Brothers Rearing	Integrated
Wishkah 22.0191	Coho				150,000						
Wishkah 22.0191	Chinook	Fall	Wishkah 22.0191	Mixed	200,000	May '11	May '11	AD	No	Mayr Brothers Rearing	Integrated
Wishkah 22.0191	Chinook				200,000						
Wishkah 22.0191	Chum	NA	Wishkah 22.0191	Mixed	100,000	April '11	April '11		No	Mayr Brothers Rearing	Integrated

Release site	Species	Run type	Stock	Brood origin	Broodstock count	Start plant date	End plant date	Mark type	CWT	Facility of origin	Program type
Wishkah 22.0191	Chum				100,000						
Wynoochee 22.0260	Steelhead	Summer	Van winkle 22.0240	Hatchery	60,000	April '11	April '11	AD	No	Lake Aberdeen Hatchery	Segregated
Wynoochee 22.0260	Steelhead	Winter	Wynoochee 22.0260	Mixed	170,000	April '11	April '11	AD	No	Lake Aberdeen Hatchery	Integrated
Wynoochee 22.0260	Steelhead				230,000						

WRIA 24 Hatchery Programs

WRIA 24 has the largest number of hatchery releases of any of the five WRIAs in the Coast Region. WDFW, three cooperative volunteer projects, and Grays Harbor College together release 10,930,000 hatchery chum, coho, steelhead, and chinook juveniles into WRIA waters annually.

Figure 15:
Annual Hatchery Releases in WRIA 24



WRIA 24 Facilities and Projects Inventory

<u>Forks Creek Hatchery</u>

WDFW owns and operates Forks Creek Hatchery. Situated along Forks Creek, a tributary of the Willapa River between Raymond and Chehalis, this hatchery has facilities for egg-take, incubation, and rearing. The facility produces chum, fall chinook, coho, and winter steelhead. The Forks Creek facility annually releases into Forks Creek 2.8 million chinook, 300,000 chum, 100,000 coho, and 40,000 steelhead. In addition, the facility also supplies eyed eggs and juveniles to the Naselle Hatchery, the March Spawning Channel, the Pacific County Anglers, and the Willapa Bay Regional Fisheries Enhancement Group (RFEG).

<u>Johnson Creek RSI</u>

This is a remote site incubator operated by ______ that incubates and plants 50,000 coho into the Naselle River.

<u>March Spawning Channel</u>

March Spawning Channel is a privately owned facility along the North River that uses a combination of controlled and semi-natural rearing environments for chum, coho, and winter steelhead. The project annually releases 200,000 chum, 270,000 coho, and 10,000 steelhead into North River.

Naselle Hatchery

The Naselle Hatchery is a WDFW facility capable of egg take, incubation, and rearing. The hatchery annually produces 800,000 chinook, 300,000 chum, 1,400,00 coho, and 75,000 steelhead for release in the Naselle River. In addition, the facility provides eyed coho eggs to the Johnson Creek remote site incubator and Willapa Bay RFEG.

Nemah Hatchery

This WDFW hatchery is located on the North Nemah River, a tributary to Willapa Bay. This large hatchery has egg take, incubation, and rearing facilities. The hatchery annually releases three million chinook into the North Nemah River and 300,000 chum into tributaries of the North Nemah River.

HSRG Regional Recommendations for WRIA 24

- Develop a region-wide strategic plan for managing all stocks. This will require developing a better understanding of stock structure and identifying core populations for each species, and designing hatchery programs and strategies around this structure.

- For chinook, focus on developing properly integrated stocks on the Naselle and Willapa rivers. Straying to Nemah by these stocks would pose little risk. Given the limited potential for chinook habitat in the Nemah River, the uncertainty of the stock structure, and the history of hatchery releases in this watershed, developing viable stocks in the Naselle and Willapa Rivers may better meet the stock goals for the region than attempting to create a properly integrated Nemah River chinook stock. Consider either operating a chinook program at the Nemah Hatchery that is segregated from both the Willapa and Naselle stocks, to maintain the harvest benefits from this program, or using Nemah as a release site for the Naselle and/or Willapa chinook.

WRIA 24 Hatchery Release Sites

Hatchery programs in WRIA 24 plant fish at 14 sites. The table on the following pages identifies release sites by species.

Table 21. WRIA 24 Hatchery Releases

Release site	Species	Run type	Stock	Brood origin	broodstock count	Start plant date	End plant date	Mark type	Cwt	Facility of origin	Program type
Alder 24.0653	Coho	NA	Alder 24.0653	Mixed	1,500	April 12	April 12	AD	No	Grays Harbor College	Integrated
Alder 24.0653	Coho				1,500						
Bear 24.0036	Chum	NA	Bear 24.0689	Wild	50 Adults	Oct '10	Nov '10		No	RFEG 10 Willapa Bay	
Bear 24.0036	Chum				50 Adults						
Fork 24.0356	Coho	Late	Willapa 24.0251	Mixed	100,000	April '11	April '11	AD	No	Forks Creek Hatchery	Integrated
Fork 24.0356	Coho	NA	Willapa 24.0251	Mixed	50,000	Mar '11	May '11	AD	No	Forks Creek Hatchery	Integrated
Fork 24.0356	Coho	NA	Willapa 24.0251	Mixed	75,000	Mar '11	May '11	AD	Yes	Forks Creek Hatchery	Integrated
Fork 24.0356	Coho	NA	Willapa 24.0251	Mixed	75,000	Mar '11	May '11		Yes	Forks Creek Hatchery	Integrated
Fork 24.0356	Coho				300,000						
Fork 24.0356	Chinook	Fall	Willapa 24.0251	Mixed	2,800,000	May '11	June '11	AD	No	Forks Creek Hatchery	Integrated
Fork 24.0356	Chinook	Fall	Willapa 24.0251	Mixed	200,000	May '11	June '11	AD	Yes	Forks Creek Hatchery	Integrated
Fork 24.0356	Chinook	Fall	Willapa 24.0251	Mixed	200,000	May '11	June '11		Yes	Forks Creek Hatchery	Integrated
Fork 24.0356	Chinook				3,200,000						
Fork 24.0356	Chum	NA	Willapa 24.0251	Mixed	300,000	April '11	April '11		No	Forks Creek Hatchery	Integrated
Fork 24.0356	Chum				300,000						
Fork 24.0356	Steelhead	Winter	Willapa 24.0251	Hatchery	40,000	April '11	May '11	AD	No	Forks Creek Hatchery	Segregated
Fork 24.0356	Steelhead				40,000						
Mill 24.0322	Coho	NA	Willapa 24.0251	Mixed	50,000	Jan '11	Jan '11		No	Pacific Co Anglers	Integrated
Mill 24.0322	Coho				50,000						
N. Nemah Tribs 24.0498	Chum	NA	Nemah 24.0460	Wild	300,000	Mar '11	Mar '11		No	Nemah Hatchery	Integrated
N. Nemah Tribs 24.0498	Chum				300,000						
Naselle 24.0543	Coho	Late	Willapa 24.0251	Mixed	200,000	April '11	April '11	AD	No	Naselle Hatchery	Integrated
Naselle 24.0543	Coho	NA	Naselle 24.0543	Mixed	1,200,000	Mar '11	May '11	AD	No	Naselle Hatchery	Integrated

Release site	Species	Run type	Stock	Brood origin	broodstock count	Start plant date	End plant date	Mark type	Cwt	Facility of origin	Program type
Naselle 24.0543	Coho				1,400,000						
Naselle 24.0543	Chinook	Fall	Naselle 24.0543	Mixed	800,000	May '11	May '11	AD	No	Naselle Hatchery	Integrated
Naselle 24.0543	Chinook				800,000						
Naselle 24.0543	Chum	NA	Naselle 24.0543	Mixed	300,000	April '11	April '11		No	Naselle Hatchery	Integrated
Naselle 24.0543	Chum				300,000						
Naselle 24.0543	Steelhead	Winter	Willapa 24.0251	Hatchery	75,000	April '11	May '11	AD	No	Naselle Hatchery	Segregated
Naselle 24.0543	Steelhead				75,000						
Naselle Tribs 24.0662	Coho	NA	Naselle 24.0543	Mixed	50,000	Feb '11	Feb '11		No	RFEG 10 Willapa Bay	Integrated
Naselle Tribs 24.0662	Coho	NA	Naselle 24.0543	Mixed	100,000	Feb '11	Feb '11		No	RFEG 10 Willapa Bay	Integrated
Naselle Tribs 24.0662	Coho	NA	Naselle 24.0543	Mixed	100,000	Feb '11	Feb '11		No	RFEG 10 Willapa Bay	Integrated
Naselle Tribs 24.0662	Coho				250,000						
N Nemah 24.0460	Chinook	Fall	Nemah 24.0460	Hatchery	2,800,000	May '11	June '11	AD	No	Nemah Hatchery	Segregated
N Nemah 24.0460	Chinook	Fall	Nemah 24.0460	Hatchery	200,000	May '11	June '11	AD	Yes	Nemah hatchery	Segregated
N Nemah 24.0460	Chinook				3,000,000						
North 24.0034	Chum	NA	North 24.0034	Hatchery	200,000	April '11	April '11		No	March Spawning Channel	Segregated
North 24.0034	Chum				200,000						
North 24.0034	Coho	NA	Willapa 24.0251	Mixed	270,000	April '11	April '11		No	March Spawning Channel	Integrated
North 24.0034	Coho				270,000						
North 24.0034	Steelhead	Winter	Willapa 24.0251	Hatchery	10,000	April '11	May '11	AD	No	March Spawning Channel	Segregated
North 24.0034	Steelhead				10,000						

Release site	Species	Run type	Stock	Brood origin	broodstock count	Start plant date	End plant date	Mark type	Cwt	Facility of origin	Program type
Oxbow 24.0344	Coho	NA	Willapa 24.0251	Mixed	250,000	Feb '11	Feb '11		No	RFEG 10 Willapa Bay	Integrated
Oxbow 24.0344	Coho				250,000						
Smith 24.0035	Steelhead	Winter	Willapa 24.0251	Hatchery	10,000	April '11	April '11	AD	No	Forks Creek Hatchery	Segregated
Smith 24.0035	Steelhead				10,000						
Stringer 24.0339	Coho	NA	Willapa 24.0251	Mixed	50,000	Jan '11	Jan '11		No	Pacific Co Anglers	Integrated
Stringer 24.0339	Coho				50,000						
Stringer 24.0339	Steelhead	Winter	Willapa 24.0251	Hatchery	15,000	Mar '11	May '11	AD	No	Pacific Co Anglers	Segregated
Stringer 24.0339	Steelhead				15,000						
Walker 24.0369	Coho	NA	Willapa 24.0251	Mixed	50,000	Jan '11	Jan '11		No	Pacific Co Anglers	Integrated
Walker 24.0369	Coho				50,000						
Willapa 24.0251	Coho	NA	Willapa 24.0251	Mixed	50,000	Jan '11	Jan '11		No	Pacific Co Anglers	Integrated
Willapa 24.0251	Coho				50,000						
Willapa SF 24.0277	Steelhead	Winter	Willapa 24.0251	Hatchery	10,000	April '11	April '11	AD	No	Forks Creek Hatchery	Segregated
Willapa SF 24.0277	Steelhead				10,000						

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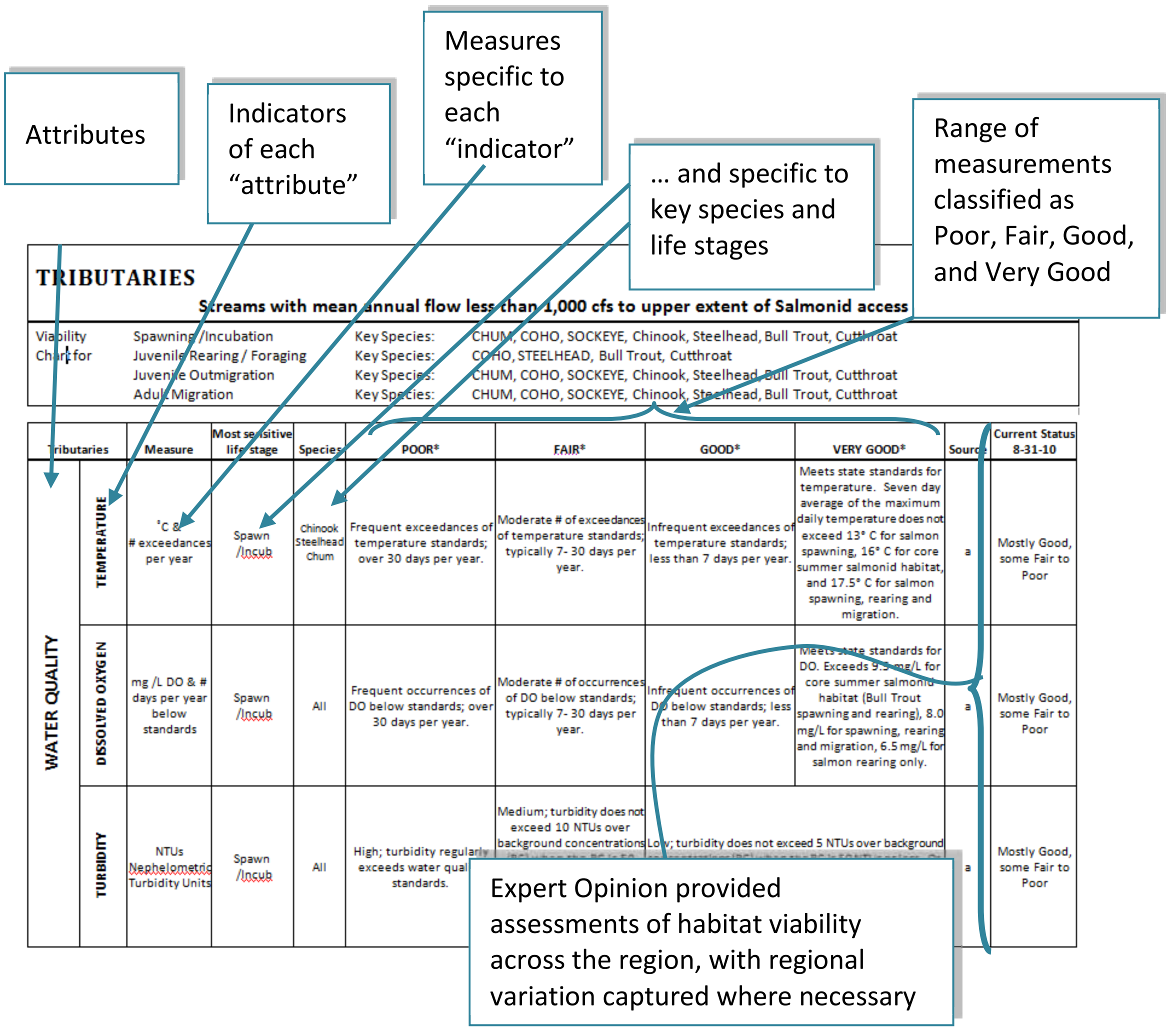
APPENDIX 7
HABITAT VIABILITY CHARTS AND ASSESSMENTS

Viability Charts for each Habitat Target



Based on the delineation of the eight habitat targets, the viability charts on the following pages were developed to answer the questions: What is critical for salmon health? And specifically, what is critical for the certain species at particular life stages that are most dependent on that habitat?

Developed with the help of the best fisheries scientists in the Region, these charts provide indicators and measures that assess the condition of each habitat and its viability to support healthy salmon populations.

The two left columns of each chart define what the technical contributors called "Key Salmon Attributes" and appropriate "Indicators." Specific metrics provide a means of rating the habitat's condition as it relates to the identified species and most sensitive life stage. See Technical Workshop and Viability Metrics in Appendix 13 for background and explanation of how these charts were developed.

Table 22. Viability Chart: HEADWATERS/UPLANDS

All landscape areas within a given drainage from its ridgeline down to 20% gradient, above Salmon access

Viability Chart for:	Headwater processes that affect downstream conditions for salmon	Coho, Steelhead, Bull Trout, and Cutthroat spend the most time in Tribs immediately below Headwaters.

HEADWATERS UPLANDS		Measure	Most sensitive life stage	Species	POOR	FAIR	GOOD	VERY GOOD	Source	Current Status 8-31-10
WATER QUALITY	Temperature	˚C & # exceedances per year	Migration	All	Frequent exceedances of temperature standards; over 30 days per year.	Moderate # of exceedances of temperature standards; typically 7- 30 days per year.	Infrequent exceedances of temperature standards; less than 7 days per year.	Meets state standards for temperature. Seven day average of the maximum daily temperature does not exceed 13° C for salmon spawning, 16° C for core summer salmon habitat, and 17.5° C for salmon spawning, rearing and migration.	a	South Region: Fair North Region: Good
WATER QUALITY	Dissolved Oxygen	mg/L DO & # days per year below standards	Migration	All	Frequent occurrences of DO below standards; over 30 days per year.	Moderate # of occurrences of DO below standards; typically 7- 30 days per year.	Infrequent occurrences of DO below standards; less than 7 days per year.	Meets state standards for DO. Exceeds 6.5 mg/L for salmon rearing and migration only.	a	South Region: Fair North Region: Good
WATER QUALITY	Turbidity	NTUs Nephelometric Turbidity Units	Migration	All	High; turbidity regularly exceeds water quality standards.	Medium; turbidity does not exceed 10 NTUs over background concentrations (BC) when the BC is 50 NTUs or less. Or, turbidity does not exceed a 20% increase over BC when the BC is greater than 50 NTUs.	Low; turbidity does not exceed 5 NTUs over background concentrations (BC) when the BC is 50 NTUs or less. Or, turbidity does not exceed a 10% increase over BC when the BC is greater than 50 NTUs.		a	South Region: Fair North Region: Good

HEADWATERS UPLANDS		Measure	Most sensitive life stage	Species	POOR	FAIR	GOOD	VERY GOOD	Source	Current Status 8-31-10
UPLANDS CONDITION	Buffer Width	Feet	Juvenile Rearing /Foraging	All	< 25	25 – 50	50 - 100	> 100	b	
UPLANDS CONDITION	Condition/ Composition	% intact & % natural	Juvenile Rearing /Foraging	All	Riparian reserve system is fragmented, poorly connected, or provides inadequate protection of habitats and refugia (<70% intact). Percent similarity of riparian vegetation to the potential natural community /composition: <25%.	Moderate loss of connectivity or function (shade, LWD recruitment, etc) of riparian reserve system, or incomplete protection of habitats and refugia (70-80% intact). Percent similarity of riparian vegetation to the potential natural community /composition: 25-50%	Riparian reserve system provides adequate shade, LWD recruitment, connectivity, and includes known refugia (80-90% intact). Percent similarity of riparian vegetation to the potential natural community /composition: 50-75%.	Riparian reserve system provides adequate shade, LWD recruitment, and connectivity in all subwatersheds, and includes known refugia (>90% intact). Percent similarity of riparian vegetation to the potential natural community /composition: >75%.	c	Poor to Fair with exceptions for Conservation areas
SEDIMENT NEEDS	Gravel	gravel abundance	spawning	All	Clean spawning gravel limited or absent throughout watershed	Clean spawning gravel is present in less than a majority of the watershed as appropriate to geomorphic setting	Clean spawning gravel present in majority of watershed as appropriate to geomorphic setting	Extent of clean spawning gravels abundant and appropriate to geomorphic setting throughout watershed	a	Fair to Good with a few Poor areas
WATER QUANTITY	Seral Stage	natural/mature dominance	All	All	Immature	<- - - - - - - - - - -	- - - - - - - - - - - ->	Fully mature		South Region: Poor To Fair North Region: Fair To Good, Very Good In Park

Table 23. Viability Chart: WETLANDS

Everything that salmon can get into that is not a mainstem, tributary, lake, estuary, nearshore, or ocean

Viability Chart for:			
	Off-Channel Spawning/Rearing	Key Species:	COHO, Cutthroat
	Juvenile Rearing/Foraging	Key Species:	COHO, Cutthroat
	Juvenile Refugia/Holding	Key Species:	COHO, Cutthroat
	Adult Migration/Staging	Key Species:	COHO, Cutthroat

WETLANDS		Measure	Most sensitive life stage	Species	POOR	FAIR	GOOD	VERY GOOD	Source	Current Status 8-31-10
WATER QUALITY	Temperature	˚C & # exceedances per year	Spawn /Incub	Chinook Steelhead Chum	Frequent exceedances of temperature standards; over 30 days per year.	Moderate # of exceedances of temperature standards; typically 7- 30 days per year.	Infrequent exceedances of temperature standards; less than 7 days per year.	Meets state standards for temperature. Seven day average of the maximum daily temperature does not exceed 13° C for salmon spawning, 16° C for core summer salmon habitat, and 17.5° C for salmon spawning, rearing and migration.	a	WRIAs 22, 23, 24 Poor – Fair
WATER QUALITY	Dissolved Oxygen	mg/L DO & # days per year below standards	Spawn /Incub	All	Frequent occurrences of DO below standards; over 30 days per year.	Moderate # of occurrences of DO below standards; typically 7- 30 days per year.	Infrequent occurrences of DO below standards; less than 7 days per year.	Meets state standards for DO. Exceeds 9.5 mg/L for core summer salmon habitat (Bull Trout spawning and rearing), 8.0 mg/L for spawning, rearing and migration, 6.5 mg/L for salmon rearing only.	a	WRIAs 22, 23, 24 Fair
WATER QUALITY	Turbidity	NTUs Nephelometric Turbidity Units	Spawn /Incub	All	High; turbidity regularly exceeds water quality standards.	Medium; turbidity does not exceed 10 NTUs over background concentrations (BC) when the BC is 50 NTUs or less. Or, turbidity does not exceed a 20% increase over BC when the BC is greater than 50 NTUs.	Low; turbidity does not exceed 5 NTUs over background concentrations (BC) when the BC is 50 NTUs or less. Or, turbidity does not exceed a 10% increase over BC when the BC is greater than 50 NTUs.		a	WRIAs 22, 23, 24 Poor – Fair

WETLANDS		Measure	Most sensitive life stage	Species	POOR	FAIR	GOOD	VERY GOOD	Source	Current Status 8-31-10
RIPARIAN CONDITION	Buffer Width	Feet	All	All	< 50 for wetlands greater than 1 acre; < 25 for wetlands less than 1 acre	50 -100 for wetlands greater than 1 acre; 25 - 50 for wetlands less than 1 acre	100 - 200 for wetlands greater than 1 acre; 50 - 100 for wetlands less than 1 acre	> 200 for wetlands greater than 1 acre; > 100 for wetlands less than 1 acre	b	WRIAs 22, 23, 24 Poor – Fair
RIPARIAN CONDITION	Condition /Composition	% intact & % natural	All	All	Riparian reserve system is fragmented, poorly connected, or provides inadequate protection of habitats and refugia (<70% intact). Percent similarity of riparian vegetation to the potential natural community /composition: <25%.	Moderate loss of connectivity or function (shade, LWD recruitment, etc) of riparian reserve system, or incomplete protection of habitats and refugia (70-80% intact). Percent similarity of riparian vegetation to the potential natural community /composition: 25-50%	Riparian reserve system provides adequate shade, LWD recruitment, connectivity, and includes known refugia (80-90% intact). Percent similarity of riparian vegetation to the potential natural community /composition: 50-75%.	Riparian reserve system provides adequate shade, LWD recruitment, and connectivity in all subwatersheds, and includes known refugia (>90% intact). Percent similarity of riparian vegetation to the potential natural community /composition: >75%.	c	WRIAs 22, 23, 24 Poor – Fair
FLOODPLAIN /CONNECTIVITY	Habitat Refugia	See RATINGS ("Poor, Fair, Good, Very Good")	Juvenile Refugia /Holding	Chum, Chinook	Habitat refugia are uncommon, nonexistent, small and/or fragmented, and many are not adequately buffered.	Habitat refugia exist in less than 50% of the watershed and some have been reduced in size. Existing refugia may have inadequate buffering.	Habitat refugia are still present in majority of the watershed. Existing refugia have adequate buffering.	Refugia for fish species to survive natural disturbances, including wetlands, oxbows, pools, overhanging banks and vegetation and late succession forests, are widely available throughout the watershed as appropriate to geomorphic setting. These habitats are adequately buffered from human disturbances.	c	WRIAs 22, 23, 24 Poor

WETLANDS		Measure	Most sensitive life stage	Species	POOR	FAIR	GOOD	VERY GOOD	Source	Current Status 8-31-10
SEDIMENT NEEDS	Fines And Embeddedness	% Fines and Embeddedness combined	Spawning/ Incubation	All	>16%	14% - 16%	12% - 14%	<11%	d	WRIAs 22, 23, 24 Poor – Fair
IN-WATER VEGETATION	Presence Of Native Vegetation Species	Dominance native v. non-native species	Juvenile Rearing /Foraging	All	Community structure dominated by non-native species.	Community structure dominated equally by native and non-native species.	Community structure dominated by native species, but some exotic species present.	Community structure dominated by native species.	d	WRIAs 22, 23, 24 Fair

Table 24. Viability Chart: TRIBUTARIES

Streams with mean annual flow less than 1,000 cfs to upper extent of Salmon access

Viability Chart for:	Spawning /Incubation	Key Species:	CHUM, COHO, SOCKEYE, Chinook, Steelhead, Bull Trout, Cutthroat
	Juvenile Rearing / Foraging	Key Species:	COHO, STEELHEAD, Bull Trout, Cutthroat
	Juvenile Outmigration	Key Species:	CHUM, COHO, SOCKEYE, Chinook, Steelhead, Bull Trout, Cutthroat
	Adult Migration	Key Species:	CHUM, COHO, SOCKEYE, Chinook, Steelhead, Bull Trout, Cutthroat

TRIBUTARIES		Measure	Most sensitive life stage	Species	POOR	FAIR	GOOD	VERY GOOD	Source	Current Status 8-31-10
WATER QUALITY	Temperature	˚C & # exceedances per year	Spawn /Incub	Chinook Steelhead Chum	Frequent exceedances of temperature standards; over 30 days per year.	Moderate # of exceedances of temperature standards; typically 7- 30 days per year.	Infrequent exceedances of temperature standards; less than 7 days per year.	Meets state standards for temperature. Seven day average of the maximum daily temperature does not exceed 13° C for salmon spawning, 16° C for core summer salmon habitat, and 17.5° C for salmon spawning, rearing and migration.	a	Mostly Good, some Fair to Poor
WATER QUALITY	Dissolved Oxygen	mg /L DO & # days per year below standards	Spawn /Incub	All	Frequent occurrences of DO below standards; over 30 days per year.	Moderate # of occurrences of DO below standards; typically 7- 30 days per year.	Infrequent occurrences of DO below standards; less than 7 days per year.	Meets state standards for DO. Exceeds 9.5 mg/L for core summer salmon habitat (Bull Trout spawning and rearing), 8.0 mg/L for spawning, rearing and migration, 6.5 mg/L for salmon rearing only.	a	Mostly Good, some Fair to Poor
WATER QUALITY	Turbidity	NTUs Nephelometric Turbidity Units	Spawn /Incub	All	High; turbidity regularly exceeds water quality standards.	Medium; turbidity does not exceed 10 NTUs over background concentrations (BC) when the BC is 50 NTUs or less. Or, turbidity does not exceed a 20% increase over BC when the BC is greater than 50 NTUs.	Low; turbidity does not exceed 5 NTUs over background concentrations (BC) when the BC is 50 NTUs or less. Or, turbidity does not exceed a 10% increase over BC when the BC is greater than 50 NTUs.		a	Mostly Good, some Fair to Poor

TRIBUTARIES		Measure	Most sensitive life stage	Species	POOR	FAIR	GOOD	VERY GOOD	Source	Current Status 8-31-10
RIPARIAN CONDITION	Buffer Width	Feet	All	All	< 50	50 – 100	100 - 215	> 215	b	Poor in Ag. & Residential; Good in Commercial Forest & Conservation areas
	Condition/ Composition	% intact & # natural	All	All	Riparian reserve system is fragmented, poorly connected, or provides inadequate protection of habitats and refugia (<70% intact). Percent similarity of riparian vegetation to the potential natural community /composition: <25%.	Moderate loss of connectivity or function (shade, LWD recruitment, etc) of riparian reserve system, or incomplete protection of habitats and refugia (70-80% intact). Percent similarity of riparian vegetation to the potential natural community /composition: 25-50%	Riparian reserve system provides adequate shade, LWD recruitment, connectivity, and includes known refugia (80-90% intact). Percent similarity of riparian vegetation to the potential natural community /composition: 50-75%.	Riparian reserve system provides adequate shade, LWD recruitment, and connectivity in all subwatersheds, and includes known refugia (>90% intact). Percent similarity of riparian vegetation to the potential natural community /composition: >75%.	c	Poor to Fair in Ag & Residential; Fair to Good in Commercial Forestry; Good to Very Good in Conservation areas
LWD	LWD	See Ratings (Poor, Fair, Good, Very Good) for description	All	All	LWD recruitment is infrequent to non-existent.	LWD recruitment still occurs in up to 50% of watershed, but trees are rarely mature.	LWD recruitment frequent in majority of watershed.	Large sized LWD recruitment (including conifers) frequent throughout watershed.	c	Poor to Fair, improving in Forestry

TRIBUTARIES		Measure	Most sensitive life stage	Species	POOR	FAIR	GOOD	VERY GOOD	Source	Current Status 8-31-10
FLOODPLAIN / CONNECTIVITY	Aquatic Types & Conditions	See RATINGS (Poor, Fair, Good, Very Good)	Juvenile Rearing & Spawning /Incubation	All	One aquatic habitat type is dominant. Off-channel habitat is limited or absent. Floodplain habitats limited and not connected below a 10-yr. event. Local habitat is fairly distant from upstream / downstream, and aquatic and terrestrial habitats are typically isolated.	Off-channel habitat areas, if present at site, have low flow or other accessibility difficulties. Riparian and floodplain habitats still function, but are disturbed and /or fragmented. Local habitat is partially fragmented from adjacent upstream /downstream habitats by roads, bridges or other human development.	Off-channel habitat areas, if present at site, are accessible at least during the winter and spring flows. Riparian and floodplain areas are generally well connected to upstream / downstream areas.	Off-channel habitat areas, if present at site, are accessible at most or all flows. Riparian and floodplain areas provide a diverse mix of habitat types and local habitat is well connected to upstream and downstream areas.	a	Fair to Good except in some Ag. & Residential areas
SEDIMENT NEEDS	Fines And Embeddedness	% Fines & Embeddedness combined	Spawning / Incubation	All	>16%	14% - 16%	12% - 14%	<11%	a	South Region: Poor to Fair North Region: Fair to Good
	Gravel	Gravel & Cobble Dominance	Spawning / Incubation	All	Bedrock, sand, silt or small gravel dominant	Gravel and cobble is subdominant	Dominant substrate is gravel or cobble		c	WRIA 24: Poor to Fair Rest of Region: Fair to Good
FORAGE ABUNDANCE	Macro-Invertebrates	IBI: Multimetric index score	Juvenile Rearing / Foraging	All	< 20	20 – 30	30 - 40	40 – 50	e	Poor in disturbed Residential & Ag. Areas; Fair to Very Good elsewhere

TRIBUTARIES		Measure	Most sensitive life stage	Species	POOR	FAIR	GOOD	VERY GOOD	Source	Current Status 8-31-10
ABUNDANCE	Marine Derived Nutrients	Escapement goals	Juvenile Rearing / Foraging	Coho, Chum	Escapement goals not met three years in a row	Not consistently meeting escapement goals	Consistently meeting escapement goals	Exceeding escapement goals	d	Poor to Good
ABUNDANCE	Run Size	Escapement Goals	Adult Migration	All	Does not meet escapement goals.	Sometimes meets escapement goals.	Meets escapement goals.	Exceeds escapement goals.	e	Poor to Good
WATER QUANTITY	Hydrology	See RATINGS (Poor, Fair, Good, Very Good)	Spawning /Incubation and Juvenile Rearing Foraging	All	Significant changes in hydrologic regime. Base flows, peak flows, and flow timing characteristics all modified such as from dams, water withdrawals, land uses, etc.	Changes in hydrologic regime from undisturbed conditions are moderate; base flows and/or peak flows are reduced due to small dams, water withdrawals and/or reduced groundwater discharge from land uses.	Hydrologic regime has minimal changes from undisturbed conditions. One element may have been modified. Effect is felt primarily in a portion of the basin rather than throughout the watershed.	Hydrologic regime (i.e., peak flows, base flows, and flow timing characteristics) similar to undisturbed conditions throughout most of the watershed. No dams or significant withdrawals occur in the watershed.	a	WRIA 23: Poor to Fair Rest of Region: Fair to Good
POOL FREQUENCY AND QUALITY	Pool Frequency And Quality	See RATINGS (Poor, Fair, Good, Very Good)	Juvenile Rearing Foraging and Juvenile Outmigration	All	Pools that are present frequently lack sufficient depth or surface cover.	Pools with sufficient depth and surface cover are moderately available, but many pools present without cover.	Pools with sufficient depth and surface cover frequent throughout watershed.	Pools with sufficient depth (> 3 ft) and surface cover (LWD, overhanging banks and vegetation) occur approximately 50-50 with riffles, or as appropriate for larger channels.	a	Poor to Fair in Developed areas; Good elsewhere

Table 25. Viability Chart: LAKES

Coast Region Sockeye Lakes: Ozette, Pleasant and Quinault

Viability Chart for:	Spawning/Incubation	Key Species:	Sockeye
	Juvenile Rearing/Foraging	Key Species:	Coho, Sockeye
	Adult Migration/Staging	Key Species:	Bull Trout, Sockeye, Steelhead (freshwater phenotype), Cutthroat

LAKES		Measure	Most sensitive life stage	Species	POOR	FAIR	GOOD	VERY GOOD	Source	Current Status 8-31-10
WATER QUALITY	Temperature	# exceedances per year	Spawning/ Incubation	Sockeye	Frequent exceedances of temperature standards; over 30 days per year.	Moderate # of exceedances of temperature standards; typically 7- 30 days per year.	Infrequent exceedances of temperature standards; less than 7 days per year.	Meets state standards for temperature. Seven day average of the maximum daily temperature does not exceed 13° C for salmon spawning, 16° C for core summer salmon habitat, and 17.5° C for salmon spawning, rearing and migration.	a	**Lake Quinault** Very good w/in bkgd range & variation **Lake Pleasant** Good **Lake Ozette** Good
WATER QUALITY	Temperature	˚C	Juvenile rearing and Adult Migration /Staging	Sockeye	Poor to no growth at < 4˚ C and > 20 ˚ C	Growth fair at 4 - 5˚ C and 18 - 20 ˚ C	Growth good at 7 to 13 ˚ C diel thermocycle	Highest growth at 5˚ to 15-17 ˚ C diel thermocycle	i	**Lake Quinault** Very good w/in bkgd range & variation **Lake Pleasant** Good **Lake Ozette** Good
WATER QUALITY	Dissolved Oxygen	mg/L DO & # days per year below standards	Spawning/ Incubation	Sockeye	Frequent occurrences of DO below standards; over 30 days per year.	Moderate # of occurrences of DO below standards; typically 7- 30 days per year.	Infrequent occurrences of DO below standards; less than 7 days per year.	Meets state standards for DO. Exceeds 9.5 mg/L for core summer salmon habitat (Bull Trout spawning and rearing), 8.0 mg/L for spawning, rearing and migration, 6.5 mg/L for salmon rearing only.	a	**Lake Quinault** Very good w/in bkgd range & variation **Lake Pleasant** Good **Lake Ozette** Good

LAKES		Measure	Most sensitive life stage	Species	POOR	FAIR	GOOD	VERY GOOD	Source	Current Status 8-31-10
	Turbidity	NTUs Nephelometric Turbidity Units	Spawning/ Incubation	Sockeye	High; turbidity regularly exceeds water quality standards.	Medium; turbidity does not exceed 10 NTUs over background concentrations (BC) when the BC is 50 NTUs or less. Or, turbidity does not exceed a 20% increase over BC when the BC is greater than 50 NTUs.	Low; turbidity does not exceed 5 NTUs over background concentrations (BC) when the BC is 50 NTUs or less. Or, turbidity does not exceed a 10% increase over BC when the BC is greater than 50 NTUs.		a	**Lake Quinault** n/a w/in bkgd range & variation; haven't evaluted NTU using State WQS; secchi depth (water clarity) should be added) **Lake Pleasant** Good **Lake Ozette** Poor
SHORELINE CONDITION	**Buffer Width**	Feet	Juvenile Rearing /Foraging	All	< 50	50 – 100	100 - 215	> 215	b	**Lake Quinault** Fair-moderate shoreline development & riparian vegetation alterations **Lake Pleasant** Fair **Lake Ozette** Good
SHORELINE CONDITION	**Condition/ Composition**	% intact & % natural	Juvenile Rearing/Foraging	All	Riparian reserve system is fragmented, poorly connected, or provides inadequate protection of habitats and refugia (<70% intact). Percent similarity of riparian vegetation to the potential natural community /composition: <25%.	Moderate loss of connectivity or function (shade, LWD recruitment, etc) of riparian reserve system, or incomplete protection of habitats and refugia (70-80% intact). Percent similarity of riparian vegetation to the potential natural community /composition: 25-50%	Riparian reserve system provides adequate shade, LWD recruitment, connectivity, and includes known refugia (80-90% intact). Percent similarity of riparian vegetation to the potential natural community /composition: 50-75%.	Riparian reserve system provides adequate shade, LWD recruitment, and connectivity in all subwatersheds, and includes known refugia (>90% intact). Percent similarity of riparian vegetation to the potential natural community /composition: >75%.	c	**Lake Quinault** Fair-moderate shoreline development & riparian vegetation alterations **Lake Pleasant** Fair **Lake Ozette** Fair

LAKES		Measure	Most sensitive life stage	Species	POOR	FAIR	GOOD	VERY GOOD	Source	Current Status 8-31-10
FORAGE ABUNDANCE	Forage Abundance	ZOOPLANKTON TRAWL INDEX	Juvenile Rearing/ Foraging	All	Few prey items of any size or motility	Small and evasive prey dominant	Mix of large non-evasive and small or evasive prey (e.g., *Diaphanosoma*)	Large non-evasive prey (e.g., *Daphnia*) abundant	b	**Lake Quinault** Fair to Poor w/in natural range & variation as degraded habitat **Lake Pleasant** Good **Lake Ozette** Good

Table 26. Viability Chart: MAINSTEMS

Rivers and Streams with mean annual flow of 1,000 CFS or greater (Shorelines of State Significance) [See Appendix 9 for list.]

Viability Chart for:	Spawning /Incubation	Key Species:	CHINOOK, STEELHEAD, (Chum)
	Juvenile Rearing / Foraging	Key Species:	CHINOOK, COHO, STEELHEAD, BULL TROUT, CUTTHROAT
	Adult Migration/Staging	Key Species:	CHINOOK, COHO, STEELHEAD, Sockeye, Chum, Bull Trout, Cutthroat
	Juvenile Outmigration	Key Species:	CHINOOK, COHO, STEELHEAD, Sockeye, Chum, Bull Trout, Cutthroat

MAINSTEMS		Measure	Most sensitive life stage	Species	POOR	FAIR	GOOD	VERY GOOD	Source	Current Status 9-3-10
WATER QUALITY	Temperature	˚C & # exceedances per year	Spawn /Incub	Chinook Steelhead Chum	Frequent exceedances of temperature standards; over 30 days per year.	Moderate # of exceedances of temperature standards; typically 7- 30 days per year.	Infrequent exceedances of temperature standards; less than 7 days per year.	Meets state standards for temperature. Seven day average of the maximum daily temperature does not exceed 13° C for salmon spawning, 16° C for core summer salmon habitat, and 17.5° C for salmon spawning, rearing and migration	a	Some of WRIA 23: Poor Most of the rest of the Region: Fair to Good
WATER QUALITY	Dissolved Oxygen	mg/L DO & # days per year below standards	Spawn /Incub	All	Frequent occurrences of DO below standards; over 30 days per year.	Moderate # of occurrences of DO below standards; typically 7- 30 days per year.	Infrequent occurrences of DO below standards; less than 7 days per year.	Meets state standards for DO. Exceeds 9.5 mg/L for core summer salmon habitat (Bull Trout spawning and rearing), 8.0 mg/L for spawning, rearing and migration, 6.5 mg/L for salmon rearing only.	a	Some of WRIA 23: Fair Most of the rest of the Region: Good
WATER QUALITY	Turbidity	NTUs Nephelometric Turbidity Units	Spawn /Incub	All	High; turbidity regularly exceeds water quality standards.	Medium; turbidity does not exceed 10 NTUs over background concentrations (BC) when the BC is 50 NTUs or less. Or, turbidity does not exceed a 20% increase over BC when the BC is greater than 50 NTUs.	Low; turbidity does not exceed 5 NTUs over background concentrations (BC) when the BC is 50 NTUs or less. Or, turbidity does not exceed a 10% increase over BC when the BC is greater than 50 NTUs.		a	Wynoochee & Skookumchuck below dams: Poor Most of the rest of the Region: Fair

MAINSTEMS		Measure	Most sensitive life stage	Species	POOR	FAIR	GOOD	VERY GOOD	Source	Current Status 9-3-10
RIPARIAN CONDITION	Buffer Width	Feet	All	All	< 50	50 - 100	100 - 215	> 215	b	Poor to Fair
	Condition / Composition	% intact & % natural	All	All	Riparian reserve system is fragmented, poorly connected, or provides inadequate protection of habitats and refugia (<70% intact). Percent similarity of riparian vegetation to the potential natural community /composition: <25%.	Moderate loss of connectivity or function (shade, LWD recruitment, etc) of riparian reserve system, or incomplete protection of habitats and refugia (70-80% intact). Percent similarity of riparian vegetation to the potential natural community /composition: 25-50%	Riparian reserve system provides adequate shade, LWD recruitment, connectivity, and includes known refugia (80-90% intact). Percent similarity of riparian vegetation to the potential natural community /composition: 50-75%.	Riparian reserve system provides adequate shade, LWD recruitment, and connectivity in all subwatersheds, and includes known refugia (>90% intact). Percent similarity of riparian vegetation to the potential natural community /composition: >75%.	c	Poor to Fair
LWD	LWD	See Ratings ("Poor, Fair, Good, Very Good) for description	All	All	LWD recruitment is infrequent to non-existent.	LWD recruitment still occurs in up to 50% of watershed, but trees are rarely mature.	LWD recruitment frequent in majority of watershed.	Large sized LWD recruitment (including conifers) frequent throughout watershed.	c	South Region: Poor to Fair North Region: Fair

MAINSTEMS		Measure	Most sensitive life stage	Species	POOR	FAIR	GOOD	VERY GOOD	Source	Current Status 9-3-10
FLOODPLAIN / CONNECTIVITY	Aquatic Types And Conditions	See RATINGS ("Poor, Fair, Good, Very Good")	Juvenile Rearing /Foraging	All	One aquatic habitat type is dominant. Off-channel habitat is limited or absent. Floodplain habitats limited and not connected below a 10-yr. event. Local habitat is fairly distant from upstream/ downstream, and aquatic and terrestrial habitats are typically isolated.	Off-channel habitat areas, if present at site, have low flow or other accessibility difficulties. Riparian and floodplain habitats still function, but are disturbed and/or fragmented. Local habitat is partially fragmented from adjacent upstream/downstream habitats by roads, bridges or other human development.	Off-channel habitat areas, if present at site, are accessible at least during the winter and spring flows. Riparian and floodplain areas are generally well connected to upstream/ downstream areas.	Off-channel habitat areas, if present at site, are accessible at most or all flows. Riparian and floodplain areas provide a diverse mix of habitat types and local habitat is well connected to upstream and downstream areas.	a	South Region: Fair North Region: Mostly good, a few exceptions
SEDIMENT NEEDS	Fines And Embeddedness	% Fines and Embeddedness combined	Spawning/ Incubation	All	>16%	14% - 16%	12% - 14%	<11%	a	WRIAs 23 and 24: Poor to Fair Rest of region: Fair to occasionally Good
ABUNDANCE	Run Size	Escapement Goals	Adult Migration	All	Does not meet escapement goals.	Sometimes meets escapement goals.	Meets escapement goals.	Exceeds escapement goals.	d	Fair with Poor areas and species

Table 27. Viability Chart: ESTUARIES

From the head of tide to the outermost headlands separating the estuary from the ocean

Viability Chart for:	Juvenile Rearing/Foraging	Key Species:	CHUM, CHINOOK, COHO
	Juvenile Outmigration	Key Species:	CHUM, CHINOOK, COHO, Steelhead, Sockeye, Bull Trout, Cutthroat
	Adult Foraging	Key Species:	Bull Trout, Cutthroat

ESTUARIES		Measure	Most sensitive life stage	Species	POOR	FAIR	GOOD	VERY GOOD	Source	Current Status 8-31-10
WATER QUALITY	Temperature	˚C	Adult Migration /Staging	All	> 22˚C	19.0˚C - 22˚C	16.0˚C	13.0˚C	j	WRIAs 22, 23, 24 Poor – Fair
WATER QUALITY	Dissolved Oxygen	1-day minimum in m/L DO	Adult Migration /Staging	All	< 4.0 mg/L	4.0 mg/L	5.0 mg/L	> 6.0 mg/L	a	WRIAs 22, 23, 24 Poor – Fair
WATER QUALITY	Sediment/ Nutrient Input	See Ratings ("Poor, Fair, Good, Very Good")	All	All	Gross interruption of estuarine circulation and nutrient and sediment delivery	Fairly significant interruption of estuarine circulation and nutrient and sediment delivery	Moderate interruption of estuarine circulation and nutrient and sediment delivery	Fresh water inflow and other hydrologic circulation patterns and sediment and nutrient inputs are similar to historic conditions.	c	Poor

ESTUARIES		Measure	Most sensitive life stage	Species	POOR	FAIR	GOOD	VERY GOOD	Source	Current Status 8-31-10
LWD	LWD	See Ratings ("Poor, Fair, Good, Very Good") for description	All	All	Large-sized (key piece) LWD recruitment is infrequent to non-existent.	Large-sized (key piece) LWD recruitment still occurs in up to 50% of watershed, but trees are rarely mature.	Large-sized (key piece) LWD recruitment frequent in majority of watershed.	Large-sized (key piece) LWD recruitment frequent throughout watershed.	b	WRIAs 22, 23, 24 Poor
	Eelgrass								k	
SHORELINE CONDITION	Buffer Width	feet		All	< 50	50 - 100	100 -215	> 215	b	WRIAs 22, 23, 24 Poor – Fair
	Condition/Composition	% intact & % natural	All	All	Riparian reserve system is fragmented, poorly connected, or provides inadequate protection of habitats and refugia (<70% intact). Percent similarity of riparian vegetation to the potential natural community /composition: <25%.	Moderate loss of connectivity or function (shade, LWD recruitment, etc) of riparian reserve system, or incomplete protection of habitats and refugia (70-80% intact). Percent similarity of riparian vegetation to the potential natural community/ composition: 25-50%	Riparian reserve system provides adequate shade, LWD recruitment, connectivity, and includes known refugia (80-90% intact). Percent similarity of riparian vegetation to the potential natural community/ composition: 50-75%.	Riparian reserve system provides adequate shade, LWD recruitment, and connectivity in all subwatersheds, and includes known refugia (>90% intact). Percent similarity of riparian vegetation to the potential natural community/ composition: >75%.	c	WRIAs 22, 23, 24 Poor

ESTUARIES		Measure	Most sensitive life stage	Species	POOR	FAIR	GOOD	VERY GOOD	Source	Current Status 8-31-10
FORAGE ABUNDANCE	Mudflat Productivity	k. per sq. meter corophium salmonis	Juvenile Rearing /Foraging	Chinook Chum	*Corophium salmonis* not present	< 100 k. per sq. meter *corophium salmonis*	100 - 500 k. per sq. meter *corophium salmonis*	> 500 k. per sq. meter *corophium salmonis*	l	WRIAs 22, 23, 24 Poor – Fair
	Annual Trends	meters of shoreline with eggs	Juvenile Rearing /Foraging	All						WRIAs 22, 23, 24 Poor – Fair
ESTUARINE EXTENT	Estuarine Quantity	% intact historic	All	All	< 50% of pre-modification area or volume; low diversity of habitats.	50 - 80% of pre-modification area or volume and diversity of habitats.	Estuary provides for most (greater than 80% intact) of its historical area extent and diversity of shallow water habitat types including vegetated wetlands and marshes, tidal channels, submerged aquatic vegetation, tidal flats and large woody material.		b	WRIAs 22, 23, 24 Poor
ESTUARINE ABUNDANCE	Run Size	Escapement Goals	All	All	Does not meet escapement goals.	Sometimes meets escapement goals.	Meets escapement goals.	Exceeds escapement goals.		WRIAs 22, 23, 24 Poor – Good

Table 28. Viability Chart: NEARSHORE

Photic zone up to the ordinary high water line (< 60 ft)

Viability Chart for:	Juvenile Rearing/Foraging Adult Migration/Foraging	Key Species: Key Species:	Chinook, Bull Trout, Cutthroat Bull Trout, Cutthroat

NEARSHORE		Measure	Most sensitive life stage	Species	POOR	FAIR	GOOD	VERY GOOD	Source	Current Status 9-3-10
WATER QUALITY	General Nearshore Water Quality	% coverage of eelgrass in reference areas.	Juvenile Rearing/ Foraging	Chinook					f	South Coast: Unknown
WATER QUALITY	Available Forage In The Nearshore	Trends in nesting success of seabird Rhinoceros Auklet on Tatoosh & Destruction Islands.	Juvenile Rearing/ Foraging & Adult Foraging	Chinook					g	Region: Unknown
WATER QUALITY	Nearshore Water Quality	% coverage of kelp in reference areas.	Juvenile Rearing/ Foraging & Adult Foraging	Chinook					h	Region: Unknown

Table 29. Viability Chart: OCEAN

Everything Waterward of 60 ft.

