

Washington State Framework for Monitoring Salmon Populations Listed under the Federal Endangered Species Act and Associated Freshwater Habitats

Produced by

The Governor's Forum on Monitoring Salmon Recovery
and Watershed Health

March 2007



Edited by
Bruce A. Crawford
Olympia, Washington

Governor's FORUM Participants

Co-Chair William Ruckelshaus	Washington Salmon Recovery Funding Board
Co-Chair Jeff Koenings	Washington Department of Fish and Wildlife
Josh Baldi	Washington Department of Ecology
Craig Partridge	Washington Department of Natural Resources
Chris Drivdahl	Washington Governor's Salmon Recovery Office
Carol Smith	Washington Conservation Commission
Ginny Stern	Washington Health Department
Jim Cowles	Washington Department of Agriculture
Laura Johnson	Washington Interagency Committee For Outdoor Recreation
Ron Shultz	Puget Sound Action Team
Jeff Breckel	Washington Council of Salmon Recovery Regions
Paul Ancich	Regional Fishery Enhancement Groups
Terry Wright	Northwest Indian Fisheries Commission
Steve Waste	Northwest Power and Conservation Council
Barry Thom	US Department of Commerce, National Marine Fisheries Service
Robert Wunderlich	US Department of Interior, Fish and Wildlife Service
Gretchen Hayslip	US Department of Environmental Protection Agency
Alan Christensen	US Department of Agriculture, Forest Service

Other Contributors:

Kit Paulsen, City of Bellevue
 The Nature Conservancy
 Washington Trout
 Tetra Tech EC Inc.
 KWA Ecological Sciences Inc
 Skagit County
 Ed Chadd, Streamkeepers, Clallam County
 Gino Lucchetti, King County Metro
 Frank Leonetti, Snohomish County
 Phil Larsen, USEPA

Introduction

The Washington Legislature asked the Monitoring Oversight Committee (MOC) to develop a comprehensive monitoring strategy for the state that would address salmon recovery and watershed health (SSB5637). The strategy was delivered to the Governor and Legislature in 2002. The strategy evaluated existing monitoring and identified monitoring gaps that were important for tracking future conditions of Washington's natural resources and to determine, as part of the adaptive management process, whether management actions to restore habitat and fish populations have been effective from physical, biological, and economic perspectives. Seventy-six separate recommendations were made that would materially improve our ability to determine the health of Washington's natural resources.

Combined, this information would enable comprehensive and scientifically sound reporting to Congress, the Governor, Legislature, and to the public. Much of the federal funding available to the state is dependent upon the ability to provide accountable and transparent assessment of progress towards meeting our shared goals. Funding resources are under constant pressure to be reduced, or even eliminated, if progress cannot be demonstrated.

To begin to implement the recommendations of the MOC, The Governor's FORUM on Monitoring Salmon Recovery and Watershed Health (FORUM) was created by Executive Order 04-03 in August 2004, to coordinate monitoring consistent with the *Comprehensive Monitoring Strategy and Action Plan for Watershed Health and Salmon Recovery (CMS)*.

The FORUM is comprised of state and federal agencies, named by the Governor in the Executive Order, involved in watershed health and salmon recovery. It also includes representation from the Northwest Power and Conservation Council (NWPCC), non government organizations (NGOs), and the tribes, as well as local government. According to the Executive Order, the FORUM is chartered to:

Provide a multi-agency venue for coordinating technical and policy issues and actions related to monitoring Washington's salmon recovery and watershed health.

This framework document is the result of cooperative efforts of FORUM members and is offered as guidance to state natural resource agencies, regional salmon recovery groups, and federal and tribal co-managers.

Why a Framework is Needed

There is a tendency for various agencies to attempt to meet Endangered Species Act (ESA) monitoring requirements without a connecting framework and "game plan" that allows the public, and government to determine the overall status of ESA listed salmon and their trends. This framework document only addresses fish abundance and productivity and habitat conditions. Future work may clarify how other listing factors should be addressed, as well as develop standards and increased consistency for other types of monitoring, such as implementation and effectiveness monitoring, which monitors habitat projects to increase accountability of funds. At this reporting, the framework is only partially funded.

At the October 2005 FORUM meeting, the Governor's Salmon Recovery Office (GSRO) and the National Marine Fisheries Service (NMFS) provided an overview of the criteria needed for delisting salmon species listed under the ESA. The following chart (Figure 1) illustrates the two branches (biological and statutory) of the decision framework used in determining when a listed

species can be upgraded from “endangered” to “threatened” or is recovered and removed from the list. On the left-hand section of the chart are the fish population factors that must be considered for salmon Evolutionary Significant Unit (ESUs). The component populations to be deemed Viable Salmonid Populations (VSP) must address abundance, productivity, spatial distribution, and diversity. On the right side of the chart are statutory considerations; those threats and factors limiting survival that were the reasons for the listing. In making a determination to upgrade or de-list, NMFS must have a reasonable expectation that the listed ESU is viable and that the threats to the species have been corrected. Thus, the biological factors (left side) must be addressed in complete coordination with the physical and administrative factors (right side).

The bottom of the chart lists the evaluation of actions such as how effective various types of habitat restoration projects or habitat/water programs were, and allows for adaptive management. Actions in all three sections of the chart work together to form a complete cycle that informs the public and government of salmonid recovery progress.

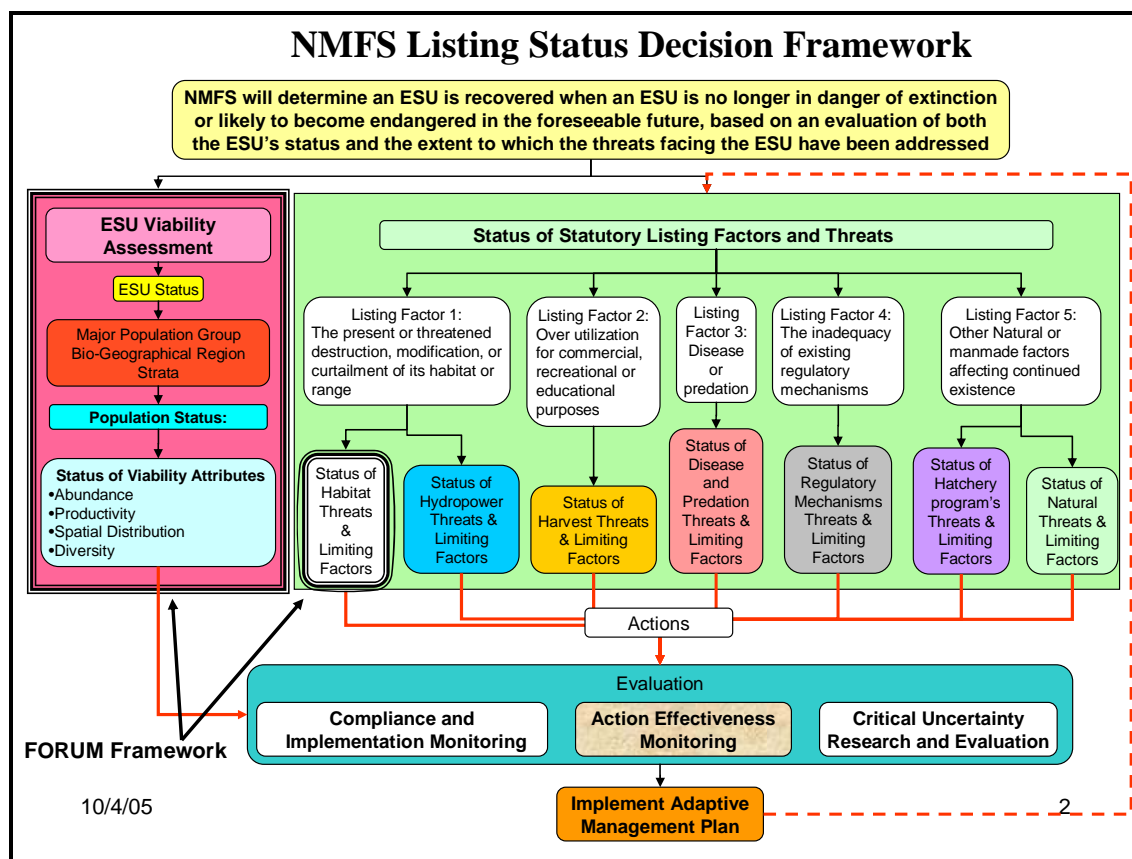


Figure 1. NMFS listing status decision framework and relationship to the FORUM framework.

