

# **Overview**

## **of Federal Hydrosystem Proposals and Analyses**

**Federal Actions to Advance Recovery  
for ESA-listed Salmon and Steelhead  
in the Columbia River Basin**

**Federal Columbia River  
Power System Action Agencies**

**August 2007**

# An Overview of Federal Hydrosystem Proposals and Analyses

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### **Introduction: Response to Judicial Rulings**

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In October 2005, U.S. District Court Judge James Redden remanded the 2004 Federal Columbia River Power System (FCRPS) Biological Opinion (BiOp) to National Marine Fisheries Service (NMFS.) He directed NMFS and the action agencies – the U.S. Army Corps of Engineers, Bonneville Power Administration and the Bureau of Reclamation – to collaborate with state and tribal sovereign parties to develop new actions, as part of the FCRPS operations plan, to help advance the recovery of Columbia River Basin salmon and steelhead listed under the Endangered Species Act (ESA).

Using results from this collaboration and guided by Judge Redden’s rulings, the action agencies have developed a new proposed Reasonable and Prudent Alternative (proposed action).<sup>1</sup> The proposed action describes how the action agencies will operate and maintain the FCRPS, emphasizing the survival and recovery needs of these fish. Based on a comprehensive analysis that looks at each listed stock and the individual populations within those stocks, the proposed action includes strategies to address the unique needs of each of the stocks. It includes new or expanded commitments in many areas to address the factors that limit recovery at all stages of the salmon and steelhead lifecycle.

This overview describes the development of the new proposed action. Beginning with a description of the context for this proposed action, it outlines the improvements to the hydrosystem over the past several years and the broader context of the region’s efforts to advance salmon and steelhead recovery in the Columbia River Basin. It describes the action agencies’ response to Judge Redden’s rulings, including the sovereign collaboration process and considerations in development

In the Columbia River Basin, federal hydro operations affect 13 species of ESA-listed salmon and steelhead.

Under the ESA, the action agencies – in this case the Corps of Engineers, the Bureau of Reclamation and the Bonneville Power Administration – submit a Biological Assessment to NMFS. The BA outlines the how the agencies propose to operate the FCRPS and their assessment of the biological consequences of those actions for listed species.

NMFS evaluates the proposals and renders a Biological Opinion. The primary goal is to ensure that the action doesn’t appreciably reduce the likelihood of survival and recovery of the listed species.

The federal action must also avoid adverse modification of habitat that has been designated as critical for a listed species.

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<sup>1</sup> Although substantial improvements have been made in the operation and configuration of the hydrosystem, and survival rates at the projects have improved significantly, the existence and operation of the FCRPS alone is likely to result in a jeopardy finding from NMFS for all ESUs unless improvements are undertaken in tributary and estuary habitat, predator management and hatcheries management. So, rather than submit a proposed hydro operation and then have NMFS suggest mitigation in the form of an RPA, the action agencies have instead proposed an RPA that includes the hydro operation and a full mitigation package, developed in collaboration under the remand.

of biological objectives, strategies and analyses. It summarizes the portfolio of actions to benefit ESA-listed fish, which will become part of the overall FCRPS multi-purpose operating plan. Finally, it sets out the agencies' implementation commitments, including performance standards, regional checks and balances and funding.

The action agencies have submitted the proposed action and comprehensive analysis to NMFS, which will conduct its own independent analysis of the actions. NMFS' scientific review will determine whether the proposed action will avoid jeopardy to the listed species.

The new proposed action differs from the action implemented under the 2004 FCRPS Biological Opinion in several important ways:

- **Collaboration among federal agencies, states and tribes** in the design of the proposed action has helped increase regional support and produce a better plan. The proposed action includes a provision to continue that collaboration long-term to monitor implementation and continue to improve actions to ensure biological performance objectives are achieved.
- A **comprehensive analysis of the salmon lifecycle**, conducted down to the population level, based on the best available science and the most recent data from technical recovery teams. This analysis focuses on the biological needs of the fish (key "limiting factors.")
- A **broader analysis of actions affecting ESA-listed fish**, including federal actions that have undergone section 7 consultation and other non-federal actions that are reasonably certain to occur.
- Identification of a logical **10-step framework process**, developed in collaboration with the states and tribes, used to help develop actions based on the status and biological needs of listed fish.
- A **portfolio of "All H" (hydro, habitat, hatcheries and harvest, as well as predator management) strategies**, based on clear biological objectives and projected to improve the survival of listed fish and contribute toward their recovery.
- An **extensive research, monitoring and evaluation program**, coordinated with regional parties and designed to address the status of the fish, effectiveness of actions and critical uncertainties using the most current scientific information and techniques.
- **Evaluation of benefits of habitat improvements and hatchery reform** based on the best available scientific information and expert opinion, to ensure the appropriate focus in the proposed action.
- Development of a **new peer-reviewed fish passage model** using the most recent empirical information to assess the effectiveness of modifications to the hydro system. This model allowed assessment of spill and flow strategies developed by states and tribes.