Viability Chart for:			
	Juvenile Foraging	Key Species:	Chinook, Coho, Chum, Sockeye, Steelhead
	Adult Foraging	Key Species:	Chinook, Coho, Chum, Sockeye, Steelhead

OCEAN		Measure	Most sensitive life stage	Species	POOR	FAIR	GOOD	VERY GOOD	Source	Current Status 8-31-10
PDO	Annual Trend In The PDO Index	PDO Regime Type	Juvenile Foraging	All	Warm regime	Neutral phase	Cool regime <10 years	Extended cool regime >10 years	m	Neutral/ Good
ENSO	Annual Trend In The ENSO Index[40]	MEI Multivariate ENSO Index	(Sub)Adult Foraging	All	>1	1 to 0	0 to -1	-1 to -2	n	Good

[40] Annual trend in the M-ENSO index relative to size of returning adult salmon by species

OCEAN		Measure	Most sensitive life stage	Species	POOR	FAIR	GOOD	VERY GOOD	Source	Current Status 8-31-10
FORAGE ABUNDANCE	Annual Copepod Diversity Index	# of Northern vs Southern Zooplankton	(Sub)Adult Foraging	All	Low # of low-fat Southern Zooplankton	High # of Zooplankton but all low-fat Southern	Mix of low-fat Southern and high-fat Northern Zooplankton	High # of high-fat Northern Zooplankton	o	Fair/Good
JUVENILE SALMON SAMPLING	Annual June Spring Chinook Juv. Sampling	# per kilometer towed	(Sub)Adult Foraging	Spring Chinook	< 1	1 to 3	3 to 5	5 to 7	b	FAIR
	Annual September Coho Juvenile Sampling	# per kilometer towed	(Sub)Adult Foraging	Coho	< 1	1 to 3	3 to 5	5 to 7	b	POOR
WATER QUALITY	Ocean Acidity	pH	(Sub)Adult Foraging	All	< 7.8	7.8	7.9	8.9	p	7.8 (Fair)

Sources/References for Appendix 7

[a] US Army Corps of Engineers, *Centralia flood damage reduction project, Chehalis River, Washington, Final environmental impact statement, Appendix A: Fish, riparian, and wildlife habitat study, June 2003*; and *Chapter 173-201A WAC: Water quality standards for surface waters of the state of Washington*, State of Washington.

[b] Department of Natural Resources (DNR), *Forest practices habitat conservation plan* (p. 190) and *Riparian forest restoration strategy*

[c] National Marine Fisheries Service Environmental and Technical Services Division, Habitat Conservation Branch. August 1996. *Making Endangered Species Act determinations of effect for individual or grouped actions at the watershed scale*, Table 3-3.

[d] WCSSP Planning Committee Work Group

[e] Pacific Northwest Aquatic Monitoring Partnership, *Methods for the collection and analysis of benthic macroinvertebrate assemblages in wadeable streams of the Pacific Northwest* , p. 19.

[f] Thom, R.M., A.B. Borde, S. Rumrill, D.L. Woodruff, G.D. Williams, J.A. Southard, and S.L. Sargeant. Factors influencing spatial and annual variability in eelgrass meadows in Willapa Bay, Washington and Coos Bay, Oregon estuaries. *Estuaries* 2003 26: 1117-1129. Online at: http://www.jstor.org/pss/1353389

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2) Roth, J.E., K.L. Mills, and W.J. Sydeman. 2007. Chinook salmon - seabird co-variation off central California: Possible forecasting applications. *Canadian Journal of Fisheries and Aquatic Sciences* 64: 1080-1090.
3) Pearson, S.F., P.J. Hodum, M. Schrimf, J. Doliver, T.P. Good, and J.K. Parish. 2009. *Rhinoceros Auklet (Cerorhina Monocerta) burrow counts, burrow density, occupancy rates and associated habitat variables on Protection Island, Washington: 2008 Research Progress Report*. Wildlife Science Division, Department of Fish & Wildlife, State of Washington, Olympia WA, 23 p.

[h] Berry, H.D., T.F. Mumford, Jr., and P. Dowty. 2005. *Using historical data to estimate changes in floating kelp*. Proceedings of the Puget Sound/Georgia Basin Research Conference, March 28-31, 2005. Department of Natural Resources, State of Washington, Olympia, WA. Online at: http://www.dnr.wa.gov/Publications/aqr_nrsh_floating_kelpbed.pdf

[i] Burgner, R. 1991. Life history of sockeye salmon. In: Groot, D and L. Margolis (eds.). *Pacific Salmon Life History*, pp. 41-42.

[j] Department of Ecology, *Water Quality Standards; Marine water designated uses and criteria 173-201A-210 WAC,* State of Washington. Online at: http://apps.leg.wa.gov/wac/default.aspx?cite=173-201A-210

[k] Department of Natural Resources, State of Washington, data no longer available.

[l] Simenstad, C.A. 1984. *Epibenthic organisms of the Columbia River estuary: Final Report on the epibenthic organisms work unit of the Columbia River Estuary Data Development Program.* College of Ocean and Fishery Sciences, University of Washington, Seattle, WA.

[m] http://www.nwfsc.noaa.gov/research/divisions/fed/oeip/kb-juvenile-salmon-sampling.cfm

[n] http://www.nwfsc.noaa.gov/research/divisions/fed/oeip/b-latest-updates.cfm

[o] Work of Ed Casillas, NOAA's National Marine Fisheries Service (NMFS).

[p] "Ocean Acidification in Washington," presentation at Ocean Caucus Public Meeting in Westport, WA, April 17, 2010 by Dr. Adrienne Sutton, NOAA Pacific Marine Environmental Lab.

APPENDIX 8
SELECTED SOURCES USED IN VIABILITY CHARTS

On the following pages, there are three documents used in development of the Habitat Viability Charts in Appendix 7. As noted in the Viability Charts and Sources/References, there were other documents used, but these are the main ones.

Table 30: REVISED EVALUATION METHODOLOGIES FOR WETLAND HABITATS (4 pp.) Table 5.2-1 from:

Centralia Flood Damage Reduction Project, Chehalis River, Washington, Final Environmental Impact Statement, Appendix A: Fish, Riparian, and Wildlife Habitat Study, June 2003, US Army Corps of Engineers, and *Chapter 173-201A WAC: Water quality standards for surface waters of the state of Washington.*

Table/document 31: RIPARIAN PROTECTION FOR TYPED WATERS IN WESTERN WASHINGTON (8 pp.) Section 4b-3.1 From:

Department of Natural Resources (DNR), *Forest practices habitat conservation plan* and *Riparian forest restoration strategy.*

Table 32: HABITAT OBJECTIVES (4 pp.) Table 3-3 from:

Making endangered species act determinations of effect for individual or grouped actions at the watershed scale, prepared by the National Marine Fisheries Service Environmental and Technical Services Division, Habitat Conservation Branch, August 1996,

Table 5.2-1: Revised Evaluation Methodology for Wetland Habitats

Parameter	Rating	Definition
	1	Coarse sediment sources inaccessible except at >100 yr events. Fine sediment deposition/ erosion common in majority of watershed. Wetlands and riparian areas provide no sediment retention. Clean spawning gravel rare.
Floodplain Interactions	5	Overbank flows occur at a ~2 year flow and occupy a majority of the floodplain. Channel armoring occurs rarely within watershed. Natural floodplain plant communities extensive; wetlands are present as expected for geomorphic setting.
	4	Overbank flows occur at ~5 year flows and occupies a majority of the floodplain. Channel armoring occasional throughout watershed. Natural floodplain plant communities common, particularly along tributaries; disturbance is localized. Wetland habitats present in majority of watershed as appropriate to geomorphic setting; few constraints to channel migration.
	3	Overbank flows occur at >5-10 year flood levels. Channel armoring in approximately a third of the watershed. Natural floodplain plant communities present in less than 50% of watershed; many wetland areas modified for timber harvest, agriculture or development. River is disconnected from ~50% of its former off-channel areas. Channel migration significantly reduced in 30-50% of watershed.
	2	Overbank flows are typically restricted to ~25 year flood levels. Channel armoring or other channelization widely distributed in the watershed. Characteristic floodplain plant communities are infrequent or highly fragmented. Wetlands are highly altered and/or have low functional value.
	1	Overbank flows restricted to ~100 yr flood levels. Channel armoring occurs in most of the watershed. Natural floodplain communities rare or absent. Wetlands are rare or absent.
LWD	5	Abundant LWD of all size classes, but including primarily large-sized pieces, present throughout wetlands, creating habitat diversity and complexity.
	4	Abundant LWD of all size classes present throughout wetlands, creating habitat diversity and complexity.
	3	Moderate amounts of LWD of any size classes present throughout the majority of the wetland.
	2	Low levels of LWD present throughout the majority of the wetland, does not significantly contribute to increased habitat diversity or complexity.
	1	LWD absent or rare.

Table 5.2-1: Revised Evaluation Methodology for Wetland Habitats

Parameter	Rating	Definition
Water Quality	*5*	Wetland functions are sufficient to remove the majority of sediment, nutrients, heavy metals, and toxic organics from water. Multiple vegetation classes present, including forested, scrub-shrub, and emergent wetland, and wetland is inundated throughout the growing season.
	4	Wetlands functions are sufficient to remove a significant portion of sediment, nutrients, heavy metals, and toxic organics from water. Multiple vegetation classes are present and wetland is inundated during part of the season.
	3	Wetland functions provide removal of some pollutants. More than one vegetation class is present and wetland is inundated during part of the season.
	2	Wetland functions are limited and do not provide significant removal of pollutants from water. One vegetation class is dominant throughout most of the wetland and only inundated during small portions of the season.
	1	Wetlands do not provide sufficient function to remove pollutants. One vegetation class is present and inundation occurs for only brief periods during the growing season or not at all.
Terrestrial Habitat	*5*	Adjacent floodplain and upland areas provide a diverse mix of habitat types. Habitats are well connected to provide migration corridors and connections between the wetland and upland areas. Disturbance is limited to sparse residential or agricultural/timber harvest.
	4	Adjacent floodplain and upland habitats provide a moderately diverse mix of habitat types with minor fragmentation. Migration corridors are still common between the wetland and upland areas. Watershed has low-moderate level of development or agricultural/ timber harvest, which has fragmented some corridors and reduced overall terrestrial habitat.
	3	Adjacent floodplain and upland habitats are moderately disturbed. Migration corridors primarily only intact along the riparian zone with few connections between wetland and uplands. Residential, agricultural/timber harvest, and commercial development are common throughout the watershed and terrestrial habitat is significantly reduced.
	2	Floodplain and upland habitat is highly fragmented. Migration corridors barely intact along wetlands, and are further fragmented as a result of roads and bridges. Development and agricultural/timber harvest, and have significantly reduced available habitat.
	1	Terrestrial habitat and migration corridors limited. Development, agricultural/timber harvest, and roads/bridges cause severe disturbance in majority of watershed.
Refu life Wild and	*5*	Refugia for fish and wildlife are widely available throughout the project area in the form of wetlands, as appropriate to geomorphic setting. These habitats provide protection from elements and predators and are adequately buffered from human disturbances.

Table 5.2-1: Revised Evaluation Methodology for Wetland Habitats

Parameter	Rating	Definition
	4	Wetland refugia are present in majority of the project area. Existing refugia have adequate buffering.
	3	Wetland refugia exist in less than 50% of the project area and are typically small in size. Existing refugia may have inadequate buffering.
	2	Wetland refugia are uncommon and many are not adequately buffered.
	1	No wetland refugia in project area.
Habitat Complexity/ Connectivity	5	Wetland habitats are highly diverse. Wetlands are inundated throughout the growing season and much of the year. Multiple native vegetation communities and classes are present and well interspersed. Microhabitats are diverse with abundant and varying water depths; cover types, rearing and basking sites. Wetlands throughout the project area are well connected.
	4	Wetland habitats are moderately diverse. Wetlands are inundated throughout majority of growing season. Multiple native vegetation communities and/or classes present and moderately interspersed. Microhabitats include moderately diverse water depths; cover types, rearing and basking sites. Wetlands throughout project area are typically connected, with few roads or bridges.
	3	Wetland habitats are of moderate to low diversity. Inundation occurs through only a portion of the growing season. Native vegetation is dominant, but communities and microhabitats are of low diversity and interspersion. Wetlands have low connectivity with large areas of fragmentation.
	2	Wetland habitats are of low diversity. Two or fewer vegetation classes are dominant and microhabitats have limited diversity. Non-native or invasive species are dominant in many areas. Local habitat is significantly fragmented.
	1	Wetland habitats are not diverse. Vegetation is dominated by non-native species and microhabitats are not diverse. Habitats are not connected and do not provide a migratory link between upstream and downstream habitats.
Species Diversity	5	Localized habitat support multiple native species of fish and wildlife and plants, including rare species. Habitat structure complex and provides suitable habitat for a variety of life history stages. Adjacent habitats are well connected to localized habitat.
	4	Localized habitat support multiple native species of fish and wildlife and plants, although only occasionally for rare species. Provides habitat for a variety of life history stages, although fragmentation of habitats may create slight disconnectedness from adjacent areas.
	3	Localized habitat supports common native species. Exotic species are present but are not dominant in any habitat. Fragmentation has occurred between habitats for different life history stages, and habitats primarily support one or two life history stages.

Table 5.2-1: Revised Evaluation Methodology for Wetland Habitats

Parameter	Rating	Definition
	2	Localized habitat supports common native species. Exotic species are present and are dominant in some areas. Significant fragmentation between life history stage habitats, and habitats primarily support one life history stage. Fish and wildlife populations reduced due to lack of necessary habitats.
	1	Localized habitat supports few native fish; wildlife or plant species and exotic species are frequently dominant. Localized habitat is completely isolated from adjacent habitats. Habitat is poor even for one life history stage. Most fish and wildlife populations not present due to lack of necessary habitats.

Riparian management zones (RMZs) and equipment limitation zones (ELZs) are the primary riparian protection measures for typed waters. RMZs are areas adjacent to Type S, Type F and Type Np waters where trees are retained so that ecological functions such as LWD recruitment, shade, litterfall and nutrient cycling are maintained. ELZs apply to Type Np and Type Ns waters and are areas where equipment use is limited so that forest practices-related erosion and sedimentation are minimized. Other riparian protection measures that apply to typed waters include restrictions on the salvage of down woody debris and the disturbance of stream banks.

4b-3.1 Riparian Protection for Typed Waters in Western Washington

Strong climatic gradients across Washington produce riparian forests west and east of the Cascade crest that differ in their structure and composition. These differences produce subtle but important variations in how riparian areas influence adjacent aquatic environments. Riparian protection measures have been developed with these variations in mind. As a result, some riparian requirements differ between western and eastern Washington.

Protection measures for typed waters in western Washington include establishing riparian management zones along Type S, Type F and Type Np waters; retaining no-harvest buffers adjacent to Type Np-associated sensitive sites; and establishing equipment limitation zones along Type Np and Type Ns waters (WAC 222-30-021).

4b-3.1.1 TYPE S AND TYPE F WATERS IN WESTERN WASHINGTON

Riparian management zones associated with Type S and Type F waters in western Washington are made up of three sub-zones: the "core zone," the "inner zone" and the "outer zone." The core zone is closest to the water, the inner zone is the middle zone and the outer zone is farthest from the water (Figure 4.5).

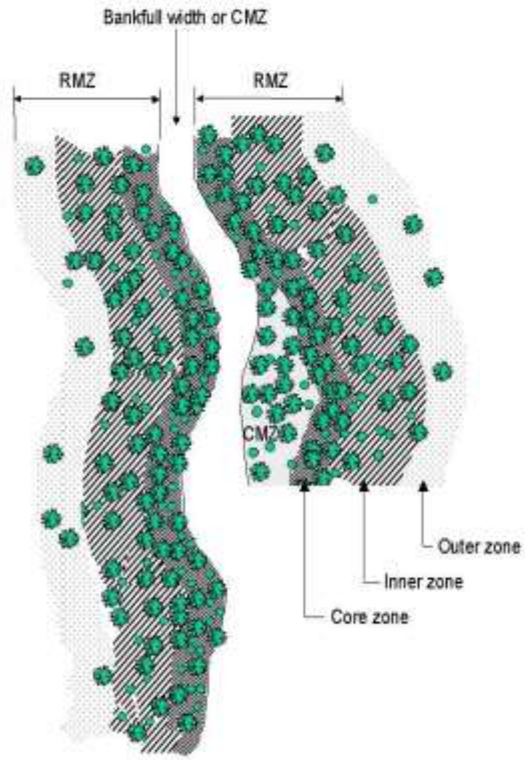
Core Zone in Western Washington

The core zone begins at the bankfull or channel migration zone edge and is 50 feet wide. No timber harvest or road construction is allowed in the core zone except for the construction and maintenance of road crossings and the creation and use of yarding corridors in accordance with applicable rules. Any trees cut for or damaged by yarding corridors in the core zone must be left on-site. Any trees cut as a result of road construction to cross a stream may be removed from the site unless they are to be used as part of an LWD replacement strategy or are needed to meet stand requirements (see Inner Zone discussion below).

Inner Zone in Western Washington

The inner zone begins at the outside edge of the core zone, and its width depends on site class, bankfull width and the management option selected by the landowner. Management options in the inner zone include: 1) no harvest, 2) hardwood conversion, 3) thinning from below and 4) leaving trees closest to the water. Timber harvest is allowed within the inner zone if *stand requirements* are met. Stand requirements apply to the combined core and inner zones, and are minimum values for the following parameters: 1) the number of trees per acre, 2) the basal area per acre, and 3) the proportion of conifer.

Figure 4.5 Schematic of the core, inner and outer zones within riparian management zones.



Riparian Management Zone (RMZ)

The riparian management zone (RMZ) is measured from the outer edge of the bankfull width or channel migration zone (CMZ).

The RMZ for Type S and Type F waters is composed of a core, inner and outer zone, with less management permitted closer to the water body and more management permitted further away.

Note: These diagrams are not to scale and are conceptual only. They do not depict actual zone widths or size, or spacing and placement of trees within the zones.

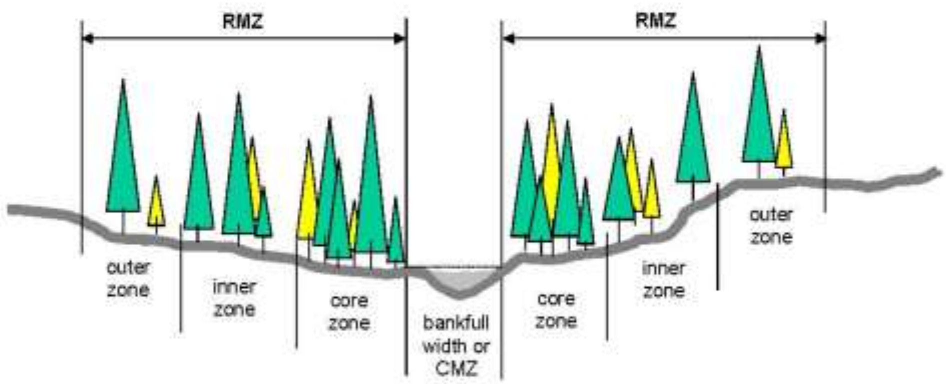


Table 4.5 Western Washington riparian management zone widths for western Washington Type S and Type F waters where no harvesting occurs in the inner zone

Site Class	RMZ width	Core zone width (measured from bankfull or CMZ edge)	Inner zone width (measured from outer edge of core zone)		Outer zone width (measured from outer edge of inner zone)	
			stream width ≤10'	Stream width >10'	stream width ≤10'	stream width >10'
I	200'	50'	83'	100'	67'	50'
II	170'	50'	63'	78'	57'	42'
III	140'	50'	43'	55'	47'	35'
IV	110'	50'	23'	33'	37'	27'
V	90'	50'	10'	18'	30'	22'

If stand requirements are met, the combined core and inner zones are capable of attaining a target condition known as "desired future condition." DFC is the condition of a mature riparian forest stand at 140 years of age and is based on basal area. DFC basal area targets have been developed for five site classes in western Washington.

Growth modeling is used to determine if a particular stand meets the DFC basal area target. Stand attribute data are collected and input to a model that "grows" the stand to 140 years of age. If, at age 140, the estimated basal area exceeds the DFC target, harvesting may occur within the inner zone in accordance with applicable rules. In these cases, only the "surplus" basal area (i.e., basal area beyond that needed to meet the DFC basal area target) may be harvested. If the DFC basal area target is not met, no harvest is allowed within the inner zone except in cases where the landowner chooses the hardwood conversion management option. Each inner zone management option is described below.

No Inner Zone Harvest
When the combined core and inner zones for a particular riparian stand do not meet the DFC stand requirements, no harvest is allowed in the inner zone. When no harvest is permitted in the inner zone, or the landowner elects to forego harvesting in the zone, the width of the core, inner and outer zones follow the requirements in Table 4.5.

Hardwood Conversion in the Inner Zone
If the combined core and inner zones for a particular riparian stand do not meet stand requirements, but the landowner wants to convert a hardwood-dominated inner zone to one that is dominated by conifers, inner zone harvest may be permissible. To be eligible for the hardwood conversion option, the site must meet certain minimum requirements. The requirements include, but are not limited to: 1) evidence that the site can be

successfully converted to conifer, 2) a maximum number and size of existing conifers, and 3) contiguous ownership upstream and downstream of the site. All requirements are described in WAC 222-30-021(1)(b)(i)(A).

If a site meets the minimum requirements, the spatial extent of conversion and the number and type of trees that can be harvested are limited. Harvested inner zones must be reforested with conifer species suitable to the site and must be maintained in order to ensure acceptable stocking levels are achieved. The forest practices rules also require DNR to track hardwood conversion activities and identify watershed administrative units (WAU) with high percentages of hardwood-dominated riparian areas that may be susceptible to high rates of conversion. More information on hardwood conversion within the inner zone of Type S and Type F RMZs is contained in WAC 222-30-021(1)(b)(i).

Inner Zone Harvest

Harvesting in the inner zone is allowed when basal area beyond that needed to meet the DFC target is present (i.e., "surplus" basal area). Harvesting in the inner zone must be carried out in accordance with one of two options: 1) thinning from below, or 2) leaving trees closest to the water (WAC 222-30-021(1)(b)(ii)).

Thinning From Below – Under this option, harvesting focuses on those trees that occupy subordinate canopy positions. The removal of surplus basal area begins with suppressed and intermediate trees and progresses towards co-dominant trees until the surplus is exhausted. Typically, this results in the retention of most co-dominant and all dominant trees in the stand. Larger trees generally provide greater ecological benefits, particularly in terms of LWD recruitment and shade.

Under the "thinning from below" option, the width of the core, inner and outer zones must follow the requirements in Table 4.6. In addition, inner zone harvest must comply with all of the following:

- Harvesting cannot decrease the proportion of conifers in the stand
- Any harvest within 75 feet of the bankfull edge or CMZ edge must meet minimum shade requirements described in WAC 222-30-040
- Following harvest, there must be at least 57 conifer trees per acre in the inner zone

Leaving Trees Closest To The Water – Generally, trees closer to the water influence the aquatic environment to a greater degree than trees farther away. Therefore, concentrating required leave trees in that portion of the inner zone closest to the water may, in some cases, provide equal or greater ecological benefit than other management options. The "leaving trees closest to the water" management option is based on this concept.

When "leaving trees closest to the water," the width of the core, inner and outer zones must follow the requirements in Table 4.7. This option only applies to Site Class I, Site Class II, and Site Class III RMZs on streams less than or equal to ten feet bankfull width and to Site Class I and Site Class II RMZs on streams greater than ten feet bankfull width. In addition, inner zone harvest must comply with all of the following:

Table 4.6 Western Washington riparian management zone widths for Type S and Type F waters when employing the "thinning from below" harvest option

Site class	RMZ width	Core zone width (measured from bankfull or CMZ edge)	Inner zone width (measured from outer edge of core zone)		Outer zone width (measured from outer edge of inner zone)	
			stream width ≤10'	stream width >10'	stream width ≤10'	stream width >10'
I	200'	50'	83'	100'	67'	50'
II	170'	50'	63'	78'	57'	42'
III	140'	50'	43'	55'	47'	35'
IV	110'	50'	23'	33'	37'	27'
V	90'	50'	10'	18'	30'	22'

Table 4.7 Western Washington riparian management zone widths for Type S and Type F waters when employing the "leaving trees closest to the water" harvest option.

Site class	RMZ width	Core zone width (measured from bankfull or CMZ edge)	Inner zone width				Outer zone width (measured from outer edge of inner zone)	
			stream width ≤10'	stream width ≤10'	stream width >10'	stream width >10'	stream width ≤10'	stream width >10'
				minimum floor distance		minimum floor distance		
			(measured from outer edge of core zone)	(measured from outer edge of core zone)	(measured from outer edge of core zone)	(measured from outer edge of core zone)		
I	200'	50'	84'	30'	84'	50'	66'	66'
II	170'	50'	64'	30'	70'	50'	56'	50'
III	140'	50'	44'	30'	**	**	46'	**

**Option 2 for site class III on streams >10' is not permitted because of the minimum floor constraint.

1) Harvest is not permitted within 30 feet of the outer edge of the core zone for streams that are no more than ten feet bankfull width and within 50 feet of the outer edge of the core zone for streams greater than ten feet bankfull width.

2) A minimum of 20 conifer trees per acre—each with a minimum 12-inch diameter at breast height (dbh)—must be retained in all portions of the inner zone where harvest occurs. These trees cannot be counted towards applicable stand requirements.

3) Selection of trees for harvest must begin in the outermost portion of the inner zone and progress toward the core zone.

If compliance with 1) through 3) above requires a landowner to retain basal area beyond the DFC target, the excess or "surplus" basal area may be used as a credit toward harvest in the outer zone. Surplus inner zone basal area may be applied, on a basal area-for-basal area basis, toward trees in the outer zone that the landowner would otherwise be required to retain (see discussion of outer zone requirements later in this section). In any case, the number of leave trees in the outer zone cannot be reduced below ten trees per acre.

Stream-Adjacent Parallel Roads
When the basal area component of the stand requirements cannot be met due to the presence of a stream-adjacent parallel road in the core and/or inner zones, two parameters must be estimated: 1) the basal area that would have been present if the road was not occupying the space, and 2) the corresponding shortfall in the basal area component of the stand requirements.

The total basal area equivalent to the shortfall must be retained elsewhere in the inner and/or outer zones as mitigation. If the inner and/or outer zones contain insufficient trees to address the shortfall, trees within the RMZ of other Type S or Type F waters in the same harvest unit or along Type Np or Type Ns waters in the same harvest unit must be retained as mitigation. In cases where other in-unit RMZs are unavailable, the landowner may implement an LWD placement strategy to address the shortfall in basal area (See Board Manual Section 26 for guidelines). More information on stream-adjacent parallel roads is contained in WAC 222-30-021(1)(b)(iii).

Yarding Corridors in Core and Inner Zones
When yarding corridors are necessary to facilitate harvesting within RMZs, all calculations of the basal area component of the stand requirements are to be made as if the corridors were established prior to any other harvest activity. Inner zone trees cut or damaged by yarding may be removed if they represent surplus basal area. Trees cut or damaged by yarding in a unit that does not meet the DFC basal area target may not be removed from the site. More information on yarding corridors in RMZs is contained in WAC 222-30-021(1)(b)(iv).

Outer Zone in Western Washington

The outer zone begins at the outside edge of the inner zone and—like the inner zone—its width is dependent on site class, bankfull width and management option selected by the landowner (see Tables 4.2 through 4.4). Timber harvest is allowed in the outer zone; however, 20 riparian leave trees per acre must be retained following harvest (WAC 222-30-021(1)(c)).

Outer zone riparian leave trees must be retained according to one of two strategies, selected and identified by the landowner at the time he/she submits a forest practices application. The strategies are known as the "dispersal" strategy and the "clumping" strategy. Under the dispersal strategy, leave trees must be distributed approximately evenly throughout the outer zone. Leave trees must be conifer with a minimum dbh of 12 inches, if available. If conifers at least 12 inches dbh are not available, then the next largest conifers must be retained. If conifers are not present, leave trees must be retained according to the clumping strategy.

Under the clumping strategy, leave trees must be grouped around sensitive features to the extent the features are present in the outer zone. Sensitive features include seeps and springs; forested wetlands; locations where leave trees will be recruited to the water; areas where the leave trees may provide windthrow protection; small, unstable or potentially unstable slopes; registered archaeological or historical sites and sites with evidence of Native American cairns, graves or glyptic records. When clumping trees around sensitive features, leave trees must be at least eight inches dbh and representative of the overstory canopy in or around the sensitive feature. Clumped leave trees may include both hardwood and conifer species. If sensitive features are not present, then clumps must be distributed throughout the outer zone and the leave trees must be conifers with a minimum dbh of 12 inches.

The outer zone riparian leave tree requirement of 20 trees per acre may be reduced in cases where surplus basal area exists as a result of "leaving trees closest to the water" or surplus basal area retention is required due to the presence of a stream-adjacent parallel road, where trees are retained in CMZs, or where a landowner implements an LWD placement strategy. An LWD placement strategy involves the voluntary placement of woody debris in stream channels by forest landowners. The intent of the strategy is to enhance fish habitat in streams on managed forestlands by creating incentives for landowners to place wood. Guidance for placing woody debris in streams is found in Section 26 of the Board Manual. Wood placement projects require an HPA permit from WDFW and are subject to additional requirements under the state's Hydraulic Code (WAC 220-110-030(17)).

More information on outer zone riparian leave tree requirements is contained in WAC 222-30-021(1)(b)(ii)(B)(II), WAC 222-30-021(1)(b)(iii)(B), and WAC 222-30-021(1)(c)(iii) and (iv).

4b-3.1.2 TYPE NP AND TYPE NS WATERS IN WESTERN WASHINGTON

Protection measures for non-fish bearing waters in western Washington include the establishment of equipment limitation zones adjacent to Type Np and Type Ns waters and the establishment of RMZs adjacent to Type Np waters and associated sensitive sites (WAC 222-30-021(2)).

Equipment Limitation Zones in Western Washington

An equipment limitation zone is an area where equipment use is limited in order to minimize ground and soil disturbance and thus protect stream bank integrity and prevent sediment delivery to non-fish-bearing waters. ELZs apply to all Type Np and Type Ns waters, are 30 feet wide and are measured from the bankfull width.

Mitigation is required if equipment use exposes soil on more than ten percent of the surface area of the ELZ. These activities include operating ground-based equipment, constructing and using skid trails and stream crossings, and yarding partially suspended, cabled logs.

Mitigation must be designed to replace the equivalent lost function, particularly as it relates to the prevention of sediment delivery. Mitigation measures include—but are not limited to—water bars, grass seeding and mulching. These requirements do not reduce or eliminate DNR's authority to prevent actual or potential material damage to public resources under WAC 222-46-030 (notice to comply) or WAC 222-46-040 (stop work order) or any related authority to condition forest practices notifications or applications. More information on ELZs is contained in WAC 222-30-021(2)(a).

Riparian Management Zones for Type Np Waters and Associated Sensitive Sites in Western Washington

Protection of Type Np waters includes the establishment of RMZs along portions of Type Np waters and around all sensitive sites. The RMZs are either 50 or 56 feet in width (depending on the feature being protected) and no harvesting is allowed within the buffer. Requirements ensure that two-sided RMZs are established along at least 50 percent of the Type Np water length. The approach targets the most ecologically sensitive parts of Type Np waters, resulting in a discontinuous network of buffers that protects areas most important to aquatic resources (Figure 4.6).

High priority areas for RMZ protection include the lower reaches of Type Np waters immediately above the confluence with Type S or Type F waters and designated sensitive sites including seeps, springs, Type Np confluences, Type Np initiation points and alluvial fans (see WAC 222-16-010 for detailed definitions of sensitive sites). If RMZ establishment adjacent to these areas does not protect 50 percent of the Type Np water length, additional buffers must be left along other priority areas, including low gradient stream reaches, tailed frog habitat, groundwater influence zones and areas downstream from other buffered reaches.

The width of RMZs adjacent to sensitive sites varies according to the type of sensitive site. Headwall and side-slope seep RMZs are measured from the perennially saturated soil edge and are 50 feet wide. RMZs associated with Type Np confluences, headwater springs and Type Np initiation points are measured from the center of the feature or point of confluence, are circular in shape and are 56 feet wide (i.e., have a radius of 56 feet). No-harvest RMZs along areas not designated as sensitive sites are measured from the bankfull edge and are 50 feet wide. The full extent of alluvial fans—irrespective of shape or size—receives no-harvest protection. More information on RMZs for Type Np waters is contained in WAC 222-30-021(2)(b).

TABLE 3-3. Habitat Objectives. The ranges of criteria presented here are generally applicable but not absolute, some watersheds may have unique geology, geomorphology, hydrology and other conditions that may not permit achieving the target habitat conditions. Target conditions can be established on a regional or site specific basis as needed to account for those factors (*please see footnote). (Page 1 of 3)

PATHWAY	INDICATORS	PROPERLY FUNCTIONING	AT RISK	NOT PROPERLY FUNCTIONING
Water Quality:	Temperature	50-57� F[1/]	57-60�F (spawning) 57-64�F (migration &rearing)[2/]	> 60�F (spawning) > 64�F (migration & rearing)[2/]
	Sediment/Turbidity	< 12% fines (<0.85mm) in gravel[3/], turbidity low	12-17% (west-side)[3/], 12-20% (east-side)[2/], turbidity moderate	>17% (west-side)[3/], >20% (east side)[2/] fines at surface or depth in spawning habitat[2/], turbidity high
	Chemical Contamination/ Nutrients	low levels of chemical contamination from agricultural, industrial and other sources, no excess nutrients, no CWA 303d designated reaches[5/,13/]	moderate levels of chemical contamination from agricultural, industrial and other sources, some excess nutrients, one CWA 303d designated reach[5/]	high levels of chemical contamination from agricultural, industrial and other sources, high levels of excess nutrients, more than one CWA 303d designated reach[5/]
Habitat Access:	Physical Barriers	any man-made barriers present in watershed allow upstream and downstream juvenile and adult fish passage at all flows	any man-made barriers present in watershed do not allow upstream and/or downstream fish passage at base/low flows	any man-made barriers present in watershed do not allow upstream and/or downstream fish passage at a range of flows
Stream Habitat Elements:	Substrate	dominant substrate is gravel or cobble (interstitial spaces clear), or embeddedness <20%[3/]	gravel and cobble is subdominant, or if dominant, embeddedness 20-30%[3/]	bedrock, sand, silt or small gravel dominant, or if gravel and cobble dominant, embeddedness >30%[2/]
	Large Woody Debris quantity of key pieces	Coast: >80 pieces/mile >24"diameter >50 ft. length[4/]; East-side: >20 pieces/ mile >12"diameter >35 ft. length[2/]; and adequate sources of woody debris recruitment in riparian areas.	currently meets standards for properly functioning, but lacks potential sources from riparian areas of woody debris recruitment to maintain that standard	does not meet standards for properly functioning and lacks potential large woody debris recruitment
	Pool Frequency channel width # pools/mile[6/] 5 feet 184 10 " 96 15 " 70 20 " 56	meets pool frequency standards (left) and large woody debris recruitment standards for properly functioning habitat (above)	meets pool frequency standards but large woody debris recruitment inadequate to maintain pools over time	does not meet pool frequency standards

	25 " 47 50 " 26 75 " 23 100 " 18			
	Pool Quality	pools >1 meter deep (holding pools) with good cover and cool water[3], minor reduction of pool volume by fine sediment	few deeper pools (>1 meter) present or inadequate major reduction of pool volume by fine sediment cover/temperature[3], moderate reduction of pool volume by fine sediment	no deep pools (>1 meter) and inadequate cover/temperature[3], Major reduction of pool volume by fine sediment
	Off-channel Habitat	backwaters with cover, and low energy off-channel areas (ponds, oxbows, etc.)[3/]	some backwaters and high energy side channels[3/]	few or no backwaters, no off-channel ponds[3/]
	Refugia (important remnant habitat for sensitive aquatic species)	habitat refugia exist and are adequately buffered (e.g., by intact riparian reserves); existing refugia are sufficient in size, number and connectivity to maintain viable populations or sub-populations[7]	habitat refugia exist but are not adequately buffered (e.g., by intact riparian reserves); existing refugia are insufficient in size, number and connectivity to maintain viable populations or sub-populations[7/]	adequate habitat refugia do not exist[7/];
Channel Condition & Dynamics	Width/Depth Ratio	<10[2,4/]	>10	>10
	Streambank Condition	>90% stable; i.e., on average, less than 10% of banks are actively eroding[2/]	80-90% not eroding	<80% not eroding
	Floodplain Connectivity	off-channel areas are frequently hydrologically linked to main channel; overbank flows occur and maintain wetland functions, riparian vegetation and succession	reduced linkage of wetland, floodplains and riparian areas to main channel; overbank flows are reduced relative to historic frequency, as evidenced by moderate degradation of wetland function, riparian vegetation/succession	severe reduction in hydrologic connectivity between off-channel, wetland, floodplain and riparian areas; wetland extent drastically reduced, riparian vegetation/succession altered significantly, and channel degradation apparent
Flow/Hydrology:	Change in Peak/ Base Flows	watershed hydrograph indicates peak flow, base flow and flow timing characteristics comparable to an undisturbed watershed of similar size, geology and geography	some evidence of altered peak flow, baseflow and/or flow timing relative to an undisturbed watershed of similar size, geology and geography.	pronounced changes in peak flow, baseflow and/or flow timing relative to an undisturbed watershed of similar size, geology and geography
	Increase in Drainage Network	zero or minimum increases in drainage network density from roads[8/,9/]	moderate increases in drainage network density from roads (e.g., about 5%)[8/,9/]	significant increases in drainage network density from roads (e.g., 20-25%)[8/,9/]
Watershed Conditions:	Road Density & Location	<2 mi/mi� [11/], no valley bottom roads	2-3 mi/mi�, some valley bottom roads	>3 mi/mi�, many valley bottom roads

	Disturbance History	<15% ECA **(entire watershed) with no concentration of disturbance in unstable or potentially unstable areas, and/or refugia, and/or riparian area; and for NWFP area (except AMAs**), }15% retention of LSOG in watershed[10]	<15% ECA** (entire watershed) but disturbance concentrated in unstable or potentially unstable areas, and/or refugia, and/or riparian area; and for NWFP area (except AMAs), }15% retention of LSOG in watershed[10]	>15% ECA** (entire watershed) and disturbance concentrated in unstable or potentially unstable areas, and/or refugia, and/or riparian area; does not meet NWFP standard for LSOG retention
	Riparian Reserves	the riparian reserve system provides adequate shade, large woody debris recruitment, and habitat protection and connectivity in all subwatersheds, and includes known refugia for sensitive aquatic species (>80% intact),and/or for grazing effects: percent similarity of riparian vegetation to the potential natural community/ composition >50%[12/]	moderate loss of connectivity or function (shade, LWD recruitment, etc.) of riparian reserve system, or incomplete protection of habitats and refugia for sensitive aquatic species (}70-80% intact), and/or for grazing effects: percent similarity of riparian vegetation to the potential natural community/composition 25-50% or better[12/]	riparian reserve system is fragmented, poorly connected, or provides inadequate protection of habitats and refugia for sensitive aquatic species (<70% intact), and/or for grazing effects: percent similarity of riparian vegetation to the potential natural community/composition <25%[12/]
Estuarine Conditions	Habitat quantity/ quality	The estuarine system provides for adequate, prey production, cover, and habitat complexity, for both smolts and returning adults.	Moderate loss of prey production, cover, and habitat complexity	Gross loss of prey production, cover, and habitat complexity
	Aerial extent	Estuary provides for most (i.e., greater than 80% intact) of its historical areal extent and diversity of shallow water habitat types including vegetated wetlands and marshes, tidal channels, submerged aquatic vegetation, tidal flats, and large woody debris.	50-80% of pre-modification area or volume and diversity of habitats	< 50% of pre-modification area or volume; low diversity of habitats
	Hydrologic conditions/ sediment/ nutrient input	Fresh water inflow and other hydrologic circulation patterns and sediment and nutrient inputs are similar to historic conditions.	Moderate interruption of estuarine circulation and nutrient and sediment delivery	Gross interruption of estuarine circulation and nutrient and sediment delivery
Estuarine Water Quality	Dissolved Oxygen, Temperature, Nutrients, Chemical Contamination	Water quality standards for aquatic life protection met	Water quality standards are not met intermittently when salmon are present	Water quality standards are consistently not met when salmon are present
	Sediments	Sediments have low levels of chemical contamination, especially of persistent aromatic hydrocarbons, heavy metals, or other compounds known to bio-accumulate.	Sediments have moderate levels of chemical contaminants	Sediments have high levels of chemical contaminants
	Exotic species that are non-indigeneous aquatic nuisance	Exotic species that are non-indigeneous and aquatic nuisance species are at low and decreasing levels and not interfering with estuarine system functions.	Sustained presence of multiple exotic species that are non-indigeneous and aquatic nuisance species in significant abundance	Predominance of exotic species that are non-indigenous and aquatic nuisance species, low abundance of many native species with some low or extirpated.

	species			

* This table is adapted from an August 1996 NMFS report entitled: Making Endangered Species Act Determinations of Effect for INDIVIDUAL or Grouped Actions at the Watershed Scale. Target conditions to account for specific conditions in various areas have been developed, including, but not limited to: Oregon Coast Province, Southwest Province Tyee Sandstone, Western Cascades Physiographic Region, High Cascades Physiographic Region, Klamath Province/Siskyou Mountains.