In view of the above criteria and the complexity of salmon and their recovery, and given limitations of available funding for monitoring, the State of Washington will need to work with all salmon recovery partners to prioritize and sequence what is monitored and at what intensity in a statewide adaptive management approach. If funding were sufficient, it would be possible to measure all of the things shown in the diagram which would provide knowledge desired at all biological and geopolitical levels of interest (population, regional recovery region, ESU, etc.). Funding is limited however, and there is a need to find a balance between VSP fish monitoring and the status/trends of limiting factors and threats. This FORUM framework identifies a

reasonable approach to monitoring fish abundance, productivity and habitat. Especially important is the use of volunteers and technology.

Efforts are just beginning to develop consistency and data sharing to facilitate project monitoring (implementation and effectiveness monitoring) that is needed for fiscal accountability and adaptive management. However, work on these is too undeveloped to included in this framework.

Viable Salmonid Populations (VSP) Criteria

The NMFS guidance has emphasized that the decision criteria for delisting at the ESU level will depend upon information available that the aggregate status and change in status of the major population groups (MPGs) in the ESU demonstrate a level of risk, natural sustainability, or probability of persistence sufficient to warrant a change in ESU listing status. NMFS will at their species status reviews, seek to answer the following questions with available information:

- “Are MPGs within the ESU at, or clearly trending toward, a low risk status?”
- “Are primary populations within the MPG at high viability/low risk consistent with recovery plans and Technical Review Team (TRT) recommendations?” A decision about population viability considers the population status indicators (abundance, productivity, diversity, spatial structure) based on TRT recommendations.

Statutory Listing Factors (Habitat)

Statutory listing factors such as habitat will go through a similar process. Questions NMFS must ask include:

1. “Have statutory listing factors been addressed such that threats to the ESU have been ameliorated to the extent that they no longer pose a threat to the continued existence of the ESU?”
2. “Is the ESU achieving or clearly trending toward a low risk status in response to actions that have been implemented to diminish those factors limiting achievement of ESU viability objectives?” If there are habitat-related effects of limiting factors on observed abundance, productivity, diversity, or distribution of natural-origin fish, what is their significance for population viability?

This framework coordinates how the state can begin to address the VSP criteria on the left portion of the NMFS chart and Limiting Factor 1, the present or threatened destruction, modification, or curtailment of its habitat or range. This framework is a coordinated approach that monitors fish and habitat at complimentary scales and in a manner that will determine whether habitat destruction as a limiting factor is being reduced.

Statewide Salmon Abundance Monitoring for ESA Salmon De-Listing

Although the Washington Department of Fish and Wildlife (WDFW) and the treaty tribes have monitored many adult salmon and steelhead populations important for harvest management for years, there are many others that have little or no information available. This is particularly true for determining watershed production by enumerating juvenile migrants.

The Salmon Monitoring Framework is a strategy outlined by the FORUM to track salmon abundance and productivity and to relate changes in freshwater productivity to habitat conditions. NMFS and their associated TRTs have identified 28 MPGs and a minimum of 86 primary populations that may require monitoring to effectively assess delisting criteria statewide. The concept driving the Salmon Monitoring Framework is based upon their guidance. The framework seeks to develop “fish in and fish out” specific information for selected primary populations and to

tie this fish abundance information directly to habitat and water quality conditions in those watersheds and the overall Salmon Recovery Region (SRR) and regional planning. It recognizes that it is not economically feasible for Washington to monitor all 86 salmon populations and their habitats at a level of intensity suggested by the criteria laid out under NMFS VSP criteria. Given the limited funding available from both state and federal sources, the state must determine what is the risk versus cost of obtaining less information, but sufficient information collected in a methodical and scientifically defensible approach that can lead to ESA de-listing in the future.

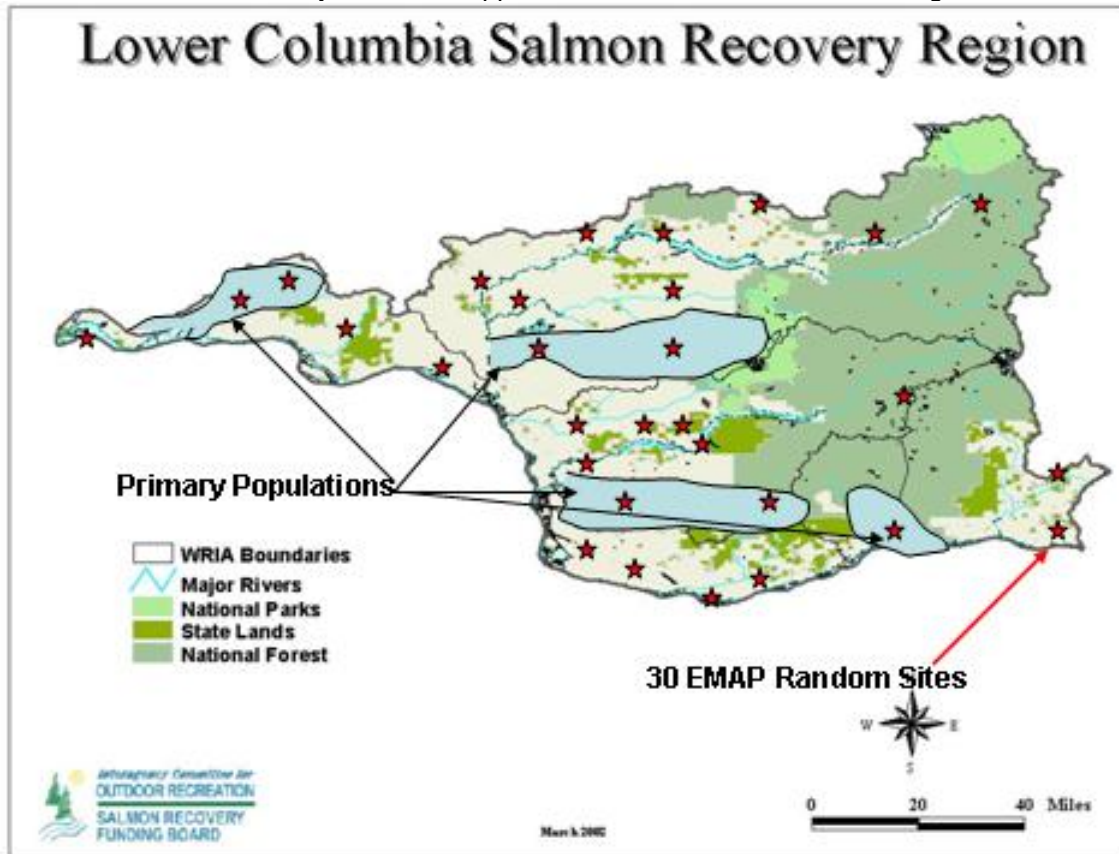


Figure 2. Illustration of coordinated sampling of primary populations for “fish in” and “fish out” and randomized EMAP habitat sample points across the salmon recovery regions.

Simultaneous Monitoring of Juvenile Out Migrants and Adult Spawners

Data on both juveniles and adults should be simultaneously and continuously collected for at least one primary population for each major population group (MPG) within an ESU for all listed salmon statewide. Primary populations are those that must demonstrate low risk of extinction in order to recover the MPG and ESU. The FORUM has developed this statewide Framework that identifies a set of the most important populations, including at least one from each MPG, for monitoring. In total, the salmon framework identifies a cumulative total of 28 major population groups containing a total of 86 primary populations for chinook, coho, chum, and steelhead. The FORUM proposes to monitor juvenile migrants at the mouth of 34 rivers. By monitoring these 34 rivers, Washington will obtain information on 70 of the primary populations requiring monitoring. Currently, juvenile salmon production is monitored for 19 of these rivers. Additional funding is needed to fill gaps to provide juvenile monitoring for 15 rivers identified in the salmon framework. Funding should be provided through a consortium of interests including the state legislature, tribal governments, local governments, and the Bonneville Power Administration. Adult monitoring

gaps have been identified for Lower Columbia Coho. Adaptive management questions answered include:

- What is the status and trends in productivity of 70 primary populations statewide?
- What is the status and trends in adult spawner abundance for 70 primary populations statewide?
- What is the status and trends in juvenile migrant abundance for 70 primary populations statewide?
- What is the status and trends of fish abundance and productivity in 28 MPGs statewide?
- What is the status and trends of fish abundance and productivity in all ESA listed chinook, coho, and steelhead ESUs statewide?