The ESA also requires that NMFS develop long-term recovery plans for listed species. NMFS is working with local stakeholder teams to develop long-term plans for listed Columbia Basin fish runs.

Ultimately, the goal of recovery plans is to recover listed species and restore their ecosystems to the point that protections under the ESA are no longer needed.

The FCRPS BiOp will provide a solid foundation to support this long-term recovery of salmon and steelhead in the Columbia River Basin.

Judge Redden's rulings also emphasized that the proposed action must be reasonably certain to occur. The action agencies are committed to implementing this proposed action and are preparing to mobilize and utilize the full range of our technical and programmatic expertise to do so.

The analysis used to develop this portfolio of actions looked at the total lifecycle of the fish – from spawning and rearing in streams and tributaries, to migration through the mainstem and into the ocean, through their return to the tributaries to spawn. This approach yields an “all-H” portfolio of actions and improvements at all stages of the salmon and steelhead's complex lifecycle. Actions in the hydrosystem, habitat, hatcheries, predator management and – where the action agencies can support innovative voluntary actions – in harvest, are designed to ensure the survival of listed fish and close the gap between existing conditions and those required to support a trend to recovery for listed stocks.

Hundreds of technical experts, planners and policy makers over many months have produced this comprehensive set of measures, proposed for a 10-year period:

- **Hydro** – Improvements to the hydro system, including water management operations, dam modifications, spill, juvenile transport improvements and operations and maintenance activities, to improve juvenile passage survival and adult returns;
- **Habitat** – A significantly expanded program that will protect and improve tributary and estuary habitat based on specific biological needs of the fish;
- **Hatcheries** – New or expanded facilities for safety net and conservation programs to promote recovery; further actions to improve steelhead productivity (kelt reconditioning, local broodstocks); and support of implementation of hatchery reforms to reduce impacts on listed fish;
- **Predator management** – Expanded efforts to reduce the level of juvenile and adult salmon losses from avian, fish and marine mammal predators.

To ensure that the proposed action continues to be effective in achieving desired biological results for fish, the plan emphasizes the action agencies' commitment to new and higher **performance standards at multiple levels**. This provides needed certainty and demonstrates the agencies' commitment to achieving results. In addition, the proposed action include **an extensive research, monitoring and evaluation program** to address the status of the fish, the effectiveness of actions and critical uncertainties.

This portfolio of actions reflects the reality that there is no simple solution to the complex problems affecting fish throughout the Columbia River Basin. The program is dynamic and evolving based on new information regarding biological results. Even now, discussions continue with other regional parties that may further strengthen this plan.

## **Part 1: The Context for the Proposed Action – Recovery Goals, Biological Objectives and All H Strategies**

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The FCRPS proposed action is just one piece of a larger recovery effort throughout the Columbia River Basin. The proposed action builds upon what has been done to date as well as the current and future actions of others.

### **Long-Term Regional Recovery Goals**

Throughout the period of the FCRPS consultation, NMFS and local planning entities have been working concurrently on long-term recovery plans. These locally-driven efforts have been guided by scientists appointed to Technical Recovery Teams (TRTs) as well as four salmon recovery boards in Washington, three stakeholder groups in Oregon and a state-wide involvement process in Idaho. Collectively, they directly involve over 300 participants including watershed councils, Tribal representatives, federal land management agencies, agricultural organizations, irrigation districts, state agencies, city and county jurisdictions and interested citizens. NMFS has approved the recovery plan for the Lower Columbia and expects to adopt recovery plans for the Upper Columbia, Snake and Middle Columbia regions by the end of 2008.

In the comprehensive analysis for each Evolutionarily Significant Unit (ESU), the action agencies attempt to assess the region's progress toward recovery in some detail. Determining the overall effectiveness of actions by the FCRPS and others is challenging for a number of reasons. To truly understand an action's impact often requires years of data, and many efforts have not been in place long enough to have a complete understanding of their effects. Highly variable ocean conditions also confound our ability to understand the direct impact of actions in the rivers.

As a starting point for those assessments, the action agencies used data developed by the Interior Columbia Basin TRTs for the seven listed ESUs (and DPSs) in the Interior Columbia River basin. For the Lower Columbia and Willamette River ESUs, the assessment was more qualitative because data are much more limited.

The charts in Part 3 starting on p. 16 show the abundance trends for each of the interior ESUs using the most recent data available for our analysis. The charts also compare NMFS' 2002 interim recovery goals with annual adult returns. (NMFS has not yet formally adopted delisting goals for the listed fish in the Columbia River Basin.)