APPENDIX 9
WASHINGTON COAST REGION MAINSTEM RIVERS

Washington Coast Region Mainstem Rivers	
Quillayute River	From confluence of Soleduck and Bogachiel rivers (Sec.20, T28N, R14W) where the 1,000 cubic feet per second mean annual flow begins, downstream to the head of tide and the estuary zone at the river mouth at the Pacific Ocean.
Soleduck River	From the mouth of Bockman Creek (Sec.1, T29N, R13W), where the 1,000 cubic feet per second mean annual flow begins downstream from Sapho and Beaver Creek, to the river mouth at the Quillayute River (Sec.20, T28N, R14W).
Calawah River	From confluence of North and South Forks of Calawah River (Sec.35, T29N, R13W), where the 1,000 cubic feet per second mean annual flow begins, downstream to the river mouth at the the Bogachiel River (Sec.13, T28N, R14W).
Bogachiel River	From that point where the 1,000 cubic feet per second mean annual flow begins, downstream to the river mouth at the Quillayute River (Sec.20, T28N, R14W). The flow exceeds 1,000 cubic feet per second mean annual flow at the Olympic National Park Boundary. The National Park Service does not identify where mean annual flow reaches 1,000 cubic feet per second.

Hoh River	From the Olympic National Park boundary (Sec.29, T27N, R10W), where the 1,000 cubic feet per second mean annual flow begins, downstream to the head of tide and the estuary zone at the river mouth at the Pacific Ocean.
Clearwater River	From the mouth of Miller Creek (Sec.27, T25N, R12W), where the 1,000 cubic feet per second mean annual flow begins, downstream to the head of tide and the river mouth at the Queets River.
Queets River	From that point where the 1,000 cubic feet per second mean annual flow begins, downstream to the head of tide and the estuary zone and the river mouth at the Pacific Ocean. The National Park Service does not identify where the mean annual flow reaches 1,000 cubic feet per second.
Upper Quinault River	From that point where the 1,000 cubic feet per second mean annual flow begins downstream to Quinault Lake (Sec.16, T23W, R9W). The flow exceeds 1,000 cubic feet per second mean annual flow at the Olympic National Park boundary. The National Park Service does not identify where the mean annual flow reaches 1,000 cubic feet per second.
Lower Quinault River	From Quinault Lake downstream to the head of tide and the estuary zone and the river mouth at the Pacific Ocean. The flow exceeds 1,000 cubic feet per second mean annual flow at the outflow of Quinault Lake.
Humptulips River	From the confluence of East and West Forks of Humptulips River (Sec.2, T20N, R10W), where the 1,000 cubic feet per second mean annual flow begins, downstream to the head of tide and the estuary zone and the river mouth at North Bay (Sec.21, T18N, R11W).

Wynoochee River	From the mouth of Carter Creek (Sec.14, T19N, R8W), where the 1,000 cubic feet per second mean annual flow begins, downstream to the head of tide and the estuary zone at the river mouth at the Chehalis River (Sec.18, T17N, R7W).
Satsop River	From the confluence of East and West Forks of Satsop River (Sec.23, T18N, R7W) downstream to mouth at Chehalis River (Sec.7, T17N, R6W). The flow is more than 1,000 cfs MAF at mouth of East Fork Satsop River (Sec.23, T18N, R7W).
East Fork Satsop River	From the Middle Fork Satsop River (Sec.3, T19W, R6W), where the 1,000 cubic feet per second mean annual flow begins, downstream to the mouth of the East Fork at the Satsop River (Sec.23, T18N, R7W).
Chehalis River	From the mouth of the South Fork Chehalis River (Sec.13, T13N, R4W), where the 1,000 cubic feet per second mean annual flow begins, downstream to the head of tide and the estuary zone at or near the mouth of the Satsop River .
North River	From the mouth of Lower Salmon Creek (Sec.7, T15N, R9W), where the 1,000 cubic feet per second mean annual flow begins, downstream to the head of tide and the estuary zone at the river mouth on Willapa Bay (Sec.35, T15N, R10W)
Willapa River	From confluence of Willapa River and unnamed creek (Sec.8, T12N, R6W), where the 1,000 cubic feet per second mean annual flow begins, downstream to the head of tide and the estuary zone at the river mouth at Willapa Bay (Sec.18, T14N, R9W). The stream flow is 1,000 cubic feet per second mean annual flow at the mouth of South Fork Willapa River (Sec.24, T14N, R9W).

References for Appendix 9

Chapter 173-18 WAC: Shoreline management act — streams and rivers constituting shorelines of the state , State of Washington.

APPENDIX 10
WASHINGTON COAST SUSTAINABLE SALMON PARTNERSHIP

Creation of the Washington Coast Sustainable Salmon Partnership

In 2007, the Salmon Recovery Funding Board ("SRFB") funded the facilitation of meetings bringing together the four coastal Lead Entity Groups as a Planning Group to consider forming a Washington coast regional salmon organization. After six months of intense discussion of issues, as well as consideration of the pros and cons of establishing a regional organization in the Coast Region, a *Report on the Consideration of Forming a Coastal Regional Governance Unit for Salmon Sustainability* ("ROC") (Triangle Associates, June 2007)[41], summarizing the Planning Group's deliberations, points of agreement and ongoing concerns, was issued.

The Planning Group proposed the creation of what they named the Washington Coast Sustainable Salmon Partnership ("WCSSP"), with the following organizational structure and functions:

> ***Organizational Structure***
>
> *The Planning Group chose a structural option that favored the formation of a "Federation with Strong Lead Entities." For this option, the Lead Entities remain distinct and prioritize projects within their own WRIAs. They also maintain relationships with project sponsors. The Washington Coast Sustainable Salmon Partnership would perform the functions listed . . .*
>
> ***Functions***
>
> - ***Broad and Regional Functions for the Washington Coast Sustainable Salmon Partnership***
>   a. *Develop a holistic view of the region, e.g., watershed planning, salmonid recovery, economic development (including tourism and recreation, business and others)*
>   b. *Continue participation in Council of Regions as the coastal region*
>   c. *Develop and advocate for regional policies*
>   d. *Influence federal or state salmonid recovery activities affecting the region*
>   e. *Promote "sustainability" to prevent new ESA listings*
>   f. *Coordinate and collaborate with all Lead Entities*
>   g. *Provide regional communication, community outreach, and education*

[41] The full document is located at http://wcssp.org/Documents/_fullcolorREPORTONCONSIDERATION.pdf

- ***Planning and Projects***
    a. *Develop a regional plan or strategy*
    b. *Coordinate and track implementation of a regional plan or strategy*
    c. *Support implementation of recovery plan(s) within the region (e.g., Lake Ozette sockeye)*
    d. *Develop regional habitat project lists, schedules and priorities*
    e. *Participate in activities to guide monitoring of salmon and their habitat*
- ***Funding***
    a. *Allocate salmon recovery funding within the region*
    b. *Advocate for unused returning funds to stay within the Coast region*
    c. *Identify funding options and obtaining funding for salmonid recovery activities*

(ROC, 2007, p. 5-6)

As result of the work of this Planning Group, the Washington Coast Sustainable Salmon Partnership was formed and recognized by the Governor's Salmon Recovery Office in 2008. WCSSP organized as a Joint Board under the Interlocal Cooperation Act, RCW 39.34 in 2010. As suggested by the original Planning Group, WCSSP continues to be governed by consensus, with each of the four Lead Entities having one vote if an issue or decision cannot be settled through consensus.

WCSSP was formed as a "Federation with Strong Lead Entities" (ROC, 2007, p. 5) in recognition of the Region's wide diversity of geography, land use, population, and salmon habitats. The relative independence of the Lead Entities and the desire to maintain local control over decisions affecting salmon habitats was and continues to be a defining characteristic of the Coast Region.

In addition to considering the creation of a regional organization, the formative WCSSP meetings in 2007 identified a number of issues the new organization should address. Chief among these was the creation of a regional plan for salmon recovery. The group identified the intent to "avoid ESA listings and further diminished populations through sustainability instead of ESA recovery planning" (ROC, 2007, p. 5) as a primary motivation for coming together as a single, regional organization. Below are the major regional issues identified:

- ***Region-Wide Salmonid Recovery and Prioritization***

    There is agreement that a regional coast salmonid recovery approach is a common key for all Lead Entities and that a regional body should be organized to address salmonid recovery and preservation in the coastal region. There is recognition that a regional approach has a better opportunity to protect existing healthy habitats and help recover diminished populations throughout the coast. A regional approach is also seen as beneficial for addressing fish passage issues, a common concern for all Lead Entities.

- ***Need for a Regional Plan/Strategy for Salmonid Recovery***

    The Planning Group interprets recovery to mean achieving healthy, self-sustaining, harvestable populations. Having a coast-wide recovery plan/strategy in place would strengthen each individual Lead Entity strategy and would provide a more coordinated and broad-based approach for identification and *filling of data gaps, developing a coast-wide financial strategy and for promoting project development and funding.*

- ***Save What We Have***

  A regional organization was seen as a way to develop a coordinated approach and therefore bring more attention and funding to the need to save functional habitat and prevent further degradation of diminished salmonid stocks.

- ***Avoid ESA Listings and Further Diminished Populations through Sustainability Instead of ESA Recovery Planning***

  A coordinated approach through a regional organization is seen as a way to develop a region-wide recovery strategy that focuses on sustaining and rebuilding activities. Such an approach is seen as much more desirable than having to work within the ESA structure for recovery planning.

- ***We are a unique region and we will create our own future***

  The circumstances and issues in the coastal region are unique in the State of Washington. While we can learn from the lessons of other areas, only those of us living and working in the coastal area are in a position to best determine how we should approach salmonid recovery and preservation.

- ***All the partners need to support and buy into a regional strategy for this to work***

  In order to make a regional organization work effectively, the support and participation of all of the *Lead Entities and partners is necessary.*

(ROC, 2007, p. 12)

In addition, as described in Appendix 3 of the ROC,

> *Bob Wheeler and Betsy Daniels of Triangle Associates interviewed 28 stakeholders in order to gauge interest in and ideas for regional collaboration for salmon recovery and other coast-wide issues. This is a brief summary of the common themes heard and specific recommendations provided by the interviewees.*

1a. What resource management/environmental issues do you consider to be priorities for the coast of Washington?

Answers to this question fell into the same common themes in almost every interview . .

Common resource themes included:

- o *Protection of existing healthy salmon stocks and the restoration of depressed salmon stocks*
- o *Protection and restoration of existing healthy salmon habitat*

- *Address fish passage/barrier issues - culverts in particular*
- *Address the nearshore habitat and ocean component of the salmon life cycle*
- *Fishing and the connection to economics of the coast*
- *Availability of water with increasing development*
- *Concern with global warming impacts*
- *Address land use issues such as forestry and agriculture and new development*
- *Estuaries especially in the South*
- *Address issues with bull trout*
- *Protection of habitat rather than restoration of impacted habitat*
- *Keep salmon from being listed*
- *Address noxious weeds and invasive species*
- *Need for data in order to make decisions, especially the ocean*

(ROC, 2007, p. 24)

We think that it shows the depth of conviction of those in the Region that these were identified as important issues in 2007 and are still identified as important in this Plan now.

Development of the Washington Coast Salmon Sustainability Plan

For more than a decade the four coastal Lead Entities have been doing important and effective work to restore habitats, remove fish barriers, and protect riparian areas, with many projects funded by the state Salmon Recovery Funding Board ("SRFB"). Yet, with each Lead Entity focusing on its home watersheds, the broader regional perspective has been lacking until recently. Since one of the primary purposes of creating WCSSP was to avoid future ESA listings, a perspective at the Evolutionarily Significant Unit/Distinct Population Segment ("ESU/DPS") scale is necessary to coordinate and prioritize actions that will have the most direct impact to maintain the sustainability of these populations.

In keeping with the broad, Region-wide perspective this planning effort represents, the relatively healthy condition of coastal habitats and the relative absence of ESA listings has afforded WCSSP the opportunity to approach its planning for the protection and preservation of salmon at an ecosystem scale.

Further, this Plan seeks to integrate with existing local, tribal, state, and federal planning and management efforts at both the watershed and regional scales. An overarching strategy for this Plan is to build, support and maintain broad partnerships that can maximize opportunities for complementary actions, reduce duplication of efforts, and make the best use of limited human and financial resources.

The planning process[42] began January 21, 2009 with a Scoping Workshop. It was at this first meeting that WCSSP partners most clearly stated that this should be an ecosystem-scale planning effort. The planning process grew around identification and definition of salmon habitats – eight focal habitat targets that encompass every habitat salmon occupy at various life history stages, as well as the headwaters/upland habitat that directly affects salmon habitat downstream from it. These eight habitat targets are:

Headwaters/Uplands	Mainstems
Wetlands and Off-Channel	Estuaries
Tributaries	Nearshore
Lakes	Ocean

WCSSP formed a Planning Committee with representatives from the four Lead Entities, the Governor's Salmon Recovery Office ("GSRO"), the Washington Department of Fish and Wildlife ("WDFW"), the Wild Salmon Center ("WSC"), and The Nature Conservancy ("TNC"). This committee has been the working group that has met monthly for over two years to move this process from a concept to this document.

Through ten facilitated workshops involving more than 65 different participants representing tribes, local, state and federal agencies, timber and agricultural interests, non-profit conservation organizations and interested citizens, the Plan has developed into a series of twenty-four strategies and sixty-three targeted actions designed to ensure the long-term sustainability of salmon and their habitats in the Coast Region.

The breadth of this suite of strategies and action steps is far more than the Washington Coast Sustainable Salmon Partnership can ever hope to implement on its own. Still, this breadth speaks to the ecosystem-based vision and the need for WCSSP to be effective and achieve the Plan's vision and goals; to reach out to others involved in complementary work; and, to promote and maintain broad partnerships involving many other groups, individuals, agencies, and organizations working together to protect and maintain sustainable salmon in our Region. For a detailed review of the Planning process, the people involved, and the analyses that went into the process, see Appendix 13 – Planning Process and Analyses.

[42] See Appendix 13 - Planning Process and Analyses for a full description of the process.

References for Appendix 9

Triangle Associates. 2007. *Report on consideration of forming a coastal regional governance unit for salmon sustainability* ("ROC"). Prepared for the Coast Lead Entities Planning Group. Triangle Associates, Seattle, WA. Online at: http://wcssp.org/Documents/_fullcolorREPORTONCONSIDERATION.pdf

APPENDIX 11
IMPORTANCE OF THE WASHINGTON COAST IN SALMON RECOVERY

White Paper prepared by Philip E. Miller, February 2003

Introduction

Salmon[43] recovery in Washington is increasingly focused on regional efforts to develop recovery plans that emphasize recovery of salmon species that have been listed as threatened or endangered under the federal Endangered Species Act (ESA). Regional salmon recovery planning processes in Puget Sound and the Columbia River Basin are a necessary and appropriate response to ESA listings and are now underway. It is also appropriate to highlight the importance of Washington's coastal streams and estuaries to the long-term health of wild salmon populations. As pointed out in the Statewide Strategy to Recover Salmon (September 1999), coastal populations tend to be better off than populations inhabiting interior drainages. With the exception of Lake Ozette sockeye and certain bull trout populations, Washington's coastal salmon populations from Cape Flattery in the north to Cape Disappointment in the south have not been listed under the ESA. Given the relatively healthy status of these populations and the more limited risks to their continued health, maintaining the health of salmon populations along Washington's Pacific coast is an important part of our prospects for overall, long-term success in preserving healthy runs of wild salmon.

Conceptual Foundation

Recovery of wild salmon populations from Northern California to the Canadian border is a massive enterprise facing many challenges. In a recent presentation addressing basic barriers to salmon recovery, Dr. Robert Lackey[44] points out the ecological reality that wild salmon in the Pacific Northwest are well on their way to a status similar to wolves, grizzlies, and bison; wild remnants of once flourishing species struggling to hang on in a small portion of their original range. The long-term decline of Pacific Northwest wild salmon has not yet been reversed. Looking at the current wild salmon situation, Dr. Lackey anticipates that by 2100 wild salmon runs in the Pacific Northwest

[43] In this paper, "salmon" refers to all species of salmon, steelhead, trout and char native to Washington.
[44] Dr. Lackey is a fisheries biologist with the U.S. Environmental Protection Agency, National Health and Environmental Effects Research Laboratory, Corvallis, Oregon. The presentation "Salmon Recovery in the Twenty-First Century: Breaching the Basic Barriers" was given at a conference in Spokane, Washington, April 29, 2002 and represents the views and comments of Dr. Lackey.

will be a shadow of the past over much of their original range, and in Washington – biological remnants. On a more optimistic note, Dr. Lackey points out that some wild salmon recovery possibilities are more promising; with the coastal watersheds of Northern California, Oregon and Washington having the brightest prospects. Dr. Lackey asserts that the most efficient way to address wild salmon recovery is to focus efforts in those geographic locations with the greatest chance for success in maintaining wild salmon, i.e. the coastal watersheds.

Dr. Lackey has recently commented that the importance of the coastal watersheds is supported by basic realities and common sense. Coastal populations are currently relatively healthy and their habitat is relatively intact. A large percentage of land in coastal drainages is publicly owned or is in large private parcels managed as forestland. There are few hydropower facilities and relatively minor irrigation withdrawals. Although the influence of fish hatcheries is significant, the effects on wild salmon can be managed. More options for maintaining wild salmon remain viable in the coastal watersheds. The importance of these points is reinforced by a recent paper published by scientists at the Northwest Fisheries Science Center[45]. In proposing a strategy for setting priorities for restoring Pacific Northwest watersheds, these scientists stress protection of existing high-quality habitats and assert that protection of high quality habitat should be given priority over habitat restoration because it is far easier and more successful to maintain good habitat than to try and recreate or restore degraded habitat. Similar conclusions have been reached by many others.

Additional support for the importance of Washington's coastal watersheds to the long-term health of salmon comes from the work of Ecotrust, a nonprofit organization based in Portland, Oregon. Ecotrust is dedicated to supporting a conservation economy along the North American coast from San Francisco to Anchorage. Ecotrust has developed an approach to setting priorities for wild salmon recovery among the coastal watersheds of the Pacific Northwest based upon historical abundance and current production of selected salmon species in the watersheds and the relative risk to current wild salmon production posed by land use, dams, and hatchery practices[46]. Using this approach, Washington's northern coastal watersheds (Sol Duc/Hoh/Quillayute, Queets/Quinault) have been defined as high priority and its southern coastal watersheds (Grays Harbor/Chehalis, Willapa Bay) have been defined as medium priority by Ecotrust. The southern coastal area was rated as a lower priority by Ecotrust primarily due to the more prominent influence of hatcheries in those watersheds.

Status of Washington Coast Salmon and Steelhead Populations

Information on the current status of wild chinook, coho, chum, sockeye, and steelhead populations is available from the Washington Department of Fish and Wildlife (WDFW) and the National Marine

[45] Philip Roni, Timothy J. Beechie, Robert E. Bilby, Frank E. Leonetti, Michael M. Pollock, and George R. Pess, "A Review of Stream Restoration Techniques and a Hierarchical Strategy for Prioritizing Restoration in Pacific Northwest Watersheds", North American Journal of Fisheries Management 22:1-20, 2002.

[46] Charley Dewberry, "The Development of Regional priorities for Salmon Restoration in the Coastal Watersheds of the Pacific Northwest (Cascadia)", Ecotrust, 2001.

Fisheries Service (NOAA Fisheries). In 1992, WDFW published the Washington State Salmon and Steelhead Stock Inventory (SASSI) and is in the process of publishing a revised Salmonid Stock Inventory (SaSI) for 2002. NOAA Fisheries has published a series of Species Status Review Reports by their Biological Review Teams (BRT) for Evolutionarily Significant Units (ESUs) of coho (September,1995), steelhead (August, 1996), chum (December, 1997), and chinook (February, 1998).

A summary of 1992 SASSI data[47] shows that 57% of stocks (65 out of 115) in the Washington coastal region were rated healthy compared to 44% of stocks (93 out of 209) that were rated healthy in Puget Sound and 26% of stocks (29 out of 111) that were rated healthy in the Columbia Basin. Although only 26% of the total number of stocks in the state are in the coastal area, that area had 35% of the state's total number of healthy stocks. The coastal area had no stocks rated "critical" and only eight stocks rated as "depressed" in 1992. The coastal area had only 6% of the statewide total of critical and depressed stocks.

Preliminary data from the 2002 SaSI show a continuing high percentage of coastal stocks are rated healthy, i.e. 54% or 65 out of 120 rated stocks. Unfortunately, the number of stocks rated as depressed has apparently risen since 1992 from 8 to 13 stocks, and one stock is now rated as critical.

NOAA Fisheries Biological Review Team (BRT) reports provide the basis for determinations that ESA listings for Washington coastal ESUs for chinook, coho, chum and steelhead are not warranted. A second southwestern Washington ESU for coho is still a candidate for ESA listing.

The 1998 BRT report for chinook salmon noted that recent abundance of chinook has been relatively high, with long-term trends being predominantly upward for medium and larger populations, but with sharply downward trends for several smaller populations. In general, indicators are more favorable for the north coast and for fall run populations than for spring or summer run chinook. The report expressed special concern for spring run populations throughout the ESU and fall run populations in Willapa Bay and parts of the Grays Harbor drainage. The report noted that all basins are affected by habitat degradation, largely related to forestry practices.

The 1995 BRT report for coho salmon concluded that the population of southwest Washington coastal coho is likely to remain stable but is vulnerable to overharvest. The largest production of coho in this area is in the Chehalis River Basin. Most of the northern coastal coho stocks were considered to be healthy or of unknown status. Although no historical population estimates were available to compare to recent abundance, the report presumed there have been substantial declines in coho populations as a result of well-documented habitat degradation since European settlement.

[47] " Statewide Strategy to Recover Salmon: Extinction is Not an Option", Table 2, Joint Natural Resources Cabinet, November, 1999.

The 1997 BRT report on chum salmon concluded that ESA listing was not warranted with an important factor being the abundance of natural populations in Grays Harbor and Willapa Bay. Elsewhere on the Olympic Peninsula, available data suggested that populations of chum are depressed from historical levels but relatively stable.

The 1996 BRT report for steelhead noted that no Olympic Peninsula ESU stocks have been identified as being at risk or of special concern. However, because of their limited distribution in upper tributaries, summer steelhead in the Olympic Peninsula ESU appear to be more at risk from habitat degradation than winter steelhead. For the Southwest Washington ESU, most steelhead stocks of concern were in Lower Columbia tributaries and most healthy stocks were in tributaries to Grays Harbor. The report noted the major threat to genetic integrity for steelhead in the Southwest Washington ESU comes from past and present hatchery practices.

Risk Factors for Washington Coast Salmon

Salmon and steelhead populations along the coast are healthier largely because their habitat is more intact. Several factors contribute to this condition. In contrast to Puget Sound and especially the Columbia River Basin, there are few hydropower dams or other large-scale diversions of water in coastal basins. Furthermore, the human population of the coastal area is low and growing relatively slowly. The population of the five Water Resource Inventory Areas (WRIAs) along the coast is projected to grow by less than 50,000 by 2020 and total population will still be less than 200,000[48]. In contrast, the population of the 19 WRIAs of the Puget Sound region is projected to grow by over 2 million people by 2020 to a population that exceeds 6 million. Human population growth and the land development associated with such growth is a reasonable measure of the level of risk to salmon habitat.

The percentage of land area in forest or developed for urban use are also general indicators of risk to salmon habitat. Prior to implementation of more recent and salmon-friendly forest practices, extensive timber harvest in forested areas often resulted in degraded salmon habitat. However, in general, the greater the percent of forest land the lower the risk to habitat; and conversely, the greater the percent of urban land use the higher the risk. Forest land in the five WRIAs along the coast ranges from a low of 69% of the total area to a high of 81%[49]. Urban land in these WRIAs is at 0% for two WRIAs, 1% for two WRIAs, and 2% for one WRIA. In contrast, four WRIAs in the most heavily populated area of central Puget Sound range from a low of 33% of total area in forest to a high of 67%. Urban land in these four WRIAs ranges from a low of 8% of total area to a high of 40%.

Although coastal salmon populations are relatively healthy and face relatively lower risks to their habitat, the NOAA Fisheries BRT reports identified several risk factors that are noteworthy in relation to the long-term prospects of salmon and steelhead populations along the Pacific coast of

[48]"Washington's Water Quality Management Plan to Control Nonpoint Sources of Pollution", Appendix A, Washington Department of Ecology, #99-26, December, 2001.
[49] Ibid.

Washington. These risk factors are: 1) habitat degradation caused by past forestry practices; 2) vulnerability of populations to excessive harvest; and 3) threats to the genetic integrity and diversity of populations from hatchery practices. Given the importance of coastal salmon populations, it does make sense to consider investments in addressing these risk factors when determining priorities for salmon recovery efforts.

Conclusions

It is clear that, given their relative health and the lower risks they face from human population growth and development, coastal salmon populations are important to long-term success in preserving healthy populations of salmon in the State of Washington. These populations do face risks from past and current practices affecting fish and their habitat that warrant attention in order to assure the populations' continued health. These risks can be addressed by investing in: 1) reforms for hatchery practices, such as those initially being implemented in Puget Sound; 2) harvest management practices that reflect the latest technologies for avoiding too much harvest; 3) implementing the Northwest Forest Plan for federal forests, the Habitat Conservation Plan approved for state-owned forests, and the Forests and Fish Agreement for private forest lands, with emphasis on assisting small land owners; and 4) habitat protection and restoration actions that complement the progress being made in addressing the impacts of past forest practices.

Fortunately, the current status of coastal populations has generally not warranted endangered or threatened listings under the ESA. So the ESA is not a driving force on the coast, as it is elsewhere in the state, for conserving salmon populations. Therefore, there is a need to develop alternative approaches and strategies for salmon conservation along the coast. There is also a need, both within the coastal region and across the state, to increase awareness of the importance of these coastal populations and advocate their significance for long-term success in conserving salmon. This will help ensure adequate attention is given to salmon health and recovery along Washington's Pacific coast.

APPENDIX 12
NEEDS ASSESSMENT

WILD SALMON CENTER

Coastal Lead Entities Needs Assessment

WHITE PAPER

October 2009

Authors: John Kliem and Deborah Holden, Creative Community Solutions
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Executive Summary

In preparation of developing a regional salmon sustainability strategy, the Washington Coast Salmon Recovery Region conducted a regional gap analysis to assess the availability and accessibility of research relating to salmon populations, habitat, hatcheries, harvest, and hydropower in Water Resource Inventory Areas (WRIAs) 20, 21, 22, 23, and 24.

The project approach entailed 1) collecting related electronically accessible documents from the region and collating them into web-based library[50]; and 2) holding workshops with WRIA Lead Entities members and other state, federal, and tribal representatives to identify and make recommendations for addressing local and regional data needs.

Project Background

The Coastal Needs Assessment project was made possible by a grant from the Grays Harbor County Community Salmon Fund Creative Partnerships Program, established by the National Fish and Wildlife Foundation and the Salmon Recovery Funding Board. The project was designed to identify regional needs and data gaps as described in the "Report on Consideration of Forming a Coastal Regional Governance Unit for Salmon Sustainability" authored June 20, 2007, to prepare resource and conservation planners for development of a forthcoming regional salmon plan. The effort served to inventory existing data and assess data needs within four Washington Coast Lead Entities regarding the status of salmon populations and the recovery efforts needed within each lead entity. The four coastal Lead Entities encompass five Water Resource Inventory Areas (WRIAs): Sol Duc-Hoh (20), Queets-Quinault (21), Lower Chehalis (22), Upper Chehalis (23), and Willapa (24) as shown in Figure 1. This area includes all or parts of seven counties and six tribal governments.[51]

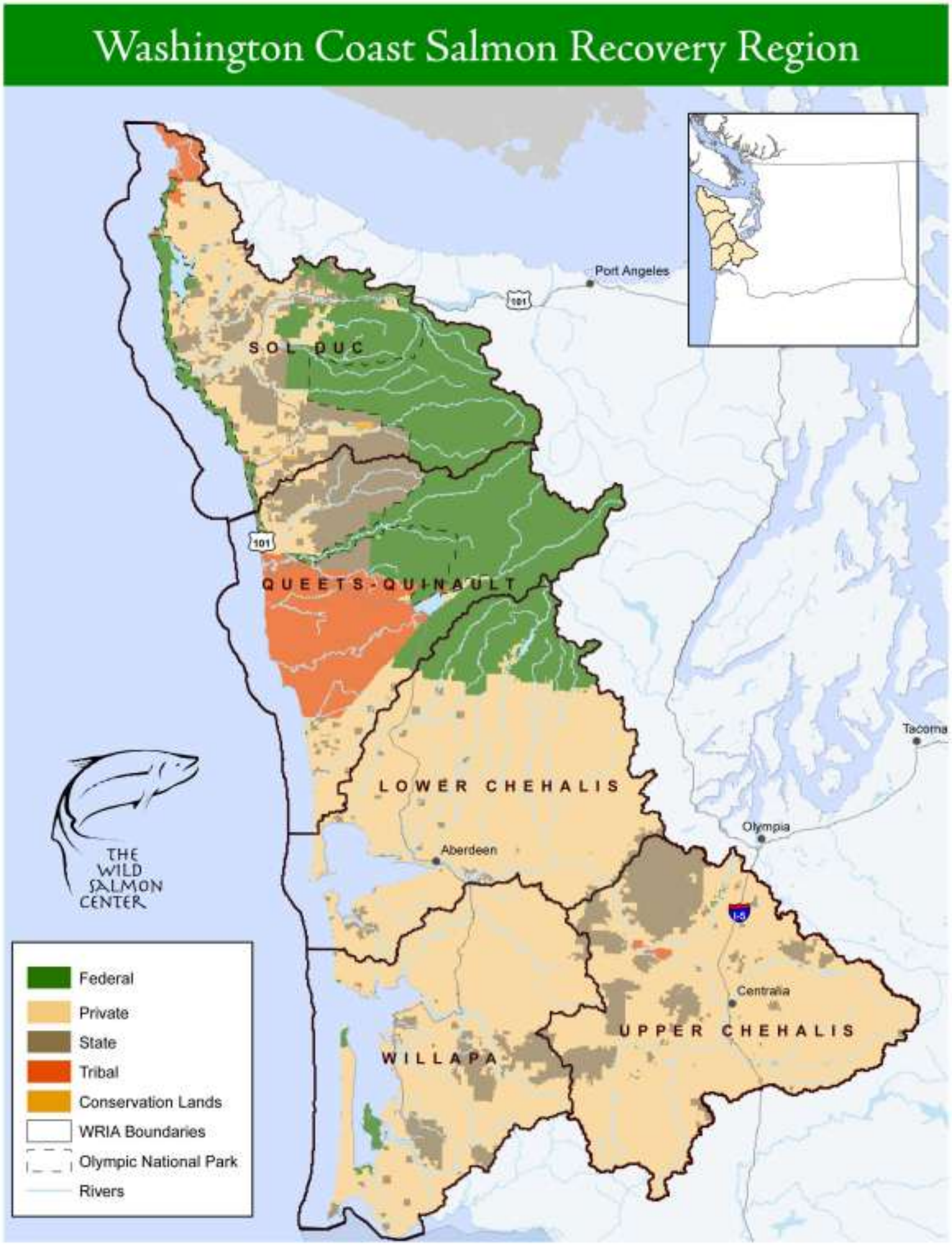
The study assists two organizations currently involved in planning activities: the North American Salmon Stronghold Partnership (Stronghold Partnership) and the Washington Coast Sustainable Salmon Partnership (WCSSP).

The Stronghold Partnership is a public-private partnership that focuses on protecting the healthiest remaining Pacific salmon ecosystems in North America. After a rigorous two-year process, the Stronghold Partnership conferred status to the first nine stronghold areas in the Pacific Northwest.

[50] Available at: http://www.wcssp.org/WCSSP_library/index.html

[51] Clallam County, Jefferson County, Grays Harbor County, Thurston County, Mason County, Lewis County, Pacific County, Makah Nation, Quileute Indian Tribe, Hoh Indian Tribe, Quinault Indian Nation, the Confederated Tribes of the Chehalis, and the Shoalwater Bay Indian Tribe.

Figure 1: Washington Coast Salmon Recovery Region



One of these Strongholds includes the Quinault/Queets Basins in WRIA 21. It was during this stronghold conferment process that participating scientists realized that information about salmon populations in the four Coastal Lead Entities was not readily accessible, incomplete, or nonexistent. The Stronghold Partnership is interested in entertaining additional Stronghold requests in the coastal region, but there remains a need for more information before further action can take place.

At the same time, WCSSP, a recently formed regional organization to serve the needs of the four Coastal Lead Entities, has initiated a regional salmon sustainability planning effort. The purpose of this plan is to lay out a strategy to ensure the long-term sustainability of salmonids from an all-inclusive approach addressing habitat, harvest, hatchery, and hydropower. The first step in developing the plan was to collate known data about salmon populations and recovery needs within each lead entity. It also sought to identify data gaps and approaches for overcoming them.

Given the similar data needs for both the Stronghold Partnership and WCSSP efforts, the Wild Salmon Center decided to commission a project that would achieve three objectives:

- Collect from each coastal Lead Entity pertinent electronic reports or studies on salmon relating to population status, habitat, hatcheries, harvest, and hydropower and compile them into an electronic coastal salmonid library that would be readily available to the public
- Have each lead entity technical committee identify key documents and data gaps from an individual WRIA-wide perspective
- Have technical representatives from throughout the region pinpoint data needs held in common by all four lead entities

There were two intended benefits to this project. One was to build a sense of "community" among the four Coastal Lead Entities by engaging the participants in a short-term, collaborative project. The other outcome was to begin building a regional technical team consisting of experts within and beyond the region who could contribute to both the Stronghold Partnership and WCSSP planning processes.

Individual Lead Entity Needs Assessment Workshops

The Wild Salmon Center held a workshop with each of the Lead Entities during the months of June and July 2009 to satisfy the first two objectives of the project. The format of the workshops asked three questions:

- Which existing documents would you identify as containing essential data for understanding the status of salmonids and the efforts needed for their recovery within your Lead Entity?
- If you had a "wish list" for new data that would help you better understand the status of salmonids and the efforts needed for their recovery within your Lead Entity, what would be on that list?

- Looking at your wish list, what would be the priority or sequencing of filling these data gaps?
- The intent of the first question was to have each Lead Entity think about what data was available for their Lead Entity and then to prioritize its relevance in educating regional planners about local, fully integrated salmon sustainability/recovery issues.

The intent of the next two questions was to 1) get workshop participants to consider when existing data was insufficient or nonexistent, and 2) assign priority to resolving data needs.

The workshops revealed many similarities and a few differences between the four Coastal Lead Entities. Below is a summary of each workshop by Lead Entity.

WRIA 20: NORTH PACIFIC COAST LEAD ENTITY

The North Pacific Coast Lead Entity identified a number of key documents as essential for understanding population status and recovery needs for salmonids in their region. These were the:

- Lake Ozette Limiting Factors Analysis
- Lake Ozette Recovery Plan and associated documents
- Watershed analyses prepared by the US Forest Service, the Quileute Indian Tribe, and the Makah Nation
- WRIA 20 Watershed Management Plan (2009)
- State of Our Watershed (SSHIAP)

The primary focus of the WRIA 20 technical committee was to acquire those tools that would facilitate the completion of other projects, such as an updating salmonid limiting factors analyses. The top three data needs identified by this group were:

1. Acquiring NetMap for further in-depth watershed analyses
2. Collaborating with the co-managers to update the Salmonid Stock Inventory (SaSI) using a neutral third party
3. Conducting a complete channel migration study using LIDAR

Other identified data needs for the WRIA are:

- Updating the original limiting factors analysis
- Analyzing urban development impacts along the Pacific Coastline
- Carrying out a genetic inventory of salmonids within rivers and along the Pacific Coastline
- Completing culvert assessment for those areas not already completed
- Selecting and applying an ecosystem valuation model to habitat within the WRIA
- Adding staffing for data stewardship and GIS management

WRIA 21: QUINAULT INDIAN NATION LEAD ENTITY

Members of the Quinault Indian Nation Lead Entity technical group chose not to identify key documents. They reported that the majority of studies currently available consist of level-one assessments that either lack sufficient detail or are very site-specific. In addition, the studies used differing methodologies that make forming general conclusions about population status and recovery issues difficult on a watershed scale. Representatives of the Quinault Indian Nation in particular did not support the findings contained within the 2002 Salmonid Stock Inventory (SaSI).

The group did clearly state their desire to fill large-scale data gaps by preparing Level III watershed assessments for the entire WRIA. Recognizing the immensity of this task, the Lead Entity suggested phasing the assessments in by starting with the major systems and gradually progressing towards the smaller tributaries. For example, WRIA 21 would first focus on the Quinault, then the Queets, the Raft, the Copalis, and so on.

These watershed studies would involve sampling of streams for populations/fish use, fish distribution studies, noxious weeds assessment, surveys conducted on the ground (aerial photograph inventories are ineffective), measure human impacts in the watershed, inventory hard armoring along rivers, inventory culvert and other barriers on County, state, and private lands, LIDAR flyovers, mapping stream connectedness and channel migration zones in relationship to land-use and historic disturbances.

However, the technical group members emphasized that any assessments completed within the Lead Entity should use standardized, repeatable methodologies to create a uniform baseline of information.

Other data needs identified by WRIA 21 participants included:

- Acquiring a data steward to collate non-published documents and raw data resources that could provide valuable information if made accessible
- Developing and applying water quality standards, especially for sediment and temperature, that provide a greater array of analysis than current state standards
- Implementing quality long-term monitoring, including monitoring temperature

WRIAS 22-23: GRAYS HARBOR LEAD ENTITY

The Grays Harbor Lead Entity workshop participants indicated that the key published documents and websites for their Lead Entity were:

- The Chehalis Basin Salmon Restoration and Preservation Work Plan
- Assessment of Salmon and Steelhead Performance in the Chehalis River Basin in Relation to Habitat Conditions and Strategic Priorities for Conservation and Recovery Actions
- Growth Management Act development regulations for each jurisdiction
- **Washington Department of Natural Resources Water Typing**

Technical group members added that there are several raw data sources important for planning within the Lead Entity. These include annual escapement goals and data for subbasins within the WRIA.

The WRIA 22-23 Lead Entity data needs reflect the desire to fine-tune existing resources or else add new dimensions to local knowledge about populations and conditions. The top priority data needs include:

1. Expanding habitat diagnosis tools, such as EDT, or integrating new models into planning processes, such as SSHIAP, SHIRAZ, and NetMap (staffing to keep the models up-to-date and consistent data were mentioned as critical to making this happen)
2. Developing a limiting factors analysis and EDT model for marine and estuarine areas, including determining the carrying capacity of the marine areas
3. Conducting an ecosystem valuation for the entire Chehalis Basin
4. Improving/updating information about stock status, historic stock use within the basin, and determining the carrying capacity of the basin

The group had a wide-range of additional data needs that include:

- Evaluating fish use before and after a project to determine the efficacy of restoration projects
- Assessing the impacts of local land use policies on habitat
- Expanding the knowledge base about function and contribution of the estuary to life history cycles of salmonids
- Studying local stream conditions to identify and locate prime spawning areas and use this information to target fish barrier projects that will yield high results
- Determining salmonid influences on Orca populations in Pacific marine waters

WRIA 24: PACIFIC COUNTY LEAD ENTITY

The two key documents for understanding salmonid population status and recovery needs within the Pacific County Lead Entity area are the limiting factors analysis and the Lead Entity strategy.

The Lead Entity technical group intends to update both of these documents in the future, but the quality of that effort will depend on increasing the number of "tools" available to them. While group members mentioned there they have strong anecdotal knowledge about local habitat conditions, they also recognize their inability to "quantify" their data into a useable format. Therefore, the priority data needs of the Lead Entity are to acquire "data tools" such as EDT, SSHIAP, and NetMap. LIDAR was another data set group members felt would be useful.

The Lead Entity also expressed their desire for more complete population status information beyond SaSI, including the ability to identify populations genetically. Accompanying this need was fish distribution data beyond Washington Department of Natural Resource stream typing; the data should undergo ground truthing to ensure accuracy.

Regional Needs Assessment Workshop

Technical representatives from each of the Coastal Lead Entities and other organizations and agencies convened on July 22, 2009 to provide a regional interpretation to the data needs assessment. These participants:

- Analyzed the similarities in the data needs of the Coastal Lead Entities,
- Discussed data gaps from a regional standpoint, and
- Laid out an approach for resolving regional data needs

Common Data Needs among the Lead Entities

Clearly, the Coastal Lead Entities all have unique identities and needs. However, they also recognize that their linked Pacific Coast ecosystems make it sensible to work together to their mutual benefit. This concept naturally surfaced when regional workshop participants examined the prioritized data needs of individual Lead Entities. They discovered several strong commonalities among the Lead Entities in relation to data needs that include:

- Selecting, acquiring, and applying common data tools that assess habitat conditions within WRIAs and across the region
- Ground-truthing assessments to ensure accuracy and to improve future models
- Expanding the general knowledge base of regional planning participants on habitat, harvest, hatchery, and hydropower issues and their integration at an ecosystem level
- Completing culvert / fish barrier inventories
- Completing noxious weed assessments

- Conducting assessments along the estuaries and marine coastline
- Updating and expanding the Salmonid and Stock Inventory (SaSI) data on populations
- Analyzing land use practices that impact habitat along the Pacific Coastline
- Documenting water quantity within Lead Entities
- Preparing ecosystem valuations

Regional Gap Analysis

Regional workshop participants added several of their own unique data gaps from a coast-wide perspective.

- There are multitudes of databases within the region (and state) that are not compatible with one another. This makes integrating data sharing difficult if not impossible. Data assimilation through systems like NetMap could address much of this problem.
- The region needs to design a uniform approach for ground-truthing projects to prove and demonstrate their efficacy.
- Large private landowners in the region, such as the timber holding companies, have substantial data currently inaccessible to salmon sustainability efforts. The Lead Entities need to show these landowners that improving access to this data will prove beneficial to all parties.
- Standardized methodologies for assessments and ground-truthing will encourage approaches that benefit both individual Lead Entities and the region.
- There is a need for hatchery genetic management plans (HGMPs) within the region.

Establishing Priority Data Needs within the Region

Workshop participants prioritized four main thrusts for addressing data needs within the coast region. These priorities are integral to one another and serve as the basis for any planning effort aimed at sustaining salmon populations along the Washington Coast.

1. Update Data on Coastal Lead Entity Salmonid Populations

Individual Lead Entity and regional workshop participants agree that SaSI needs significant updating to provide a more accurate assessment of the status of salmonids in the coastal area. Resolving this data gap needs to include identifying the number of distinct populations in the region and assessing their relative health. This information will be critical for making informed decisions about project design and implementation as described through WCSSP planning process.

The group proposes initiating discussion with the co-managers in revisiting SaSI for the coast region. It may prove helpful for a neutral, third party to facilitate this effort.

2. Analytical Tools

The Coastal Lead Entities need access to effective analytical tools throughout the region to fully assess and plan for habitat that sustains salmon. Regional workshop participants see distinct advantages in collaborating in the selection and use of common assessment tools throughout the four WRIAs.

- Economies of scale suggest it would be more cost effective in acquiring one system or methodology as opposed to four different ones.
- It would prove more cost-effective for the Coastal Lead Entities to share staff expertise.
- Using common assessment tools would allow the Coastal Lead Entities to evaluate their ecosystems independently and on a larger regional basis. Collaboration in this way will tie recovery planning to an ecosystem-wide approach rather than an isolated watershed focus. Having common analytical tools may forge a more regional identity for the four Lead Entities, a collaboration that will reap improved planning and access to project funding.

Moving forward with the common analytical tools approach begins with evaluating and selecting which methodologies are appropriate for the region. Preliminary discussions suggest LIDAR imaging, NetMap, and EDT as tools of interest. A planning subcommittee should compare and contrast the variety of methodologies, examine local needs and resources, and make a recommendation on which tools the Coastal Lead Entities should select for common use. Once completed, the Coastal Lead Entities can pursue funding options.

3. Broad-scale Habitat Assessments

A recurring theme throughout the Lead Entities focused on the need for more advanced watershed and limiting factors analyses. Lead entities also recognized that current habitat assessments in the region use different methodologies and vary in detail. The combination of these factors makes it difficult to assess conditions accurately on either a watershed or landscape scale.

The regional group recognizes that completing more thorough habitat assessments within each Lead Entity is a regional priority. If done using standardized methodologies and common analytical tools, recovery planning will move from simply a watershed level to a landscape scale. This approach in turn may improve overall watershed health and will increase the likelihood of funding opportunities over the long-term by elevating the four Coastal Lead Entities into a regional force on par with the Lower Columbia and Puget Sound.

4. Data Stewardship

Tracking data throughout the four Coastal Lead Entities is a major task currently left undone. Until now, there has been no central depository for published data in the Coast region; the library collated during this needs assessment will continue to grow and will need maintenance to be of use to those individuals doing research or projects. There are also large numbers of critical documents that remain inaccessible because of limited copies available in paper format in isolated locations. These documents could prove essential if made available on-line in electronic format.

There is also the need to collate, organize, and distribute reportedly large quantities of unpublished data. Workshop participants indicate that agencies and organizations within the region collect specific data that never makes its way into a document, or at least in a timely fashion. Making this data accessible for those within each Lead Entity and throughout the region will be important for upcoming planning processes and long into the future. As a result, a data stewardship program is high on the region's needs assessment list. Workshop participants felt that the development of this program ties closely with decisions regarding analytical tools.

Conclusion

Closing the needs assessment gap in the Washington Coast Salmon Recovery Region will require securing a level of resources far and beyond those currently allocated to it. To this end, the local Lead Entities, joined by those state, federal, tribal, and nonprofit agencies and organizations engaged in coastal salmon recovery, need to continue communicating and planning strategically as a single entity to increase the awareness of public and nonprofit funders to recognize the importance of sustaining coastal salmon populations.

APPENDIX 13
PLANNING PROCESS AND ANALYSES

BACKGROUND

The first steps toward creation of the *Washington Coast Sustainable Salmon Plan* ("Plan") were taken between January and June of 2007. Supported by a grant from the Salmon Recovery Funding Board, representatives of the four Lead Entity organizations and associated stakeholders came together during that time to consider the opportunities, pros and cons, and benefits and risks for regional collaboration on common issues including salmon recovery. The purpose of these discussions was to determine whether to form a coast-wide regional body and, if so, outline what the purpose and functions of this organization would be.