Table 1 reflects the locations where it is feasible to collect fish in and out information and collected with the greatest number of primary populations encountered. To view the status of spawner abundance and juvenile migrant information for Washington please consult the Appendix.

Table 1. Listing of targeted watersheds for fish-in and fish-out monitoring. It describes the current juvenile monitoring status and who is performing it. A watershed may have more than one listed species therefore having more than one primary population.

Salmon Recovery Region	Targeted Primary Watersheds For Juvenile Trapping	Number of primary populations within the watershed	Current Juvenile Trapping Status
Puget Sound	Nooksack	2	Yes - Tribal
	Skagit	6	Yes - WDFW
	Stillaguamish	2	Yes - Stillaguamish Tribe
	Skykomish	1	Yes - Tulalip Tribe
	Snoqualmie	1	Yes - Tulalip Tribe
	White	1	No
	Nisqually	1	No - State budget request
	Skokomish	1	No
	Dosewallips	2	No - State budget request
	Hamma Hamma	1	Yes - USFWS funded
	Elwha	1	Yes - Lower Elwha Tribe
	Dungeness	1	No - State budget request
Coast	Ozette	1	Yes - Makah Tribe
Lower Columbia	Grays	3	No - State budget request
	EF Lewis	5	No - State request
	Cedar Creek-NF Lewis	2	Yes - Ongoing SRFB Funding
	Kalama	4	Yes - WDFW Federal Funds
	Cowlitz	3	Yes - Tacoma City Light
	Coweeman	3	No - NPCC Proposal
	Toutle	4	No
	Mill	1	Yes - SRFB
	Wind	2	No - NWPCC Proposal
	Duncan Creek	1	No - NWPCC Proposal
Middle Columbia	Klickitat	1	Yes - Tribal/BPA
	Yakima	3	Yes - Tribal/BPA
	Touchet	1	No - State request
Upper Columbia	Wenatchee	2	Yes - PUD-Fed
	Entiat	2	Yes - USFWS
	Methow	2	Yes - PUD
	Okanogan	1	Yes - Tribal BPA

Snake	Tucannon	2	No - NWPCC Proposal
	Walla Walla	1	Yes - Umatilla Tribe
	Asotin	2	No - NWPCC Proposal
	Grand Ronde	4	No - State budget request
Total	34	70	15 traps need funding

It is important to note here that, as we move into the follow sections, these efforts are not mutually exclusive to meeting goals and objectives. A holistic approach that includes adequate monitoring of both the biological (fish) and physical (listing and threats) elements is compulsory. Monitoring of fish populations and habitat health are equally important, and as efforts progress, improved project monitoring can be added to enable adaptive management and increased fiscal accountability. Finally, the FORUM is working to identify and eliminate monitoring activities that provide no benefit to the resource or the goals and objectives of the FORUM, Governor, Legislature and to the species populations themselves.

Fish Sampling Protocols

Fish sampling protocols have been subject to wide variations and adaptations by field biologists. Recent activities sponsored by the Pacific Northwest Aquatic Monitoring Partnership (PNAMP) and EcoTrust have resulted in the Salmonid Field protocols handbook now in press.

Habitat Monitoring Framework

In 2005, the Governor's FORUM on Monitoring Salmon Recovery and Watershed Health sponsored a workshop to determine whether high level indicators of salmon recovery and watershed health reported biennially in the Washington State of Salmon in Watersheds Report could be improved. It was concluded, and later affirmed by subcommittees of experts, that there is no current habitat evaluation program in practice today that can provide the status and trends necessary to inform the public and meet federal ESA recovery purposes, in contrast to existing efforts to monitor fish populations. Thus, the essential question remains whether habitat necessary for salmon is improving. It was also concluded that the state ambient monitoring program for water quality does not adequately typify water quality conditions over the landscape, but is useful for measuring trends at selected locations. In response to recommendations from the FORUM, the Washington State Salmon Recovery Funding Board (SRFB) provided funds to the Department of Ecology (Ecology) to produce a habitat monitoring framework to be used in addressing large data gaps for Washington currently existing in evaluating habitat and water quality. The concept is consistent with PNAMP which has recommended a regional monitoring framework using multiple jurisdictions and funding sources to complete the needed geographic coverage. The document, *"Status and Trend Monitoring for Watershed Health and Salmon recovery, Quality Assurance Monitoring Plan (2006)"* publication 06-03-203 can be accessed at the Ecology website at <http://www.ecy.wa.gov/biblio/0603203>.

The habitat framework relies upon remote sensing and instream and riparian sampling. The habitat framework has the following characteristics.

- It provides status and trends of land use and land cover using remote sensing.
- It provides a probability-based sampling framework that can be used at the state, SRR, and Water Resource Inventory Area (WRIA) scales by all levels of government and volunteers to assess the conditions of the state's aquatic resources.
- Initiates a sampling site selection process that provides a minimum of 80% confidence in the estimated status of Wadeable and non-Wadeable rivers and streams.
- Identifies the specific indicators that will be monitored as well as the protocols used to measure them.

- Incorporates existing information and monitoring data, where possible, into the assessment.
- Develops partnerships with other agencies, local governments, and volunteer groups to implement the monitoring plan or share data.

Remote Sensing

The WDFW should acquire high altitude satellite imagery to compare changes in land conversion, impervious surfaces, and floodplain area for each SRR and ESA MPG in the state. Aerial photos would be used to generate a total census of the status and trends in riparian vegetation type and cover, roads, stream crossings, and where possible river channel morphology and large woody debris for at least one listed primary salmon population per major population group in each recovery region. Aerial photography monitoring would be done where there are complimentary salmon productivity (i.e., fish in-fish out) data and where local groups want to do monitoring. Remote sensing data provides “big picture” metrics of land use changes and avoids intrusion into private property. Remote sensing, however, cannot measure water quality, stream sedimentation and other parameters needed to quantify some aspects of watershed health. Therefore, a combination of remote sensing and on-the-ground probabilistic sampling is necessary. This will complement ongoing US Forest Service actions on federal forestlands in Washington where the Aquatic Resource Effectiveness Monitoring Program (AREMP) and Pacific Intermountain Biological Opinion (PIBO) sampling programs are using satellite imagery to typify forest seral changes and roads on the national forests. Satellite imagery provides low cost answers to large scale questions of habitat change in Washington. Monitoring questions answered include:

- What is the status of land cover and land use (agriculture, forestry, urban)?
- What are the trends in land cover and land use (agriculture, forestry, urban)?