Achieving full ESA and broader recovery goals in the Columbia River Basin will require the commitments made in this FCRPS proposed action and the many other ESA consultations and programs that address the needs of the listed fish. It will certainly require a longer time than the 10 years covered by the proposed action. It will need to address all the factors that have affected the decline of the listed salmon and steelhead – the federal hydropower system as well as other non-federal hydro and irrigation dams, habitat degradation, hatchery effects, actions by various predator species, other human activities and, depending on the species, harvest. This will require the efforts of many in the region beyond the action agencies, including the regional recovery planning organizations, the Northwest Power and Conservation Council (Council) and the many programs operated by state and tribal entities.

## Biological Objectives and All H Strategies

In developing actions through the collaboration, the action agencies took into account a number of guiding principles. First, we focused on the biological needs and environmental factors limiting the survival and recovery for each species (limiting factors.) We considered the relative magnitude of the FCRPS effects, compared to the other effects, in identifying appropriate strategies. The actions were designed to take an ecosystem approach, considering the needs of all the species. Finally, actions on the hydrosystem as well as in habitat, hatchery, predator management and harvest were based on approaches that could be shown to be biologically sound. Where different approaches were shown to yield similar results for the fish, we proposed the least cost strategy.

**Building on progress to date:** The resulting portfolio of measures in the FCRPS proposed action represents the culmination of fundamental changes in the region's approach to hydrosystem mitigation and operation since the 2000 FCRPS BiOp. These measures, which extend over the period 2007-2017, build on the action agencies' progress to date in "overhauling" the structure and operation of the FCRPS since court rulings in 1994.

A program once characterized by Judge Marsh as "small steps, minor improvements and adjustments" has made significant changes, including a number of improvements and additions to fish passage facilities, operational changes in flow, spill and the juvenile transportation program and aggressive predator management. Over \$1 billion has been invested from the mid-1990s through 2006 in research, development and testing of prototype improvements and construction of new facilities and upgrades. The improvements in the physical facilities, along with improvements in the flow and spill programs, have delivered real improvements in both juvenile survival numbers and adult returns.

Since 1994, significant structural changes, innovative techniques and capital improvements have been made to **reconfigure the dam system** to improve passage conditions for adult and juvenile fish. For example, highly effective bypass collectors and flumes were added at Bonneville Dam and removable spillway weirs (RSWs) have been installed at Lower Granite and Ice Harbor dams. These systems now provide more efficient surface passage routes for migrating juveniles.

There have also been changes in the operation of the system year round to **augment flows for juvenile fish migration**. Fish operations draw on up to five million acre feet (MAF) of stored water annually – about one-sixth of the 32 MAF of storage in U.S. reservoirs in the FCRPS and storage in Canadian reservoirs. An objective of fish operations today is to provide flows in a more natural pattern or hydrograph, to the extent that the design of the system to meet multiple purpose responsibilities will allow.

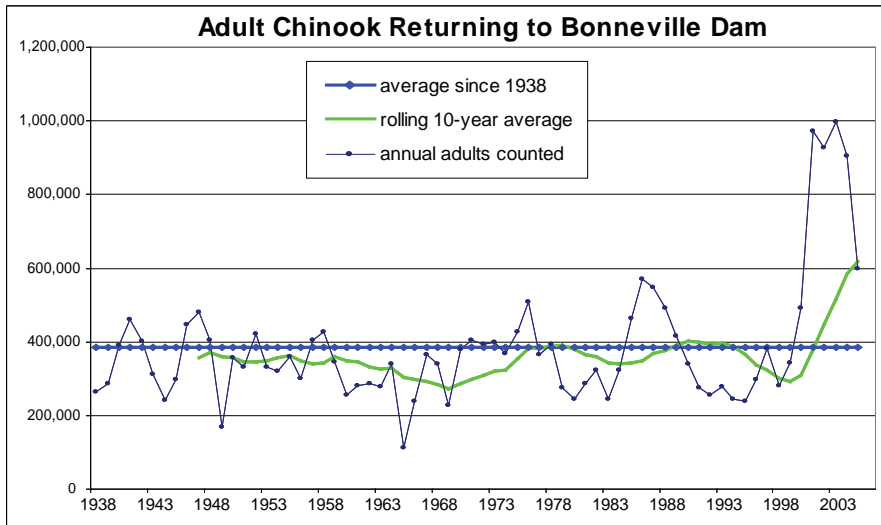
**Spill** is provided throughout the juvenile fish migration to help the fish get safely past the dams on their way to the ocean. The action agencies have continued to evaluate the effectiveness of different spill regimes, and as biological results became available, we have increased the amount and timing to provide more benefits to fish. Today, generation of electricity from the FCRPS has been reduced by more than 900 average annual megawatts to provide flow and spill for juvenile fish migration.