After six months of collaborative effort, the group agreed to form the Washington Coast Sustainable Salmon Partnership ("WCSSP") to work on common issues affecting the Region, including avoiding ESA listings and, through sustainability, further diminished salmon populations. Functions outlined by the group included developing a holistic view of the Region that encompassed watershed planning, salmon recovery and economic development. The first task in their list of "planning and projects" was the development of a regional plan or strategy.

Developing an organization necessitated attending to other details first, such as creating an organizational structure. Another year and a half passed before WCSSP took up the planning challenge in earnest. Still, it is the work of that first organizational planning group that provides the foundation and basis of this Plan. The results of that first six months are summarized in the *Report on the Consideration of Forming a Coastal Regional Governance Unit for Salmon Sustainability* (see http://wcssp.org/resource2.html), and articulate the common issues and concerns that WCSSP and its sustainability plan should consider and address.

SCOPING WORKSHOP

The process of developing a regional salmon Plan began with a Scoping Meeting on January 21, 2009. Stakeholders from across the Region came together in Forks for a one-day facilitated workshop to envision what a plan might look like and what it should contain, as well as how to create it.

It was the conclusion of the participants at this meeting that a regional plan should be a collaborative, ecosystem-based effort by WCSSP and its partners, and should focus on common needs, bridge differences by developing solutions, and achieve broad agreement and support. It should reflect the values and priorities of the communities within the five coastal Water Resource Inventory Areas ("WRIAs"). Moreover, the Regional Plan should strengthen and complement local Lead Entity Group ("LEG") strategies.

> ***Whereas recovery plans are driven by the federal Endangered Species Act, the Washington Coast Regional Plan should be a visionary, innovative document that meets the needs held in common by the Coast Lead Entities.***
>
> ***Presently the Washington Coast Region and its four LEGs have a relatively small voice in comparison to the Puget Sound and Columbia Basin Salmon Recovery Regions. This can hamper getting the key message out about the benefit of public investment in the protection of high-quality habitats; that is, it is far easier, more likely to be successful, and less expensive to maintain good habitat than to recreate or restore degraded habitat in highly urbanized or altered landscapes and ecosystems.***
>
> ***Until the Washington Coast story reaches the larger audience, it will receive far less attention, and subsequently, fewer resources than other regions. However, by collaborating to develop a Regional Plan that promotes addressing issues at an ecosystem-wide scale, the Coast Region and its Lead Entity Groups (LEGs) will raise awareness of their importance to Washington's salmonids and the long-term sustainability of their wild stocks. This higher profile will promote delivery of greater resources locally as the Coast Region proves it can provide higher return for dollars spent.***
>
> (Creative Community Solutions, 2009)

The Scoping Meeting detailed a ten-step general project approach to guide the Plan development process and frame the elements of the final product:

VISION, GOALS AND MEASURABLE OBJECTIVES

The foundation to the Regional Plan should be its Vision and Goals for Salmonid Sustainability and the identification of measurable objectives for evaluating success within the Coast Region ecosystem.

CLEAR SCIENCE

The Regional Plan should rely on a framework of best available science to support community-driven approaches to salmon sustainability in the Coast Region.

ECOSYSTEM-BASED PLANNING SCALE

The Washington Coast forms a unique ecosystem within the Pacific Northwest that is critical to the future of salmonids in this state and in the Pacific Northwest. Integrating an ecosystem approach into its salmon recovery strategy will likely provide each LEG with greater insight into its own habitat restoration and protection efforts and priorities.

LOCAL SCALE

The approach and structure for the Regional Plan should strengthen local efforts and emphasize collaboration among LEGs. It should not supplant or supersede individual Lead Entity strategies.

ASSESSING STOCK AND HABITAT STATUS AND IDENTIFYING LIMITING FACTORS

A key component of the Regional Plan should be a review and assessment of stock and habitat status on an ecosystem scale.

STRATEGIES FOR PROTECTION

The Regional Plan should, wherever possible, contribute to local efforts at implementing protection strategies by emphasizing their link to the greater coastal ecosystem.

INTEGRATED STRATEGIES

The Regional Plan process should allow WCSSP and the LEGs to understand the harvest and hatchery strategies of the co-managers and assess local habitat strategies within an integrated All-H (Hatchery, Harvest and Habitat) framework. An improved understanding of how habitat strategies integrate with hatchery and harvest strategies may lead to a better understanding of the regional needs for sustaining wild salmon. The resulting dialog also may benefit the co-managers by allowing them to consider habitat strategies as they work to improve their hatchery and harvest strategies.

IMPLEMENTATION PRIORITIZATION

The Regional Plan should look for common factors affecting local stocks, watershed systems, and the larger Region, and rate them by their level of impact to Washington Coast salmonids. In addition to strategies, actions, and related projects, the Regional Plan should set out a monitoring program and identify which data gaps are most important to address.

FUNDING AND WAYS TO MEASURE PROGRESS

The Regional Plan should develop a funding package for any further planning or monitoring needs and for Plan implementation. This should include a review and prioritization of all funding mechanisms and sources: federal, tribal, local, and state governments, nonprofit foundations, donors, and in-kind.

The Regional Plan should establish a method for measuring progress in implementing the Plan and achieving Plan goals and objectives. Showing progress is essential for ensuring a long-term funding stream.

ADAPTIVE MANAGEMENT

Adaptive management is critical to keeping the Regional Plan valid, effective, and on track. The Regional Plan should establish an adaptive management process to test Plan assumptions on a regular basis and set up a process for integrating new science and responding to community values and circumstances.

(Creative Community Solutions, 2009)

NEEDS ASSESSMENT

A key project identified at the Scoping Meeting as a first step in the planning process was development of a data gaps analysis, or Needs Assessment. The Wild Salmon Center stepped forward to carry out this project, providing the first critical collaboration of the planning process.

Through a collaborative process involving a broad set of stakeholders from throughout the WCSSP Region, the four Lead Entities and the North American Salmon Stronghold Partnership, the Needs Assessment was designed to:

- Collect from each coastal Lead Entity any electronic reports or studies on salmon relating to stock status, habitat, hatcheries, harvest, and hydropower and compile them into an electronic coastal salmon library;
- Have each Lead Entity technical committee identify key documents and data gaps from an individual WRIA perspective; and,
- Have technical representatives from throughout the Region pinpoint data needs held in common by all four Lead Entities.

The Needs Assessment is summarized in the *Coastal Lead Entities Data Needs Assessment* (see Appendix 12). In addition, the assessment produced a Region-wide data library, which is now housed on the WCSSP web site (http://wcssp.org/resource2.html) and contains over 125 documents collected during the course of the project. This data collection continues to grow and is designed to serve the needs of WCSSP and partners throughout the implementation of the Plan.

An additional product of the assessment and other work of the Wild Salmon Center was an expert ranking of the current status of the 118 identified salmon populations found within the Coast Region. The results of this assessment are integrated into the Stock Status summary in Chapter 2 – Salmon Species and Status.

OPEN STANDARDS FOR CONSERVATION - CAP

Following the direction provided by the Scoping Meeting participants, WCSSP sought to identify and select a planning process that would include the elements of the general planning approach outlined at the Scoping Meeting. WCSSP decided to use The Nature Conservancy's Conservation Action Plan ("CAP") process because it is a flexible, science-based model which incorporates monitoring and adaptive management. This method was selected in part because it is proven and adaptable at multiple scales and could easily adjust to the unique needs of the Coast Region's planning challenge. The selection was also strongly influenced by the commitment of The Nature Conservancy of Washington to dedicate staff to assist WCSSP through the entire process, which led to the second formal partnership in support of this Plan's development.

CAP is The Nature Conservancy's version of the Open Standards for the Practice of Conservation. The Open Standards were developed by the Conservation Measures Partnership, a joint venture of more than a dozen conservation organizations seeking better ways to design, manage, and measure the impacts of their conservation actions (http://www.conservationmeasures.org/; http://www.conservationgateway.org/topic/conservation-action-planning). The methodology has been modified and applied in a wide variety of processes by conservation and non-conservation organizations for almost 20 years, including regional salmon recovery planning in California (NOAA) and performance management development (Puget Sound Partnership). While we began with a direct application of the CAP model, the flexibility of the open standards allowed for our planning team and participants to adjust the model to accommodate the innovative ways they sought to use it. In addition to its flexibility, strengths of this process for WCSSP included the emphasis on incorporating scientific data and information, goal setting, strategy development and prioritization, integrated monitoring, adaptive management, and its usefulness as an effective tool for broader stakeholder and partner input.

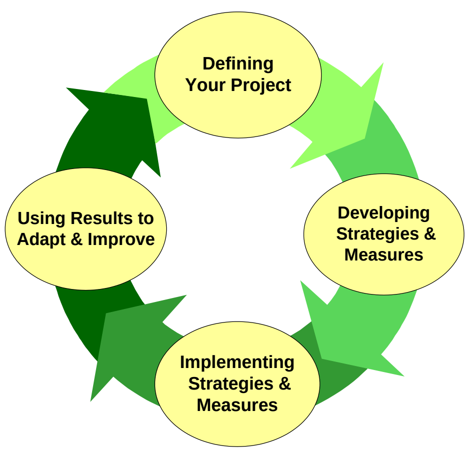


Figure 16: Graphic Depiction of the Open Standards/Conservation Action Plan Process

In general, the open standards follow an iterative process of:

- Defining the project
- Developing strategies and measures
- Implementing strategies and measures
- Using the results to adapt and improve.

The production of this planning document is, in fact, only half the process; the second half, effectiveness monitoring and adaptive management, will follow. The idea is to create a living Plan that will be improved and updated to maximize outcomes for salmon populations as implementation and adaptive management are undertaken.

PLANNING COMMITTEE

The first step, after selecting the CAP process for regional Plan development, was the appointment by the WCSSP governing body of the Regional Planning Committee. The members are:

Miles Batchelder, Chair, WCSSP staff
Bob Burkle, Washington Department of Fish and Wildlife
Chris Byrnes, Washington Department of Fish and Wildlife
Dana Jo Dietz, WCSSP staff
Devona Ensmenger, Wild Salmon Center
Mike Johnson, Pacific County Lead Entity
Katie Krueger, North Pacific Coast Lead Entity
Key McMurry, Pacific County Lead Entity
Phil Miller, Governor's Salmon Recovery Office
Lee Napier, Grays Harbor County Lead Entity
Kara Nelson, Lead Planner, The Nature Conservancy
Rich Osborne, North Pacific Coast Lead Entity
James Schroeder, The Nature Conservancy
John Sims, Quinault Indian Nation Lead Entity

The first job of the Planning Committee was to identify every person that the committee wanted to invite to participate in the process. This list included representatives of tribes, state and federal agencies, citizens, business and industry representatives and elected officials. One of the real success stories of this process has been the extraordinary participation and assistance the committee received from around the Region throughout the entire process.

Once our participants were identified, the committee articulated the Plan's vision and scope. The scope was fairly straightforward: since WCSSP is the regional organization for a specific geographic area, we understood from the outset what our Scope was. However, it also became clear that, as the only outer coast salmon recovery organization, we needed to extend our planning vision offshore to include not only estuaries but also the nearshore and ocean environments where salmon spend such a huge portion of their lives.

These statements are included in earlier sections of the Plan, but are repeated here to capture the continuity of the planning process. The geographic **Scope of the Plan** was defined as:

All of Washington's watersheds that drain directly into the Pacific Ocean between Cape Flattery in the north and Cape Disappointment in the south, together with their inland, estuarine and nearshore environments, lying within all or parts of Clallam, Jefferson, Grays Harbor, Pacific, Cowlitz, Mason, Lewis, Thurston and Wahkiakum Counties.

The **Plan Vision** was articulated as:

All watersheds in the Washington Coast Region contain healthy, diverse and self-sustaining populations of salmon, maintained by healthy habitats and ecosystems, which also support the ecological, cultural, social, and economic needs of human communities.

TARGET SELECTION WORKSHOP

In December 2009, WCSSP held the first workshop of the CAP planning process at Lake Quinault Lodge to select eight focal targets. Focal targets are essentially a limited suite of species, communities, or ecological systems that encompass the processes necessary for the long-term sustainability of salmon in the Coast Region.

After an orientation provided by the workshop facilitators, including a description of the way in which the targets selected would be used to move and guide the Plan, the attendees participated in an extended work session. Through a vigorous and often intense exchange focusing on what is most important to salmon, the group eventually came up with two lists: one included a combination of salmon life history stages and habitats, while the other was entirely habitats.

Efforts to bring the group together to a compromise position raised numerous questions about how the Plan might be better served by one list over the other, or whether it should be a combination of the two. Consensus could not be reached after extended discussion. Those advocating for targets that included salmon life history stages felt that the Plan must be focused, specifically, on the fish the Plan is supposed to be about, whereas those advocating for the habitat targets felt that capturing every place salmon are found throughout the ecosystem (as well as habitats “upstream”) was the best way to achieve the objective of an ecosystem scale plan and a whole-systems perspective that had been identified previously as the Plan nexus.

In the end the attendees resorted to a vote to resolve the question – not the best outcome, but one that in the end made for a much more rigorous and in-depth Plan.

The targets selected were all of the habitats where salmon spend a part of their life history, as well as headwaters/upland habitat that directly influences salmon freshwater habitat “downstream:”

Headwaters and Uplands	**Mainstems**
Wetlands and Off-Channel	**Estuaries**
Tributaries	**Nearshore**
Lakes	**Ocean**

The next step was to specifically define each habitat target so the boundaries between them or, more accurately, where one habitat becomes another, would be clearly understood. In some cases, this was fairly simple, in others not so much. Some of the results may seem at first glance to be counter-intuitive. Yet, based on an understanding of how fish use each habitat, the definitions themselves make sense. It was important to capture these distinctions so everyone involved in the process shared a common understanding of each habitat’s meaning.

TARGET DEFINITIONS

Headwaters and Uplands: All landscape areas within a given drainage from its ridgeline down to 20% gradient, above Salmon access

Wetlands and Off-Channel: Everything that salmon can get into that is not a mainstem, tributary, lake, estuary, nearshore, or ocean

Tributaries: Streams with mean annual flow less than 1,000 cfs to the upper extent of Salmon access

Lakes: Coast Region Sockeye Lakes: Ozette, Pleasant and Quinault

Mainstems: Rivers and Streams with mean annual flow of 1,000 CFS or greater (Shorelines of State Significance)

Estuaries: From the head of tide to the outermost headlands separating the estuary from the ocean

Nearshore: The Photic zone up to the ordinary high water line (< 60 ft)

Ocean: Everything waterward of 60 ft.

A few of these definitions deserve further explanation. The planning committee felt that the distinctions between different habitats should be about how salmon use them. Where a mainstem becomes a tributary, to a fish, has little to do with a name on a map. The distinction in this case is more a matter of flow – mainstems are larger and move more water; but where should that line be drawn? In this case, a convenient and very appropriate line had already been drawn by the Washington Department of Ecology in the Shoreline Management Act (SMA) (RCW 90.58.030(2)(e) in its definition of Shorelines of Statewide Significance west of the Cascades : streams and rivers with a mean annual flow of 1,000 cubic feet per second or greater. These rivers – our *mainstem* habitats – are all clearly identified. (See Appendix 9 for a complete list.) All smaller streams and rivers, with mean annual flow less than 1,000 cubic feet per second, were then defined as *tributaries.*

Similarly, the distinction between *estuaries* and *mainstems* is of particular importance in the south of the Region where the watersheds are defined by the Region's two large estuaries, Grays Harbor and Willapa Bay. To capture the distinction of how fish use the two distinct habitats, *estuaries* and *mainstems*, the committee settled on placing the boundary between them at the head of tidal influence; this placed the point of demarcation much further upstream on some of our mainstems than might otherwise be assumed, but accurately captured how fish use them.

Concerning *lakes*, for the purposes of a regional salmon sustainability plan, the Coast Region lakes that were/are deserving of separate definition and consideration were those that support the three regional Sockeye ESUs – Lakes Ozette, Pleasant and Quinault. The few regional lakes that do not support sockeye were just as accurately categorized as ponds or wetlands – which the planning committee used to capture all other salmon habitat not specifically defined by one of the other habitat targets.

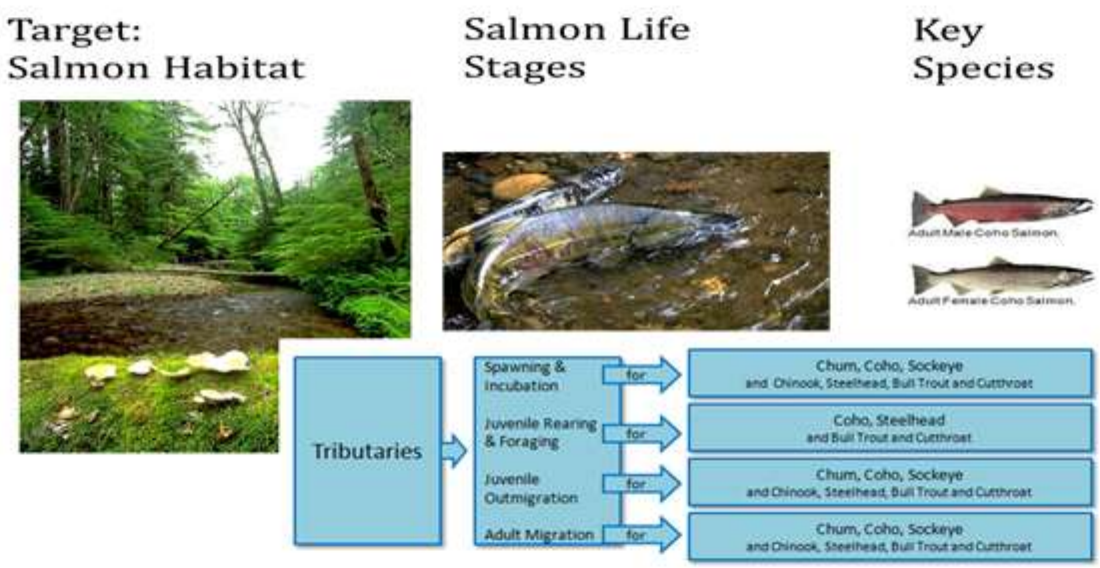
NESTED TARGETS

Following the workshop the planning committee undertook to address the concerns raised by attendees of the first workshop, namely, that habitat targets alone do not adequately address the needs of the fish. It was unanimously agreed by the committee that the appropriate remedy was to identify, for each habitat, the salmon life history stages associated with that habitat and identify them specifically as "nested targets."

Nested targets are essentially additional targets that are specifically addressed in further steps of the planning process when considering the next step of the process, the identification of attributes to describe the condition of the targets.

So, each habitat target was further defined in terms of how salmon use it, for which life stage that habitat is critical, and which species's specific needs, if met, cover all other salmon species needs.

Figure 17: EXAMPLE OF NESTED TARGETS



Through a series of work sessions, the planning committee identified the key life stages and the associated key salmon species for each habitat, as follows:

Table 33: **KEY SALMON SPECIES and SALMON LIFE STAGES PER HABITAT**

Habitat Target	Key Life Stages/Nested Targets	For Key Salmon Species
Headwaters and Uplands	Absence of salmon in this habitat is part of its defining characteristics. However, headwater processes directly affect downstream conditions for salmon at all life stages.	Coho, Steelhead, Bull Trout, Cutthroat
Wetlands and Off-Channel	Spawning and incubation	**Coho,** Cutthroat
	Juvenile rearing and foraging	**Coho,** Cutthroat
	Juvenile refugia and holding	**Coho,** Cutthroat
	Adult migration and staging	**Coho,** Cutthroat
Tributaries	Spawning and incubation	**Chum, Coho, Sockeye,** Chinook, Steelhead, Bull Trout, Cutthroat
	Juvenile rearing and foraging	**Coho, Steelhead,** Bull Trout, Cutthroat
	Juvenile outmigration	**Chum, Coho, Sockeye,** Chinook, Steelhead, Bull Trout, Cutthroat
	Adult migration	**Chum, Coho, Sockeye,** Chinook, Steelhead, Bull Trout, Cutthroat
Lakes	Spawning and incubation	Sockeye
	Juvenile rearing and foraging	Coho, Sockeye
	Adult migration and staging	Bull Trout, Sockeye, Steelhead (freshwater phenotype), Cutthroat
Mainstems	Spawning and incubation	**Chinook**, **Steelhead,** Chum
	Juvenile rearing and foraging	**Chinook, Coho, Steelhead, Bull Trout, Cutthroat**
	Juvenile outmigration	**Chinook**, **Coho,** Chum, Sockeye, **Steelhead,** Bull Trout, Cutthroat
	Adult migration and staging	**Chinook**, **Coho**, Chum, Sockeye **Steelhead**, Bull Trout, Cutthroat
Estuaries	Juvenile rearing and foraging	**Chinook, Coho, Chum**
	Juvenile outmigration	**Chinook, Coho, Chum,** Steelhead, Sockeye, Bull Trout, Cutthroat
	Adult foraging	Bull Trout, Cutthroat
	Adult migration and staging	**Chum,** Chinook, Coho, Steelhead, Cutthroat
Nearshore Marine	Juvenile rearing and foraging	Chinook, Bull Trout, Cutthroat
	Adult migration and foraging	Steelhead, Cutthroat
Ocean	Juvenile foraging	Chinook, Coho, Chum, Sockeye, Steelhead
	Adult foraging	Chinook, Coho, Chum, Sockeye, Steelhead

TECHNICAL WORKSHOP AND VIABILITY METRICS

Once the question of Plan focal targets was settled, and salmon life history stages and species were nested within these targets, the work turned toward an assessment of target "viability," or health. With the help of the best fisheries scientists in the Region, we held our second workshop in Neilton in March 2010 to consider how we could best measure each habitat in terms of its suitability to support the key salmon species in the specific life stages identified.

Essentially we asked our experts: What is critical for salmon health, specifically, for these species at these life stages? The workshop got us off to a great start, and we couldn't have done it without the knowledge, experience and hard work of those brought together for this workshop. A number of subsequent meetings of the planning committee and a newly-formed technical sub-committee were needed to fully develop the ideas generated at the workshop. When we finished, each habitat had been further defined by its Key Salmon Attributes and Indicators, with specific metrics selected to capture a rating of the habitat's condition.

For instance:

Tributaries: Attribute – Indicator

Water Quality – Temperature

Water Quality – Dissolved Oxygen

Water Quality – Turbidity

Riparian Condition – Buffer Width

Riparian Condition – Condition/Composition

Large Woody Material

Floodplain Connectivity – Aquatic Types and Conditions

Sediment Needs – Fines and Embeddedness

Sediment Needs – Gravel

Forage Abundance – Macroinvertebrates

Forage Abundance – Marine Derived Nutrients*

Abundance – Run Size

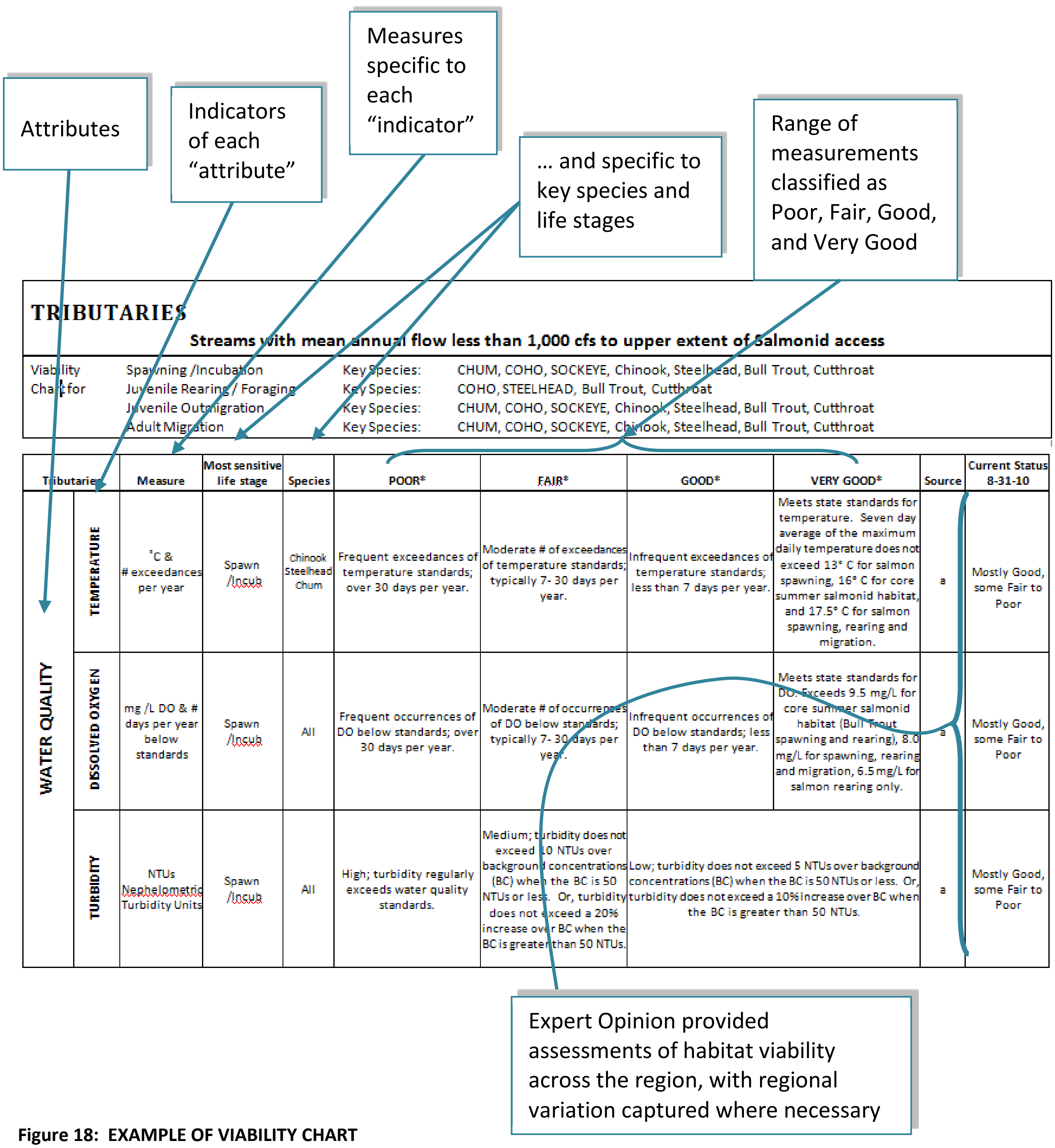
Water Quantity – Hydrology

Pool Frequency and Quality

* In some cases "proxy" metrics were used. For instance, as a way of measuring the quality of forage abundance in tributaries, our experts selected the presence of marine derived nutrients as an indicator, measured in this case by whether the local salmon populations meet or exceed escapement goals.

Utilizing the work of many others including the National Marine Fisheries Service, the Army Corps of Engineers, and the Washington Department of Natural Resources, we selected specific ranges of each metric with which we could rank the viability indicator as poor, fair, good, or very good.

Put together in Viability Charts like the one depicted here (see Appendix 7), we sought an assessment of each habitat target's condition as salmon habitat.



TRIBUTARIES

Streams with mean annual flow less than 1,000 cfs to upper extent of Salmonid access

Viability Chart for	Spawning /Incubation	Key Species:	CHUM, COHO, SOCKEYE, Chinook, Steelhead, Bull Trout, Cutthroat
	Juvenile Rearing / Foraging	Key Species:	COHO, STEELHEAD, Bull Trout, Cutthroat
	Juvenile Outmigration	Key Species:	CHUM, COHO, SOCKEYE, Chinook, Steelhead, Bull Trout, Cutthroat
	Adult Migration	Key Species:	CHUM, COHO, SOCKEYE, Chinook, Steelhead, Bull Trout, Cutthroat

Tributaries		Measure	Most sensitive life stage	Species	POOR*	FAIR*	GOOD*	VERY GOOD*	Source	Current Status 8-31-10
WATER QUALITY	TEMPERATURE	°C & # exceedances per year	Spawn /Incub	Chinook Steelhead Chum	Frequent exceedances of temperature standards; over 30 days per year.	Moderate # of exceedances of temperature standards; typically 7- 30 days per year.	Infrequent exceedances of temperature standards; less than 7 days per year.	Meets state standards for temperature. Seven day average of the maximum daily temperature does not exceed 13° C for salmon spawning, 16° C for core summer salmonid habitat, and 17.5° C for salmon spawning, rearing and migration.	a	Mostly Good, some Fair to Poor
	DISSOLVED OXYGEN	mg /L DO & # days per year below standards	Spawn /Incub	All	Frequent occurrences of DO below standards; over 30 days per year.	Moderate # of occurrences of DO below standards; typically 7- 30 days per year.	Infrequent occurrences of DO below standards; less than 7 days per year.	Meets state standards for DO. Exceeds 9.5 mg/L for core summer salmonid habitat (Bull Trout spawning and rearing), 8.0 mg/L for spawning, rearing and migration, 6.5 mg/L for salmon rearing only.	a	Mostly Good, some Fair to Poor
	TURBIDITY	NTUs Nephelometric Turbidity Units	Spawn /Incub	All	High; turbidity regularly exceeds water quality standards.	Medium; turbidity does not exceed 10 NTUs over background concentrations (BC) when the BC is 50 NTUs or less. Or, turbidity does not exceed a 20% increase over BC when the BC is greater than 50 NTUs.	Low; turbidity does not exceed 5 NTUs over background concentrations (BC) when the BC is 50 NTUs or less. Or, turbidity does not exceed a 10% increase over BC when the BC is greater than 50 NTUs.		a	Mostly Good, some Fair to Poor

Figure 18: EXAMPLE OF VIABILITY CHART

After distributing these charts to our experts and asking for their informed opinion on the conditions of the habitats using the indicators and metrics identified, we were able to collect ratings for all habitats. Where regional variability was noted, it was captured in our results. Appendix 7 contains the completed Viability Charts for all eight habitat targets.

Viewed a different way, with simply the attributes/indicators and their rating, we get a strong image of the condition of all eight habitats in terms of their suitability to support sustainable salmon populations.

Table 34: CURRENT HABITAT CONDITIONS IN THE COAST REGION

HEADWATERS/UPLANDS

Water Quality – Temperature	Good
► North Region – Degrees C & # exceedences per year	Good
► South Region – Degrees C & # exceedences per year	Fair
Water Quality – Dissolved Oxygen	Good
► North Region – mg/L & # of days per year below standards	Good
► South Region – mg/L & # of days per year below standards	Fair
Water Quality – Turbidity	Fair
► North Region – NTUs (Nephelometric Turbidity Units)	Poor
► South Region – NTUs (Nephelometric Turbidity Units)	Fair
Uplands Condition – Buffer Width	Not rated
Uplands Condition/Composition	Poor
Sediment Needs – Gravel	Fair
Water Quanitity – Seral Stage	Fair
► North Region – Natural/Mature Dominance	Fair
► South Region – Natural/Mature Dominance	Poor

WETLANDS/OFF-CHANNEL

Water Quality – Temperature	Poor
Water Quality – Dissolved Oxygen	Fair
Water Quality – Turbidity	Poor
Riparian Condition – Buffer Width	Poor
Riparian Condition/Composition	Poor
Floodplain Connectivity – Habitat Refugia	Poor
Sediment Needs – Fines and Embeddedness	Poor
In-Water Vegetation – Presence of Native Vegetation Species	Fair

TRIBUTARIES

Water Quality – Temperature	Good
Water Quality – Dissolved Oxygen	Good
Water Quality – Turbidity	Good
Riparian Condition – Buffer Width	Poor
Riparian Condition/Composition	Poor
LWM	Poor
Floodplain Connectivity (Aquatic types and conditions)	Fair

Sediment Needs (Fines and Embeddedness)	Fair
► North Region – % Fines and Embeddedness combined	Poor
► South Region – % Fines and Embeddedness combined	Fair
Sediment Needs (gravel)	Fair
Forage Abundance (marcroinvertebrates)	Poor
Forage Abundance (marine derived nutrients)	Poor
Abundance (run size)	Poor
Water Quantity – (hydrology)	Fair
Pool Frequency and Quality	Poor

LAKES

Water Quality – Temperature	Good
Water Quality – Dissolved Oxygen	Good
Water Quality – Turbidity	Fair
► Lake Quinault – NTUs (Nephelometric Turbidity Units)	Not rated
► Lake Pleasant – NTUs (Nephelometric Turbidity Units)	Good
► Lake Ozette – NTUs (Nephelometric Turbidity Units)	Poor
Shoreline Condition – Buffer Width	Fair
► Lake Quinault – Feet	Fair
► Lake Pleasant – Feet	Fair
► Lake Ozette – Feet	Good
Shoreline Condition/Composition	Fair
Forage Abundance	Fair
► Lake Quinault – Zooplankton Trawl Index	Poor
► Lake Pleasant – Zooplankton Trawl Index	Good
► Lake Ozette – Zooplankton Trawl Index	Good

MAINSTEMS

Water Quality – Dissolved Oxygen	Good
Water Quality – Turbidity	Fair
Riparian Condition – Buffer Width	Poor
Riparian Condition/Composition	Poor
LWM	Fair
► North Region – See Ratings for description	Fair
► South Region – See Ratings for description	Poor
Floodplain Connecitivity	Good
► North Region – See Ratings for description	Good
► South Region – See Ratings for description	Fair
Sediment Needs – Fines and Embeddedness	Fair
► WRIAs 23 & 24 – % Fines and Embeddedness Combined	Poor
► Rest of Region – % Fines and Embeddedness Combined	Fair
Abundance – run size	Poor
Water Quality – Temperature	Fair

ESTUARIES

Water Quality – Temperature	Fair
Water Quality – Dissolved Oxygen	Fair
Water Quality – Sediment/Nutrient Input	Good
► Grays Harbor	Good
► Willapa	Fair
Large Woody Debris	Poor
Eelgrass	Good
► Grays Harbor	Fair
► Willapa	Good
Estuarine Condition – Buffer Width	Fair
Estuarine Condition/Composition	Fair
Forage Abundance – Mudflat Productivity	Good
Forage Abundance – See Notes	Fair
Estuarine Extent – Quantity	Fair
Abundance – Run Size	Fair

OCEAN

PDO (Annual Trend in the PDO index)	Good
ENSO (see notes)	Good
Forage Abundance (Annual Copepod Diversity Index)	Good
Juvenile Salmon Abundance - Chinook (see notes)	Fair
Juvenile Salmon Abundance – Coho (see notes)	Poor
Water Quality – Ocean Acidity	Fair

The *nearshore* habitat remains, at the time of this writing, unknown, due to lack of good data. The planning committee was able to identify the nearshore attributes (water quality and forage availability) and appropriate metrics (percent coverage of eelgrass and kelp in reference areas for water quality, and trends in nesting success of seabirds for forage availability), but has not yet been able to identify the data with which to set standards for what is poor to very good. This work continues.

THREAT IDENTIFICATION AND RANKING WORKSHOP

The next step in the process again brought as many of our technical planning partners together as possible, this time to identify and rank threats to wild salmon sustainability. The Threats Workshop was held September 14, 2010 in Ocean Shores. Workshop attendees were oriented to the process with the reminder that the most critical threats would inform strategy development, which would be designed to minimize the impact of the threats on salmon, and to restore degraded conditions or stresses.

The Threats Analysis followed a three-step process:

1. Review of the Stresses where the habitat Targets are degraded, and what the problems (Stresses) are;

2. Identification of the sources of those Stresses (which are the Threats); and,

3. Rating of the Threats to determine the most critical threats across the entire Region. Threat ratings were based on the following criteria: scope, severity and irreversibility (see details below).

Stresses are defined as: Degraded conditions and aspects of the target's biology and ecology that result directly or indirectly from human activities. Generally equivalent to degraded key salmon attributes (e.g., high water temperature) and informed by the target viability assessment. Similar to limiting factors.

Threats are defined as: The direct human activities causing Stresses and therefore degrading the Targets.

For example, low stream flow is the Stress, and the Threats causing this problem are unsustainable residential development and climate change.

The workshop attendees were asked to break into small, habitat-based work groups by selecting the habitats they knew best. After brainstorming the critical threats to salmon in the habitat, the group reviewed each of the previously identified key salmon attributes of that particular habitat and noted if the threat had a negative impact on that attribute. To further refine each threat's impact, the participants also noted geographic variability across the Region by representing the impact of the threat on an attribute *within their "home" WRIA,* using a color-coded dot exercise.

After each small work group completed their selected habitats, all groups shifted to systematically review the other habitats in sequence, verifying the identified threats or identifying new ones, and noting both the impact of a threat on the key salmon attributes, and regional variability. After more than half a day of brainstorming and analyzing all eight focal habitat targets, the group produced eight charts – one for each habitat – that looked like this:

Figure 19: THREATS WORKSHOP IDENTIFICATION CHART: The key salmon attributes are listed in the left column and the brainstormed threats are listed across the top. The colored dots indicate whether the identified threat has an impact on the specified attribute within a particular WRIA. Four or five colors signify that a threat is an issue across the entire Coast Region. [One color for each LEG area, plus a fifth color for overall, regional participants.]

THREAT RATING CRITERIA

The next task was to rank every identified threat within each habitat. Again, the attendees broke into smaller habitat-focused groups, each with a facilitator, to rank each threat in terms of three specific criteria: scope, severity and irreversibility. To make the results meaningful across the Region and throughout the focal habitat targets, each group followed the same process using the same specific definitions and levels for each criteria:

Scope: The percentage of the Region affected by the threat (where the threat exists). This was measured as either the proportion of the habitat or the fish population affected, and reflects current or projected scope within the next 10 years. (For climate change, the time frame was appropriately longer.)

Very High: The threat affects the target across all or most (71-100%) of the Region where the threat occurs.
High: The threat is likely to be widespread in its scope, affecting the target across much (31-70%) of its area regionally.
Medium: The threat is likely to be restricted in its scope, affecting the target across some (11-30%) of its area regionally.
Low: The threat is likely to be very narrow in its scope, affecting the target across a small proportion (1-10%) of its area regionally.

Severity: How severely the threat damages the target given current circumstances and predicted trends over the next 10 years. Severity was measured as reduction in habitat or reduction in population size. (For climate change, the time frame was appropriately longer.)

Very High: Within the Region, the threat is likely to destroy or eliminate the target, or reduce its population by 71-100% within ten years.
High: Within the scope, the threat is likely to seriously degrade/reduce the target or reduce its population by 31-70% within ten years or three salmon generations.
Medium: Within the scope, the threat is likely to moderately degrade/reduce the target or reduce its population by 11-30% within ten years or three salmon generations.
Low: Within the scope, the threat is likely to only slightly degrade/reduce the target or reduce its population by 1-10% within ten years or three salmon generations.

Irreversibility (Permanence): The degree to which the effects of a threat can be reversed and the likelihood that the target affected can be restored to recover from these effects.

Very High: The effects of the threat cannot be reversed and it is very unlikely the target can be restored, and/or it would take more than 100 years to achieve this (for example, wetlands converted to a shopping center).
High: The effects of the threat can technically be reversed and the target restored, but it is not practically affordable and/or it would take 21-100 years to achieve this (for example, wetlands converted to agriculture).
Medium: The effects of the threat can be reversed and the target restored with a reasonable commitment of resources and/or within 6-20 years (for example, ditching and draining of a wetland).
Low: The effects of the threat are easily reversible and the target can be easily restored at a relatively low cost and/or within 0-5 years (for example, off-road vehicles trespassing on a wetland).

After each working group completed this ranking process, the planning committee produced the following charts, one for each focal habitat, which list all the threats identified and their ranking in that habitat in terms of scope, severity and irreversibility.

Table 35: PRELIMINARY RANKING OF THREATS, by HABITAT

HEADWATERS/UPLANDS

THREAT	SCOPE	SEVERITY	IRREVER-SIBILITY	COMMENTS
Logging practices that impact salmon	Very High	Very High	High	
Invasive species: plants	Very High	Very High	Medium	
Lack of LWM	High	High	Medium	bad in South; OK in North
High road densities	Very High	High	High	
Aquatic barriers	High	Very High	Medium	(rating depends on) barrier location; landowner
Sedimentation	High	High	High	any area above 20% will produce high sedimentation
Lack of vegetation on steep hill slopes	Very High	High	High	
Development/Planning that impacts salmon	Very High	High	High	
Runoff/Toxins	Medium	Medium	High	
Embeddedness - logging/lack of riparian	High	High	High	
Dams	Medium	Very High	Very High	regional issue WRIAs 22/23

WETLANDS AND OFF-CHANNEL

THREAT	SCOPE	SEVERITY	IRREVER-SIBILITY	COMMENTS
Disconnected wetlands	High	High	High	
Logging practices that impact salmon	Very High	Very High	Medium	
Residential development that impacts salmon	High	Very High	Very High	
Filled wetlands	Medium	Very High	High	
Ditching and draining	High	High	High	
Eutrophication				? - Hard? To Lake
Toxins and pollution	High	High	High	depends on pollutant
Agricultural practices that impact salmon	Very High	High	High	

THREAT	SCOPE	SEVERITY	IRREVER-SIBILITY	COMMENTS
Invasive species: plants	High	High	Medium	
Invasive species: fauna	Medium	Medium	Medium	bullfrog, fish, nutria, etc.
Recreational vehicles	Medium	Medium	Low	(need to find) a final alternative
Planning regulations that impact salmon	High	Very High	Very High	
Climate change	Very High	Very High	Very High	

TRIBUTARIES

THREAT	SCOPE	SEVERITY	IRREVER-SIBILITY	COMMENTS
Timber harvest - steep slopes	High	Low	Medium	Need clarification on "steep." Rules or Regulatory definition or not.
Development that impacts salmon	High	High	High	
Invasive species: plants	High	Medium	Medium	Low cost; long time.
Blocking culverts	Very High	Medium	Medium	
Roads	High	High	High	
Agriculture	High	High	Medium	
Historic stream modifications	High	High	High	
Irrigation water withdrawal	Medium	High	Medium	Severity depends on location.
Low anadromous abundance	Very High			Question: if this applies, EVERYTHING on these charts causes Low Abundance
Agricultural runoff	Medium	High	Medium	
Timber harvest/ riparian areas	High	Medium	Medium	Need to define "Riparian." Rule or not. Fundamental difference of opinion within this group.
Invasive species: animals	Medium	Medium	Medium	
Harvest of salmon	High	Medium	Medium	Need to explain relationship between Harvest & Tribs.

THREAT	SCOPE	SEVERITY	IRREVER-SIBILITY	COMMENTS
Climate change	Very High	High	Very High	
Poor hatchery practices	High	High	Medium	

LAKES

THREAT	SCOPE	SEVERITY	IRREVER-SIBILITY	COMMENTS
Residential development that impacts salmon	Medium	Medium	High	Lake Pleasant: (Severity?) MED - concentrated at one end of lake
Docks and bulkheads	Medium	Medium	High	Lake Quinault: Scope & Severity VERY HIGH General: docks can be removed
Invasive species: plants	Very High	High	Medium	Lake Quinault: Severity MED General: VERY HIGH potential SCOPE
Invasive species: fish	High	High	High	Lakes Pleasant/Ozette: Scope VERY HI (unknown: Is N.Pike Minnow invasive?) Lake Quinault: Scope MED - unknown General: Data gap on scope/severity of invasive fish General: Deprives system of nutrients
Shoreline armoring	Medium	High	High	Lake Quinault: Scope HIGH
Eutrophication	Medium	Medium	Medium	Lake Ozette: Seasonal problem (MED) from uplands
Sedimentation - past poor logging practices	Very High	High	Medium	Lake Quinault: Seasonal - above Lk.Q. sedimentation - mass wasting
Recreation activities	Medium	Low	Medium	General: FISHING - Catch & Release (SCOPE: High = Pleas. & Quinault; Low = Ozette)
Lack of LWM	High	High	High	Lake Ozette: LWD hits homes Lake Quinault: Like to use LWD as firewood (scope High) General: Hard to regulate
Planning regulations that impact salmon	High	High	High	Lake Quinault: GHC - not recog Lk. Quinault shoreline buffer

THREAT	SCOPE	SEVERITY	IRREVER-SIBILITY	COMMENTS
Transportation infrastructure	Medium	Medium	High	
Wastewater septic	High	High	High	

MAINSTEMS

THREAT	SCOPE	SEVERITY	IRREVER-SIBILITY	COMMENTS
Inappropriate hatchery management	Very High	High	Medium	More difficult to address than Harvest Mgmt. Best addressed in concert with Habitat & Harvest. Depends upon HSRG
Bridges and barriers	Medium	Medium	High	
Dams	Medium	Medium	High	Scope high in WRIAs 22/23.
Dikes and levees	High	High	Medium	Low in WRIA 21.
Water withdrawals	High	Medium	Medium	Hard to reverse when associated with exempt wells.
Inappropriate harvest management	High	Medium	Medium	There were sentiments for Very High Scope. Escapement Goals are being met in majority of populations. There was sentiment for High Severity - significant disagreement.
Derelict gear	High	High	Low	
Logging practices that impact salmon	High	Medium	Medium	
Invasive species: plants/animals	Very High	Medium	Medium	
Residential development that impacts salmon	Medium	High	High	Higher Scope in South (WRIAs 22/23). Severity depends on density. Density matters for irreversibility.
Industrial development that impacts salmon	Medium	High	High	Chehalis Scope is High including commercial development.
Transportation infrastructure	Very High	High	High	
Climate change	Very High	Medium	High	High irreversibility refers to adaptive strategies rather

				than Climate Change itself.
Agriculture practices that impact salmon	Medium	Medium	Medium	Re Severity: higher in Chehalis than any other

ESTUARIES

THREAT	SCOPE	SEVERITY	IRREVER-SIBILITY	COMMENTS
Dredging/Filling	High	Very High	Very High	
Harvest/ bycatch (fish & shellfish)	Very High	Very High	Medium	
Residential development that impacts salmon	Medium	High	High	
Shoreline hardening (armoring . . .)	High	High	High	
Aquaculture practices that impact salmon	Medium	Medium	Medium	
Pollution (stormwater)	High	High	Medium	not much in North
Wastewater pollution	High	High	Medium	
Oil spills	High	High	Medium	
Agricultural practices that impact salmon	Medium	High	Medium	
Industrial commercial development that impacts salmon	High	High	High	
Logging practices that impact salmon	Very High	High	High	
Invasive species: plants & animals	Very High	High	Very High	need more info on how invasives affect salmon (range of spp)
Climate change	Very High	Very High	Very High	
Passage barriers (levees, dikes, culverts, tidegates)	High	Very High	Medium	very high for South (@ McMurry)
Removal of wood	High	High	High	

NEARSHORE

THREAT	SCOPE	SEVERITY	IRREVER-SIBILITY	COMMENTS
Climate change (acidification; sea level rise)	Very High	High	Very High	
Harvest	Very High	Very High	Medium	
Residential development that impacts salmon	Medium	High	High	
Commercial development that impacts salmon	Medium	Medium	High	
Oil spills	High	High	Medium	
Aquaculture	Low	High	Medium	
Columbia River sand starvation from deep water & upland disposal	High	High	Very High	
Unknowns (what's out there)	Very High	Very High	Medium	
Resource management regime(s) ?				fisheries mgmt (@ Krueger and Ensmenger) ---> is this just harvest?
Invasive species	High	High	Very High	

OCEAN

THREAT	SCOPE	SEVERITY	IRREVER-SIBILITY	COMMENTS
Climate change (acidification; sea level rise)	Very High	Very High	Very High	
Harvest	Very High	Very High	Medium	
Wastewater (sewage)	High	Medium	Medium	
Oil spills	Very High	High	Medium	
Alt. (future) energy development	High	Medium	Low	
Low dissolved oxygen zones	High	High	Very High	source not entirely known
Unknowns	Very High	Very High	Medium	
Bycatch	Very High	High	Medium	

It is worth noting here that not all threats were identified in precisely the same way by everyone, or even called by the same name. In order to present a regional perspective on threats to wild salmon sustainability, however, these differences had to be addressed, and a consistent meaning and terminology, wherever possible, applied across all habitats. At this point, the planning committee exercised its responsibility to figure out where threats should be lumped or split within a habitat, and what term(s) best captured the intent of the workshop participants.