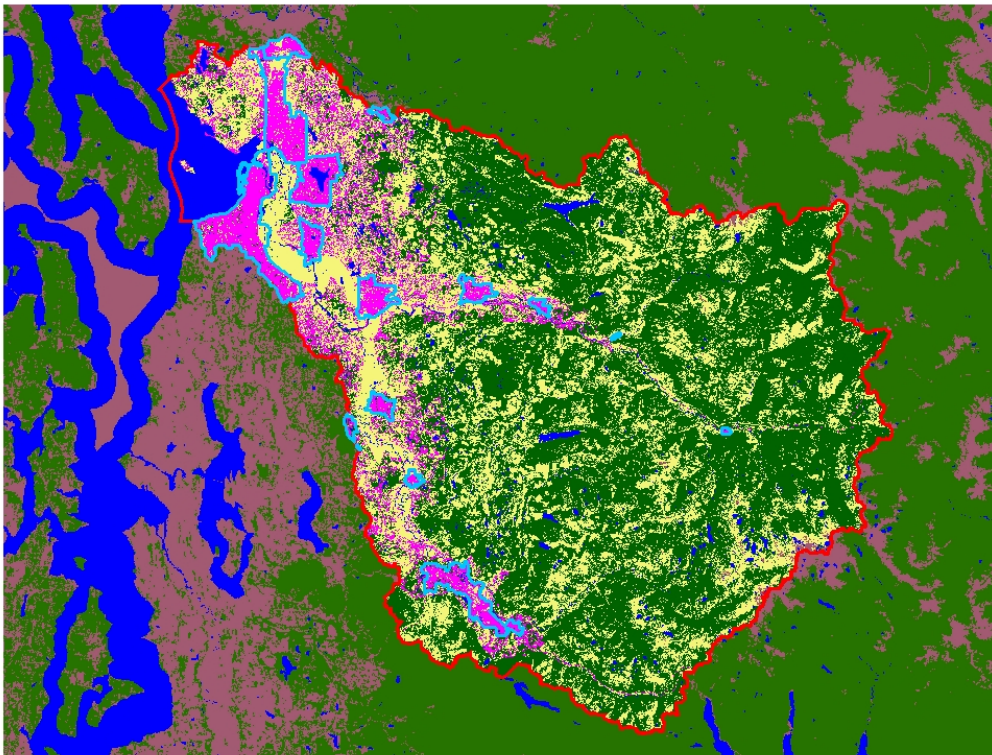


Figure 3. Landsat view of forest cover Snohomish River basin

Habitat and Water Quality Status and Trends – On-The-Ground Sampling

The Salmon Recovery Regions can collaborate with WDFW, Ecology, and private industry to identify available local resources to conduct on-the-ground fieldwork. Partners may include local Regional Fisheries Enhancement Groups, conservation districts, municipalities, counties, private corporations, state agencies, and others having expertise and interest in participating in the monitoring activity. Salmon require clean gravel, cool water, hiding cover from down logs, food organisms, and a variety of stream structures for their various life history stages. On-the-ground sampling will collect physical, chemical, and biological data that will enable the SRRs and state to detect changes in water quality, changes in in-stream sedimentation, hiding cover, and stream structure essential to salmon, and changes in fish distribution and composition. In addition, changes to stream bank vegetation and structure can also be documented. The measures serve to track the status/trends not only in salmon habitat and water quality, but also monitors distribution of many invasive species and addresses biodiversity along our rivers and streams. Adaptive management questions answered include:

- What is the status/trend of stream water quality by WRIA, Salmon Recovery Region, and statewide?
- What is the status/trend of riparian stream vegetation by WRIA, Salmon Recovery Region, and statewide?
- What is the status/trend of stream physical characteristics (sedimentation, hiding cover, and stream structure) by WRIA, Salmon Recovery Region, and statewide?
- What is the status/trend of the distribution of native and exotic fish and invertebrates by WRIA, Salmon Recovery Region, and statewide?

It should be noted that this sampling does not provide information on pesticides, toxins, and other water quality issues of concern for watershed health and salmon recovery.

“On-the-ground” monitoring focuses on streams and rivers projected on a 1:24,000 scale hydrography coverage using Environmental Monitoring and Assessment Program (EMAP) sampling techniques. EMAP is a research program developed by the USEPA to develop the tools necessary to monitor and assess the status and trends of national ecological resources. It provides for sampling at a scale that provides statistically sound evaluation without measuring everything everywhere. EMAP has developed protocols for indicators to monitor the condition of ecological resources. EMAP also developed sampling designs that address the acquisition, aggregation, and analysis of multi-scale and multi-tier data.

EMAP design employed in the framework makes inferences about the habitat within WRIsAs and Salmon Recovery Regions with +/-10% precision with 80% confidence. Data required to make these inferences would be collected over a five year period using a probabilistic rotating six panel sampling design. The panel design is shown in Figure 4 below.

Site sampling rotation by Salmon Recovery Region

Year	PS	Lower Columbia	Mid Columbia	Upper Columbia	Snake	Wa Coast	NE WA	Unlisted WA
1	30	30	1	1	1	1	1	1
2	1	1	30	30	1	1	1	1
3	1	1	1	1	30	30	1	1
4	1	1	1	1	1	1	30	30
5	30	30	1	1	1	1	1	1
6	1	1	30	30	1	1	1	1
7	1	1	1	1	30	30	1	1
8	1	1	1	1	1	1	30	30
9	30	30	1	1	1	1	1	1
10	1	1	30	30	1	1	1	1
11	1	1	1	1	30	30	1	1
12	1	1	1	1	1	1	30	30
13	30	30	1	1	1	1	1	1
14	1	1	30	30	1	1	1	1
15	1	1	1	1	30	30	1	1
16	1	1	1	1	1	1	30	30
17	30	30	1	1	1	1	1	1
18	1	1	30	30	1	1	1	1
19	1	1	1	1	30	30	1	1
20	1	1	1	1	1	1	30	30
21	30	30	1	1	1	1	1	1
22	1	1	30	30	1	1	1	1
23	1	1	1	1	30	30	1	1
24	1	1	1	1	1	1	30	30
25	30	30	1	1	1	1	1	1

Same site sampled annually per SSR for trend

30 random sites sampled in each SRR every four years for status

Figure 4. Sampling design for assessing habitat conditions of streams within each SRR. SRR status available every four years. Trend (3 data points) in instream and riparian habitat available after nine years.

Sites have been selected from a master sample of site locations developed for this framework and available for anyone wishing to participate in the overall statewide approach. A sample drawing is merely a list of latitude and longitude positions along the stream segments within the SRR and WRIA. Each sample site has been selected randomly but stratified by stream size so that there is equal representation. Over 22,000 sites have been identified statewide. The master sample draw is available via the Internet at <http://www.ecy.wa.gov/programs/eap/stsmf/> for any participating partner who wishes to begin sampling habitat in their area of interest.

Table 2. A portion of the existing sample draw for Cowlitz WRIA 28.

WRIA Number	WRIA Name	Site ID	Latitude	Longitude
28	Cowlitz	WAM06600-000029	46.45061996	-122.6503033
28	Cowlitz	WAM06600-000041	46.33578164	-122.8891076
28	Cowlitz	WAM06600-000073	46.26910571	-122.5425068
28	Cowlitz	WAM06600.000117	46.22642802	-122.2984985
28	Cowlitz	WAM06600-000121	46.38159912	-122.5077361
28	Cowlitz	WAM06600-000125	46.55288221	-122.3404624
28	Cowlitz	WAM06600-000141	46.44425792	-122.2414204
28	Cowlitz	WAM06600-000146	46.62623092	-122.3924478
28	Cowlitz	WAM06600-000229	46.1978947	-122.5582835

Sampling Protocols for Habitat

A uniform framework with multiple agencies participating can only produce information usable and comparable across jurisdictions if common protocols are used. Accepted protocols have been in existence for many years for those scientists evaluating water quality. The protocols have been published through the “Standard Methods for the Examination of Water and Wastewater” sponsored by the American Waterworks Association and the Water Environment Federation. This has not been the case with habitat evaluations. There are numerous protocols in use and field biologists have been reluctant to subscribe to any one protocol. Johnson et al (2002) published a list of habitat protocols as a first step in helping to guide scientists toward standardization of protocols.

PNAMP sponsored a protocol comparison in 2005 of seven commonly used Pacific Northwest watershed condition protocols. The preliminary results of that comparison indicate that the following protocols produce reproducible information with adequate precision sufficient to be used for large scale comparisons across Washington jurisdictions in determining stream health:

- US EPA EMAP Protocols published by Peck et al. (2003)
- US Forest Service AREMP protocols (AREMP 2006)
- US Forest Service PIBO protocols (Heitke et al. 2006)
- Upper Columbia River Protocols (Hillman 2006)

The other protocols tested contain attributes that are measured well and are repeatable, but are less comprehensive. By stream health it is meant that if the total number of measured stream attributes are summed in some fashion, then the results of the above protocols will be comparable. Individual attributes such as stream sinuosity or bank full width may vary among the protocols in precision and variance, and if only sinuosity were to be studied then one protocol may be better.

The FORUM envisions that the Salmon Recovery Regions would collaborate with WDFW and Ecology to identify available local resources to conduct on-the-ground habitat fieldwork. The

CMS identified USEPA EMAP protocols as the preferred field sampling protocol. However, partners could be using any of the four protocols shown above and obtain comparable results. Partners may include local regional fisheries enhancement groups, conservation districts, municipalities, counties, private corporations, state agencies, and others having expertise and interest in participating in the monitoring activity. EMAP sampling identified here will provide approximately 60 randomly selected, representative sample points across two Salmon Recovery Regions per year. The sampling will be conducted using the randomly selected sampling locations developed by Ecology for the SRFB, and through the use of EMAP sampling protocols developed by the USEPA. Ecology will ensure that quality control measures and training needs are met among the various participants.