Two primary changes were made: A "current inappropriate logging practices" category was lumped together with "historic logging practices" to combine similar threats to headwaters, mainstems, and tributaries. A "shoreline modification" category was created to include levees, dikes, armoring/bulkheads and docks; this combined similar threats in lakes, mainstems, and estuaries.

Once a common threats nomenclature was adopted, the results were further synthesized using an algorithm that first calculated an overall threat, *Magnitude,* within each habitat, where Magnitude is a function of *Scope* and *Severity,* as follows:

Table 36: ALGORITHM: SCOPE X SEVERITY = MAGNITUDE

Scope x Severity = Magnitude		SCOPE			
		Very High	High	Medium	Low
SEVERITY	Very High	Very High	High	Medium	Low
	High	High	High	Medium	Low
	Medium	Medium	Medium	Medium	Low
	Low	Low	Low	Low	Low

Then, a second algorithm calculated an *overall threat ranking* based on the following chart of Magnitude and Irreversibility:

Table 37: ALGORITHM: MAGNITUDE X IRREVERSIBILITY = OVERALL THREAT RANKING

Magnitude x Irreversibility = Overall Threat Ranking		IRREVERSIBILITY			
		Very High	High	Medium	Low
MAGNITUDE	Very High	Very High	Very High	Very High	High
	High	Very High	High	High	Medium
	Medium	High	Medium	Medium	Low
	Low	Medium	Low	Low	Low

Once the overall threat ranking was calculated for each habitat, the threats were rolled up into a single summary threat ranking chart with the most critical threats across the entire Region rising to the top:

Table 38: OVERALL RANKING OF THREATS

Targets: / ***Threats:***	Main stems	Tributaries	Lakes	Wetlands	Headwaters Uplands	Estuaries	Nearshore Marine	Ocean	Summary Threat Rating
Climate Change	Medium	Very High	Very High	Very High	Very High	Very High	Very High	Very High	Very High
Invasive Species: plants	Medium	Medium	High	High	High	Very High	Very High		Very High
Harvest - fish	Medium	Medium				Very High	Very High	Very High	Very High
Logging practices that impact salmon	High	High	High	Very High	Very High	High			Very High
Oil spills						High	Very High	Very High	Very High
Residential and Commercial Development	Medium	High	Medium	Very High	High	High	Medium		Very High
Low dissolved oxygen zones								Very High	High
Columbia river sand starvation/ Dredging							Very High		High
Stormwater Pollution				High	Medium	High			High
Dredging/Filling				Medium		Very High			High
Wastewater			High			High		Medium	High

Once this step was complete, the twelve most critical threats to wild salmon sustainability across the Washington Coast Region were identified. In order, from most critical to least critical, they are:

CRITICAL THREATS TO WILD SALMON SUSTAINABILITY IN THE WASHINGTON COAST REGION

Climate Change
Invasive Species
Harvest and Hatchery Interactions
Logging Practices That Impact Salmon
Oil Spills
Residential and Commercial Development that Impacts Salmon
Dredging and Filling
Removal and/or Lack of Large Woody Material

Shoreline Modification including Dikes, Levees, Armoring and Bulkheads
Agricultural Practices That Impact Salmon
Roads, Culverts, Bridges and Other Transportation Infrastructure
Water Pollution from Developed Land, Stormwater and Wastewater Pollution

STRATEGY DEVELOPMENT WORKSHOPS

Everything developed up to this point was done in order to inform strategy development. In a two-day Strategies Workshop in November 2010, participants again came together to begin crafting Plan strategies. Strategies were developed to abate critical threats and restore functioning habitats where threat abatement alone was seen as insufficient to meet the Plan's goals.

THE PROCESS INVOLVED THE FOLLOWING STEPS:

- A review of the Plan's overarching Vision Statement
- A review of the critical threats to wild salmon sustainability, as well as a review of the specific habitat function objectives
- The use of situation analysis to capture the context of what leads to threats and how they specifically impact the habitat target's function and condition
- Brainstorming potential strategies to abate threats
- Selecting the highest priority strategies based on their feasibility and potential benefit to salmon and their habitats

SITUATION ANALYSIS

Critical threats and degraded key ecological attributes typically result from incompatible economic activities and management of natural resources. To develop effective strategies, it was essential to understand the cultural, political, and economic contexts that represent both the driving forces behind the critical threats/degraded viability and, simultaneously, the opportunities for abating the threats and restoring viability.

Before brainstorming and selecting strategies, workshop participants were asked to select two critical threats and to work together in small groups to probe deeply into the underlying causes, or drivers, of each critical threat and the linkages to focal targets and other threats. The small workgroups used conceptual models (e.g., situation analysis/diagramming) to help discover and represent the linkages.

Prior to beginning the exercise, participants were asked to consider these two definitions:

> **Direct Threats:** The human activities or processes that have caused, are causing or may cause the destruction, degradation and/or impairment of biodiversity and natural processes.

Contributing Factors/Drivers or Underlying Causes: Factors, usually social, economic, political, institutional, or cultural in nature, that enable or otherwise contribute to the occurrence and/or persistence of direct threats.

There is typically a chain of underlying causes behind any given direct threat. In a situation analysis, underlying causes can be subdivided into **indirect threats** (factors with a negative effect) and **opportunities** (factors with a positive effect).

The situation analysis provided the context from which workshop attendees brainstormed strategies in a process looking approximately like this:

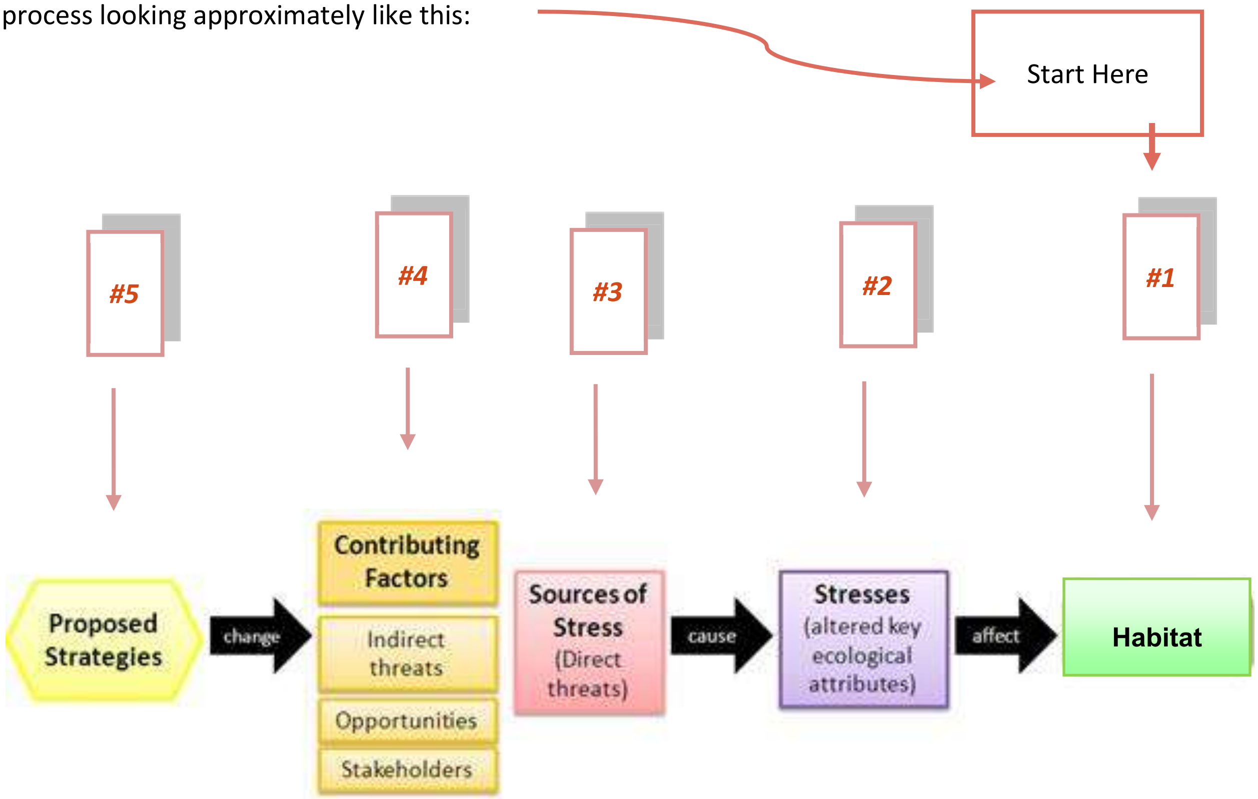


Figure 20: SITUATION ANALYSIS

Participants reviewed the previously identified:

- #1 Habitat Targets,
- #2 Stresses, and
- #3 Threats

They then brainstormed Contributing Factors/Drivers (#4 above) before proposing Strategies (#5 above) that would directly mitigate threats, intervene at another point (contributing factor), or support existing opportunities for a positive impact.

Based on focused probing of the situation, participants were asked to consider an array of strategies that could lead to threat abatement and accomplishing Plan goals. Some strategies only applied to a single threat, while others could be relevant to multiple threats. The understanding of each critical threat and the underlying causes, and the habitat's function for salmon, defined by goals and detailed in the viability assessment, guided strategy development. The most appropriate point of intervention could be at the key salmon attribute (that is, restoration), at the critical threat, or at the drivers and opportunities of the threats.

Over the course of the first day, participants identified nearly 100 strategies. On the second day, they were asked to individually review the list and select the 10 strategies they thought were the highest priority. They were asked to select those strategies that, if implemented, would most effectively and efficiently accomplish the Plan goals and objectives. The following criteria were suggested as an aid to evaluating the proposed strategies.

Potential Benefits to Salmon and their Habitats: The contribution, scope and scale of the outcome toward either threat reduction or increased target viability. Strategies that would contribute significantly to desired changes at a large scale and for a significant duration should be rated highly for impact. Leverage (degree to which the implemented strategy will achieve other important outcomes) was considered a factor as well.

> **Very High –** The strategy is very likely to completely mitigate a threat or restore a target (significant contribution to outcomes at a regional scale)
> **High –** The strategy is likely to significantly mitigate a threat or restore a target (high contribution to outcomes at a regional scale)
> **Medium –** The strategy could contribute to mitigating a threat or restoring a target (moderate contribution to outcomes at a regional scale)
> **Low –** The strategy will probably not contribute to meaningful threat mitigation or target restoration (low contribution to outcomes at a regional scale)

Feasibility: The degree to which the WCSSP or others could implement the strategy, given ease of implementation (technically, financially and politically), availability of a lead individual or institution (with the experience, support and availability to implement) and the degree to which key constituencies necessary for success would engage.

> **Very High –** The strategy is highly feasible (technically, financially, politically), has a likely leader for implementation and would be supported by key constituencies
> **High –** The strategy is feasible (technically, financially, politically), but may need additional leadership and support for implementation
> **Medium –** The strategy is mostly feasible (missing some elements technically, financially, politically), and may need additional leadership and support for implementation
> **Low –** The strategy is not technically, financially and/or politically feasible, needs substantial leadership improvement and support for implementation

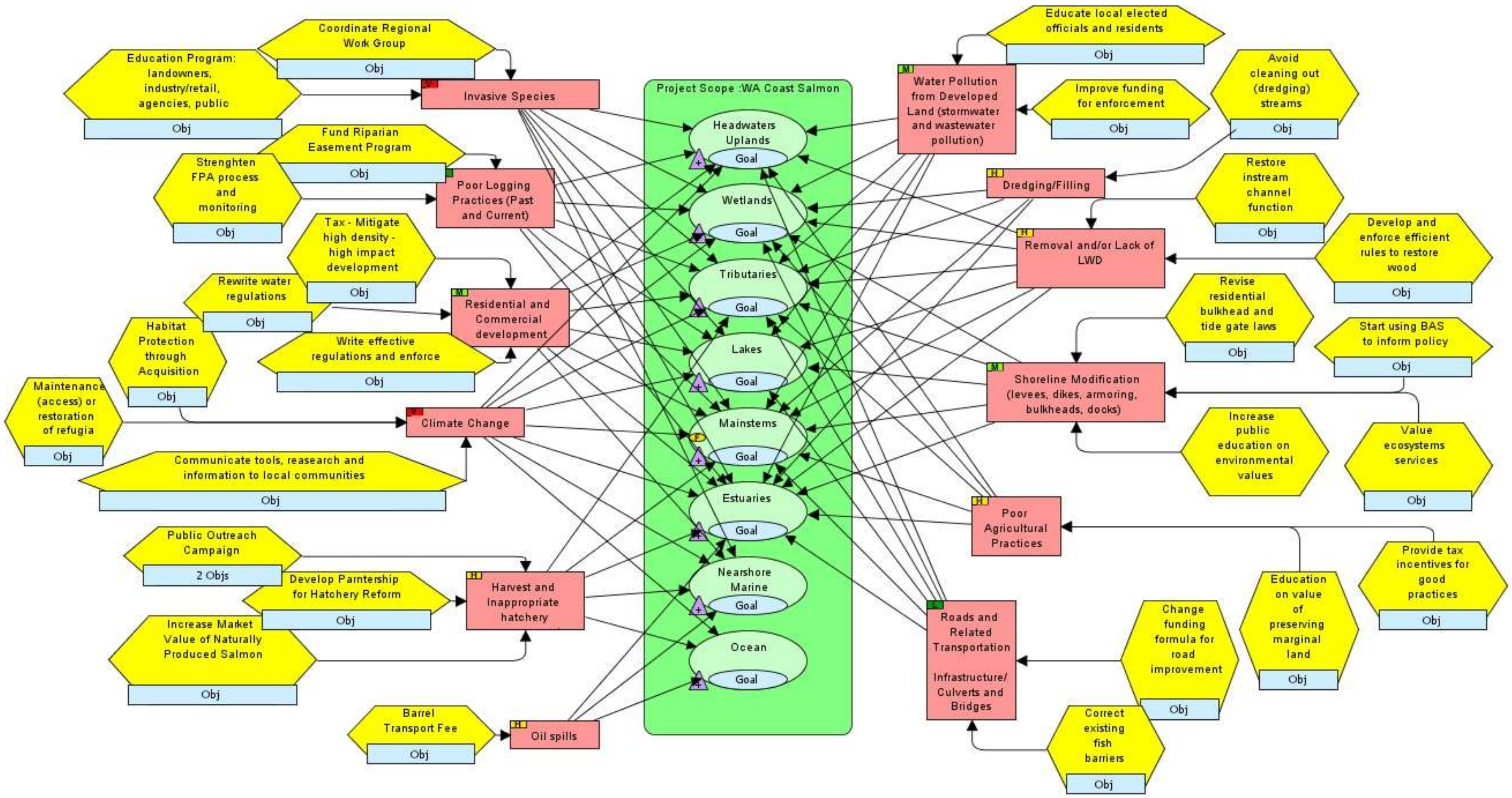
After each participant selected their "top ten" strategies, those chosen most were pulled together for additional analysis and review. All other strategies identified and not selected have been retained (see

Appendix 14 – Planning Notes) so that, as part of adaptive management, they can be reviewed and – as conditions warrant – brought forward for inclusion in future Plan revisions.

[In addition, please note that all “Parking Lot” suggestions and thoughts have been retained in Appendix 14. “Parking lots” were large blank sheets of paper put up at each workshop, which allowed participants to capture thoughts, ideas, issues, and suggestions that did not get captured in the products developed in the workshops, but that could be retained and reviewed in the future during the adaptive management process.]

At this point in the workshop, there were twenty-four chosen strategies addressing twelve critical threats as depicted in this Conceptual Model below.

Figure 21: CONCEPTUAL MODEL: ALL SALMON PLAN STRATEGIES



The workshop participants then categorized these strategies into five themes that now form the basic structure of the Plan:

EDUCATING AND INVOLVING THE COMMUNITY TO PROTECT, RESTORE AND MAINTAIN ECOSYSTEM VALUES

PROTECTING AND RESTORING SALMON HABITAT FUNCTION

SUPPORTING HATCHERY REFORM AND HARVEST PRACTICES COMPATIBLE WITH WILD SALMON SUSTAINABILITY

USING ECONOMIC TOOLS TO PROTECT, RESTORE AND MAINTAIN ECOSYSTEM VALUES

IMPROVING REGULATORY EFFECTIVENESS TO ACHIEVE SALMON SUSTAINABILITY

To further refine and develop the twenty-seven draft strategies, participants were asked to identify which of the five categories they wished to work more on, or someone else they thought we should ask to do so.

STRATEGY REFINEMENT WORKSHOPS

In February and March 2011, five additional workshops were held, each organized around one of the five strategy themes above. The purpose of these workshops was for small, select groups to look at the strategies, further develop and refine them, and lay out actions that should be taken to implement those strategies. The attendees at these and all other workshops are listed at the end of this Appendix.

The work of these five groups, with some additional review and revision by the planning committee, are the Plan's 24 strategies and 63 actions detailed in Chapter 5, Strategies and Actions. On the following pages are graphic Conceptual Models of the Strategies selected within each theme or category, the threat they address, and the habitats and habitat functions they will protect or improve.

Figure 22: CONCEPTUAL MODEL OF STRATEGIES TO EDUCATE AND INVOLVE THE COMMUNITY TO PROTECT, RESTORE AND MAINTAIN ECOSYSTEM VALUES

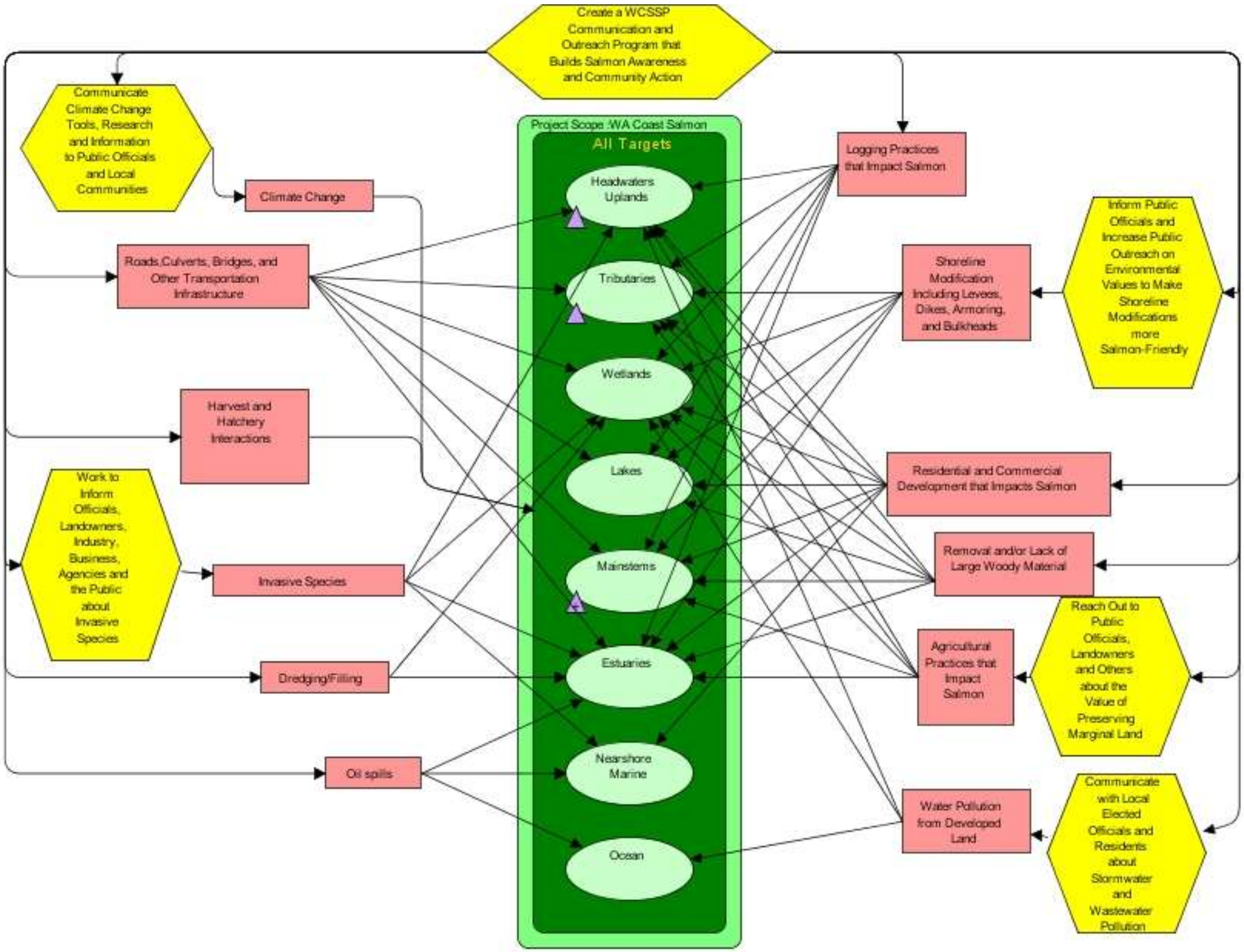


Figure 23: CONCEPTUAL MODEL OF STRATEGIES TO PROTECT AND RESTORE SALMON HABITAT FUNCTION

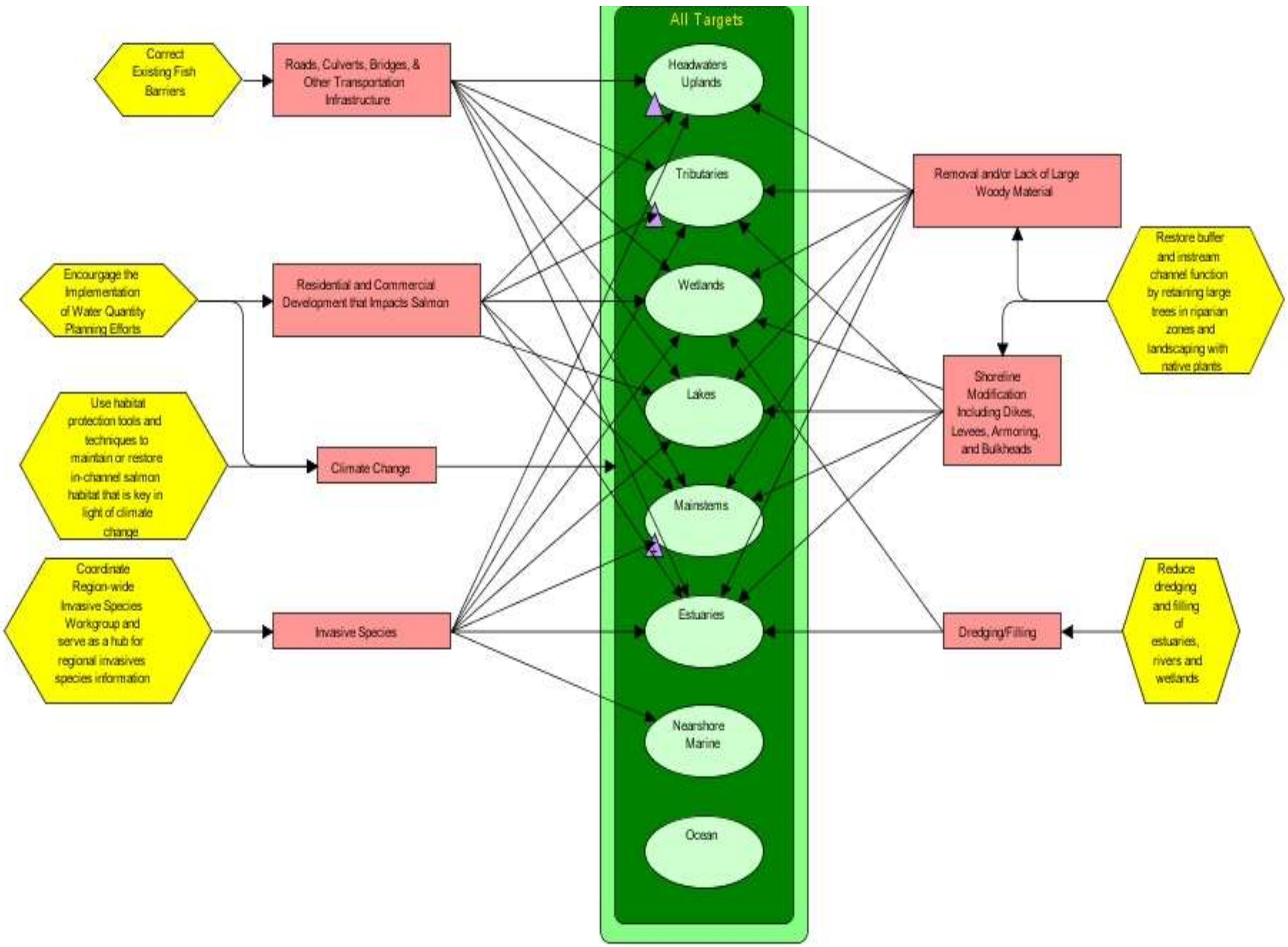


Figure 24: CONCEPTUAL MODEL OF STRATEGIES TO
SUPPORT HATCHERY AND HARVEST PRACTICES CONSISTENT WITH WILD SALMON SUSTAINABILITY

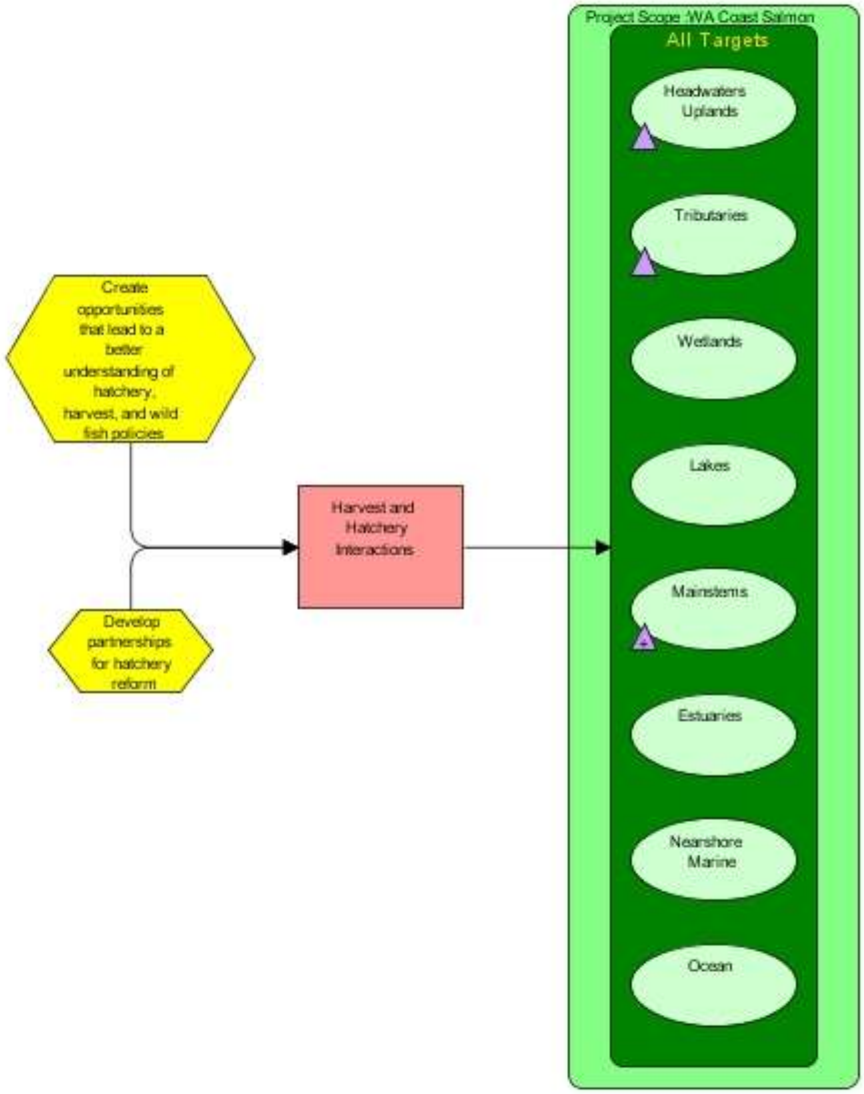


Figure 25: CONCEPTUAL MODEL OF STRATEGIES TO USE ECONOMIC TOOLS TO PROTECT, RESTORE AND MAINTAIN ECOSYSTEM VALUES

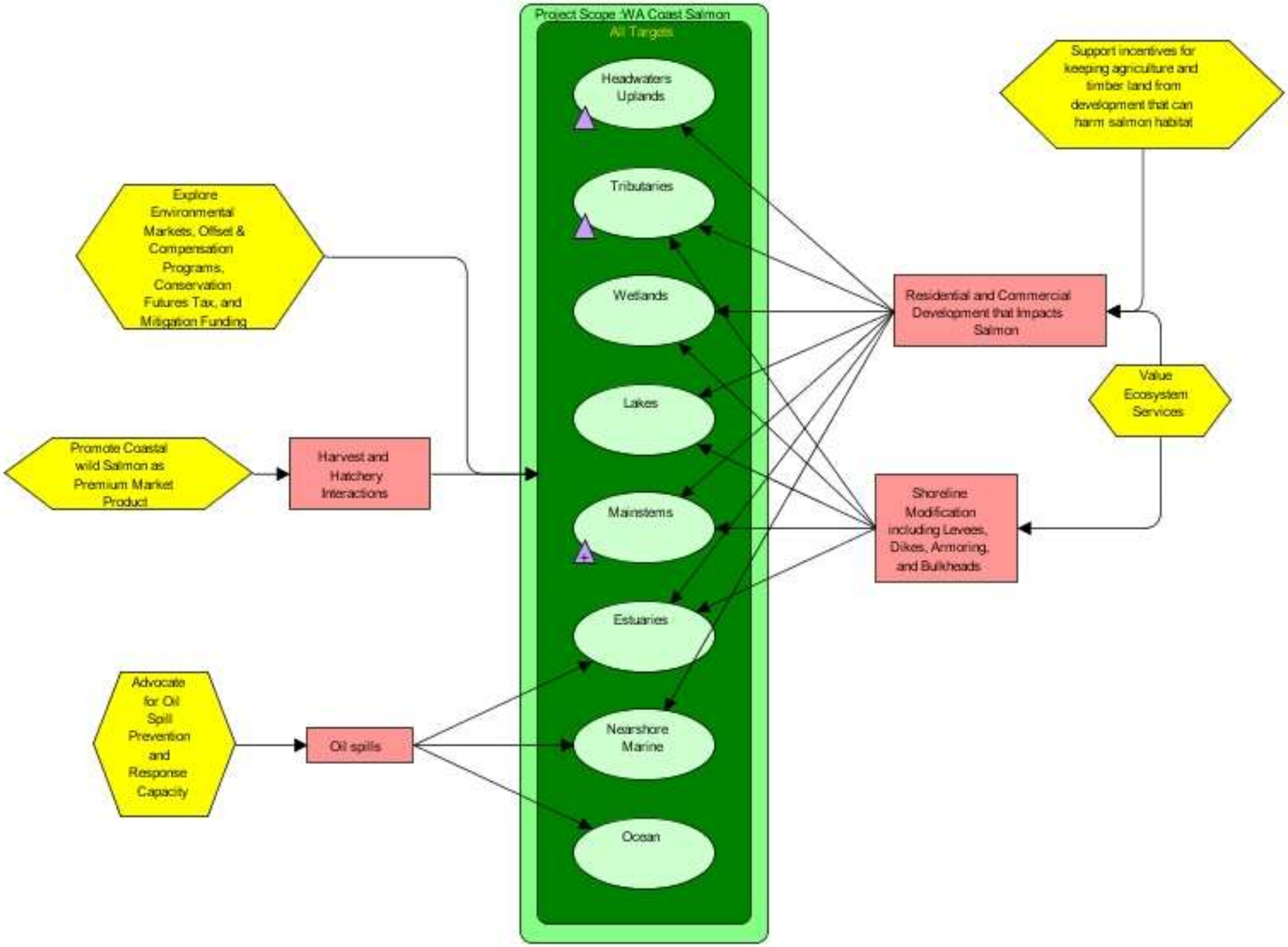
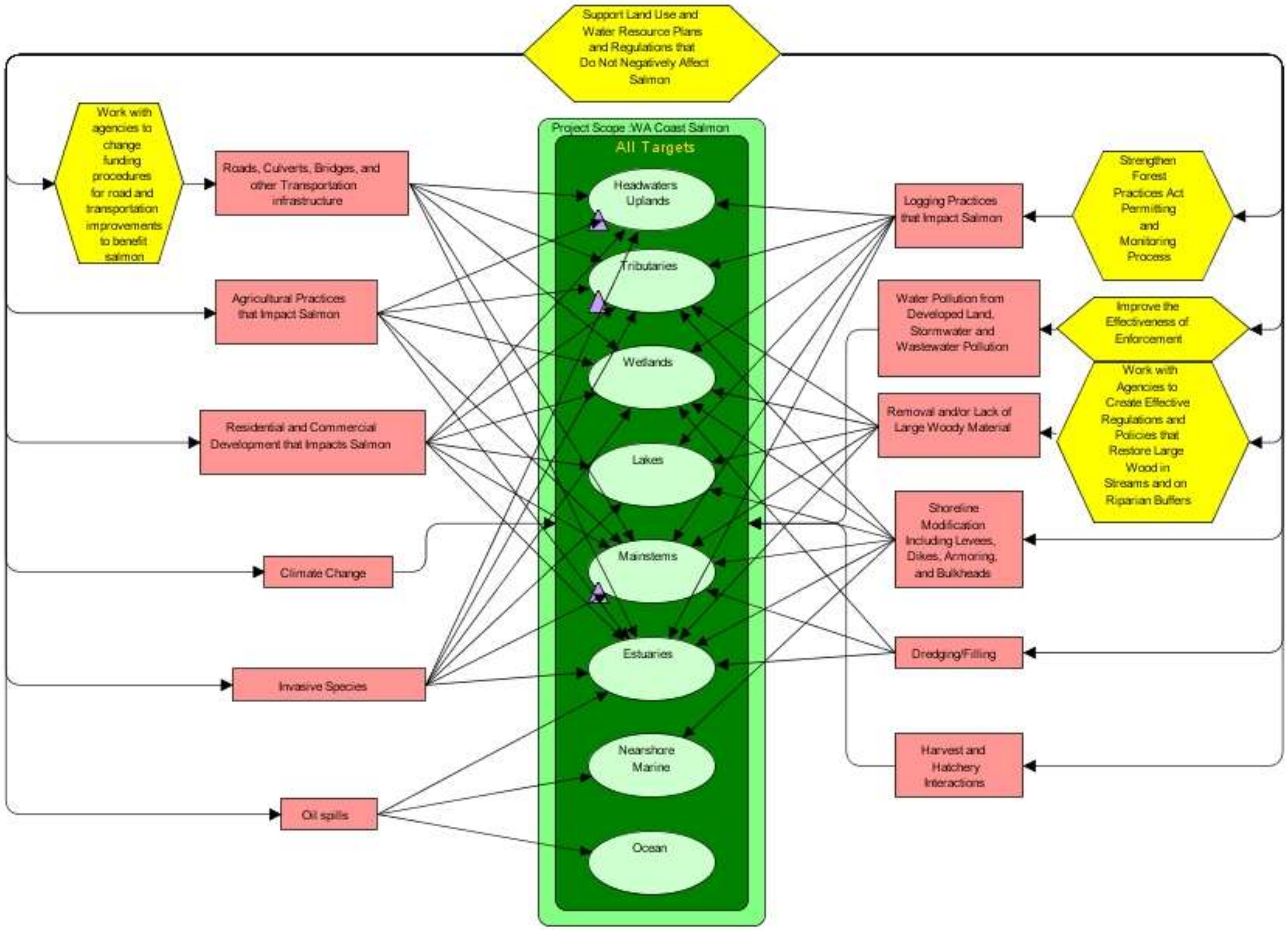


Figure 26: CONCEPTUAL MODEL OF STRATEGIES TO IMPROVE REGULATORY EFFECTIVENESS TO ACHIEVE SALMON SUSTAINABILITY



PLAN WORKSHOP Participants

Scoping Workshop

January 21, 2009 Forks, Washington

Steve Allison	Hoh Indian Tribe
Nancy Allison	WCSSP
Bill Armstrong	Quinault Indian Nation
Miles Batchelder	WCSSP
Dave Bingaman	Quinault Indian Nation
Michael Blanton	Washington Department of Fish & Wildlife
Ed Bowen	Citizen, North Pacific Coast Lead Entity
Carrie Cook-Tabor	U.S. Fish & Wildlife Service
Lonnie Crumley	Streamworks
Phil Decillis	Olympic National Forest
Eric Delvin	The Nature Conservancy
Dana Jo Dietz	WCSSP
Devona Ensmenger	Wild Salmon Center
Doug Fricke	Coalition of Coastal Fisheries
Rosemary Furfey	National Marine Fisheries Service/NOAA
Kathy Greer	Surfrider Foundation
Nicole Hill	Cascade Land Conservancy
Debbie Holden	Creative Community Solutions
Kirt Hughes	Washington Dept. of Fish & Wildlife
Mike Johnson	Pacific County LEG Coordinator
Janet Kearsley	Washington Dept. of Natural Resources
Dave King	Washington Dept. of Fish & Wildlife
John Kliem	Creative Community Solutions
Katie Krueger	Quileute Indian Tribe
Key McMurry	Willapa Bay Water Resources Coordinating Council and Key Environmental Solutions
John Miller	Clallam County
Phil Miller	Governor's Salmon Recovery Office
Lee Napier	Grays Harbor County LEG Coordinator
Andy Olson	Confederated Tribes of the Chehalis
Rich Osborne	North Pacific Coast LEG Coordinator
Tami Pokorny	Jefferson County
James Schroeder	The Nature Conservancy
John Sims	Quinault Indian Nation LEG Coordinator
Mark Swartout	Thurston County
Brad Thompson	U.S. Fish & Wildlife Service
Lauri Vigue	Washington Dept. of Fish & Wildlife

Targets Workshop

December 8, 2009 Quinault, Washington

Miles Batchelder	WCSSP
Harry Bell	Green Crow Management Services
Dave Bingaman	Quinault Indian Nation
April Boe	The Nature Conservancy
Ed Bowen	Citizen, North Pacific Coast Lead Entity
Bob Burkle	Washington Dept. of Fish & Wildlife
Chris Byrnes	Washington Dept. of Fish & Wildlife
Carrie Cook-Tabor	U.S. Fish & Wildlife Service
Lonnie Crumley	Streamworks
Eric Delvin	The Nature Conservancy
Andy Dickerson	BHE Environmental
Dana Jo Dietz	WCSSP
Francis Estalilla, MD	Interested Citizen
Kirsten Evans	The Nature Conservancy
Larry Gilbertson	Quinault Indian Nation
Jeremy Gilman	Makah Indian Tribe
Greg Good	North Olympic Land Trust
Peter Heide	Washington Forest Protection Association
Kirt Hughes	Washington Dept. of Fish & Wildlife
Mike Johnson	Pacific County LEG Coordinator
Dave King	Washington Dept. of Fish & Wildlife
Katie Krueger	Quileute Indian Tribe
Key McMurry	Willapa Bay Water Resources Coordinating Council and Key Environmental Solutions
Bob Metzger	Olympic National Forest
Phil Miller	Governor's Salmon Recovery Office
Mark Mobbs	Quinault Indian Nation
Lee Napier	Grays Harbor County LEG Coordinator
Kara Nelson	The Nature Conservancy
Mike Nordin	Pacific County Conservation District
Rich Osborne	North Pacific Coast LEG Coordinator
Miranda Plumb	U.S. Fish & Wildlife Service
James Schroeder	The Nature Conservancy
Erica Simek	The Nature Conservancy
John Sims	Quinault Indian Nation LEG Coordinator
Meghan Tuttle	Rayonier
Terry Willis	Grays Harbor County Commissioner

Technical Workshop - Viability Metrics

April 6, 2010 Neilton, Washington

Steve Allison	Hoh Indian Tribe
Bill Armstrong	Quinault Indian Nation
Miles Batchelder	WCSSP
Dave Bingaman	Quinault Indian Nation
Bob Burkle	Washington Dept. of Fish & Wildlife
Chris Byrnes	Washington Dept. of Fish & Wildlife
Lonnie Crumley	Streamworks
Phil DeCillis	Olympic National Forest
Eric Delvin	The Nature Conservancy
Dana Jo Dietz	WCSSP
Devona Ensmenger	Wild Salmon Center
Larry Gilbertson	Quinault Indian Nation
Jeremy Gilman	Makah Indian Tribe
Nicole Hill	Cascade Land Conservancy
Debbie Holden	Creative Community Solutions
Kirt Hughes	Washington Dept. of Fish & Wildlife
Mike Johnson	Pacific County LEG Coordinator
Jim Jorgensen	Quinault Indian Nation
Dave King	Washington Dept. of Fish & Wildlife
John Kliem	Creative Community Solutions

Katie Krueger Quileute Indian Tribe
Doug Martin Washington Forest Protection Association
Key McMurry Willapa Bay Water Resources Coordinating Council and Key Environmental Solutions
Lee Napier Grays Harbor County LEG Coordinator
Kara Nelson The Nature Conservancy
Rich Osborne North Pacific Coast LEG Coordinator
Miranda Plumb U.S. Fish & Wildlife Service
Warren Scarlett Hoh Indian Tribe
John Sims Quinault Indian Nation LEG Coordinator

Threats Workshop

September 14, 2010 Ocean Shores, Washington

Miles Batchelder WCSSP
Ed Bowen Citizen, North Pacific Coast Lead Entity
Bob Burkle Washington Dept. of Fish & Wildlife
Chris Conklin Quinault Indian Nation
Eric Delvin The Nature Conservancy
Dana Jo Dietz WCSSP
Devona Ensmenger Wild Salmon Center
Jeremy Gilman Makah Indian Tribe
Jamie Glasgow Wild Fish Conservancy
Debbie Holden Creative Community Solutions
Kirt Hughes Washington Dept. of Fish & Wildlife
Mike Johnson Pacific County LEG Coordinator
Jim Jorgensen Quinault Indian Nation
John Kliem Creative Community Solutions
Katie Krueger Quileute Indian Tribe
Doug Martin Washington Forest Protection Association
Key McMurry Willapa Bay Water Resources Coordinating Council and Key Environmental Solutions
Phil Miller Governor's Salmon Recovery Office
Lee Napier Grays Harbor County LEG Coordinator
Kara Nelson The Nature Conservancy
Andy Olson Confederated Tribes of the Chehalis
Rich Osborne North Pacific Coast LEG Coordinator
Miranda Plumb U.S. Fish & Wildlife Service
Tami Pokorney Jefferson County
James Schroeder The Nature Conservancy
John Sims Quinault Indian Nation LEG Coordinator

Strategies Workshops

November 3-4, 2010 Ocean Shores, Washington

Steve Allison Hoh Indian Tribe
Bill Armstrong Quinault Indian Nation
Miles Batchelder WCSSP
Dave Bingaman Quinault Indian Nation
Michael Blanton Washington Dept. of Fish & Wildlife
Ed Bowen Citizen, North Pacific Coast Lead Entity
Bob Burkle Washington Dept. of Fish & Wildlife
Carrie Cook-Tabor U.S. Fish & Wildlife Service
Lonnie Crumley Streamworks
Phil DeCillis Olympic National Forest
Eric Delvin The Nature Conservancy
Dana Jo Dietz WCSSP
Devona Ensmenger Wild Salmon Center
Doug Fricke Coalition of Coastal Fisheries
Rosemary Furfey National Marine Fisheries Service/NOAA
Christy Galitsky The Nature Conservancy
Kathy Greer Surfrider Foundation
Nicole Hill Cascade Land Conservancy
Debbie Holden Creative Community Solutions
Kirt Hughes Washington Dept. of Fish & Wildlife
Mike Johnson Pacific County LEG Coordinator
Jim Jorgensen Quinault Indian Nation
Janet Kearsley Washington Dept. of Natural Resources
Dave King Washington Dept. of Fish & Wildlife
John Kliem Creative Community Solutions
Katie Krueger Quileute Indian Tribe
Doug Martin Washington Forest Protection Association
Key McMurry Willapa Bay Water Resources Coordinating Council and Key Environmental Solutions
John Miller Clallam County
Phil Miller Governor's Salmon Recovery Office
Lee Napier Grays Harbor County LEG Coordinator
Kara Nelson The Nature Conservancy
Mike Nordin Pacific County Conservation District
Andy Olson Confederated Tribes of the Chehalis
Rich Osborne North Pacific Coast LEG Coordinator
Miranda Plumb U.S. Fish & Wildlife Service
Tami Pokorny Jefferson County
James Schroeder The Nature Conservancy
James Sellers Quinault Indian Nation
John Sims Quinault Indian Nation LEG Coordinator
Mark Swartout Thurston County
Brad Thompson U.S. Fish & Wildlife Service
Lauri Vigue Washington Dept. of Fish & Wildlife

Strategy Development – Educating and Involving the Community to Protect, Restore and Maintain Ecosystem Values

February 8, 2011 Montesano, Washington

Miles Batchelder WCSSP
Ed Bowen Citizen, North Pacific Coast Lead Entity
Bob Burkle Washington Dept. of Fish & Wildlife
Garrett Dalan GH County Marine Resource Committee
Dana Jo Dietz WCSSP
Christine Hempleman Washington Department of Ecology
Chanele Holbrook-Shaw Heernett Foundation
Debbie Holden Creative Community Solutions
Kathy Jacobson Educational Service Dist.113/CBEC
John Kliem Creative Community Solutions
Lorena Marchant Grays Harbor College
Kara Nelson The Nature Conservancy

Strategy Development – Protecting and Restoring Salmon Habitat Function

February 9, 2011 Montesano, Washington

Miles Batchelder	WCSSP
Chris Conklin	Quinault Indian Nation
Liane Davis	The Nature Conservancy
Dana Jo Dietz	WCSSP
Devona Ensmenger	Wild Salmon Center
Debbie Holden	Creative Community Solutions
Dave King	Washington Dept. of Fish & Wildlife
John Kliem	Creative Community Solutions
Katie Krueger	Quileute Indian Tribe
Kara Nelson	The Nature Conservancy
Mike Nordin	Pacific County Conservation District
Miranda Plumb	U.S. Fish & Wildlife Service
James Schroeder	The Nature Conservancy

Strategy Development – Supporting Hatchery Reform and Harvest Practices Compatible with Wild Salmon Sustainability

February 14, 2011 Montesano, Washington

Miles Batchelder	WCSSP
Devona Ensmenger	Wild Salmon Center
Nick Gayeski	Wild Fish Conservancy
Jamie Glasgow	Wild Fish Conservancy
Debbie Holden	Creative Community Solutions
Kirt Hughes	Washington Dept. of Fish & Wildlife
Jim Jorgensen	Quinault Indian Nation
John Kliem	Creative Community Solutions
John Mahan	Quileute Indian Tribe
Caroline Peter-Schmidt	Makah Indian Tribe
James Schroeder	The Nature Conservancy
Brad Thompson	U.S. Fish & Wildlife Service

Strategy Development – Using Economic Tools to Protect, Restore and Maintain Ecosystem Values

February 17, 2011 Montesano, Washington

Dan Averill	Marine Stewardship Council
Miles Batchelder	WCSSP
Bob Burkle	Washington Dept. of Fish & Wildlife
Dana Jo Dietz	WCSSP
Devona Ensmenger	Wild Salmon Center
Debbie Holden	Creative Community Solutions
John Kliem	Creative Community Solutions
Kara Nelson	The Nature Conservancy
Rich Osborne	North Pacific Coast LEG Coordinator
James Schroeder	The Nature Conservancy

Strategy Development - Improving Regulatory Effectiveness to Achieve Salmon Sustainability

March 9, 2011 Montesano, Washington

Miles Batchelder	WCSSP
Chris Conklin	Quinault Indian Nation
Dana Jo Dietz	WCSSP
Jamie Glasgow	Wild Fish Conservancy
Christine Hempleman	Washington Department of Ecology
Debbie Holden	Creative Community Solutions
Mike Johnson	Pacific County LEG Coordinator
John Kliem	Creative Community Solutions
David Kloempken	Washington Dept. of Fish & Wildlife
Katie Krueger	Quileute Indian Tribe
Mark Mobbs	Quinault Indian Nation
Lee Napier	Grays Harbor County LEG Coordinator
John Richmond	Citizen, North Pacific Coast Lead Entity

References for Appendix 12

Creative Community Solutions (CCS). 2009. *WCSSP meeting January 21, 2009 facilitation minutes.* CCS, Olympia, WA.