Together, the use of remote Landsat sensing, aerial photography and EMAP random sampling can provide information about all of the habitat limiting factors identified for the ESU's occurring in Washington. In addition, the information obtained from these sampling programs will compare directly with data being collected by the US Forest Service and Bureau of Land Management on federal lands in Washington.

Framework Relationship to Existing Regional Monitoring Efforts

Regional recovery plans for listed species in Washington contain monitoring and evaluation to support adaptive management. Monitoring and evaluation components in each plan are multi-faceted and address implementation, effectiveness, validation, and status and trends monitoring questions. Monitoring and evaluation provisions in the plans are intended to be consistent with available state and federal guidance (e.g., the Comprehensive Monitoring Strategy (2002), FORUM guidance to the regional salmon recovery organizations (2005), and NMFS guidance). Monitoring and evaluation provisions in virtually all of the plans are currently in the process of being refined with new information and additional detail.

Information on the status and trends of fish and habitat condition is identified in each regional salmon recovery plan. The primary use of the fish information is to track abundance, productivity, diversity, and spatial structure of listed populations in major population groups. The primary use of habitat status and trends information is to track changes in key environmental characteristics associated with identified factors limiting recovery, which must be addressed for delisting to occur. In addition, understanding how habitat is changing over time provides crucial context to evaluate how well the implemented recovery actions in the plans are working. Finally, the framework provides a systematic and efficient approach to help integrate information and evaluate relationships of changes in habitat on fish.

The FORUM's Status and Trends Framework provides a multi-faceted statewide design approach, and identifies primary populations and a hierarchy of sites for on-the-ground sampling. The habitat approach applies to multiple scales of interest – from the very coarse scale (statewide), to a fine scale (e.g., watershed). In total, the framework provides a backbone of minimum design elements for fish and habitat, while providing for more intensive trend sampling at finer scales as funds become available. All information collected via the framework can be incorporated and rolled up to address higher level (regional and statewide) questions.

In summary, the framework design is consistent with, and will assist, regional recovery plan needs. Some regional salmon monitoring efforts, however, may want to implement the framework monitoring design at smaller scales and with a higher sampling intensity, contingent on the availability of additional funding.

Data

Data sharing is an integral part of a workable framework, and much work remains in this area. One important example of inconsistent data is the hydro layer (river and stream GIS data). Currently, the State of Washington does not have one source for river and stream GIS data. A consolidated WDFW, DNR, and Ecology regulatory data set (stream typing, water quality, fish habitat) is needed. It should be managed and maintained with changes and updates made by all three agencies in one place. This action will affect municipal, county, and other entities relying upon accurate river and stream maps for regulatory and restoration planning and implementation.

There are currently multiple efforts underway to capture field data on both habitat projects and habitat health so that it can be used by multiple jurisdictions. The Conservation Commission is in the process of developing a new system to document conservation district projects, and has worked with IAC to assure compatibility with their database (PRISM) and with the GSRO for use in the State of the Salmon in Watersheds reports. Many databases have begun in the SRRs to track recovery efforts. Some of these are tied to state and federal databases. Continued work needs to take place to enable rollup of information at multiple scales using data portals, web-based GIS layers, and distributed database reporting systems.

Effects and Risk of Not Implementing This Framework

Failure to implement this framework would force decisions to be based on non-existent, subjective, and/or outdated historical information for a resource that is in constant flux with the changing natural environment. WDFW, the tribes, and NMFS will have no credible basis for evaluating benefits from restoration or conservation plans for salmon and steelhead and for proposing delisting. Data gaps would remain for ten major population groups across the state. De-listing decisions would only be able to rely upon partial survey information, insufficient fishery data, or anecdotal information on population trends. Decisions such as these rarely go unchallenged or successfully and recent history leads us to believe that adjudicated outcomes are not in the best interest of the citizenry, government or the resource.

Without this framework Washington State would have no comprehensive monitoring program in place during the next two years when regional adaptive management and monitoring plans are completed.

It would mean that there would be no habitat status and trend data available to report salmon habitat recovery progress to the Legislature or Congress, putting this already unstable funding stream at further risk and shifting that risk to the states. The absence of reliable quantitative information may jeopardize federal and state funding that is targeted to processes that build community support for salmon recovery and improving watershed health. Reporting of salmon recovery would rely on anecdotal observations of habitat change to assess or describe progress.

Failure to implement this framework will likely delay or preclude subsequent federal NMFS delisting decisions. Without habitat information that complements the information describing progress on Hatchery, Hydropower, and Harvest management, the federal government will resist delisting salmon even as salmon populations improve because evidence that the listing factors (threats) have been alleviated is a prerequisite for delisting (ESA Section 4(a)(1)).

Water quality status and trends analysis will continue to rely upon existing long-term ambient monitoring sites designed to support the National Pollution Discharge Elimination System (NPDES) and Total Maximum Daily Load (TMDL) programs. These stations are not intended to be representative of overall watershed conditions and are therefore inappropriate for deriving estimates of statewide or regional water quality under the USEPA Clean Water Act requirements.

Literature Cited

- AREMP, 2006. Field protocols Manual, Aquatic and Riparian Effectiveness Monitoring Program. Regional Interagency Monitoring for the Pacific Northwest Forest Plan, 2006 field season.
<http://www.reo.gov/monitoring/watershed/AREMP/2004/aremp.htm>.
- Cusimano, R., G. Merritt, R. Plotnikoff, C. Wiseman, and C. Smith. 2006. Status and Trends Monitoring for Watershed Health and Salmon Recovery - Quality Assurance Monitoring Plan. No; 06-03-203. Dept of Ecology. Olympia, WA.
<http://www.ecy.wa.gov/biblio/0603203>
- Governor's Forum on Monitoring. 2005. Recommendations to the Salmon Recovery Regions. Olympia, WA.
http://www.iac.wa.gov/Documents/Monitoring/Recommendations_to_Salmon_Recovery_Regions.pdf.
- Heitke, J.D., E.J. Archer, D.D. Dugaw, B.A. Bouwes, E.A. Archer; R.C. Henderson, J.L. Kershner. 2006. Effectiveness monitoring for streams and riparian areas: sampling protocol for stream channel attributes. Unpublished paper on file:
<http://www.fs.fed.us/biology/fishecolology/emp>.
- Hillman, T.W., 2006 (August). Draft Monitoring Strategy For the Upper Columbia Basin, Prepared for the Upper Columbia Basin Regional Technical Team and the Upper Columbia Salmon Recovery Board. BioAnalysts, Inc. Eagle Idaho.
- Monitoring Oversight Committee. 2002. The Washington Comprehensive Monitoring Strategy for Watershed Health and Salmon Recovery. Volume 1 Executive Report, Volume 2 Comprehensive Strategy, and Volume 3 Action Plan.
<http://www.iac.wa.gov/monitoring/docs.htm>.
- Peck, D., J.M. Lazorchak, and D.J. Klemm (editors), 2003. Environmental Monitoring and Assessment Program – Surface Waters: Western Pilot Study Field Operations Manual for Wadeable Streams. U.S. Environmental Protection Agency, Western Division, Corvallis, OR.
www.epa.gov/r10earth/offices/oea/ieu/WADEABLE_MANUAL_APR_2003.PDF

Appendix

Washington State Framework for Monitoring Salmon Populations Listed under the Federal Endangered Species Act and Associated Freshwater Habitats

Produced by

The Governor's Forum on Monitoring Salmon Recovery and Watershed Health

2007

Table 3. Comparison of NOAA limiting habitat factors and indicators measured on federal and non-federal lands.

NOAA Major Habitat Limiting Factor	NOAA Recommended Indicators	USFS-BLM AREMP-PIBO Federal Lands in Washington	FORUM Landsat Statewide Non-federal lands	FORUM Aerial photography Primary Populations only	FORUM EMAP ESU and Statewide
Degraded Floodplain and channel structure	Trends in land use conversion	Landsat analysis of vegetation, GIS: roads, Landslides (developing model based on topographic features) Verify vegetation data at ground sites	Landsat Land use, Land cover	Aerial photos of vegetation, roads, landslides	Verify and calibrate vegetation data at ground sites.
	Trends in stream depth-width ratio	<ul style="list-style-type: none"> • Bankfull width to depth ratio; • Pool frequency, sinuosity, and gradient; Wood frequency; • Percentage of fine sediments; water chemistry data 	Not discernible by Landsat	Not discernible by aerial photography	<ul style="list-style-type: none"> • Bankfull width to depth ratio; • Pool frequency, sinuosity, and gradient; Wood frequency; • Percentage of fine sediments; water chemistry data
Degraded riparian forest and LWD recruitment	Trends in land use conversion	Landsat: vegetation, GIS: roads, Landslides (developing model based on topographic features) Verify vegetation data at ground sites	Landsat Land use, Land cover	Aerial photos of vegetation, roads, landslides	Verify and calibrate vegetation data at ground sites
	Change in land use/land cover	Landsat: vegetation, GIS: roads, Landslides Verify Vegetation data at ground sites	Land use, Land cover	Aerial photos of vegetation, roads, landslides	Verify and calibrate remote sensing vegetation data at ground sites.

NOAA Major Habitat Limiting Factor	NOAA Recommended Indicators	USFS-BLM AREMP-PIBO Federal Lands in Washington	FORUM Landsat Statewide Non-federal lands	FORUM Aerial photography Primary Populations only	FORUM EMAP ESU and Statewide
	Classification of large woody debris	large woody debris at ground sites, macroinvertebrates, periphyton	Not discernible by Landsat satellite	Believed to be possible for most streams	large woody debris, riparian vegetation, canopy cover, macroinvertebrates
	Trends in transportation impacts-miles of road crossings	GIS: roads, Landslides (developing model based on topographic features)	Roads and landslides	Roads and landslides	No Scale too fine.
	Trends in riparian vegetation and canopy cover	Landsat vegetation, roads, Landslides Riparian vegetation and canopy data at ground sites	Landsat vegetation, roads, Landslides	Trends in riparian vegetation cover type and canopy cover	Riparian vegetation and canopy data at ground sites
Estuarine habitat loss and degradation	Trends in riparian vegetation	Not covered	Landsat Land use, Land cover	Aerial photos should be able to determine changes to many habitat parameters	Not covered
Nearshore marine habitat loss and degradation		Not covered	Landsat Land use, Land cover	Aerial photos should be able to determine changes to many habitat parameters	Not covered
Sediment routing dysfunction	Trends in water turbidity	Percent fines (at pool tail crests)	Not discernible by Landsat satellite	Not discernible by aerial photos	Yes Percent fines
	Trends in soil erosion	Streambank stability; floodplain bare ground assessment	Not discernible by Landsat satellite	Not discernible by aerial photos	Streambank erosion
Degraded water quality ¹	Trends in impervious surface	GIS , roads	Landsat Land use, Land cover	Not discernible by aerial photos	No. Scale too fine.

¹ Departments of Ecology and Agriculture note that pesticides, toxins, and other water quality issues are also important to monitor for salmon recovery.

NOAA Major Habitat Limiting Factor	NOAA Recommended Indicators	USFS-BLM AREMP-PIBO Federal Lands in Washington	FORUM Landsat Statewide Non-federal lands	FORUM Aerial photography Primary Populations only	FORUM EMAP ESU and Statewide
	Trends in water temperature	Temperature probes in stream from July to September	Not discernible by Landsat satellite	Not discernible by aerial photos	Yes placement of thermographs
Degraded riparian forest and LWD recruitment	Trends in riparian vegetation and canopy cover	Landsat: vegetative cover Tree counts, DBH, and cover by species at ground sites	Landsat Land use, Land cover	Aerial photos can determine changes to vegetation and canopy cover	Yes
Hydrologic alterations	Trends in stream flow	Not covered	Not discernible by Landsat	Not discernible by aerial photos	Not covered
	Trends in flow hydrology	Not covered	Not discernible by Landsat	Not discernible by aerial photos	Not covered
	Trends in transportation impacts - miles of roads and crossings	GIS: roads, Landslides (developing model based on topographic features)	Not discernible by Landsat	Roads and crossings can be detected	Not discernible with EMAP sites
	Trends in water temperature	Temperature probes in stream from July to September	Not discernible by Landsat	Not discernible by aerial photos	Yes
Impaired Fish Passage Conditions	Miles of newly inhabited spawning grounds	USFS barrier inventory	WDFW barrier inventory	May be possible to detect barriers	Yes. Ground verification of fish presence at EMAP sites
Man-made blocks to migration	Miles of newly inhabited spawning grounds	USFS barrier inventory	WDFW barrier inventory	May be possible to detect barriers	Yes. Ground verification of fish presence at EMAP sites

Table 4. Description of existing fish in and fish out monitoring in Washington.

Statewide Monitoring of listed species - Juveniles & Adults												
					Proposed for FY07-09 GF-S Funding							
					Proposed for FY07-09 GF-S and submitted for BPA funding							
					Submitted for BPA funding							
2/13/2007 10:34												
Recovery Region	Major Population Groups	WRIAs	Target Species	Primary Populations ¹⁶	Juveniles				Adults			
					Smolt Sites	Production Index ²	Smolt Trapping Agency	Funding	Spawners (Stocks)	Data Quality ³	Monitoring Agency	Funding
Puget Sound	North Sound	1 to 2	Chinook	NF Nooksack	Nooksack	Index ⁴	Lummi	Tribal	NF/MF Nooksack	Very Good		GFS
				SF Nooksack					SF Nooksack	Very Good		GFS
									Samish/MS Nooksack	Poor		
Puget	Whidbey Basin	3 to 7	Chinook	Upper Skagit ¹⁷	Skagit	Yes	WDFW	Federal (Dingall/ Johnson) 50% Seattle PU 50%		Good		
				Lower Skagit						Upper Skagit MS/Tribs	Very Good	
				Upper Sauk (early)						Lower Sauk	Good	
				Lower Sauk						Upper Sauk	Excellent	
				Suiattle (early)						Suiattle	Excellent	
				Cascade (early)						Upper Cascade	Excellent	
				NF Stillaguamish	Stillaguamish	Yes ⁴	Stillaguamish	Tribal		NF Stillaguamish	Good	GFS
				SF						SF	Good	GFS

Statewide Monitoring of listed species - Juveniles & Adults												
					Proposed for FY07-09 GF-S Funding							
					Proposed for FY07-09 GF-S and submitted for BPA funding							
					Submitted for BPA funding							
2/13/2007 10:34												
Recovery Region	Major Population Groups	WRIAs	Target Species	Primary Populations ¹⁶	Juveniles				Adults			
					Smolt Sites	Production Index ²	Smolt Trapping Agency	Funding	Spawners (Stocks)	Data Quality ³	Monitoring Agency	Funding
Sound	Sound			Stillaguamish					Stillaguamish			
				Skykomish	Skykomish/	Yes ⁴	Tulalip	Tribal	Skykomish	Good		GFS
				Snoqualmie	Snoqualmie				Snoqualmie	Good		GFS
	Central South Sound Basin	8 to 11	Chinook	N/A	Cedar River	Yes	WDFW	Seattle PUD	Cedar	Good		King Cons Dist GFS
				N/A	Bear Creek	Yes	WDFW	King Co.	N Lk Washington Tribs	Good		King Cons Dist GFS
				N/A	Green River	Yes	WDFW	SRF Board	Green R (Duwamish)	Good		90% State GFS/ 10% Fed (PST)
				N/A	Puyallup	Yes	Puyallup	Tribal	Puyallup	Poor (total esc est)		State General Fund 50% / Tribal 50%
				White River					White River Adult Trap	Good		GFS 10%/ Tribal 90%