APPENDIX 14
PLANNING NOTES

"PARKING LOTS"

At each workshop, large sheets were placed on the wall where attendees could note any additional ideas or suggested actions that were not being covered in the workshop, but that they thought should be included in the conversation. We called these "Parking Lots." The reasoning was that these ideas might prove valuable as the Plan is implemented, in subsequent adaptive management efforts, and in future plan revisions. They are included here to ensure they are part of future conversations.

PARKING LOT- WATER POLLUTION FROM DEVELOPED LAND, STORMWATER & WASTEWATER POLLUTION

Research surface types that promote water retention

Assess purpose of each road and determine consolidation

Native landscapes and plants:
 revegetation following perturbation – invasives, development, harvest

Tourism growth to consider impact

Read labels and understand Eco impact if you don't understand

PARKING LOT – HATCHERY AND HARVEST INTERACTIONS

Conduct separate assessments of juvenile and/or natural origin production from areas where hatchery and natural-origin spawners occur together (pedigree studies)

Improve funding to conduct intensive monitoring on the most "intact and healthy" salmon populations/ habitats, e.g., productivity of wild populations with screwstraps, etc.

Provide information from PSC and PFMC and co-managers showing data assessments and provision for limiting harvests and 8 coastal limiting Coho stocks and Chinook stocks addressed in PSC agreement

Without addressing harvest (fish) the coastal plan is useless

Communicate need for protecting wild origin fish through regulation

Communicate importance of implementing hatchery reform

Develop improved methods for selective harvest

In order to show demonstrated productivity of some coastal stocks show relevant data assessments

Implement improved selective fishing methods (commercial)

Public outreach campaign to explain the total value (including healthy habitats) of sustainable wild salmon populations

Hatchery reform policy and increased dollars to implement

Support WDFW Commission's wild salmonoid management zone policy by engaging tribal (and others') input on design and geographic areas

Design and manage (pilot) test wild fish management areas; where feasible, couple with extensive research program to adapt lessons learned

Monitor incidental take

Implement principles of hatchery reform

Determine harvest levels by the number of fish on a stream-type scale

Hatchery based recovery program for very weak stocks

Pursue funding for data collecting

Selective fisheries mark/time/area

Minimize impact to wild stocks by improving naturalization of hatchery stocks

Pacific Salmon Treaty and North Pacific Fishery Management Council

HSRG and USFWS reform actions supported and implemented

PARKING LOTS – Threats Workshop 9-14-2010

<u>Headwaters/Uplands, Wetlands</u>

1) Road failure in uplands creating wetlands as a side effect (one negative creating a positive)
2) Loss of filtration (wetland function) and storage (flood mitigation)

Tributaries

1) Water typing
2) Data needs: map development, regulatory impacts
3) Monitoring needs: stock assessment, population trend analysis (spawning/redd surveys, improved escapement estimates)
4) Nutrients – water chemistry
5) Question – Merge riparian and steep slope timber harvest?
6) Recreational vehicles
7) Septic – illegal dumping – lack of infrastructure

Lakes

1) Illegal septic dumping due to lack of infrastructure for tourism.
2) Little lakes (Elk, Dickey) aren't in the same realm as the 3 majors – probably only logging, invasive plants and eutrophication

NOTE: WRIA 24 dots should be removed because they don't have any lakes.

Mainstems

1) H20 pH?
2) Ecology – 1000 cfs not correct metric
3) Instream (habitat complexity?): aggradation, de-watering, pool frequency
4) Simplified life history
5) Hydrograph changes (flow distribution)
6) Predation – predation-prey relationship
7) Debris – derelict gear
8) Altered chemistry include higher nitrogen, pollution
9) Inappropriate harvest – bycatch for bulltrout

Estuaries/Nearshore/Ocean

1) Threat and/or gap: Lack of key information on how salmon use these habitats. We need to inform important decisions. (habitat preferences, prey preferences, timing and distribution, monitoring: status & trends, stock assessment)
2) Shorezone data: Is eelgrass present on Washington coast nearshore habitat?
3) Clarify water quality: interruption of hydrologic circ? Is this flow into estuary or is it actual water circ in estuaries?
4) Out of balance sediment loads (nearshore) creating opportunities for predation – river bars
5) Future commercial activities – aquaculture/new fisheries?

Note: WRIA 21 didn't rate estuaries because they don't have them.

STRATEGIES NOT CHOSEN AS MOST IMPORTANT

At the Strategies Workshops held November 3-4, 2010 in Ocean Shores, there were break-out groups for each of the twelve threats. Each of these groups brainstormed an unlimited number of strategies that would mitigate or directly address those threats. Later, the entire group rated the strategies by individually putting a colored dot on those that they thought would be best for the Plan. Below are the strategies that received the fewest dots. However, as you may notice, several of these strategies did find their way into the Plan as strategy refinement and development occurred after November, 2010. We are including all unchosen strategies here in the belief that these may inspire new thinking and action in the future as the Plan and Implementation evolve.

Climate Change

Maintain and emphasize good forest practices to allow for fish adaptation

Good management for old growth characteristics in riparian areas; enforce buffer widths
Answer question: Are current buffers sufficient, given climate change projections?

Human infrastructure planning (flood risk and high flows); build in consideration of fish-friendly designs (FEMA, CREP, NRCS, FREP)

Maintain and emphasize a coordinated approach to invasive species management (Invasive Species Council)

Emphasize need for effective responsiveness of harvest/hatcheries management (factoring in relationship to habitat) management but is responsive to climate change impacts

Investigate short-term historical trends help with future impacts; ground truth of effects in region

Increase tree resiliency to climate change (for example, genetic tree improvements, reintroduction of redwoods and other species) to fill ecological niche

Invasive Species

Funding for detection and eradication (SRFB, EPA, DOE, DOI, DOA, NOAFN/Commerce, BIA)

Enforcement/incentives for private landowners to manage and control invasive species

Regulation (federal, state, local) of invasive species transport and sale

Harvest and Hatchery Interactions

Where mixed stock interactions are not assessed as major detriment to natural production, Implement habitat restoration where needed

Conduct separate assessments of juvenile and/or adult natural production from areas where hatchery & natural spawners occur together

Improve data collection accessibility and dissemination to all stakeholders. Provide the established assessments held by co-managers that address the sustainability of certain stocks managed along the coast while improving data collection and accessibility for dissemination to all stakeholders for all stocks

Improve local sustainability by investing in stewardship over harvest "quotas"

Funding to enforce regulations

Develop and implement improved methods for selective harvest

At policy level use nexus of Pacific Salmon Treaty and North Pacific Fishery Management Council to reduce all harvest impact on stocks

Logging Practices that Impact Salmon

Relocate stream parallel roads (priority funding for RMAP implementation)

CMER – Continue funding research programs and data collection

Oil Spills

Station tugs at coastal ports

Increase response training opportunities

Distribute more equipment along the coast

Adjust shipping lanes further offshore

Residential and Commercial Development that Impacts Salmon

Coalition building strategy

Support preservation of natural infrastructure: ecosystem services for water quality, flood storage, flow attenuation, etc.

Outreach to public with information on development impacts and methods/decisions to reduce impacts; train volunteers to monitor

Dredging and Filling

Zoning – revise SMPs, land use modification strategy

Mitigation funding strategy

Avoid dredging by proper in-water facility location

Removal And/Or Lack of Large Woody Material (LWM)

Work with partners to address LWM gap analysis along coast

Remove barriers to LWM transport

Develop management policies that further wooded RMZ, including funding

Put wood back into streams

Shoreline Modification including Dikes, Levees, Armoring, Bulkheads

Grants, federal and state allocations for property acquisition and assessments

Agriculture Practices that Impact Salmon

Lobbying Farm Bureau to change status quo

Establish farm co-ops, and more farmers' markets

Pass legislation on regulatory hurdles for alternative agricultural technologies and conversion of farm lands to fish habitat – lead to support and for restoration

Provide funds for spawning salmon on adjacent streams

Roads, Culverts, Bridges And Other Transportation Infrastructure

Education road maintenance entities about BMPs for protecting roads – use ELJs rather than rock, relocation, etc.

Funding – user fees (tolls, licenses, fuel tax) need to be dedicated to removing and rebuilding sub-standard roads, out of floodplains, CMZ, wetlands, etc.

Increase funding for compliance checks of water crossings

Need to require designs that are better than 100-year event (use stream simulation for bridges)

Increase personnel funding for compliance checks of water crossing fixes

Water Pollution from Developed land (Stormwater And Wastewater Pollution)

Alternatives for low impact development with associated resources

Promote native planting and landscape

Road decommissioning

In addition, the following **General Strategy** (as opposed to threat-specific) was suggested, but workshop participants elected to put the entire strategy on the "back burner" for this iteration of the Plan.

Support EcoTourism Compatible with Wild Salmon Sustainability

Chartered and guide licenses combined, tourism
Action: Promote the coast as ecotourism destination

Research what a substantial ecotourism industry would look like and how it would affect the region, the economy and the salmon.

Consider creation of a campaign aimed at substantially increasing the ecotourism industry in the region.

Seek funding to carry out this research and campaign.
Action: Promote/Advocate for limited entry Sport Fisheries

In Strongholds to limit cumulative fishing pressure while increasing fishery value, for example "Blue Ribbon" fishing
Action: Require Proof of Insurance and Permit from Guides
Action: Promote weighted guiding license allocation

APPENDIX 15
PUBLIC COMMENTS

BACKGROUND

The first draft of the Washington Coast Sustainable Salmon Plan was released for public comment in June, 2012. After extensive editing, a second draft was released for public comment November, 2012.

Below is compilation of nearly every comment received. The only comments not included are those that resulted in significant changes to the document and would appear out of context to the reader if included here. All comments have been retained and are available upon request to WCSSP.

We would like to thank those who took the time to comment on the Plan, and to remind everyone that this is a living document which will be updated and improved upon in the future. Therefore, we continue to welcome your comments and/or participation in the process. Comments may be submitted by mail (WCSSP, PO Box 2392, Ocean Shores, WA 98569) or email (info@wcssp.org).

Comments received at public meetings or online – either by email or in website comments – are organized below as General Comments or by the specific Chapter or Appendix about which the comments are made. Comments received by letter, with the sender's affiliation (if any) identified in the letterhead, are included here as received.

GENERAL COMMENTS

- In general, I find the report is well written and I commend the partnership for assembling and summarizing a large body of information about the salmon resources of coastal Washington.

- Given you are using the word "salmon" and "salmonids" in this plan to include more broadly both anadromous bull trout and coastal cutthroat, the executive summary should clearly include some mention of that. You could use a footnote as you did in Chapter 1.

  WCSSP Response: The Planning Committee elected, after much consideration to make the Plan more accessible to the lay person by using the term salmon rather than "salmonid." For the purpose of this Plan, "salmon" is specifically defined as fish of the genus Oncorhynchus (salmon, steelhead, and coastal cutthroat trout) and bull trout (Salvelinus confluentus).

- Although perhaps implied in the first bullet, a further goal should be to recover those coastal populations of salmonids (i.e., Lake Ozette sockeye and bull trout) that are currently listed.

COMMENTS ABOUT CHAPTER 2 – SALMONID SPECIES AND STATUS

- Is there a plan to include the graphic for Southwest Washington Coho?

  WCSSP Response: The maps in Chapter 2 are from NOAA Fisheries who is responsible for the identification and delineation of the ESUs. The Southwest Washington Coho ESU was identified and separated from the Lower Columbia Coho ESU in 2005. Since then, the status of the ESU has not been evaluated nor has a graphic been produced depicting the ESU's geographic distribution.

Comments Received from Jeff Chan, Fish Biologist, USFWS

- Bull trout are no longer listed as DPSs. In 1999, the final listing rule listed the species as threatened in the "coterminous United States". Although this population was identified as part of the original delineated Coastal-Puget Sound DPS, we recommend deleting the parenthetical statement.

- Based on current information, the Queets population of native char only contains bull trout.

- The Quinault bull trout population is also listed as threatened. The Quinault system also contains a sympatric population of nonanadromous Dolly Varden (in the headwaters of the EF Quinault), but Dolly Varden are not listed under the ESA.

- Although the focus of these narratives has been on natal watersheds with listed "populations" or "stocks", note that bull trout are listed under the ESA in all waterbodies where they occur. Anadromous bull trout have complex migration patterns and use a number of nearshore/estuarine areas and independent freshwater streams for foraging, migration and overwintering which are outside of their natal basin but critical for completing their life history. For example, although Kalaloch Creek and Raft River do not contain a specific "population/stock" of bull trout, they seasonally support individuals from those bull trout population(s)/stock(s) identified in other watersheds.

- The USFWS assumes you did not include Dolly Varden (Salvelinus malma) in this list because they are not known to exhibit an anadromous life history here in Washington. However, it may be confusing to the reader later in the document and elsewhere when you refer to "bull trout/Dolly Varden". Although WDFW manages these two species together, they are recognized as separate species.

- Actually only three bull trout "core areas" have been identified. These are the Hoh River, Queets River, and Quinault River (see USFWS 2004 draft recovery plan). What you have listed here are the currently identified "local populations" or "the smallest groups of fish that are known to represent an interacting reproductive unit" within each of these bull trout core areas. There can be multiple local populations within a core area.

- In addition to the FMO (foraging, overwintering, and migration) habitat that has been listed here, a number of independent stream systems to the Pacific Ocean have also been identified as occupied FMO habitat for anadromous bull trout. These include Goodman Creek, Mosquito Creek, Cedar Creek, Steamboat Creek, Kalaloch Creek, Raft River, Moclips River, Joe Creek, and Copalis River. These independent stream systems were identified as important habitats for anadromous bull trout in the last Critical Habitat designation. Please see http://www.fws.gov/pacific/bulltrout/finalcrithab/index.cfm?unit=1 and select "Pacific Coast" map.

- WDFW (and USFWS) has identified three separate populations of bull trout within the Washington Coast Region: Hoh, Queets, and Quinault.

- More recent research on bull trout by the National Park Service using radio and acoustic telemetry has demonstrated that the anadromous life history form is present in the Hoh River, and that individuals can migrate large distances to forage and overwinter in other freshwater systems along the coast. It is expected that this same type of life history behavior exists in bull trout from the Queets and Quinault core areas as well.

- Dolly Varden and bull trout have only been confirmed (using genetic analysis) within the Quinault core area. Only bull trout have been identified as being present within the Hoh and Queets core areas. The only other system along the coast with confirmed Dolly Varden presence is the Sol Duc River (upstream of Sol Duc Falls).

- USFWS concluded that the Satsop **currently** does not support spawning.

COMMENTS ABOUT CHAPTER 3 – CRITICAL THREATS TO SALMON SUSTAINABILITY IN THE WASHINGTON COAST REGION

Note: Many of the following comments were obtained at Open Houses where attendees were asked if they believed the Strategies would effectively address the Critical Threats. Thus, many comments include references to specific strategies.

Comments about Invasive Species

- New concern: Japanese tsunami debris washing up on our coasts containing invasive/non-native species that could get into our environment/water.

- There is no mention of the ships emptying water ballast in Grays Harbor.

Comments about Hatchery and Harvest Interactions

- I would like to see a bit more discussion of how harvest has been modified "to allow sufficient numbers to return to spawning grounds"- does this include lowering take or increasing a buffer in the forecasts so that we don't over harvest?

  WCSSP Response: Each year state, federal, and tribal fishery managers gather to plan the Northwest's recreational and commercial salmon fisheries. This series of meetings – involving representatives from federal, state and tribal governments and recreational and commercial fishing industries – is known as the North of Falcon process *http://wdfw.wa.gov/fishing/northfalcon/*. A harvest buffer for non-tribal sports and commercial fisherman has been put in place in the lower Columbia by 30% in response to upriver tribal concerns. Such a blanket buffer could be proposed for the coast as a safety mechanism also.

- The question is what level of sustainability is acceptable. Unless we tear down all the dams from Alaska to California, eliminate all pollution, eliminate salmon by-catch by commercial fishermen, etc, etc, we'll never get back to the level of fish we had 100-150 years ago. This isn't going to happen. The tribes, commercial fishermen and sport fishermen all want more fish. I don't believe we can ever meet the demand for salmon with native fish alone. So, I don't see hatcheries going away. I think they're a necessity born from reality. So we need to do everything possible to improve them. And then there's the question of salmon farms ... (level of concern about this threat: very)

- Is there any way to know whether the salmon I'm eating is from a hatchery or not? I would like to know this when I decide to eat it.

  WCSSP Response: If the salmon's adipose fin has been clipped off, it was raised in a hatchery and then released, as opposed to a "wild" fish, whose parents (who might have come from a hatchery anyway) spawned in the wild. There are a few exceptions to this (double blind tests in tagged hatchery fish to determine if the release rate is reported accurately, and of course the occasional missed clip). If one is wondering whether they are eating farmed or wild-caught fish, they should be labeled in the grocery store. A wild-caught fish, however, could have originated in a hatchery.

Comments about Logging Practices That Impact Salmon

- My specific comments pertain to the section titled "Poor Timber Harvest Practices, Past and Present." In this section you accurately identify impacts on fish habitat that resulted from past poor logging practices and you provide a number of references including Table 4 to substantiate this finding. Although you correctly indicate that forest practices have improved, your text and associated references about the effectiveness of modern forest practices is lacking. Nearly all of the attributes that are listed in Table 4 have been influenced positively through implementation of modern BMPs as directed by the Forests and Fish Report, NW Forest Plan, and Oregon Forest Practices. For example, consider adding information from the following studies of modern forest practices: Washington Cooperative Monitoring, Evaluation, and Research (CMER) http://www.dnr.wa.gov/BusinessPermits/Topics/FPAdaptiveManagementProgram/Pages/fp_am_cmer_publications.aspx

- Bull trout shade rules are highly effective at reducing solar energy input (McGreer et al. 2012)

- Road improvement (RMAP) has significantly reduced road runoff and sediment input to streams (Dubé et al. 2010)

Comments about Residential and Commercial Development that Impacts Salmon

- In Action B5.1 you mention water storage projects. Does this describe rain gardens and similar projects that help protect water quality?

    WCSSP Response: Yes. Although the strategy is intended to address water quantity concerns and ways to reduce runoff and return water to aquifers, like many strategies it also addresses other concerns – in this case, water quality.

- In Action A6.1 you describe supporting organizations that teach property owners about water quality. A similar idea is also to support organizations that engage the general community/public in projects that improve/protect water quality, like the Grays Harbor Stream Team and others orgs. Educating the general public about ways they can protect/improve water quality is very important.

- The title "Inappropriate Development" and the strategies don't match well. The strategies are more intended for land use practices rather than development. (Level of concern about this treat: somewhat).

    WCSSP Response: The term "inappropriate" was also seen as too subjective. The threat was renamed "Residential and Commercial Development that Impacts Salmon" which more effectively describes, as the commenter suggests, what the strategies are intended to address and/or mitigate.

Comments about Dredging and Filling

- While I do think that the strategies address the threat, I believe that more is needed. Specifically there should be strongly enforced restrictions on both dredging and filling, with an emphasis on filling. (level of concern about this threat: very)

Comments about Removal and/or Lack of Large Woody Material

- There is a TON of LWD in several of the estuary tributaries (Hoquiam, Wishkah, Elk, Johns), much of it natural put also a bunch of cedar pilings (not ideal for habitat enhancement). I am unfamiliar with the upstream Chehalis tributaries. In the estuary tributaries, the problem may be rephrased to indicate that this will become an issue (for these tributaries) in the future as what's instream now is flushed out or decomposes- logging practices will limit future input, creating issues as this LWD is not replaced. Also, dissertation by Alicia Wick (UW) focused on LWD in the estuary itself, and indicated that LWD there is declining (and how it functions).

Comments about Shoreline Modifications Including Dikes, Levees, Armoring, Bulkheads

- In Action A4.4 you might want to check out existing curriculums. I think the Surfrider Foundation has a curriculum about shoreline erosion that might be able to be modified for our area.

Comments about Agricultural Practices Harmful to Salmon

- In Action A5.2 you describe celebrating positive steps by landowners. In addition to this, water quality data collection could be done in conjunction with this action to "show" real improvements in water quality. Within the past year, Dept. of Ecology and the EPA removed segments of the Chehalis River from the 303d listing, meaning water quality had improved (especially for fecal coliform) in those sections.

- Action A5.2 - good idea, maybe create a certification program/award to farms and properties that provide good practices?

- Action A6.2 - what kind of support? Financial? Where will you get the money from?

- How about education of health concerns from eating salmon from polluted areas? (level of concern about this threat: very)

- Need to add - work with counties that have adopted the Voluntary Option (Ruckelshaus Agreement) for the application of Critical Area Ordinance to Agricultural land/activities.

  WCSSP Response: We are pleased to note that most counties in the Coast Region have signed on to the Voluntary Stewardship Program referred to in the above comment and WCSSP is fully supportive of this program.

Comments about Roads Culverts, Bridges, and Other Transportation Infrastructure

- I do feel that the strategies address the threat with reasonable adequacy, but I also feel that more emphasis should be put on informing the general public about the problems which poor transportation infrastructure can create. (level of concern about this threat: somewhat)

- You mention the negative effects of impervious surfaces. An action to help alleviate the negative impacts might be building "rain gardens" or other swale-type projects that allow water to naturally infiltrate into the soil before it reaches a stream, river, or groundwater. Low-impact development (LID) should also be discussed somewhere in this strategy and actions.

Comments about Water Pollution from Developed Land, Stormwater and Wastewater Pollution

- Low-impact development (LID) should also be discussed somewhere in this strategy and actions. In Action A6.1 you could also talk about supporting organizations that engage the public in projects that improve/protect water quality -- like the Grays Harbor Stream Team and other orgs. Education and involvement makes a big difference in correcting people's actions when it comes to water quality.

COMMENTS ABOUT CHAPTER 4 – DESIRED OUTCOMES: VISION, GOALS, AND OBJECTIVES

Comments received from Jeff Chan, Fish Biologist with the US Fish and Wildlife Service.

- Would this same objective apply to bull trout and coastal cutthroat? The prior paragraph states *"…an objective to maintain populations of all Coast Region salmon populations at sustainable and harvestable levels*", so USFWS assumes you are still using "salmon populations" in the broader sense. However, if this objective is focused/limited to commercial harvest, then this should be clarified. If not, then the reason why there may be a different objective for bull trout and coastal cutthroat should also be clarified.

- Lakes can also be important for bull trout and coastal cutthroat, but Lake Quinault is particularly important for these populations in addition to the sockeye population within the Quinault River system. Although the objectives would generally be the same for bull trout and coastal cutthroat, the importance of this habitat to these two species should also be acknowledged.

- An additional bullet or an addition to the existing bullet under the nearshore objective should be, "maintained or improved habitat that supports abundant nearshore forage fish populations (e.g., surf smelt)". Similar to what is under the Estuaries and Ocean objectives. Abundant nearshore forage fish populations are especially important to anadromous bull trout and coastal cutthroat populations, in addition to most Pacific salmon species.

  WCSSP Response: A lack of data with which to objectively assess the condition of Nearshore habitats is a problem readily acknowledged by the Planning Committee. The recommended objective was added as suggested.

COMMENTS ABOUT CHAPTER 5 – STRATEGIES AND ACTIONS

- Strategy B6: Very little about estuaries here, or a discussion of how dredging may impact oyster aquaculture, as well as salmon. What is the status of the USACE deepening of the channel? How is this process regulated?

  WCSSP Response: The Army Corps of Engineers (USACE) is planning on deepening the channel from the Crossover Reach upstream to Cow Point, and is negotiating the Water Quality Certification with WDOE, who regulates what they do, and is also consulting with the USFWS and NMFS on both ESA and Essential Fish Habitat issues. WDFW advises WDOE on habitat issues. Deepening is not planned for several years as they do not have the permits or funds, but they are proposing to move the buoys marking the Crossover Channel slightly, which will align the channel better with a natural deep thalweg that will not need to be dredged, and will actually save 500,000 cubic yards of annual dredging. This is also in the worst spot in the entire channel and will allow safe passage of deeper vessels for the few years it takes to get the permits and the funds for the project. We do not expect that the project will impact salmon, as the channel is already dredged to -40 feet, well outside of the juvenile salmon migration zone.

- Strategy C1: Paragraph 4: Estimating the carrying capacity is very difficult- how do we know that hatchery salmon are not competing with wild salmon, in time and space? What is the timing of release based on? (hopefully our current estuary study can assist with this)

  WCSSP Response: Research does show that rivers with hatcheries on them have fewer wild fish, so this is a problem, but it may not be the problem the commenter has in mind. Wild fish generally compete very well with hatchery fish, so well that as many as 90% of hatchery releases usually die within the first week or two of release. Release timing is based upon several things, usually they are released when they begin to smolt and when capacity is reached at the hatchery.

- Also- the bit on pathogens in this paragraph is a little too rosy. Yes, hatchery fish can become infected from wild fish, but the converse has also been shown. I think this is a critical data gap and an area that needs some research. Yes, the state and tribes work to limit pathogen outbreaks at the hatcheries, but until the recent reforms, infected fish were released (sometimes early) into local streams to reduce the density of fish in the hope of saving much of the hatchery production (and a system of reward pay for the # of smolts released provided the incentive for hatchery managers to do so). Investigating these transmission dynamics should be a goal of the reform plan; it is alluded to in C1.2d, but measuring hatchery pathogen effluents into the water should be included, not just what's in the fish.

- Section C1, Harvest: paragraph 7: how well have we met our escapement goals in the past? In other words, how well has harvest been managed to ensure that stocks can be rebuilt? This is also critical. (Action C1.2a)

- Action C1.1: should an additional goal be to show the public the connection between hatchery production and adult returns/catch? At present, it seems much of the public thinks that more hatcheries = more fish returning to catch, but research over the past ~12 years (some of which you mention in this section) has demonstrated that this is often not the case. I think changing this public perception going forward is critical in allowing us to be flexible in our approach to rebuilding salmon runs, b/c (as you mention) public input into the process has a huge role in management practices.

- Action C1.2e: As capacity is increased through habitat restoration and/or access to spawning grounds is improved (culvert removals, etc.), the estimates on take should be modified as well. That is, with more available habitat, fewer fish should be taken as we go forward so that fish are left alive to colonize that habitat. This is the only way we can follow the moving target on restoring the runs. In the past, if fish numbers improved, the management actions simply allowed more fish to be caught- this does not improve the long term odds of the salmon runs returning to historical levels. This is a critical point. Too often there is not enough political will to allow this to happen; prepping public perceptions on this issue is extremely important.

- General point: I have heard several people (i.e. very few, and all engaged in salmon recovery) suggest that the best way to allow the runs to recover is to stop all fishing for 6 years. That would be great, but there is a huge political fight there and I think it unlikely to happen. What about reducing take by an additional 25% over 6 continuous years (beyond what the managers estimate are “necessary” for escapement) and see what effect that has? We need this kind of long term data to allow recovery to work. At present you still read about “too many fish” returning and managers responding by increasing take. We have not had too many fish for decades, probably more than half a century (if ever!). Since salmon are the major influx of nutrients from the marine environment for many of these coastal streams that receive so much rain that most of the terrestrial nutrients wash out to sea, we need to allow as many fish as possible to get to the spawning grounds (anadromous nutrient pump concept). More nutrients = better survival of the next years fry/parr/smolts, which is what the rebuilding process requires.

The Nature Conservancy
Washington Field Office
1917 First Ave.
Seattle, WA 98101

July 19, 2012

Washington Coast Sustainable Salmon Partnership
P.O. Box 2392
Ocean Shores, WA 98569

Dear WCSSP Planning Committee:

The Nature Conservancy (the Conservancy) would like to submit the following comments for the draft Washington Coast Salmon Plan, developed through the Washington Coast Sustainable Salmon Partnership. The Conservancy is highly supportive of the efforts put forth by WCSSP to develop a comprehensive regional strategy for preserving and sustaining healthy, abundant wild salmon populations on Washington's coast. The plan exhibits a tremendous amount of initiative and impressive collaboration among stakeholders. It tackles very tough issues and offers several sound strategies and actions to address these issues, producing an exciting foundation for regional salmon conservation. In offering the following comments, our intent is to hopefully provide constructive feedback that will help to strengthen this plan.

General comments on the overall draft:

- The draft is greatly improved over the previous draft, is well organized, and reflects much more clearly the body of work and ideas developed by WCSSP. Appendices are thorough and a helpful compilation of regionally relevant data that enables readers to have easy access to more in depth information.

- The largest gap noted in the plan is a lack of clarity around a framework for how the numerous strategies and actions will be facilitated, prioritized, and coordinated across the region. There is a discussion on the need for partnerships, a great summary of existing plans that WCSSP has built upon, and discussion of how the LEGs will retain control over local decisions, but there lacks a focused discussion on guidelines for how local projects and decision-making should "roll-up" within the WCSSP plan. Prioritization of actions is still forthcoming, but without a clearly outlined conceptual framework for how these actions, even once they are prioritized, will be effectively coordinated across the region, the list conveys a "shotgun" approach rather than a consolidated effort. Recommend adding guidelines for how local decisions, projects, etc. can best be coordinated to support the WCSSP plan.

- In general, the plan appears to contain sound information. However, there are many places throughout where statements are made as fact without citations for cases where significant social and/or scientific debate remains (e.g., pg 55: "Reduction or control of harvest impacts on the various runs has been well documented." and pg 57: "…the Forest Practices Act are slowing the decline, and in some cases, have significantly improved the quality of the forested riparian habitats in the region."). Adding citations where evidence is well documented or clearly distinguishing anecdotal evidence or general opinion/consensus will strengthen the plan greatly by giving it more credence and rigor.

- The terms "harvestable levels" and "salmon-friendly" are used repeatedly throughout the plan, but these are never defined. These terms can mean very different things to different people and groups of differing perspectives. Recommend explicitly defining what these terms are inferring within this plan.

Specific comments:

- The overarching goal appears to be to avoid ESA listing. Four additional goals are listed (pg 73). The goal regarding regional land use decisions appears to be one significant objective/strategy supporting the habitat goal ("habitats …in a condition that will sustain healthy salmonid populations."). Recommend removing the land use goal (and emphasizing it later in the objectives or strategies) and making the goals much simpler: one goal each for habitat, harvest, and hatcheries to support the overarching goal of avoiding ESA listing.

- Objectives should be clearly connected to the goals. It seems odd that there are several habitat objectives (in support of the habitat goal), but no mention of objectives explicitly in support of the harvest and hatchery goals. If this is captured within the species objective, recommend clearly articulating this.

- Species objectives (pg 73): Are escapement goals a reasonable measure? Couldn't these change over time? If this is the metric that is used, recommend adding a discussion of what the escapement goals currently are, how they are set, and if we should/could anticipate future changes in this management (at least as an appendix).

- Habitat objectives (pgs 74-78). In general, very few of the habitat objectives, as stated, are measurable or contain measurable indicators. Without having a measurable objective, it is difficult to track and communicate progress. Words like "improve" or "sufficient" are vague and offer little guidance. Recommend putting effort into making objectives more measurable. Perhaps this could be done using the indicators and condition classes that were already identified for many habitat attributes (e.g., 75% of headwater streams have "good" riparian condition, or 50% of streams have "good" rating for LWD). This will make the plan much easier to track and much easier to report progress on (i.e., much easier to show results and continue to fund!). Although the use of escapement goals for the species objective may be questionable for reasons stated above, at least that number is relatively easy to determine now and in the future, which is a great indicator of progress or decline.

- Strategies and Actions (pg 80): The overarching strategy is to "Organize, promote, and maintain broad partnerships…". This is critical to the overall plan, yet it lacks action steps that are included with all other strategies. What actions will be needed and taken to ensure that these partnerships are formed and maintained?

- The education and outreach strategy (A) is full of good ideas, but strongly recommend that Strategy A1.1 be established and ideas vetted with groups inside and outside of the region before endorsing all of the other strategies (A2-A6). There is mixed evidence on when/why human behavior changes as a result of more or better information, so gaining a better understanding from others about what works and does not work in terms of outreach and education should be thoroughly researched and the list of strategies/actions revised prior to embarking on many of these sub-strategies (unless of course this has already been done!).

- Strategy B.1: Agree that consideration of climate change is critical in all protection and restoration strategies; however, there is a temporal aspect to habitat protection/restoration – what is critical habitat now may not be in the future and what may be critical habitat in the future may not be now. Bridging the gap between the present and the future requires that we do both – protect and restore habitats that are critically important now as well as those that will be needed in the future. The way the current strategy is written, it can be interpreted that only those "future" habitats are being targeted. The strategy needs to articulate more clearly the importance of protection/restoration actions for current and future critical habitats to maintain the salmon we have now and help ensure their ability to adapt to climate change.

- Strategy B3: Not sure why "landscaping with native plants" is included in strategy. It's important, but there are no actions (with possible exception of B3.5d) where native plant landscaping is mentioned. Recommend being more specific about actions for promoting native plant landscaping or drop it from overall strategy.

- Action B3.2 ("Promote the conversion of alders to conifers in buffer zones."). This is not applicable advice in every circumstance. Alders provide critical nutrients to soil, streams, and food webs. In many cases conifer growth should be encouraged, particularly along larger floodplains, but this should not be a blanket recommendation across the region.

- Action B4.2a: There is mention of integrating "prioritization efforts" into RMAP efforts. What are these prioritization efforts? It seems that a first step that would be needed would be a prioritization framework or guideline developed by the region (WCSSP) to assist with this. Prioritization efforts like this seem like a huge opportunity for WCSSP to bridge connections across the region (see general comments).

- Strategy B6: There is a lot of research being done in the Puget Sound to promote "green infrastructure" and alternatives to wetland filling that can benefit farmers and promote ecosystem and coastal resiliency. Recommend adding action step to look outside the region for research, ideas, and innovative projects on how to work with people/groups to reduce the negative impacts of dredging/filling.

- Strategy C1: It's great that a hatchery and harvest strategy is included. While both harvest and hatchery management are largely outside the legal realm of WCSSP, the strategy could do go further and do a bit more to make harvest and hatchery management more transparent and accessible to a wider audience (beyond habitat project sponsors and co-managers). Two suggestions:
    - It seems that it may be a good project for the region to evaluate tools or analyses that could assess aspects of questions relevant to relative impacts of harvest, hatchery, and habitat strategies on coastal populations to better inform these discussions and guide habitat prioritization efforts across region. An example may be an analysis using EDT or SHIRAZ in partnership with researchers at University of Washington.
    - All information identified in Action C1.2 should be available, in laymen's term, to the people beyond co-managers and habitat project sponsors. The public as well as foundations/donors are becoming more concerned about the impacts of habitat protection/restoration relative to harvest and hatchery management. Having clear

information on how decisions are made, how they affect populations where habitat protection/restoration is proposed, and risks/uncertainties will make it easier to understand and communicate the pros/cons of the habitat efforts.

- Action C1.2: Suggest developing and including a glossary of terminology associated with hatchery management (e.g., words such as "broodstock", "plant", and "integrated" in Appendix 6 are not common terminology for most people).
- Action C1.2d: Suggest inclusion of research to fill two large data gaps: (1) evaluation of hatchery impacts on wild fish in relation to climate change (e.g., run-timing overlaps that may result in selecting out segments of the natural run critical for adaptation); (2) interactions between hatchery and wild fish in the ocean.
- Action D1.1a: Is there a list of specific ecosystem services that would be of highest interest? Seems like this would be needed prior to seeking funding and analysis.
- Action D5.1b: There are studies in the Puget Sound evaluating these questions. Recommend adding action step to evaluate existing programs and summarizing lessons gained from these projects prior to undertaking efforts in coast.
- Appendix 4 and Appendix 5: The stock assessment and trend charts are helpful, but recommend adding some caveats about trend line interpretation (trends can often be skewed heavily by 1-2 years of data) and standardizing the x-axis (years) for the WDFW stocks to make it easier for people to quickly read the charts and avoid misinterpretation. Standardizing the x-axis on the WDFW charts will make it more readily apparent which stocks have more or less data available to base the trend on as well as where data gaps exist.

Thank you for allowing us to review and comment on the draft Washington Coast Region Salmon Plan; we hope that the feedback is helpful. Please contact Liane Davis if you have any questions or need clarification.

Sincerely,
Liane Davis

Liane Davis
Forest Ecologist, The Nature Conservancy
Ph: 971-255-1651
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Washington Coast Sustainable Salmon Partnership
P.O. Box 2392
114 E. Chance A La Mer NE
Ocean Shores, WA 98596
March 12, 2013

Dear Partnership members:

Thank you for the opportunity to comment on the Second Draft of the Washington Coast Sustainable Salmon Plan. I have limited my comments to Chapter 3 "CRITICAL THREATS TO SALMON SUSTAINABILITY IN THE WASHINGTON COAST REGION" pages 48-52.

Should you have comments or questions you may contact me at the e-mail address or phone number below.

Sincerely yours:

Gary A. Ritchie

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Comments on Washington Coast Sustainable Salmon Plan

These comments pertain only to Chapter 3 "Critical Threats to Salmon Sustainability in the Washington Coast Region", pages 48-52.

Page 48, Par 1. The chapter begins by proclaiming that climate change is the most critical threat to the Region's salmon largely because it is irreversible. This statement has no basis in science or history. Anyone who studies long term climates is well aware that climate change is totally reversible at every level. The Pleistocene Ice Ages, for example, were completely reversible (Figure 1). First the climate was warm, then cold, then warm, then cold – the cycle repeating roughly every 100,000 years for the past million or two years. In fact the *reversibility* is striking.

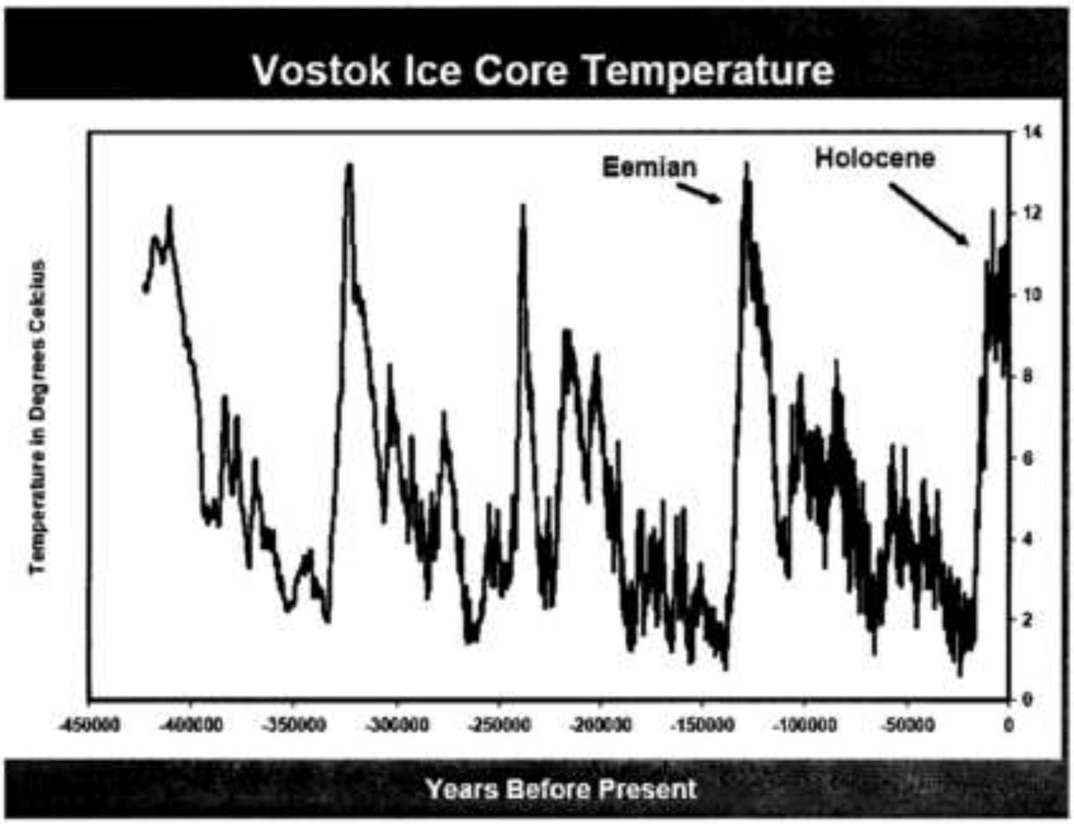

Figure 1. Temperature record during the last four Pleistocene ice advances as determined from examination of ice cores extracted at Vostok, Antarctica.

2

The trend is similar with respect to shorter term climate change as well. Take the Holocene Epoch (geologic time beginning at the end of the Pleistocene and continuing to today), for example (Figure 2). Following the retreat of the Pleistocene glaciers the temperature has been going up and down repeatedly on a roughly 1,500 year cycle. Every up has been followed by a down and *vice versa,* and there is no indication that that cycle will be broken in the near future.