Statewide Monitoring of listed species - Juveniles & Adults												
					Proposed for FY07-09 GF-S Funding							
					Proposed for FY07-09 GF-S and submitted for BPA funding							
					Submitted for BPA funding							
2/13/2007 10:34												
Recovery Region	Major Population Groups	WRIAs	Target Species	Primary Populations ¹⁶	Juveniles				Adults			
					Smolt Sites	Production Index ²	Smolt Trapping Agency	Funding	Spawners (Stocks)	Data Quality ³	Monitoring Agency	Funding
Puget Sound				White River					White River Spawner Surveys			GFS 50%/ Tribal 50%
				Nisqually	Nisqually	Pro-posed	WDFW	GF-S	Nisqually			GFS 50%/ Tribal 50%
	Hood Canal	16	Chinook	N/A	Hamma Hamma River	Index ⁶	LLK/HC SEG/ Port Gamble/ WDFW	USFWS (DOI) /Tribal/ State	Good			State General Fund (GFS) 90% / LLTK 10%
				Skokomish					Skokomish	Good		GFS 90%/ Tribal 10%
				Dosewallips	Dosewallips	Pro-posed	WDFW	GF-S	Mid-Hood Canal / Dosewallips	Good		State General Fund (GFS) 90% /

Statewide Monitoring of listed species - Juveniles & Adults																
						Proposed for FY07-09 GF-S Funding										
						Proposed for FY07-09 GF-S and submitted for BPA funding										
2/13/2007 10:34																
Recovery Region	Major Population Groups	WRIAs	Target Species	Primary Populations ¹⁶	Juveniles					Adults						
					Smolt Sites	Production Index ²	Smolt Trapping Agency	Funding			Spawners (Stocks)	Data Quality ³	Monitoring Agency	Funding		
Puget Sound														LLTK 10%		
			Summer Chum	Quilcene						Quilcene	Good		GFS 100%			
			Dosewallips	Dosewallips	Proposed	WDFW	GF-S		Dosewallips	Good		GFS 100%				
			Duckabush						Duckabush	Good		GFS 100%				
			Lilliwaup						Lilliwaup	Good		GFS 100%				
			Union River						Union River	Good		GFS 100%				
			Hamma Hamma	Hamma Hamma River	Production ¹ ₂	LLK/HC SEG/ Port Gamble/ WDFW	USFWS (DOI) /Tribal/ State		Good		GFS 100%					
Eastern JDF	18	Chinook	Dungeness	Dungeness River	Production	WDFW	SRF Board		Dungeness	Excellent		GFS 100%				
			Elwha	Elwha River	Production	Lower Elwha	Tribal		Elwha	Excellent		GFS 80%/ Tribal 20%				

Statewide Monitoring of listed species - Juveniles & Adults												
					Proposed for FY07-09 GF-S Funding							
					Proposed for FY07-09 GF-S and submitted for BPA funding							
					Submitted for BPA funding							
2/13/2007 10:34												
Recovery Region	Major Population Groups	WRIAs	Target Species	Primary Populations ¹⁶	Juveniles				Adults			
					Smolt Sites	Production Index ²	Smolt Trapping Agency	Funding	Spawners (Stocks)	Data Quality ³	Monitoring Agency	Funding
			Summer Chum	Jimmycome-lately					Jimmycome-lately			NOSC 60% /GFS 40%
				Salmon/Snow					Salmon/Snow			NOSC 30% / GFS 70%
Coastal	Ozette	20	Sock-eye	Lake Ozette	Ozette River	Index	Makah	Tribal	Ozette	Excel-lent		Tribal
Lower Columbia	Coast	25	Chinook	Grays/Chinook Falls	Grays River	Proposed	WDFW	NPCC BPA, GF-S				
				Elochoman/ Skamokawa Falls		Proposed	WDFW	NPCC/BPA				
				N/A	Mill Creek	Production	WDFW	SRF Board	Mill/Abernathy/Germany	Good		SRF Board
					Abernathy Creek	Production	WDFW					
					Germany Creek	Production	WDFW					
			Chum	Mill/Abernathy / Germany	Mill Creek	Production	WDFW	SRF Board	Mill/Abernathy/ Germany			BPA

Statewide Monitoring of listed species - Juveniles & Adults																
						Proposed for FY07-09 GF-S Funding										
						Proposed for FY07-09 GF-S and submitted for BPA funding										
						Submitted for BPA funding										
2/13/2007 10:34																
Recovery Region	Major Population Groups	WRIAs	Target Species	Primary Populations ¹⁶	Juveniles					Adults						
					Smolt Sites	Production Index ²	Smolt Trapping Agency	Funding		Spawners (Stocks)	Data Quality ³	Monitoring Agency	Funding			
									Abernathy Creek					Produ ction	WDFW	
									Germany Creek					Produ ction	WDFW	
									Grays/Chinoo k Riv					Grays River	Prop osed	WDFW
			Elochoman/ Skamokawa	Elocho/Skam okawa	Pro- posed	WDFW	NPCC/B PA									
			Coho	Grays/Chinoo k	Grays River	Prop osed	WDFW	NPCC BPA, GF-S	Grays River	Pro- posed		NPCC/B PA, GF-S				
				Elochoman/ Skamokawa	Elocho/Skam okawa	Pro- posed	WDFW	NPCC/B PA								
				N/A	Mill Creek	Produ ction	WDFW	SRF Board	Mill/Abernathy/ Germany	Very Good ⁷		SRF Board				
					Abernathy Creek	Produ ction	WDFW									
		Germany Creek			Produ ction	WDFW										
		Lower Columbia	Cascade	26 to 28	Chinook	Upper Cowlitz Springs	Cowlitz Falls	Produ ction	WDFW	Tacoma PUD						

Statewide Monitoring of listed species - Juveniles & Adults															
						Proposed for FY07-09 GF-S Funding									
						Proposed for FY07-09 GF-S and submitted for BPA funding									
2/13/2007 10:34															
Recovery Region	Major Population Groups	WRIAs	Target Species	Primary Populations ¹⁶	Juveniles					Adults					
					Smolt Sites	Production Index ²	Smolt Trapping Agency	Funding		Spawners (Stocks)	Data Quality ³	Monitoring Agency	Funding		
Lower Columbia				Cispus Springs											
				N/A	Mayfield Dam	Index	WDFW	Tacoma PUD							
				Coweeman Falls	Coweeman	Pro-posed	WDFW	GF-S, Mitchell Act							
				Kalama Falls											
				Kalama Springs											
				NF Lewis Falls	Cedar Creek	Index ¹¹	WDFW	State GFS/ SRF Board							
				NF Lewis Springs											
				EF Lewis Falls	EF Lewis	Pro-posed	WDFW	GF-S							
				Washougal Falls											
			Chum	EF Lewis	EF Lewis	Pro-posed	WDFW	GF-S							
				Washougal											
			Coho	N/A	Cowlitz Falls	Produ- ction	WDFW	Tacoma PUD		Upper Cowlitz	NA ⁸		Tacoma PUD		
		Mayfield Dam	Index	WDFW	Tacoma PUD										

Statewide Monitoring of listed species - Juveniles & Adults												
				Proposed for FY07-09 GF-S Funding								
				Proposed for FY07-09 GF-S and submitted for BPA funding								
				Submitted for BPA funding								
2/13/2007 10:34												
Recovery Region	Major Population Groups	WRIAs	Target Species	Primary Populations ¹⁶	Juveniles				Adults			
					Smolt Sites	Production Index ²	Smolt Trapping Agency	Funding	Spawners (Stocks)	Data Quality ³	Monitoring Agency	Funding
Lower Columbia	Cascade			Lower Cowlitz								
				SF Toutle								
				NF Toutle								
				Coweeman	Coweeman	<i>Pro- posed</i>	WDFW	GF-S, Mitchell Act				
				N/A	Cedar Creek	Produ ction	WDFW	GF-S, SRFB	Lewis	N/A ^{5,9}		
				<i>EF Lewis</i>	<i>EF Lewis</i>	<i>Pro- posed</i>	WDFW	GF-S	<i>EF Lewis</i>	<i>propo sed</i>		<i>NPCC BPA, GF- S</i>
			Steel- head	N/A	Cowlitz Falls	Produ ction	WDFW	Tacoma PUD	Upper Cowlitz winter	NA ⁸		Tacoma PUD
					Mayfield Dam	Index	WDFW	Tacoma PUD				
				SF Toutle Winters								
				NF Toutle Winters								
				<i>Coweeman Winters</i>	<i>Coweeman</i>	<i>Pro- posed</i>	WDFW	GF-S, Mitchell Act				
				Kalama Winters	Kalama River	Produ ction	WDFW	Mitchell Act (NMFS-NOAA)	Excel- lent			Mitchell Act

Statewide Monitoring of listed species - Juveniles & Adults												
					Proposed for FY07-09 GF-S Funding							
					Proposed for FY07-09 GF-S and submitted for BPA funding							
					Submitted for BPA funding							
2/13/2007 10:34												
Recovery Region	Major Population Groups	WRIAs	Target Species	Primary Populations ¹⁶	Juveniles				Adults			
					Smolt Sites	Production Index ²	Smolt Trapping Agency	Funding	Spawners (Stocks)	Data Quality ³	Monitoring Agency	Funding
												(NMFS-NOAA)
				Kalama Summers					Kalama winter	Good		
				N/A	Cedar Creek	Production	WDFW	GF-S, SRFB	NF Lewis summer	N/A ^{5,9}		State GFS/ SRF Brd
									NF Lewis winter	Just starting		
				EF Lewis Winters	EF Lewis	Proposed	WDFW	GF-S				
				EF Lewis Summers	EF Lewis	Proposed	WDFW	GF-S				
				Washougal Summers								
Gorge	29	Chinook	N/A	NONE ¹⁰					Wind Tule Fall	Good		
									Wind Springs ¹⁰	Poor		
									Wind Bright Fall	Poor		
									White Salmon Tule Fall			
									White Salmon Bright Fall			

Statewide Monitoring of listed species - Juveniles & Adults																
						Proposed for FY07-09 GF-S Funding										
						Proposed for FY07-09 GF-S and submitted for BPA funding										
					Submitted for BPA funding											
2/13/2007 10:34																
Recovery Region	Major Population Groups	WRIAs	Target Species	Primary Populations ¹⁶	Juveniles					Adults						
					Smolt Sites	Production Index ²	Smolt Trapping Agency	Funding		Spawners (Stocks)	Data Quality ³	Monitoring Agency	Funding			
		Gorge	Chum	Lower Gorge	Duncan Creek	Produ ction	WDFW	NPCC/B PA		Duncan Creek						
					Hamilton Creek		USFS	Federal: Forest Service								
					Hardy Creek		USFS		Hardy Creek							
			Coho	Lower Gorge												
				Upper Gorge	Wind River ¹¹	Index	WDFW	NPCC/B PA		Bonneville Tributaries	Fair					
			Steel-head	Lower Gorge Winters												
				Upper Gorge Summers	Wind River	Produ ction	WDFW	NPCC/B PA		Wind summer	Good					
										Wind winter	NONE					
		Middle Columbia	Eastslope	29 to 31	Steel-head	Klickitat summer	Klickitat River ¹¹	Index	Yakama	Tribal (NPCC/B PA)		Klickitat summer				Tribal (NPCC/B PA)
										Klickitat winter						
										Rock Creek summer						

Statewide Monitoring of listed species - Juveniles & Adults														
						Proposed for FY07-09 GF-S Funding								
						Proposed for FY07-09 GF-S and submitted for BPA funding								
						Submitted for BPA funding								
2/13/2007 10:34														
Recovery Region	Major Population Groups	WRIAs	Target Species	Primary Populations ¹⁶	Juveniles					Adults				
					Smolt Sites	Production Index ²	Smolt Trapping Agency	Funding		Spawners (Stocks)	Data Quality ³	Monitoring Agency	Funding	
	Yakima	37 to 39	Steel- head	Satus Creek summer	Yakima River (Prosser Dam a.k.a. Chandler Juv. Eval. Facility)	Produ- ction	Yakama	Tribal (NPCC/B PA)		Satus Creek summer	NA		Tribal (NPCC/B PA)	
				Toppenish Creek summer					Toppenish Creek summer	NA		Tribal (NPCC/B PA)		
				Naches summer ²⁰					Naches summer	NA		WDFW 50%; USFS 50%		
				Upper Yakima summer ²⁰					Upper Yakima summer	NA		Tribal (NPCC/B PA); USBR		
	Walla Walla	32	Steelhe- ad	Walla Walla	Walla Walla ¹³	Produ- ction	Umatilla	Tribal		Walla Walla summer	poor in WA	CTUIR, WDFW	NPCC/B PA	
				Touchet	Touchet	Prop- osed ¹⁵	WDFW	NPCC BPA, GF-S	Touchet summer	Fair- index	WDFW	LSRCP+ BPA		

Statewide Monitoring of listed species - Juveniles & Adults														
					Proposed for FY07-09 GF-S Funding									
					Proposed for FY07-09 GF-S and submitted for BPA funding									
					Submitted for BPA funding									
2/13/2007 10:34														
Recovery Region	Major Population Groups	WRIAs	Target Species	Primary Populations ¹⁶	Juveniles				Adults					
					Smolt Sites	Production Index ²	Smolt Trapping Agency	Funding	Spawners (Stocks)	Data Quality ³	Monitoring Agency	Funding		
Snake	Lower Snake ¹⁴	33 to 35	Chinook	Tucannon Spring	Tucannon River	Production	WDFW	NPCC/BPA	Tucannon spring	Good	WDFW	LSRCP/BPA		
				Asotin Spring	Asotin Creek	Production	WDFW	BPA	Snake fall	Good	WDFW	LSRCP/BPA		
			Steelhead	Tucannon Summer	Tucannon River	Production	WDFW	BPA	Asotin Spring	Fair	WDFW	LSRCP/BPA		
				Asotin Summer	Asotin Creek	Production	WDFW	BPA	Tucannon summer	Fair	WDFW	LSRCP/BPA		
								Asotin Co. Conservation Dist			WDFW	Asotin Co. Conservation Dist//BPA		
			Grande Ronde		Chinook	Wenaha Spring	Grand Ronde	Index ¹⁹	WDFW/ODFW	PSMFC	Wenaha Sprng	Fair	ODFW/CTUIR	NPCC/BPA
					Steelhead	Joseph Summer				NPCC/BPA GF-S	Joseph Summer	Fair	ODFW	NA
	Lower Grande Ronde Summer					Cottonwood Creek				Fair	WDFW	LSRCP/BPA		

Statewide Monitoring of listed species - Juveniles & Adults														
						Proposed for FY07-09 GF-S Funding								
						Proposed for FY07-09 GF-S and submitted for BPA funding								
2/13/2007 10:34														
Recovery Region	Major Population Groups	WRIAs	Target Species	Primary Populations ¹⁶	Juveniles					Adults				
					Smolt Sites	Production Index ²	Smolt Trapping Agency	Funding		Spawners (Stocks)	Data Quality ³	Monitoring Agency	Funding	
Upper Columbia	East Cascades	45 46 & 48	Chinook	Wenatchee Spring	Wenatchee	Produ ction	WDFW	Chelan Co PUD		Chiwawa spring	Excel- lent		Chelan Co PUD	
								NMFS- NOAA	Nason Creek spring	Excel- lent		Chelan Co PUD		
								NPCC BPA	Little Wenatchee spring	Excel- lent		Chelan Co PUD		
									White River spring	Excel- lent		Chelan Co PUD		
	East Cascades		Chinook	Entiat Spring	Entiat	Produ ction	USFWS	Federal (DOI)		Entiat spring	Good			
				Methow spring	Methow	Produ ction	WDFW	Douglas Co PUD	Methow spring	Excel- lent		Douglas Co PUD		
									Twisp spring	Excel- lent				
									Chewuch spring	Excel- lent				
			Lost River spring						Excel- lent					
			Steelhe ad	Wenatchee summer	Wenatchee	Produ ction	WDFW	Chelan Co PUD NMFS-NOAA NPCC/BPA		Fair		Chelan Co PUD		
				Entiat Summer	Entiat	Produ ction	USFWS	Federal (DOI)		Entiat Summer	Fair			

Statewide Monitoring of listed species - Juveniles & Adults														
						Proposed for FY07-09 GF-S Funding								
						Proposed for FY07-09 GF-S and submitted for BPA funding								
						Submitted for BPA funding								
2/13/2007 10:34														
Recovery Region	Major Population Groups	WRIAs	Target Species	Primary Populations ¹⁶	Juveniles					Adults				
					Smolt Sites	Production Index ²	Smolt Trapping Agency	Funding			Spawners (Stocks)	Data Quality ³	Monitoring Agency	Funding
				Methow summer	Methow	Produ ction	WDFW	Douglas Co PUD						
				Okanogan summer	Okanogan ¹⁸	Produ ction	Okan- ogan Tribe	BPA		Methow/Okan- ogan summer	Good			Douglas Co PUD