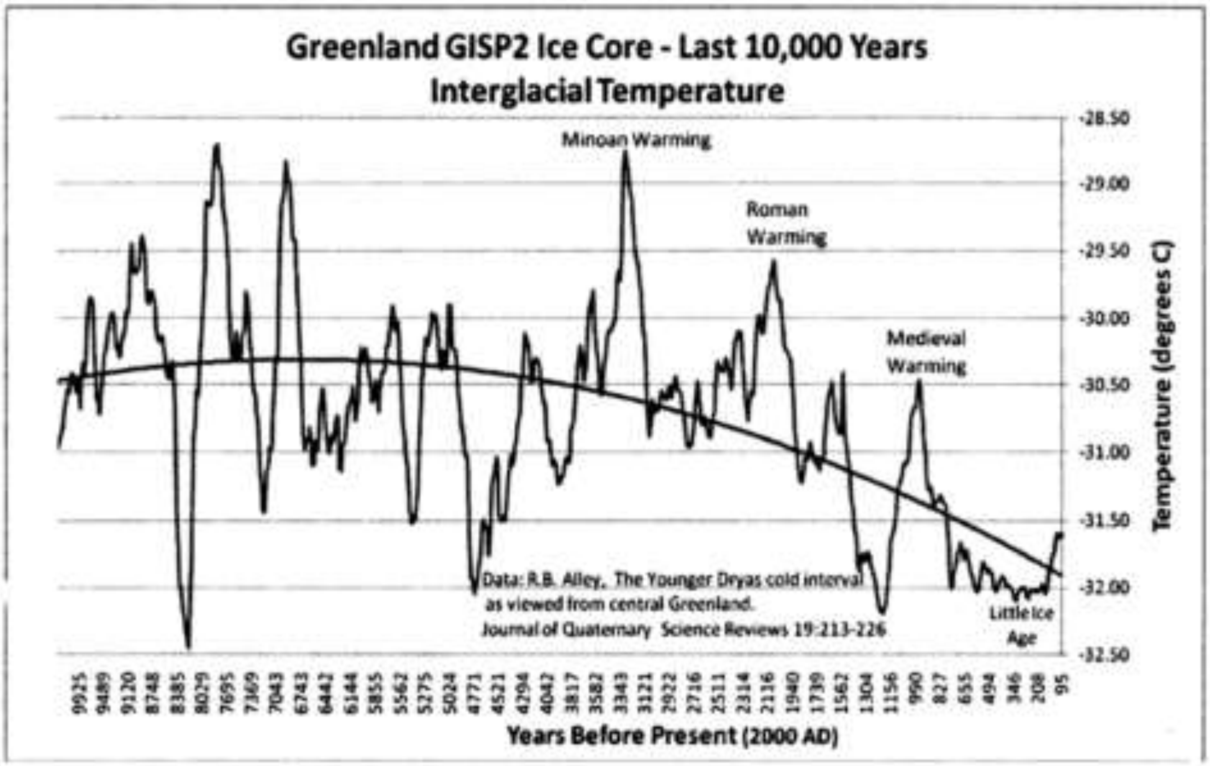

Figure 2. Temperature reconstruction from the Holocene Epoch as determined from ice cores from the Greenland Ice Sheet Project 2 (GISP2) as published in the Journal of Quaternary Science Reviews (19:213-226). Every peak is followed by a valley, which is followed by another peak, etc. None of the ups or downs during the past 10,000 years has been "irreversible". Note that the current warm period (in red), which is now plateauing, is much cooler than former warm periods.

The idea that climate change is "irreversible" is alarmist ecobabble without scientific basis whatsoever and has no place in a scholarly report such as this. The fact that irreversibility is used to rank climate change as the most serious of twelve threats listed needs some serious re-thinking.

Page 49, Par. 1 Why were no "for-profit sector" advisors included? After all, they ultimately will be paying the bills.

Page 49, Par. 4 states: "In the Pacific Northwest, climate change will produce increasing temperature, changes in annual and seasonal precipitation, declining snowpack, alterations to streamflows and flood risk, increasing summer water temperature, rising sea level, higher storm frequency and increasing ocean acidification" citing a Climate Impacts Group report (CIG, 2009).

Let's take them one at a time.

Increasing temperature. According to NOAA's National Climatic Data Center (NCDC), Washington temperatures have been decreasing at a rate of about -0.3°F per decade for at least the past 25 years (Figure 3).

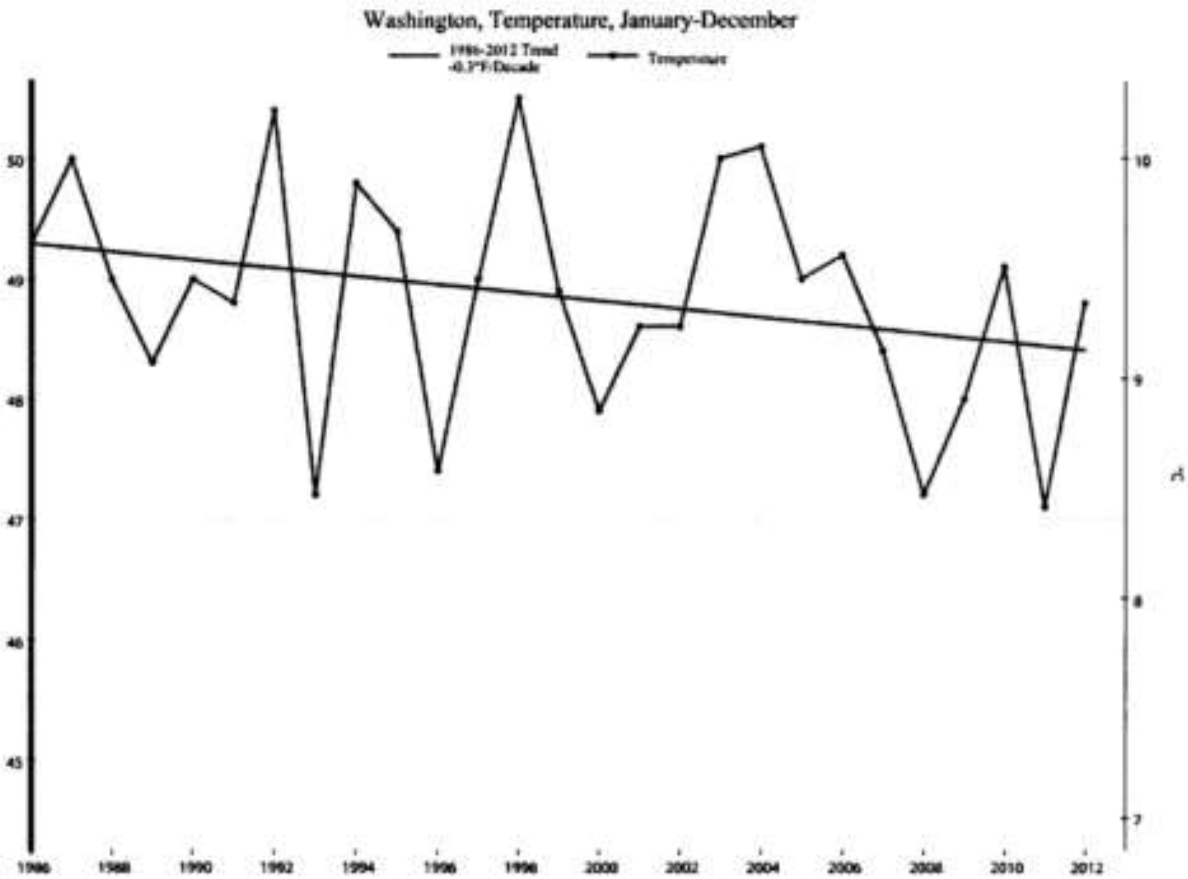

Figure 3. Mean annual temperatures for the State of Washington collected from 44 weather stations managed by NOAA (National Oceanographic and Atmospheric Administration). These data can be retrieved on line by going to NOAA's web site, and searching for "Climate at a Glance".

4

This is consistent with worldwide temperature data that show a leveling off of temperature for the past 16 years and a slight decline in the past 5 to 10 years (Figure 4).

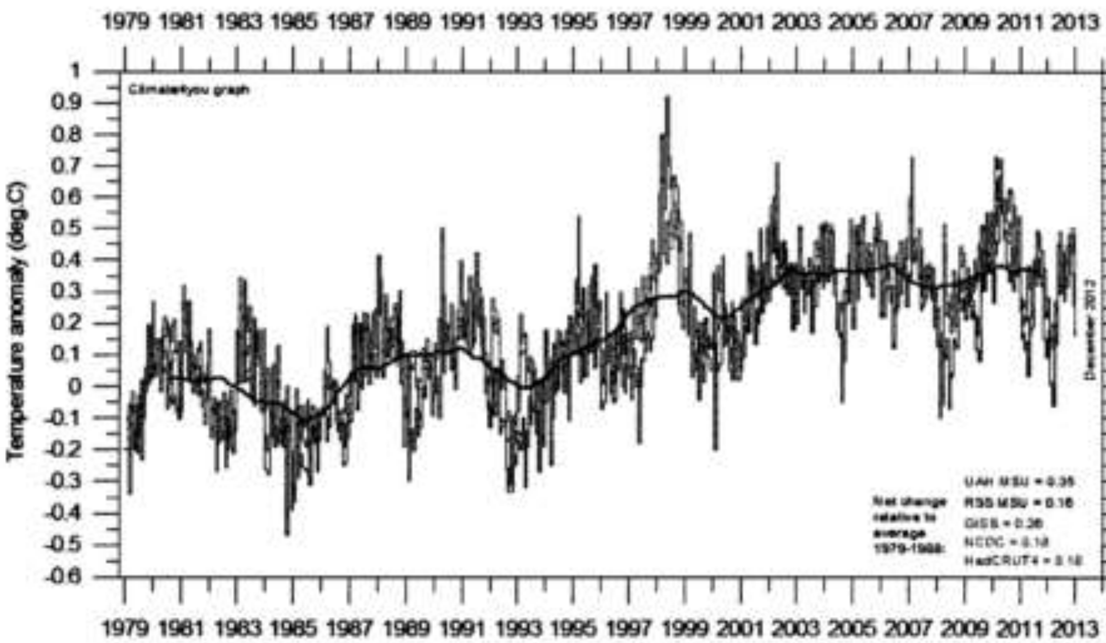

Figure 4. Superimposed plots of five global monthly temperature estimates. As the base period differs for the different temperature estimates, they have all been normalised by comparing to the average value of their initial 120 months (10 years) from January 1979 to December 1988. The heavy black line represents the simple running 37 month (c. 3 year) mean of the average of all five temperature records. The numbers shown in the lower right corner represent the temperature anomaly relative to the above average. These combined temperature data are from UAH and RSS satellite sensing systems, NASA GISS, NOAA NCDC, and the UK Meteorology Office at the Hadley Centre, UK (sources are identified in the lower right corner of the graph). Source: modified from www.climate4you.com.

Changes in annual and seasonal precipitation. What in the world does this mean? What kinds of changes are expected? Even the report Climate Impacts Group report cited (CIG 2009) suggests changes only in the 1% to 2% range.

Alterations to stream flow and flood risk. Ditto the above comment.

5

Declining snowpack. Cascade snowpack has been measured on April 1 annually since 1976 on 36 "Snotel" sites in the Washington and Oregon Cascades. The April 1 snowpack has *increased* 28% from the late 1970s to the present time as defined by the 5-yr mean Snow Water Equivalent (SWE) measured at all 36 sites (Figure 5).

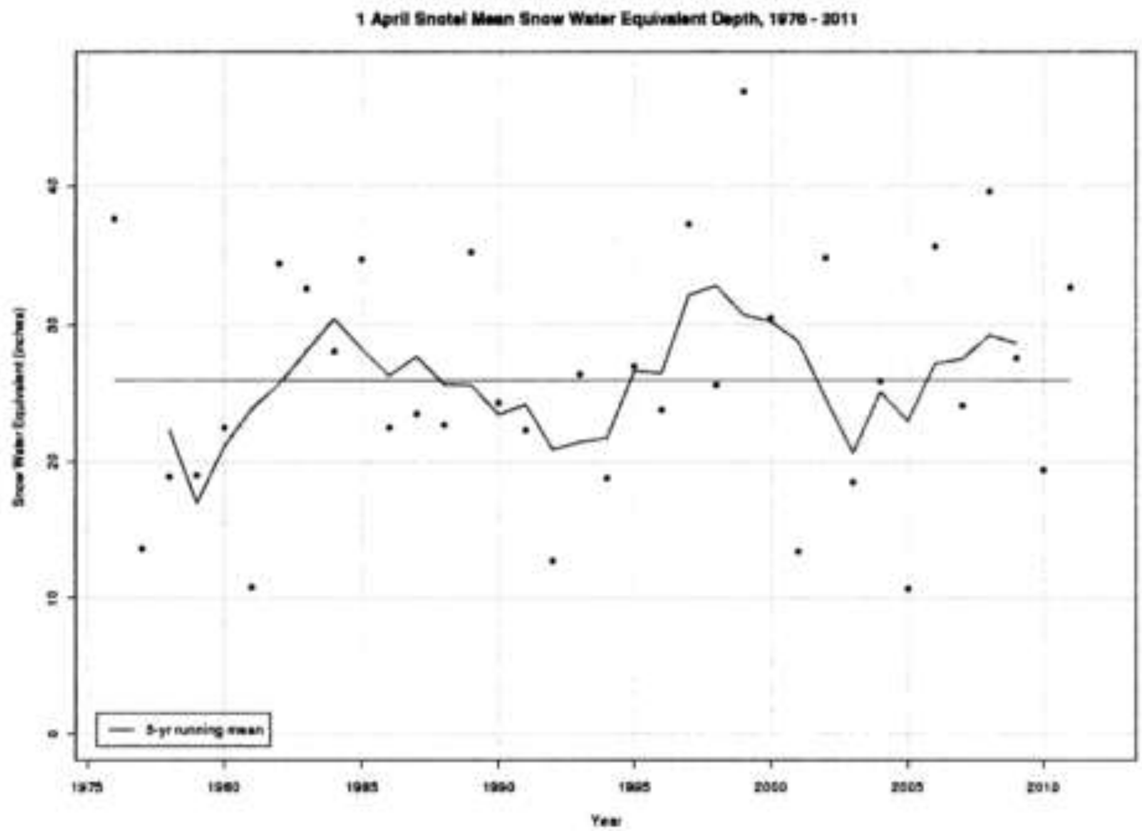

Figure 5. Mean snow water equivalent depth for 36 Snotel sites in the Washington and Oregon Cascades Measured April 1 from 1976 to 2010 (Source: Mark Albright, Univ. of Washington Dept. of Atmospheric Sciences, personal communication).

Increasing summer water temperature. Is this stream water, river water, lake water, ocean water? It's hard to visualize a mechanism whereby water temperatures would increase at the same time air temperatures are decreasing and snowpack is increasing. Please explain.

6

Rising sea level. Sea level has been rising steadily ever since the last glaciation, which ended about 10,000 years or so. This rise has amounted to several hundred feet owing to the waning of the last ice age, melting of continental ice sheets and thermal expansion of a warming sea. The rate of rise has varied from about 0.6 to 1.1 foot per century for many decades (Figure 6). Some argue that the rate of change is increasing; some argue that it is not. No one knows for certain because of the extreme difficulty of reconstructing sea levels prior to the advent of satellite measurements in the early 1990s.

Of the various impacts of climate change listed in the CIG report, sea level rise is the most predictable and manageable. As indicated in this draft Sustainable Salmon Plan this will result in the need for structures to protect shorelines and these may affect salmon recovery. This seems to be the only area of genuine concern relative to climate change.

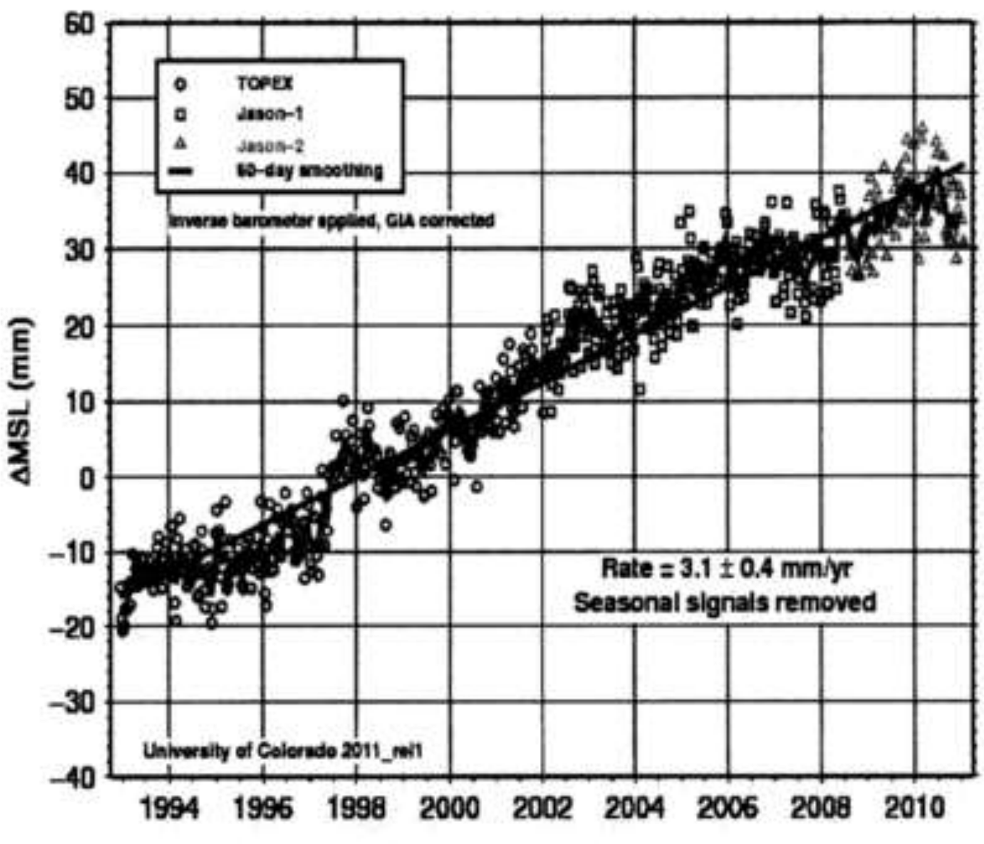

Figure 6. Changes in Mean Sea Level as reported by the Sea Level Research Group, University of Colorado. Different colored dots represent measurements made by three different series of satellite radar altimeters.

Higher storm frequency. There is no data to support the argument that global warming causes more and stronger storms. In contrast, Meteorologist Dr. Ryan Maue, the manager of the Florida State University dataset on Accumulated Cyclone Energy (ACE), reports that during the past 40 years, the tropical cyclone ACE, an index of storm intensity, has fallen sharply during the past decade (Figure 7). Global hurricane frequency has exhibited substantial year to year variability, with frequency of intense hurricanes trending slightly downward since the early 1940s (Figure 8).

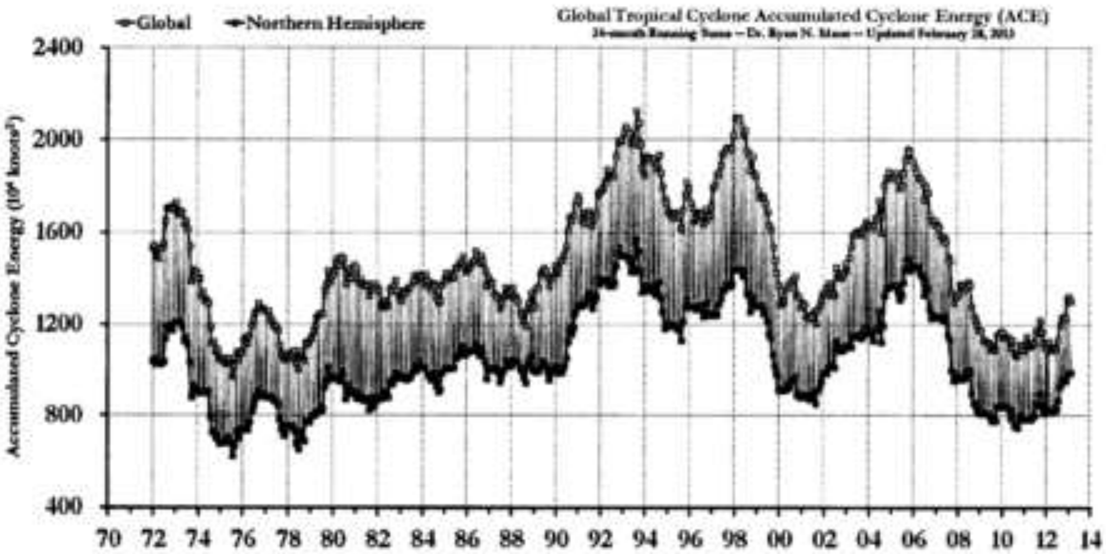

Figure 7. Global Tropical Cyclone Accumulated Cyclone Energy (ACE) from 1972 through 2012 as compiled by Florida State University (http://policlimate.com/tropical/).

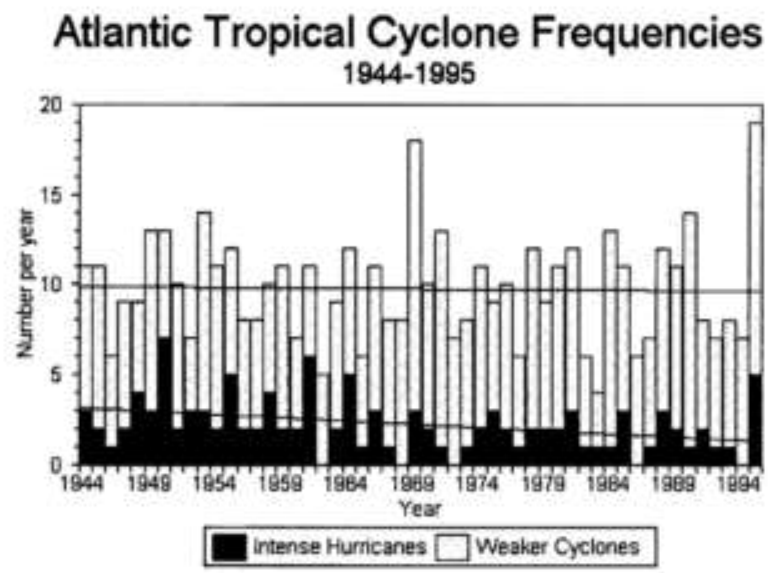

Figure 8. The frequency of Atlantic hurricanes from 1944 to 1994. (Source: Christopher Landsea, NOAA).

8

Increasing ocean acidification. It's hard to know where to begin on this one. In the first place, what "ocean" are we talking about? The Atlantic Ocean, the Pacific Ocean, the Indian Ocean? Or all the oceans of the world?

In any case, the oceans are enormous and extremely variable in depth, temperature, salinity, chemistry, etc. and have a huge buffering capacity. And it is well documented that ocean pH itself varies dramatically across both time and space. To make a claim that the "acidity" of the oceans is greater now than at some time in the past presumes: (1) that we know how to measure the average pH of the world's oceans, and (2) we knew how to measure it in the past in order to establish a baseline for comparison. Both of these presumptions are unsupportable.

There are other problems with the argument for "ocean acidification". I'll list only a couple. One is that there are untold thousands of submarine volcanos on the ocean floor. Many of them are erupting and injecting huge quantities of CO_2 directly into the ocean water affecting pH. The problem is that we don't know how many there are, how many are erupting, and how much CO_2 is being introduced directly into the sea. In face of this uncertainty, how can we possibly assume that changes in "ocean acidity" are the result of human CO_2 emissions (which, by the way, represent less than 4% of total annual CO_2 emissions into the atmosphere – the other 96% arising from natural sources).

Another problem is that Earth's oceans contain upwards of 70 *times* as much CO_2 as the atmosphere. So even if all of the CO_2 in the atmosphere were to be somehow absorbed by the ocean (impossible) the increase would be less than 2%.

It is also very likely that the pH drop in near shore waters off the Washington and Oregon coasts, which is of local concern, results from upwelling of very deep, oxygen-starved, cold water that has a lower pH than surface water – having nothing to do with climate change.

Finally, a point on terminology. Many data suggest that mean pH of sea water may vary between about 7.9 to 8.1. This is not acid but alkaline. If this value does indeed go down it means that the oceans are become *less alkaline*, not *more acidic*. Or you could also say that that they are trending toward neutral (pH = 7.0 is neutral). Saying that the oceans are becoming more acid is like saying that the afternoon is becoming more dark. The choice of the word "acidic" in this context mirrors alarmism, not science.

In summary, of the various claims of climate catastrophes offered up in the report, only sea level rise enjoys any scientific support. And this is not really a "climate change" issue. The sea level has been rising steadily over many centuries – centuries that have seen both warm and cold periods (Figures 2). It would seem that sea level rise should be in a category of its own and not lumped in with Climate Change.

Next I would like to comment on the report of the U.W. Climate Impacts Group (CIG 2009), which was the source of most of the climate disaster claims cited in this draft Sustainable Salmon Plan. CIG (2009) cites as a prime source of information "*The Washington Climate Change Impacts Assessment*" another un-peer reviewed document generated by the Climate Impacts Group, which was funded by money from the Washington State Legislature. Their Global Climate Scenario is after Mote and Salathe (2009), another un-peer reviewed report.

Here is an abstract from a section of that report titled *Future Climate in the Pacific Northwest*:

"Climate models used in the Intergovernmental Panel on Climate Change (IPCC) Fourth Assessment Report (AR4) on the whole reproduce the observed seasonal cycle and 20th century warming trend of 0.8°C (1.5°F) in the Pacific Northwest, and point to much greater warming for the next century. These models project increases in annual temperature of, on average, 1.1°C (2.0°F) by the 2020s, 1.8°C (3.2°F) by the 2040s, and 3.0°C(5.3°F) by the 2080s, compared with the average from 1970 to 1999, averaged across all climate models. Rates of warming range from 0.1 to 0.6°C (0.2° to 1.0°F) per decade. Projected changes in annual precipitation, averaged over all models, are small (+1 to +2%), but some models project an enhanced seasonal cycle with changes toward wetter autumns and winters and drier summers."

Note, here, that the projections for Pacific Northwest climates are based on models used to generate the IPCC Fourth Assessment Report. None of these models has correctly forecast the decline in temperature that has been occurring for the past 25 years in Washington State (Figure 3), nor the flat or declining global trends shown in Figure 4. Yet we are being asked to believe that their projections for the next 80 years will be spot on.

Don't be fooled by the phrase "averaged across all climate models". This means all the models are run together as an ensemble. Then the outcomes of the models are summed and averaged to yield the numbers presented. All that this exercise accomplishes is to quantify the amount of variability among the model outputs - it reveals nothing about their accuracy in forecasting what is going to happen in 80 years.

Note also that the projections carry with them an unjustified aura of accuracy and precision. For example, the models predict a temperature increase of 2.0°F by the 2020s, 3.2°F for the 2040s, and 5.3°F for the 2080s. We have no way of knowing what the error around these projections is. Is it ±1°F, ±10°F, ±20°F or what? This cannot be calculated until the internal errors in the models have been determined, and to my knowledge this has never been attempted.

So we are left with numbers, based on computer simulations, about which we have no information to guide us as to the amount of error they contain. It's certainly possible, perhaps even inevitable, that the errors around these projections are greater than the projections themselves. If the error around 2.0°F is ±3°F, then the temperature could actually go down, rather than up. Perhaps this is why the model projections for the past 15 years or so have been wrong, not only in degrees but also in sign. Nevertheless we are asked to believe that by the 2020s our temperature will be 2.0°F warmer than it was from 1970-1999, but we do not know what the error of this estimate is and furthermore, we have no way of calculating it.

So, if I could wrap this up.

The chapter on Critical Threats (beginning on page 48) lists "Climate change" as the most serious critical threat to salmon largely because of its 'irreversibility". Using actual long term climate data, extracted from ice cores going back several hundreds of thousands of years, it can be shown that this is not true. In contrast, these data clearly demonstrate that climate change is totally reversible.

Temperatures in the State of Washington are not going up, as stated in the report, but have been declining at a rate of about -0.3°F per decade for at least 25 years. This is not inconsistent with global temperatures, which have been flat or trending downward for the past 16 years, despite IPCC model projections of a rising temperature during this period.

Of the various climate catastrophes presumed in the report, none are supportable with data – temperatures are not going up, snowpack is not going down, storms are not increasing. The only one worthy of concern is sea level change, which proceeds at the rate of about 6 inches to 1 foot per century and will continue to do so for the foreseeable future. Sea level rise is a real threat but, fortunately, one that can be met with engineering solutions and regulatory (zoning) initiatives. Impacts of these structures on salmon recovery could well be a concern, as indicated in the report.

Ocean acidification, the latest environmental scare, rests on very shaky evidence, is not supportable by current science and may or may not become a problem. If it does, it is unlikely that human CO_2 emissions will be found responsible.

Virtually all of the climate projections that underpin this analysis are derived from models operated by the IPCC. These models suffer from many serious problems. The main one is that they don't work – having failed to correctly predict the first 16 years of the 80 years they aspire to forecast. Even more troubling is the fact that no one knows for certain what the internal errors of these models are, so it is impossible to have any confidence in their outcomes.

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WFPA

March 15, 2013

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Dana Jo Dietz, Program Assistant danajd@wcssp.org
Washington Coast Sustainable Salmon Partnership
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Via email: milesb@wcssp.org, danajd@wcssp.org

Re: "Draft Washington Coast Sustainable Salmon Plan (November 30, 2012)

Dear Mr. Batchelder and Ms. Dietz:

Thank you for this opportunity to comment on the Draft Washington Coast Sustainable Salmon Plan (WCSSP). The Washington Forest Protection Association (WFPA) is a forestry trade association in the state of Washington. We represent large and small forest landowners and managers of nearly 4 million acres of productive working timberland located in the coastal and inland regions of the state. Our members support rural and urban communities through the sustainable growth and harvest timber and other forest products for U. S. and international markets.

In reviewing the Draft Plan, WFPA was pleased to see the acknowledgement in the Draft WCSSP of the 1999 Forests and Fish Law which greatly enhanced forestry practices and regulation. We were also heartened to see the recognition that "harvestable working forests are better for salmon than other human land uses." The Forests & Fish Law was developed in collaboration with federal, state, tribal, and county governments and private forest landowners. Representatives from each of these groups worked together for 18 months to make changes to the forest practices rules to protect clean water and riparian habitat on non-federal forestland in Washington State. Changes were made to improve forest roads and culverts, enlarge buffer zones along stream banks, and identify and protect unstable slopes. An Adaptive Management monitoring program has also been put into place to test the effectiveness of the new rules. In 2006, the Forests & Fish Law was endorsed by the federal government, through a statewide Habitat Conservation Plan. As one of the largest and most comprehensive pieces of environmental legislation in the U.S., the law is designed to fully comply with both the federal Endangered Species Act (ESA) and the Clean Water Act (CWA) to protect Washington's native fish and aquatic species and assure clean water compliance. Simply put, the forest practice rules implementing the Forest & Fish Law are assured by the regulating authorities to protect aquatic species and maintain water quality standards.

We're managing private forests so they work for all of us. ®

While the Draft WCSSP does state that current timber practices are "slowing the decline and, in some cases, have significantly improved the quality of the forested riparian habitats in the Region," in many places, the Draft's language confuses the impact of past and current forest practices. For example, the Draft WCSSP states that "Numerous studies have directly linked past logging practices, including forest management and road placement, to deleterious effects on many habitat-forming processes that drive the freshwater habitat complexity upon which salmon depend"; and that, "The disturbances along fish-bearing channels that can be attributed to past logging practices have ranged from timber harvests on steep slopes and drainages, to roads built in the forests for lumber trucks, to devegetated surfaces, to inadequately maintained culverts – all of which have the potential to increase sediment load through runoff or bank instability, thereby harming fish habitat" (Draft WCSSP, pages 55-56; emphasis added). But, there is no acknowledgement that the FPHCP and current forest practices rules explicitly require new forest practices for forest road and culverts, buffer zones, and unstable slopes as part of the overall strategy to recover salmon population levels.

While it appears to be somewhat semantic, the implications of blending past and current practices are quite dramatic. Clearly there have been impacts to aquatic species as a result of historic logging practices, and these should be acknowledged. However, those impacts are of different magnitude than the mitigated impacts from present day logging.

One example of new forestry prescriptions is road building and maintenance. Under current rules, forest landowners are required to maintain their roads to very high standards. All large forest landowners have submitted road maintenance and abandonment plans (RMAPs) to the Department of Natural Resources. Under these plans, landowners assessed their entire historic and current road system and either improved roads to meet the higher standards, relocated them, or abandoned them. . As of June 2011, across the state, both small and large landowners have completed over 247 RMAPs and more than 10,000 RMAP checklists, covering more than 57,000 miles of forest road. These actions have resulted in more than 3,200 miles of fish habitat being opened by removing or replacing nearly 5,000 stream blockages. The investment made so far is $172.2 million, a critically important investment to the future of Washington's natural resources. While the Draft WCSSP identifies logging roads as a historic problem near stream channels, but it does not recognize the significant improvements that forest landowners have made to their road systems (Draft WCSSP, page 65).

The confusion in the text is compounded by the implications in Table 4, titled: "Impact of poor past and current forestry practices on salmonid habitat and the resulting biological effects on salmonids" (emphasis added). Column #2 reports "How Poor Past and Current Forestry Alters Attribute." Nowhere in the chart or the accompanying discussion is there any mention of the FPHCP prescriptions, the Forests and Fish Law, or current Forest Practices Rule. Further, there is no acknowledgement of the extensive science- and data-driven mandated Adaptive Management Process that reviews and modifies forest practices. We feel that all of these language deficiencies could be remedied by clearly delineating the impacts of past and current practices.

Two final comments, in Strategy E4 "Work with Agencies to Strengthen the Forest Practices Act Permitting and Monitoring Process" there should be explicit recognition to current Forest Practice Board processes. The Growth Management Act citation to RCW 36.70A.172(2) seems misplaced for forest practices activities on non-converted lands. For forest practices, a more appropriate citation would be to the Forests Practices Act. The Cooperative Monitoring, Evaluation and Research Committee organized under the Adaptive Management Process was explicitly created to investigate implications of science on forest practices rules (RCW 76.09.370(6)). Second, we'd also like inclusion of the substantial financial contributions made by forest landowners in the funding section of the Draft WCSSP (page 135). As you finalize the WCSSP, we'll be very interested in working with you on language to reduce confusion and accurately portray current forest rules and practices.

Sincerely,

Karen Terwilleger
Senior Director for Forest and Environmental Policy

GLOSSARY

Notes: Definitions in this Glossary refer to factors of salmon sustainability; they may have other meanings in other contexts. Not all of these glossary terms are in this Plan; however, we are including them here because they may be useful as we develop Implementation Steps and a Monitoring Schedule for the Plan Strategies.

A

ABUNDANCE

The number of fish in a POPULATION at a particular LIFE-HISTORY STAGE of development.

ACTIVE CHANNEL WIDTH

The distance across a stream or channel measured from bank to bank at bankfull flow (NWFSC, 2008).

ADFLUVIAL

Describes NONANADROMOUS salmon who rear in their natal stream, then migrate to a lake to grow further, then return to their natal stream to spawn (Quinn, 2005, p. 4). (As distinct from FLUVIAL and RESIDENT.)

ALEVIN

The developmental life stage of young SALMON between the embryo and FRY stages. A salmon hatchling with its large, external yolk sac still attached. The yolk sac has not yet been absorbed and the ALEVIN has not emerged from the spawning gravels (Quinn, 2005, p. 3).

ALLELE

An alternative form of a gene (one member of a pair) that is located at a specific position on a specific chromosome. These DNA codings determine distinct traits that can be passed on from parents to offspring (NWFSC, 2008).

ALL “H”

An approach to salmon management and planning that integrates issues relating to all four “H”s -- habitat, hatcheries, harvest, and hydro-power production.

ANADROMY/ANADROMOUS

Describes fish that hatch and rear in fresh water, migrate to the ocean to grow and mature, and migrate back to fresh water to spawn and reproduce. ANADROMOUS fish such as salmon spawn in freshwater, where their eggs incubate and hatch, allowing the emergent FRY to initially rear in the freshwater. Following freshwater rearing, JUVENILES (SMOLTS) migrate to the ocean and spend most of their remaining lives (as adults; usually one or more winters) before they return to freshwater to spawn. Some species spawn just once and then die, while others subsequently migrate back to the ocean for repeated cycles. One of three general biological traits of SALMON (the others being HOMING and SEMELPARITY), although there are exceptions (Quinn, 2005, p. 5-6).

ANAEROBIC

Literally "*without oxygen,*" as opposed to aerobic. Inadequate levels of DISSOLVED OXYGEN ("DO") in water (<6.5 mg/L) can cause significant stress in SALMON.

ANTHROPOGENIC FACTOR

A circumstance or influence caused or produced by human action (NWFSC, 2008).

ARTIFICIAL PROPAGATION

Hatchery spawning and rearing of salmon, usually to the SMOLT stage (NWFSC, 2008).

ATTRIBUTE

A characteristic or aspect of something; in this Plan, ATTRIBUTES usually relate to habitats, for example, the water quality of a tributary.

AVULSION

The rapid abandonment of a river channel by its waters and the subsequent formation of a new river channel as a result.

B

BARRIER

A blockage such as a waterfall, culvert, or rapid that impedes the movement of fish in a stream system (NWFSC, 2008).

BASIN

An extent or area of land where surface water from rain and melting snow or ice converges to a single point, usually the exit of the basin, where the waters join another body of water, such as a river, lake, estuary, wetland, or the ocean.

BEST AVAILABLE SCIENCE ("BAS")

The scientific findings about something specific that are accepted by most experts at the present time. Usually, when the phrase is used, it is left undefined. Therefore, interpretations of BAS have been developed in state, regional, and federal courtrooms to guide scientists, policy makers, and natural resource managers in deciding what is *good* science. BEST AVAILABLE SCIENCE includes biological, ecological, economic, and social data, and the generation of BAS normally involves peer review, scientific methodologies, logical conclusions and reasonable inferences, quantitative analysis, appropriate context, and thorough references.

BEST PROFESSIONAL JUDGMENT ("BPJ")

The process of analyzing a problem by utilizing an expert or expert panel using their collective experience and professional assessment of the problem (NWFSC, 2008).

BOLDT DECISION

Named after the judge in the original *United States v. Washington* decision, at 384 F. Supp. 312 (W. D. Wash. 1974), which citation is the actual name of this case. Upheld by the United States Supreme Court, this federal district court opinion acknowledged that the TREATY TRIBES of Washington had a 50% interest in the

FISHERY, in common with the state (i.e., non-tribal interests) and that the tribes were CO-MANAGERS of the FISHERY with the state. The case has never closed, being left open to further define treaty rights. For example, the original decision did not contemplate hatchery fish or fish other than salmon, but now includes not only hatchery fish but all marine animal resources that tribes could have originally fished for. The case also defines tribal fishing grounds by treaty, based on anthropological evidence. It is this case that established the need for REDD surveys to determine ESCAPEMENT and also established what the tribes can regulate versus what the state can, with respect to fishery management (Boldt, 1974).

BRAIDED CHANNEL/SIDE CHANNEL

Low-gradient and low-velocity streams with a high sediment load may form a geomorphic feature known as braiding, in which the channel is divided by a network of bars or islands. Factors such as log jams can increase the formation of braiding and in fact stabilize it (King, undated).

BUFFER/RIPARIAN BUFFER

A riparian buffer is a vegetated area (a "buffer strip") adjacent to a stream (from tributaries to estuaries), usually forested, which plays a key role in increasing water quality, providing shade and other environmental benefits for salmon. With the deterioration of many aquatic ecosystems, healthy riparian buffers have become a very common conservation goal aimed at increasing water quality and reducing pollution.

C

CARRYING CAPACITY

The number of individuals at a certain LIFE-HISTORY stage that the volume, complexity, ATTRIBUTES and resources of a habitat can support.

CATASTROPHIC EVENTS

Sudden events, either natural or man-made, that disastrously alter large areas of landscape. These can include floods, landslides, forest fires, earthquakes, volcanic eruptions and oil tanker spills.

CHANNEL AGGRADATION

Describes the raising of the streambed elevation, an increase in width/depth ratio, and a corresponding decrease in channel capacity. Over-bank flows occur more frequently with less-than-high-water events. Excess sediment deposition in the channel and on floodplains is characteristic of an aggrading river. Often, the cause of aggradation is an increase in upstream sediment load and/or size of sediment exceeding the transport capacity of the channel.

CHANNEL GRADIENT

The slope of a stream reach (NWFSC, 2008).

CHANNEL MIGRATION, CHANNEL MIGRATION ZONE (“CMZ”)

River and stream channels are not fixed in a single location over time. Channels meander from side to side within the flood plain, as a result of gradient and geomorphology (land features). The area defined by this range of channel movement is called the Channel

Migration Zone ("CMZ"). The rate of this migration responds to the existing channel and bank conditions and the input of water. In storms the greater input may increase the rate and area. Whether channel migration is slow or rapid, it is a natural function of the river system and a source of nutrients, spawning gravel, and LARGE WOODY MATERIAL (King, undated).

CITIZEN SCIENCE

A term used for the systematic collection and analysis of data, development of technology, testing of natural phenomena and/or the dissemination of these activities by researchers on a primarily avocational basis. Individual CITIZEN SCIENCE volunteers or networks of volunteers, many of whom may have no specific scientific training, perform or manage research-related tasks such as observation, measurement, or computation. Citizen science requires QAQC (quality assurance/quality control) after training by a qualified scientist to effectively supplement peer-reviewed field or lab studies.

CODED-WIRE TAG ("CWT")

A small piece (0.25 x 0.5 or 1.0 mm) of stainless steel wire that is injected into the snouts of JUVENILE salmon and steelhead. The tags are produced in large batches, each set etched with a unique binary code for each returning fish, so that when the fish is recovered, its tag identifies its particular origin and release group (NWFSC, 2008).

CO-MANAGERS

The State of Washington and TREATY TRIBES, as established under the 1974 BOLDT DECISION, that share joint responsibility for management of the state's FISHERIES.

COMPENSATORY SURVIVAL

The increased rate of survival that would occur as a result of a decrease in density of fish rearing in a habitat.

CONSPECIFICS

Organisms belonging to the same species as one another. (As opposed to HETEROSPECIFICS.)

CRITICAL AREAS ORDINANCE ("CAO")

Pursuant to the Growth Management Act ("GMA") (RCW 36.70A.060), Washington cities and counties are required to adopt CRITICAL AREAS regulations. The GMA was amended in 1995 to require counties and cities to include BEST AVAILABLE SCIENCE in developing policies and development regulations to protect the functions and values of critical areas (RCW 36.70A.172). All jurisdictions are required to review, evaluate, and, if necessary, revise their CRITICAL AREAS ORDINANCES according to an update schedule. There are five critical areas identified in the GMA: *Wetlands; Areas with a critical recharging effect on aquifers used for potable water; Frequently flooded areas; Geologically hazardous areas; and, Fish and wildlife habitat conservation areas.*

D

DECISION SUPPORT SYSTEM ("DSS")

A computer application that assists users in using data and models to solve problems (Morton, 1971). Typically, DECISION SUPPORT SYSTEMS are computer programs that analyze many pieces of data or models, producing results that aid in decision-making. (Turban & Aronson, 2001) (NWFSC, 2008).

DELISTING (or NARROW-SENSE RECOVERY)

A process resulting in the ESU being removed from the formal protections of the ENDANGERED SPECIES ACT as a consequence of no longer being endangered or no longer being likely to become endangered within the foreseeable future in a significant portion of its range.

DEM (DIGITAL ELEVATION MODEL)

A digital data set representing a topographic map that can be used for computer analysis.

DEMOGRAPHIC

Pertaining to the processes of birth, development, growth, and mortality that control the dynamics of human populations (NWFSC, 2008).

DENSITY EFFECTS

The type of effects that cause COMPENSATORY SURVIVAL or create increased competition for limited space or resources. Survival of JUVENILE salmon may be influenced by their density. Survival is usually higher when density is low (NWFSC, 2008).

DIEL THERMOCYCLE

A 24-hour temperature cycle.

DISSOLVED OXYGEN (“DO”)

A relative measure of the amount of oxygen that is dissolved or carried in water or other liquid media. Most often referred to by its acronym, DO levels of at least 6.5 mg/L are necessary to support healthy SALMON POPULATIONS and may need to be as great as 9.5 mg/L depending on SPECIES and LIFE STAGE (WAC 173-201A-200).

DISTINCT POPULATION SEGMENT (“DPS”)

The smallest division of a taxonomic species permitted to be protected under the U.S. ENDANGERED SPECIES ACT. It is a POPULATION, or group of populations, of a SPECIES that is "discrete" from other populations and significant to the biological species as a whole.

DIVERSITY

The total number of genetic characteristics in the genetic makeup of a SPECIES (ODFW, 2003). More specifically, variation in the genetic coding among the genes of individuals of a single POPULATION of organisms, where a higher number genes located across the chromosomes of the various individuals contains genetic variation in their DNA code. The code variations contribute slight variations of expression among different ALLELES at various gene sites (loci) among the individuals, which can provide for favorable responses to ECOYSTEM changes/other challenges. Differences can express as, for example, greater temperature tolerance.

E

ECOREGION

A geographic area that displays an integration of similar physical and biological factors such as geologic history, climate, and vegetation (NWFSC, 2008).

ECOSYSTEM SERVICES

Collectively, the benefits of resources and processes supplied to humankind by natural ecosystems. Definitions of these services were formalized by the United Nations 2005 Millennium Ecosystem Assessment ("MA"), a four-year study involving more than 1,300 scientists worldwide. The MA grouped ECOSYSTEM SERVICES into four general categories: *provisioning,* such as the production of food and water; *regulating*, such as the control of climate and disease; *supporting*¸ such as nutrient cycles and crop pollination; and *cultural*, such as spiritual and recreational benefits (MA, 2005).

ECOSYSTEM VALUATION

A tool used to assign an economic value to an ECOSYSTEM or its ECOSYSTEM SERVICES. In its simplest form, it places a value on an ECOSYSTEM equivalent to its ecological yield valued as it would be on commodity markets, for example, the value of clean and abundant water, wood, fish, or game that is purified, nurseried, generated or harbored in that ecosystem.

EDGE HABITAT

The place where two distinct habitat areas meet. In a river or stream setting, the habitat types that meet one another are the water and land. Stream banks and streambeds are very productive areas, particularly if these areas are natural and untidy. A natural stream bank will rarely exhibit a smooth or straight line. The irregularities in the structure of the channel create eddies and holes that serve as pockets of habitat, particularly for JUVENILE fish. Overhanging branches, undercut banks, and submerged rootwads are some examples of EDGE HABITATS that benefit fish by providing cover, shade and a source of food (fish feed on the insects that like to use these structures, too). Banks that have been armored have been shown to be used by fish less than natural banks. (King, undated).

EFFECTIVE MIGRATION RATE

The proportion of successfully spawning adults that migrate to a new population. The EFFECTIVE MIGRATION RATE excludes migrants that do not successfully reproduce (NWFSC, 2008). (See also MIGRATION RATE.)

EL NIÑO/SOUTHERN OSCILLATION ("ENSO")

A pattern of Pacific climate variability that is the major source of inter-*annual* climate variability in the Pacific Northwest. Each ENSO phase typically lasts 6 – 18 months. Often referred to as "El Niño" (the warm phase of ENSO) and "La Niña" (the cool phase of ENSO). The warm phase (El Niño) is characterized by higher than average sea surface temperatures in the central and eastern equatorial Pacific Ocean, reduced strength of the easterly trade winds in the Tropical Pacific, and an eastward shift of intense tropical rainfall. The cool phase (La Niña) is characterized by the opposite. Average years when there is no statistically significant deviation from average conditions at the equator are known as "ENSO-neutral" years (CIG: ENSO). (See also PDO.)

ENDANGERED SPECIES

A SPECIES in danger of EXTINCTION throughout all or a significant portion of its range (NWFSC, 2008).

ENDANGERED SPECIES ACT ("ESA")

The federal law designed to protect critically imperiled species from EXTINCTION. The ESA's primary goal is to prevent the EXTINCTION of imperiled plant and animal life, and secondly, to recover and maintain those populations by removing or lessening threats to their survival. After receiving a petition to list a species, federal agencies take a series of steps, or rule-making procedures, which includes significant opportunity for public input, and make a decision as to whether the species should be listed as THREATENED or ENDANGERED. Once a species is listed, the U.S. Fish and Wildlife Service (for bull trout) or the National Marine Fisheries Service (for salmon and steelhead because of the ocean part of their life cycle) is required to create a RECOVERY PLAN outlining the goals, tasks required, likely costs, and estimated timeline to RECOVER the ENDANGERED SPECIES. There is a similar process to DELIST species. (EPA, 1973; ODFW, 2003)

ESCAPEMENT

The number of adult salmon or steelhead that escape the FISHERY, predation, and all other mortality, and return to the spawning grounds to breed (NWFSC, 2008).

ESTUARINE HABITAT

Areas available for feeding, rearing, and SMOLTING in tidally-influenced lower reaches of rivers. These include marshes, sloughs and other backwater areas, tidal swamps, and tide channels (NWFSC, 2008).

EVOLUTIONARILY SIGNIFICANT UNIT ("ESU")

An ESU represents a DISTINCT POPULATION SEGMENT of Pacific salmon under the ENDANGERED SPECIES ACT that 1) is substantially reproductively isolated from CONSPECIFIC populations and 2) represents an important component of the evolutionary legacy of the species. (See also DISTINCT POPULATION SEGMENT.) (NWFSC, 2008).

EXCLUSIVE ECONOMIC ZONE ("EEZ")

The area from three to 200 nautical miles offshore over which a state has rights over the exploration and use of marine resources, including the production of energy from water and wind.

EXPLOITATION RATE

The proportion of adult fish from a POPULATION that die as a result of harvest in FISHERIES (NWFSC, 2008).

EXTINCTION

The total loss of a SPECIES, or ESU. Term may also be used for the extirpation of local populations, for example, EXTINCTION on a local basis, but not throughout the ESU range (NWFSC, 2008).

EXTINCTION RISK

The probability of a SPECIES going EXTINCT within a particular time period (NWFSC, 2008).

EYED EGGS

A fish egg containing an embryo that has developed enough so the eyes are visible through the egg membrane (StreamNet, 2012). Black eyes develop about one month after fertilization and about one month before they hatch in the gravel as ALEVINS.

F

FACTORS FOR DECLINE

Factors identified as causing a SPECIES to decrease in abundance and distribution; these factors are considered as part of the ENDANGERED SPECIES ACT listing process (NWFSC, 2008).

FECUNDITY

The number of eggs produced per female of a given species or stock (NWFSC, 2008).

FINES AND EMBEDDEDNESS

Together used as indicators of river bed gravel suitability for salmon spawning and rearing. FINES are fine-grained, silt-sized particles that enter the INTERSTICES of larger gravel materials. EMBEDDEDNESS rates the degree to which gravel and cobbles are covered or sunken into silt, sand or mud on the stream bed. Studies conducted in REDDS in Olympic Peninsula streams in Washington found that if more than 13% fine sediment (<0.85 mm) intruded into the REDD, almost no steelhead or coho salmon eggs survived (McHenry et al., 1994).

FISHERY

Refers to harvesting fish defined by the type of fishing gear operating on one or several species in a particular area. A FISHERY can be defined in terms of the people involved, SPECIES or type of fish, area of water or seabed, method of fishing, class of boats, purpose of the activities or a combination of these features. The definition often includes a combination of fish and fishers in a region, the latter fishing for similar species with similar gear types; for example, the gillnet fishery for sockeye salmon in Bristol Bay, Alaska (Quinn, 2005, p. 4).

FISHERY MORTALITY RATE

The proportion of fish that die when intercepted by a FISHERY compared to (divided by) the total number of fish (NWFSC, 2008).

FISHERY REGULATION ASSESSMENT MODEL (“FRAM”)

Model developed for the Pacific Fisheries Management Council (“PFMC”) management process. This is used by Pacific Salmon Commission and other co-MANAGER processes (see Hatchery and Harvest discussions). The model estimates the impacts of proposed ocean and TERMINAL FISHERIES on each of the full range of separately managed chinook and coho salmon stocks along the West Coast from SE Alaska to the border with Mexico (PFMC).

FITNESS

The capability of an individual of a certain genotype to rear and successfully reproduce within a certain environment (ODFW, 2003).

FLUVIAL

Describes NONANADROMOUS salmon who rear for some time in their natal stream, then migrate to a larger river to grow, and return to their natal stream to spawn (Quinn, 2005, p. 4). (as distinct from RESIDENT and ADFLUVIAL.)

FOREST AND FISH LAW

In order to update the Timber Fish Wildlife Agreement between Washington State and the tribes, a new protocol was negotiated, and in April 1999 was formalized in the Forests and Fish Report ("FFR"). Following the release of the FFR, the state's Salmon Recovery Act of 1999, sometimes called the FORESTS AND FISH LAW, was enacted. This act directed the adoption of the goals of the FFR into the state Forest Practice Rules. These Rules (Title 222 WAC) are guided by the state's Forest Practices Board, which sets standards for timber harvests, pre-commercial thinning, road construction, buffers, and many other forest practices on state and private forestland (WDNR:FF). See www.dnr.wa.gov/BusinessPermits/Topics/ForestPracticesHCP/Pages/forestfishreport.aspx

FRESHWATER HABITAT

Areas available for spawning, feeding, rearing, and migration in freshwater (NWFSC, 2008).

FRY

Young salmon that have emerged from the gravel and have absorbed their yolk sac (NWFSC, 2008). Also sometimes called "fingerlings." Depending on the species, FRY migrate directly to sea, migrate to a lake, or remain the stream to grow there (Quinn, 2005, p. 3).

FUNCTIONALLY INDEPENDENT POPULATION

A high-PERSISTENCE POPULATION whose dynamics or EXTINCTION RISK over a 100-year time frame is not substantially altered by exchanges of individuals with other POPULATIONS (MIGRATION). Functionally independent populations are net "donor" populations that may provide migrants for other types of populations. This category is analogous to the "independent populations" of McElhaney et al. (2000). (NWFSC, 2008).

G

GENETIC DIVERSITY

The level of biodiversity referring to the total number of genetic characteristics in the genetic makeup of a SPECIES, making it possible for POPULATIONS to adapt to changing environments over time and multiple generations.

GEOGRAPHIC INFORMATION SYSTEM ("GIS")

A computer system that captures, stores, analyzes, manages, and/or presents data that are spatial (StreamNet, 2012), linked to location. Technically, a GIS is a system that includes mapping software and tools that can be implemented with GIS software to analyze spatial data. GIS data are captured by Global Positioning System ("GPS") devices that use multiple satellites to establish position.

GRADIENT

Vertical decline/drop of a stream, per unit of horizontal distance (StreamNet, 2012).

H

HABITAT and HABITAT FUNCTION/PROCESS

A HABITAT is an ecological or environmental area where a particular SPECIES lives or which it uses. HABITAT FUNCTION AND PROCESSES are those attributes of physical and biological elements that are naturally created or otherwise interact with the environment. Salmon HABITATS and HABITAT FUNCTION AND PROCESSES depend upon adjacent land to influence the amount, complexity and suitability of HABITAT available to the LIFE-HISTORY STAGES of salmon.

HABITAT QUALITY

The suitability of physical and biological features of an aquatic system to support salmon in the freshwater and estuarine system (NWFSC, 2008).

HATCHERY

A facility where artificial propagation of fish takes place. Salmon hatcheries typically capture adults just before they are ready to spawn, take the eggs and milt, fertilize the eggs, and raise the resulting progeny in the hatchery for release into the natural environment (NWFSC, 2008).

HATCHERY FISH

Fish incubated or reared under artificial conditions for at least a portion of their LIFE CYCLE (ODFW, 2003; NWFSC, 2008).

HETEROSPECIFICS

Organisms not belonging to the same SPECIES. (As opposed to CONSPECIFICS.)

HISTORICAL ABUNDANCE

The number of fish that were produced before a specific designated point in time, such as the influence of European settlement (NWFSC, 2008).

HOH VERSUS BALDRIGE

A decision in the federal district court of the Western District of Washington, cited as 522 F. Supp. 683 (W.D. Wash. 1981), in which tribes challenged the federal and state process of management regimes for coho spawning ESCAPEMENT goals. The court ruling affects the Quillayute, Hoh, Quinault, and Queets Rivers and the Grays Harbor watershed. The court held that the treaty right of the coastal tribes (of said watersheds) is a right to take approximately fifty percent of each run of salmon, managed on a river system-by-river system, run-by-run basis (Hoh v. Baldrige, 1981). (See discussion of harvest and hatcheries in Chapter 3: Critical Threats and under C.1 of in Chapter 5: Strategies.)

HOMING

Describes the SALMON behavior of almost invariably returning to site where they were spawned and hatched to themselves spawn the next generation. One of three general biological traits of SALMON (the others being ANADROMY and SEMELPARITY), although there are exceptions (Quinn, 2005, p. 6).

HPA (HYDRAULIC PROJECT APPROVAL)

In the Hydraulic Code, RCW 77.55, the law requires that any person, organization, or government agency wishing to conduct any construction activity that will use, divert, obstruct, or change the natural flow or bed of state waters must do so under the terms of a permit (called a HYDRAULIC PROJECT APPROVAL, or “HPA”) issued by the Washington Department of Fish and Wildlife. State waters include all marine waters and fresh waters of the state, except those watercourses that are entirely artificial, such as irrigation ditches, canals and stormwater run-off devices (RCW 77.55).

HYDROLOGIC REGIME

The characteristics in a stream, river or other waterbody that describe the variability in its discharge in response to precipitation, temperature, evapotranspiration, and drainage basin characteristics.

HYDROLOGIC UNITS (“HUCS”)

"The United States is divided and sub-divided into successively smaller hydrologic units which are classified into four levels: regions, sub-regions, accounting units, and cataloging units. The hydrologic units are arranged within each other, from the smallest (cataloging units) to the largest (regions). Each hydrologic unit is identified by a unique HYDROLOGIC UNIT code (HUC) consisting of two to eight digits based on the four levels of classification in the hydrologic unit system.” (USGS; NWFSC, 2008). These are federal designations and do not correspond completely with the WATER RESOURCE INVENTORY AREAS (“WRIAs”) of Washington.

HYDROLOGY

The scientific study of the water of the earth, its occurrence, circulation and distribution, its chemical and physical properties, and its interaction with its environment, including its relationship to living things (StreamNet, 2012). The study of the movement, distribution and flow of water in an aquatic system. This includes the hydrologic cycle, water resources, and watershed sustainability. Subsets include but are not limited to: hydrometeorology, surface hydrology, groundwater hydrology, drainage basin management.

I

INBREEDING DEPRESSION

Reduced survival rates of individuals in a POPULATION suffering from the effects of harmful recessive genes through spawning between close relatives. Inbreeding depression may become a problem when populations get very small (NWFSC, 2008).

INCIDENTAL TAKE

Section 10 of the ENDANGERED SPECIES ACT provides for permits to take LISTED SPECIES as an incident of certain activities (for example, timber harvest may impact spotted owls or salmon). Such “takes” are deemed, as a matter of law, *not* to jeopardize the LISTED SPECIES, as long as the provisions of the permit are followed. Permits must be approved by the federal services (NMFS and USFWS) and, before they are approved, permit plans must demonstrate, for example, that take will be incidental, minimal, and not threaten the SPECIES’ survival.

INDEPENDENCE

Reflects the interaction between ISOLATION and PERSISTENCE. A PERSISTENT POPULATION that is highly isolated is highly INDEPENDENT (NWFSC, 2008).

INDEPENDENT POPULATION

A POPULATION that historically would have had a high likelihood of persisting in isolation from neighboring populations for 100 years (Lawson et al., 2007). (NWFSC, 2008).

INDEX AREA/REACH

A part of a stream that is selected to represent POPULATION aspects of an ESU in the watershed. It is surveyed for REDDS throughout the season on a much more regular basis than the supplemental streams or areas. INDEX AREAS are used to save time and reduce surveying costs.

INTERSTITIAL SPACES (in spawning gravel)

The empty spaces or gaps in gravel which allow water flow to provide oxygen to salmon eggs in salmon REDDS. Fine sediment (FINES) can enter and fill these spaces, raising the percentage of EMBEDDEDNESS, resulting in less INTERSTITIAL SPACES and stream gravels with less DISSOLVED OXYGEN and therefore less suitable as salmon spawning habitat.

INTRINSIC GROWTH RATE

The growth rate of a POPULATION at a low enough density so that density-dependent (COMPENSATORY) SURVIVAL is not a factor. The INTRINSIC GROWTH RATE of an individual fish is considered to be an outcome of the genetic selection traits that balance out the ability of the species to best utilize the variety of habitat, balance risks, and use resources available across its LIFE HISTORY and range.

INTRINSIC POTENTIAL

A modeled attribute of streams that refers to a measure of potential salmon habitat quality (Burnett et al., 2003). It takes into account such things as channel GRADIENT, valley constraint and mean annual discharge of water (NWFSC, 2008).

INTRINSIC PRODUCTIVITY

Productivity of a POPULATION in the absence of compensation, estimated as the mathematical limit of POPULATION productivity as abundance approaches zero. (See also SPAWNER/RECRUIT RELATIONSHIP.) (NWFSC, 2008).

INVASIVE SPECIES

A plant or animal that is not native to a habitat, especially when such nonnative species successfully outcompete native species for habitat and thereby becomes a threat to the stability and resilience of native communities.

INTROGRESSION

Introduction of genes from one POPULATION or SPECIES into another, by repeated backcrossing of an interspecific hybrid with one of its parent species (NWFSC, 2008).

ISOLATING MECHANISMS

Physical or behaviorial attributes that reduce the ability of POPULATIONS to interbreed. These could include physical mechanisms such as distance, and behavioral mechanisms such as RUN TIMING in spatially overlapping populations, or development of separate mate selection behaviors in populations that are temporarily separated, then commingled (NWFSC, 2008).

ISOLATION

The degree to which a POPULATION is unaffected by migration to and from other POPULATIONS. As the influence of migration decreases, a population’s isolation increases (NWFSC, 2008).

J

JACK

A segment of each salmon POPULATION for each salmon SPECIES describing the precocious males that spend one or two winters fewer in the marine environment than the first female that returns to spawn. For example, a male coho jack that matures at age 2 and returns from the ocean to spawn a year earlier than the normal three-year-old female coho. Jacks can be half the size of a normal adult male. (ODFW, 2003)

JACKING RATE

The proportion of adult salmon from a brood that return as JACKS before the first typical female counterpart returns (NWFSC, 2008).

JUVENILE

A salmon that has not matured sexually (gonads not fully mature) (NWFSC, 2008).

JUVENILE FRESHWATER HABITAT CARRYING CAPACITY

The capacity of habitat to provide conditions for rearing nonadult fish that have not SMOLTED and subsequently migrated to sea.

L

LACUSTRINE

Of or relating to a lake.

LARGE WOODY MATERIAL (“LWM”)

Previously called LARGE WOODY DEBRIS (“LWD”). The term used for trees that meet a certain minimum length and size and fall into adjacent streams or other bodies of water. Their capacity to affect habitat depends on their size relative to the channel size and the types of soils in the CHANNEL MIGRATION ZONE. LWM, once in a channel, can serve to stabilize banks, create channel diversity, trap spawning gravel, and provide REFUGIA. See related discussions under POOLS AND RIFFLES and RIPARIAN in this Glossary. (King, undated)

LEAD ENTITY

Pursuant to RCW 77.85.50 (Salmon Recovery Act), local governments and tribes can establish project lists for salmon habitat restoration. These entities may select a lead among them, which will form a committee comprised not only of the initiating governments, but also interest groups, examples of which are set forth in paragraph (b) of RCW 77.85.50, in order to provide a citizen-based evaluation of the projects. The area must consist of one or more WRIAs (WATER RESOURCE INVENTORY AREAS).

LEAD ENTITY GROUPS

Lead Entity Groups are the local, watershed-based organizations in Washington that develop local salmon habitat recovery strategies and then recruit organizations to do habitat protection and restoration projects that will implement the strategies. They consist of a coordinator or administrative body (the “Lead Entity,” usually a county, conservation district, or tribal staff), a committee of local, technical experts, and a committee of local citizens.

LIFE HISTORY

The specific life cycle of a fish from egg to adult (NWFSC, 2008).

LIFE HISTORY DIVERSITY

The extent of variation in the timing of key events in an individual's or a POPULATION'S lifetime, as shaped by natural and/or sexual selection.

LIMITING FACTORS
LIMITING FACTORS ANALYSIS ("LFA")

Factors that limit survival or abundance, either by causing a loss of habitat or habitat-forming function and processes, resulting in lowered carrying capacity of the watershed for critical stages of SALMON LIFE HISTORY. (See Chapter 3: Critical Threats for examples.)

LISTED SPECIES

Species included on the *List of Endangered and Threatened Species* authorized under the ENDANGERED SPECIES ACT and maintained by the U.S. Fish and Wildlife Service and National Marine Fisheries Service of NOAA (NWFSC, 2008).

LITTORAL ZONE

In lakes, the area of lake bottom that receives enough light for rooted plants to grow. In the ocean, the marine ecological realm that experiences the effects of tidal and longshore currents and breaking waves to a depth of 5 to 10 m (16 to 33 feet) below the low-tide level, depending on the intensity of storm waves (Encyclopedia Britannica 2004; NWFSC, 2008).

LOWLAND HABITAT

Low-gradient stream habitat with slow currents, pools, and backwaters used by fish. This habitat is often converted to agricultural or urban use (NWFSC, 2008).

LWM/LWD RECRUITMENT

The process of the natural introduction of LARGE WOODY MATERIAL ("LWM" – formerly large woody debris, or "LWD") into a stream or river system, usually through flooding and erosion of riparian zones.

M

MACROINVERTEBRATES

As used in relationship to salmon habitat, insect larvae that live in POOLS AND RIFFLES and in the hyporheic (saturated) zone of stream banks, and provide forage food for salmon.

MARINE SURVIVAL RATE

The proportion of SMOLTS entering the ocean that survive to be harvested or return to freshwater (NWFSC, 2008).

MASS WASTING

The technical name for landslides large and small. MASS WASTING is a natural process that wears down mountains and forms valleys over time. Improper forest practices can accelerate mass wasting, which can cause damage to fish streams. Mass wasting can also be triggered naturally by tectonic activity or saturation of sediment on steep slopes (WFPA, 2012).

MEAN ANNUAL DISCHARGE OF WATER

A single value or average that summarizes or represents the annual discharge amount of a waterway, typically expressed in cubic meters per second (NWFSC, 2008).

METADATA

Data that describes other data and provides information about a certain item's content. For example, an image may include METADATA that describes how large the picture is, the color depth, the image resolution, when the image was created, and other data. A text document's METADATA may contain information about how long the document is, who the author is, when the document was written, and a short summary of the document.

MIGRANT

A fish that is born in one POPULATION but returns to another POPULATION to spawn (NWFSC, 2008). An alternative use of this word refers to MIGRATION of fish from one habitat during a particular rearing stage, to a different habitat for the next rearing stage.

MIGRATION

Movement of fish from one POPULATION to another (NWFSC, 2008); or from one habitat to another during the rearing stages.

MIGRATION RATE

The proportion of spawners that migrate from one population to another (NWFSC, 2008); or, from one habitat to the next as they change rearing stages. (See also EFFECTIVE MIGRATION RATE.)

MORTALITY; MORTALITY RATE

The death of one individual in a population; or, the death rate for individuals in a population (NWFSC, 2008).

N

NATURAL RETURN RATIO (“NRR”)

The ratio N/T, where N is naturally produced SPAWNERS in one generation and T is total (hatchery produced + naturally produced) spawners in the previous generation (NWFSC, 2008).

NATURALLY PRODUCED FISH

Fish that were spawned and reared in natural habitats, regardless of parental origin. (See also WILD FISH.) (NWFSC, 2008)

NEPHELOMETRIC TURBIDITY UNIT (“NTU”)

A unit measuring the lack of clarity of water. Water containing 1 milligram of finely divided silica per liter has a turbidity of 1 NTU. The NTU is measured with an electronic instrument called a nephelometer. See also: http://www.sizes.com/units/nephelometric_unit.htm

NETMAP

A web-based watershed science computer program/system comprised of uniform digital watershed (map) databases, analysis tools, and technical support materials. The analysis tools contain multiple functions and parameters that address fluvial geomorphology, aquatic habitat development, erosion, watershed disturbance, road networks, wildfire, hydrology, and large wood in streams, among other processes and attributes. NetMap is designed to integrate with ESRI ArcMap 9.2/9.3 and with non-proprietary GIS systems. It continues to be developed by Earth Systems Institute. (Benda et al., 2007).

NOAA FISHERIES SERVICE/NMFS

The fisheries branch of NOAA, now correctly referenced as the National Marine Fisheries Service ("NMFS").

NONANADROMOUS

Salmon that stay in freshwater their entire lives. NONANADROMOUS fish who are RESIDENT spend their entire lives in the stream where they were spawned. NONANADROMOUS fish who are FLUVIAL rear for some time in their natal stream, then migrate to a larger river to grow, and return to their natal stream to spawn. NONANADROMOUS fish who are ADFLUVIAL rear in their natal stream, then migrate to a lake to grow further, then return to their natal stream to spawn. (Quinn, 2005, p. 4).

O

OCEAN-TYPE

Salmon most often found in coastal streams, and those which tend to migrate to saltwater at a younger age (e.g. fall Chinook) (ODFW, 2003). (As opposed to STREAM-TYPE.)

OFF-CHANNEL HABITAT

Habitat types including abandoned, formerly-active side channels, sloughs, dead-end channels, wetlands, isolated oxbows, and smaller watercourses and lakes in the floodplain, close to a river and maintaining an outlet connection to the main channel. These habitats are extremely important to JUVENILE SALMON for overwintering rearing and as REFUGIA during high flow events (King, undated).

P

PACIFIC DECADAL OSCILLATION (PDO)

A pattern of Pacific climate variability that is the predominant source of inter-*decadal* climate variability in the Pacific Northwest. The PDO shifts phases on at least an inter-decadal time scale, usually about every 20 to 30 years. Identified in 1996 by the University of Washington's Climate Impacts Group researcher Nate Mantua and others, the PDO (like ENSO) is characterized by changes in sea surface temperature, sea level pressure, and wind patterns. The PDO is detected as warm or cool surface waters in the Pacific Ocean north of 20° N. During a "warm" or "positive" phase, the west Pacific becomes cool and part of the eastern Pacific warms; during a "cool" or "negative" phase, the opposite pattern occurs. (CIG: PDO). (See also ENSO.)

PARR

A JUVENILE SALMON that is more mature than a FRY, but has not yet started to SMOLT to adapt for saltwater entrance. Recognizable in most species by dark vertical bars (PARR marks) on the sides of the fish (Quinn, 2005, p. 3).

PERSISTENCE

A population's relative ability to sustain itself over a specified period of time, based on its population size and other potential factors (e.g., FECUNDITY, spatial variation of habitat quality, population structure, age at maturity, etc.) See http://warnercnr.colostate.edu/~gwhite/pva/fslide4.htm (White)

PERSISTENT POPULATION

A fish POPULATION that is able to persist (i.e., not go extinct) over a 100-year period without artificial support. This includes an ability to survive prolonged periods of adverse environmental conditions, which may be expected to occur at least once in the 100-year time frame (NWFSC, 2008).

PHENOTYPE

The composite of an organism's observable characteristics or traits, such as its morphology, development, biochemical or physiological properties, phenology, behavior, and products of behavior (e.g., a salmon REDD). Phenotypes result from the expression of an organism's genes as well as the influence of environmental factors and the interactions between the two.

PHOTIC ZONE

The depth of the water in a lake or ocean that is exposed to sufficient sunlight for photosynthesis to occur. The depth of the photic zone can be affected greatly by seasonal TURBIDITY.

POOLS AND RIFFLES

In a flowing stream, a POOL-RIFFLE sequence develops as the hydrologic flow alternates from relatively shallow to deeper water, and then back to shallower water. The sequence occurs only in streams carrying gravel or coarser sediments. RIFFLES form in shallow areas by gravel deposits over which water flows. POOLS are deeper, calmer areas with a bedload of finer material such as silt. Streams with only sand or silt do not form this POOL-RIFFLE sequence pattern. The typical sequence is at intervals of 5 to 7 stream widths. LWM in forested channels can decrease the spacing to as much as 1 per <2 channel widths and increase pool numbers. Meandering streams with a coarse bedload typically have POOLS on the outsides of the bends and RIFFLES in the crossovers between one meander to the next. POOLS are areas of active erosion and the eroded material tends to be deposited in the RIFFLE area between. (See also LARGE WOODY MATERIAL and RIPARIAN.) (King, undated)

POPULATION (of salmon)

A group of fish of the same SPECIES that spawns in a particular locality at a particular season and does not interbreed substantially with any other group (NWFSC, 2008).

POPULATION DYNAMICS

Changes in the number, age, and sex of individuals in a POPULATION over time, and the factors that influence those changes. Five components of populations that are the basis of population dynamics are: *birth rate, mortality rate* (for fish, both natural and harvest mortality), *sex ratio, age structure, and dispersal* (NWFSC, 2008). For fish populations, the SPAWNER/RECRUITMENT ("S/R") relationships (see SPAWNER/RECRUITMENT) are assessed to understand the dynamics of populations subject to fishing and other population dynamic factors, including changing habitat features.

POPULATION STRUCTURE

The distribution of characteristics (such as age, size, or physiological state) of individuals within a POPULATION (NWFSC, 2008). This can refer to many aspects of population ecology, a subfield of ecology dealing with dynamics of species populations and how they interact with the environment, changing over time and space.

POPULATION VIABILITY ANALYSIS ("PVA")

"[A] set of analytical and modeling approaches for assessing the risk of EXTINCTION. LIFE HISTORY, demography, and genetics of a species are integrated with environmental variability to project the future course of populations" (Beissinger and McCullough 2002, p. xiv; in NWFSC, 2008).

PRODUCTION

The number of new, RECRUITED fish produced by a POPULATION in a year.

PRODUCTIVE CAPACITY

The number or biomass of RECRUITS that can be produced under a given set of environmental conditions, given an initial POPULATION size from a given area of habitat under existing or changed habitat conditions.

PRODUCTIVITY

The rate at which a POPULATION is able to produce reproductive offspring under a given set of environmental conditions, given an initial population size from a given area of habitat under existing or changed habitat conditions.

R

REACH

A segment of a stream with a uniform set of physical characteristics, which is usually bounded by a hardened hydraulic control point or significant change in habitat type or gradient on each end (NWFSC, 2008).

RECOVERY

A general term for the reestablishment or restoration of POPULATIONS reduced in size or at risk. It is used in two senses: in a "narrow sense" as it is defined in the ESA (see DELISTING), and in a "broad sense" to include efforts that extend beyond the requirements of the ESA (NWFSC, 2008). (See RESTORATION).

RECOVERY DOMAIN

The geographic area for which a NOAA Technical Recovery Team is responsible (NWFSC, 2008).

RECOVERY PLAN

Under the ENDANGERED SPECIES ACT (ESA), a document identifying actions needed to improve the status of a SPECIES or ESU to the point that it no longer warrants continued protection under the statute (NWFSC, 2008).

RECOVERY SCENARIOS

Various sequences of events expected to lead to RECOVERY of salmon (NWFSC, 2008).

RECRUITMENT

1) Entry of new fish into a population, whether by reproduction or immigration;

2) Addition of new individuals to the fished component of a stock (because they have acquired the size, age, or location that makes them part of it).

REDDS

Nests in the gravel of streams or rivers where salmon lay their eggs.

REFUGIA

Areas or locations in salmon habitats that provide shelter or protection during times of danger or distress, or are of high quality habitat that support populations limited to fragments of their former geographic range. REFUGIA may be a center from which dispersion may take place to re-colonize areas after a watershed- and/or sub-watershed-level disturbance event and readjustment. REFUGIA often refer to POOLS created by LWM that provide cooler temperatures and hiding places for salmon, but may also refer to places of retained water level in drought, or access to off-channel wetlands during flood events.

RESIDENT

Describes NONANADROMOUS salmon who spend their entire lives in the stream where they were spawned (Quinn, 2005, p. 4). (As distinct from FLUVIAL and ADFLUVIAL.)

RESIDUALIZE

Describes the fact that the offspring of some salmon SPECIES (steelhead, bull trout, and cutthroat) become NONANADROMOUS; that is, some offspring do not migrate to sea, but instead stay in freshwater their entire lives. Steelhead are called rainbow trout if they RESIDUALIZE.

RESTORATION (or BROAD-SENSE RECOVERY)

1) Referring to Endangered Species Listing, the process leading to, or condition under which, a particular EVOLUTIONARILY SIGNIFICANT UNIT ("ESU") of a salmon has returned to sufficient numbers and GENETIC DIVERSITY that it can be deemed self-sustaining and can be harvested economically (NWFSC, 2008);

2) Referring to habitat, an action that removes or repairs a threat (as defined in Chapter 3 - Threats of this document) or otherwise returns salmon habitat to a condition that fully supports a SALMON LIFE-CYCLE STAGE.

RIPARIAN

The interface between land and a stream; the geographic area around the edge of a waterway where the land and the waterway meet, overlap and interact most directly. Plant communities along the river banks are called riparian vegetation. RIPARIAN ZONES are significant in ecology and environmental management because of their role in soil conservation, their biodiversity, and the influence they have on aquatic ecosystems. They can occur in many forms, including grassland, woodland, wetland or even non-vegetative (ODFW, 2003). (See definitions of HABITAT, LARGE WOODY MATERIAL, and POOLS AND RIFFLES.) The RIPARIAN MANAGEMENT ZONE is sometimes referred to as the "RMZ."

RIPARIAN FUNCTIONS

Riparian and floodplain areas are the critical interface between terrestrial and aquatic ecosystems, serving to filter, retain, and process materials in transit from uplands to streams. Riparian vegetation provides habitat attributes and functions essential for salmon through LARGE WOODY MATERIAL and other native plants in the RMZ: 1) shade and microclimates to water bodies by overhanging cover, keeping temperature appropriate for SALMON; 2) bank stability and integrity by rootmass; 3) in streams, hydraulic roughness that controls velocities, allowing for retention of spawning gravel; 4) REFUGIA and other diverse features of channel morphology; and 5) organic litter required to support biotic activity within the water body, including insects on which salmon juveniles prey (Spence, et al., 1996, p. 3; King, undated). (See also HABITAT, LARGE WOODY MATERIAL, and POOLS AND RIFFLES.)

RIVER/FLOODPLAIN INTERACTIONS

Flooding occurs when a river exceeds the capacity of its channel. Rivers tend to form a channel capable of containing roughly a 2-year event (a flow that has a 50% probability of occurring in a given year). When a river remains within its channel, most of the energy of the flow acts upon the channel itself. When a river floods, some of the energy is dissipated upon the floodplain, which lessens the impact on the channel itself. If the river/floodplain interactions are altered through the construction of levees and revetments, the river channel is exposed to a different set of energy dynamics than it historically experienced. The change in channel forming processes results in a change in the character of the river and the habitat within it. Examples of alterations include downcutting of the stream bed, a drop in water table elevation, loss of floodplain rearing habitat, and loss of instream habitat diversity. (Again, see definitions for HABITAT, LARGE WOODY MATERIAL, and POOLS AND RIFFLES.) (King, undated)

ROAD MAINTENANCE AND ABANDONMENT PLAN ("RMAP")

A forest road inventory and schedule for any repair work that is needed to bring roads up to state standards. It is prepared by the landowner and approved by DNR. Washington State forest management laws require most private forest landowners to prepare and submit Road Maintenance and Abandonment Plans. (DNR:RMAP). See: http://www.dnr.wa.gov/BusinessPermits/Topics/SmallForestLandownerOffice/Pages/fp_sflo_rmap.aspx

RUN

The total number of adult salmon who survive the natural mortality agents and head back to freshwater, usually their natal stream, to spawn. Some are caught (the catch), while those who evade being caught, etc. and spawn are called the ESCAPEMENT (Quinn, 2005, p. 4).

RUN TIMING

The identified time periods each season of the year (usually identified by week) attributed to each species or separately identified stock of ANADROMOUS or RESIDENT salmon on their spawning run, when those populations typically enter an area—the mouth of a river or other terminal area—and then also when those same populations arrive and spawn in their particular upriver spawning areas (NWFSC, 2008).

S

SALMON

Any of the SPECIES of fish in the family Salmonae, including salmon, trout, and char (NWFSC, 2008).

SCOUR

The erosive action of running water in streams, which excavates and carries away material from the bed and banks. SCOUR may occur in both earth and solid rock material (StreamNet, 2012). The removal of river and stream bed material caused by swiftly moving water. The presence of LWM in a stream channel can restrict channel width, accelerating flow and increasing the water's force on stream bed material and causing SCOUR around and downstream of the restriction. This process is key in the creation of POOLS AND RIFFLES essential for good salmon habitat. SCOUR is also a major cause of bridge failure when bridge supports restrict stream channels.

SEASONAL UPWELLING CLINE

One of 66 hydrologically-based, Level 4 salmon ECOREGIONS of the North Pacific defined by Augerot in *Atlas of Pacific Salmon* (Augerot, et al., page 7). This ecoregion, the SEASONAL UPWELLING CLINE, encompasses roughly nine million acres of river drainage basins along the coasts of Washington and Oregon State. The Washington portion of the ECOREGION corresponds with the geographic area of the Washington Coast Salmon Recovery Region.

SELECTION

An evolutionary process that drives adaptation to environmental change through differential reproductive success of organisms that have variability in their genetic makeup (NWFSC, 2008). This is attributed to the various genetic forms (ALLELES) present at each gene location per pair of chromosomes and combinations (linkages of genes that may affect the traits and fitness of one individual compared to others in a population). Mutation can contribute to the variability in a gene pool.

SEMELPARITY

Describes the LIFE HISTORY characteristic of most Pacific salmon dying after they have spawned once. "This life-history pattern . . . transfers millions of kilograms of salmon flesh from the ocean to nutrient-poor freshwater ecosystems, reversing the gravity-driven tendency for water and nutrients to flow seaward" (Quinn, 2005, p.5). One of three general biological traits of SALMON (the others being ANADROMY and HOMING), although there are exceptions (Quinn, 2005, p. 6-7).

SHORELINE MASTER PLANS

Under Washington's Shoreline Management Act, which governs the use and development of Washington's shorelines to achieve responsible shoreline use and development, environmental protection, and public access, each town, city and county with "shorelines of the state" must develop and adopt its own shoreline program. "Shorelines of the state" generally refers to rivers, larger lakes, and marine waterfronts along with their associated shorelands, wetlands, and floodplains. When creating or updating their Shoreline Master Plans, local governments are required by law to engage and seek input from the public, interested agencies, and affected tribes.

SERAL

Of or relating to the entire sequence of ecological communities successively occupying an area from the initial stage to the climax. Often used to describe a phase in maturation of forests, for example, “a seral stage”; “a seral community.”

SMOLT

A LIFE STAGE of salmon that occurs just before the fish leaves fresh water. SMOLTING is the physiological process that allows salmon to make the transition from fresh to salt water. (NWFSC, 2008). The transitions involved include altering their color, shape, osmoregulatory (salt balance) physiology, energy storage, patterns of drinking, urination and behavior (Quinn, 2005, p. 3-4).

SMOLT CAPACITY

The maximum number of SMOLTS a basin can produce. SMOLT CAPACITY is related to habitat quantity and quality (NWFSC, 2008).

SPAWNER

A reproductive adult fish (NWFSC, 2008).

SPAWNER ABUNDANCE

The number of adult salmon or steelhead that return to spawning grounds to breed (ODFW, 2003).

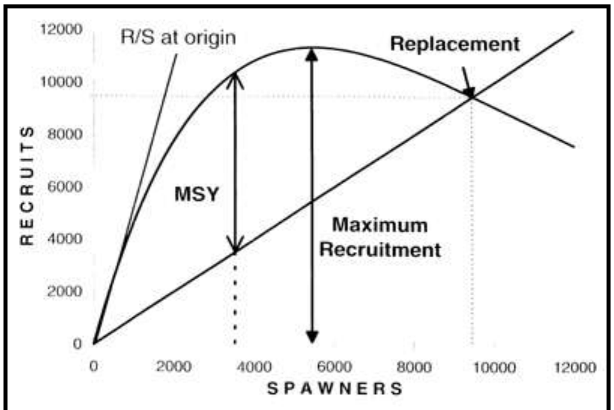
SPAWNER SURVEYS

Systematic surveys of spawning grounds, counting (and in some sections also flagging) the number of REDDS laid for each managed species of salmon and steelhead. These surveys are generally done on INDEX AREAS and supplemental streams rather than every stream; this is especially true in large basins. Surveys are repeated throughout a spawning season for the chosen INDEX and supplemental streams. Surveys are designed to allow an estimate of ESCAPEMENT for each run of fish and each river and tributary, independent from other harvest management data used to reconstruct and estimate the total combined size of each RUN after a season. Where REDDS may not apply (as in the mass sockeye spawning at Lake Pleasant), actual fish are counted. Spawner survey data can help to identify important shifts in distribution between seasons or elucidate habitat factors tied to these changes. (Sometimes spawner surveys are supplemented with fish carcass data to identify hatchery- versus wild-origin fish, and fish scale samples maybe taken to determine ages of chinook and chum.) (NWFSC, 2008)

SPAWNER-TO-RECRUIT RELATIONSHIP / SPAWNER-TO-RECRUIT RATIO

A measure of the productivity of salmon POPULATIONS, which compares the number of offspring that RECRUIT (contributing to the following return(s) of adults) on average from the range of observed levels of parental brood spawning ESCAPEMENT over a number of generations. From this relationship one can derive the SPAWNER TO RECRUIT (“S/R”) RATIO that would be expected at each level of spawning ESCAPEMENT, which generally varies in reverse proportion to the size of the spawning population as the level of spawning increases for self-sustaining populations.

Example of a Ricker Curve to display spawner/recruit relationships:



R/S	Recruits/Spawners
MSY	Maximum Sustained Yield

S/R depiction displayed at Seminar in Olympia on Jan. 30, 1998 attended by WDFW Director Bern Shanks and fish managers explaining the WDFW's proposed Wild Salmonid Policy.

SPECIES

In the ESA, either a recognized biological SPECIES, or any recognized subspecies, or (for VERTEBRATE fish or wildlife) any distinct POPULATION segment that interbreeds when mature. By NOAA policy, the last definition includes EVOLUTIONARILY SIGNIFICANT UNITS (ESUs) of salmon (NWFSC, 2008).

STAGING

Describes the gathering of salmon at the mouths of rivers and streams waiting for rain and subsequent increases in water level before beginning their migration to spawning grounds.

STAKEHOLDER

A party with an interest in a proceeding. Generally "STAKEHOLDERS" are considered distinct from governmental entities, which have a management role as opposed to a financial or political interest.

STOCK TRANSFER

The human practice of moving fish between basins or populations (NWFSC, 2008).

STRAY RATE

Refers to the proportion of spawning adults that return to a stream other than their natal stream within a basin (NWFSC, 2008) (See also MIGRATION RATE).

STREAM-TYPE

Salmon that tend to migrate to headwater streams of large river systems. They have a longer freshwater residency and thus are more dependent on freshwater habitats (e.g. , spring chinook) (ODFW, 2003). They spend at least one winter in the freshwater environment before going to sea. (As opposed to OCEAN-TYPE.)

STREAM TYPING

The method of classifying streams (e.g., fish-bearing or not) used by the Washington Department of Natural Resources (DNR).

SUSTAINABILITY

An attribute of a population that persists over a long period of time and is able to maintain its genetic legacy and long-term adaptive potential for the foreseeable future (NWFSC, 2008).

SUSTAINABLE POPULATION

A POPULATION that, in addition to being PERSISTENT, is also able to maintain its genetic legacy and long-term adaptive potential for the foreseeable future. "SUSTAINABLE" implies stability of habitat availability and other conditions necessary for the full expression of the POPULATION'S (or ESU's) LIFE HISTORY DIVERSITY into the foreseeable future (NWFSC, 2008).

T

TERMINAL FISHERIES

FISHERIES near freshwater (usually the mouth of rivers or bays or near a hatchery release site) where the targeted species is returning to spawn. This definition includes the WDFW term "extreme terminal fisheries" defined by Crawford as ". . . areas where hatchery fish can be harvested with minimum impact on WILD STOCKS" Crawford (1997, p 24).

TERMINAL RUN SIZE

The number of fish in a RUN or POPULATION that return capable of spawning.

THREATENED SPECIES

Under the ESA, any SPECIES that is likely to become an ENDANGERED SPECIES within the foreseeable future throughout all or a significant portion of its range.

TRADITIONAL ECOLOGICAL KNOWLEDGE ("TEK")

Indigenous knowledge about local environmental resources. A cumulative body of knowledge, practice, and belief that has evolved by adaptive processes and been handed down through generations by cultural transmission (IPRN).

TREATY TRIBES

In the State of Washington, the TREATY TRIBES are those tribes who negotiated and signed treaties circa 1855 with Isaac Stevens, then governor of the Territory of Washington, acting on behalf of the U.S. government. These treaties outlined many agreements, including fishing rights, the exact nature of which has been contested and settled in court cases, most notably the BOLDT DECISION. However, many issues still remain unresolved. In the Coast Region, the TREATY TRIBES are the Hoh, the Makah, the Quileute and the Quinault. By distinction, the Chehalis and the Shoalwater Bay tribes are not TREATY TRIBES. All of these six tribes are, however, formally recognized by the U.S. federal government. (See also CO-MANAGERS, and USUAL AND ACCUSTOMED AREA.)

TURBIDITY

A water quality parameter that describes suspended particles and measures the degree to which they affect water clarity. The unit of measurement is NTU (Nephelometric Turbidity Units). For salmon, the state water quality standards for TURBIDITY and the range of tolerances are found in WAC 173-201A-200 (1)(e). FINES can not only adversely impact salmon eggs (by blocking INTERSTICES and limiting oxygen), but also can harm salmon gills.

U

UNITED STATES VERSUS WASHINGTON.

See BOLDT DECISION.

UPWELLING

The upward transport of cold, nutrient-rich water to the surface, conditions that favor the survival and growth of salmon and other fish species (NWFSC, 2008).

USUAL AND ACCUSTOMED AREA (“U & A”)

This refers to the fishing rights language in the treaties negotiated circa 1855 between Isaac Stevens, then governor and superintendent of Indian affairs of the Territory of Washington, on behalf of the United States, and certain tribes of the Pacific Northwest. Most treaties have the following language: “The right of taking fish at all usual and accustomed grounds and stations is secured to said Indians in common with all citizens of the Territory.” The standard for mapping U&As is what the tribes understood to be their fishing grounds at the time of the treaty negotiations. For TREATY TRIBES in the Coast Region, the U&A for watersheds was proven by anthropological evidence in federal court, in the *UNITED STATES V. WASHINGTON* (BOLDT) case. In some cases tribes have overlapping U&As. U&As include areas within both private and public ownership.

V

VERTEBRATES

Animals that are members of the subphylum Vertebrata (chordates with backbones/spinal columns made of cartilage and/or bone), including jawless fishes, sharks and rays, bony fishes, amphibians, reptiles, birds, and mammals.

VIABILITY

The likelihood that a POPULATION will sustain itself over, for example, a 100-year time frame (NWFSC, 2008).

VIABILITY CRITERIA

A prescription of the biological conditions for POPULATIONS, biogeographic strata, and ESUs that together imply that the ESU will have a negligible risk of EXTINCTION over a 100-year time frame (NWFSC, 2008).

W

WARMWATER FISH

Spiny-rayed fish such as sculpins, minnows, darters, bass, walleye, crappie, and bluegill that generally tolerate or thrive in warm water (NWFSC, 2008).

WATER RESOURCE INVENTORY AREAS (“WRIAS")

Distinct geographic management units in the State of Washington established by the Washington Department of Ecology that are defined by physical drainage basins, not jurisdictional (e.g., county) boundaries.

WILD FISH

Fish whose ancestors have always lived in natural habitats, i.e. those with no hatchery heritage (NWFSC, 2008). (See also NATURALLY PRODUCED FISH.)

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