These operations have yielded important benefits for fish:

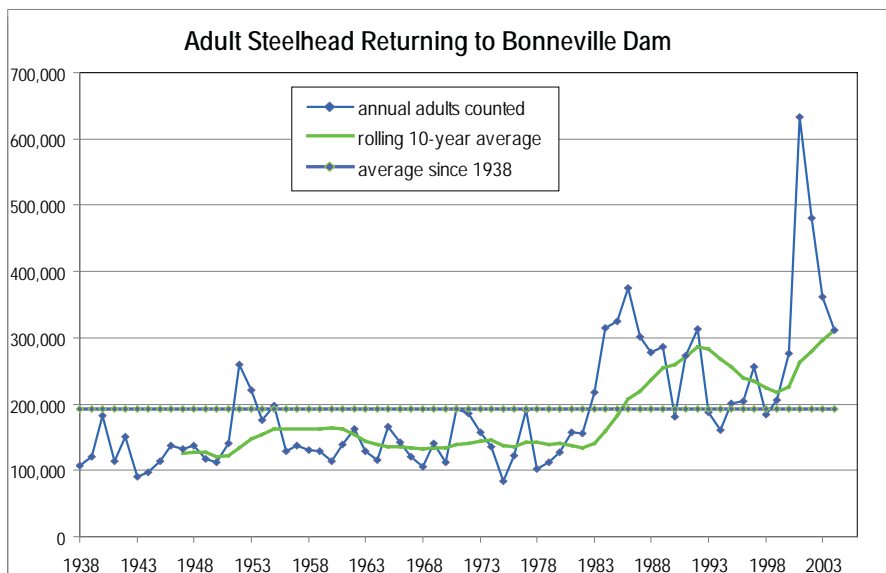
- At dams with RSWs, juvenile passage has been improved, including reductions in fish passage delay and significant increases in dam survival (e.g., biological studies at Bonneville Dam indicate corner collector survival is near 100 percent.)

- Increased survival of Snake River fish through the hydrosystem is now equivalent to what it was in the 1960s, when only four federal dams were in place on the Columbia and lower Snake.
- Recent adult salmonid travel times and passage rates are similar to those during early development of the FCRPS when fewer dams were in place and the Snake River was free flowing.

And, while many other factors contribute to fish survival and recovery, the number of adult salmon and steelhead returning to Bonneville Dam is encouraging. (See Fig. 1-2.)



**Figure 1.** Numbers of adult Chinook salmon (wild and hatchery) returning to Bonneville Dam, 1938–2006.



**Figure 2.** Numbers of adult steelhead (wild and hatchery) returning to Bonneville Dam, 1938-2006.

The proposed action continues the approach of using the best available information, combined with knowledge gained through past implementation of actions, to further improve juvenile survival through all routes of passage at mainstem dams.

As dams have been made safer for the fish, the biological benefit gained from each incremental improvement is less and less. Greater gains may be made in protecting and improving habitat, reforming and improving hatchery and harvest practices, and managing predators. The All H Strategy reflects this awareness. Here, too, the action agencies have made substantial and increasing commitments. Starting in 2001, we have increased our efforts in **“off site mitigation,”** addressing impacts that could not be mitigated in the hydrosystem. Accomplishments on the ground between 2001 and 2005 are notable:

- restoring fish access to 1,280 miles of tributary habitat
- securing over 500 cubic feet per second (cfs) of additional water in tributaries
- installing or retrofitting fish screens on more than 85 water diversions
- acquiring and protecting more than 600 acres of habitat in the estuary
- protecting or improving more than 1,000 miles of riparian habitat
- removing over 2.8 million northern pikeminnow from the Columbia River, reducing their consumption of juvenile salmon by about 30 percent
- reducing consumption of juvenile salmon by Caspian terns (from 15 million in 1999 to 3.6 million in 2005)
- reducing extinction risk of populations of Snake River sockeye, Snake River spring/summer Chinook, Snake River fall Chinook and steelhead and mid- and lower Columbia steelhead with safety-net hatchery programs

In the past two years (2006-07), these programs have continued and expanded, so today the on-the-ground results are even greater than described above. Collectively, these strategies for the hydrosystem and “off-site” mitigation have contributed to the improved prospects for ESA-listed fish that we see today.

**All-H strategies in the new proposed action:** The new proposed action continues commitments to improve juvenile fish survival and adult fish returns using water management, dam modification, spill and transportation improvement and fish facility operations and maintenance strategies. They include new and expanded commitments for habitat, hatchery and predator control actions. These strategies are described in more detail in Part 4.



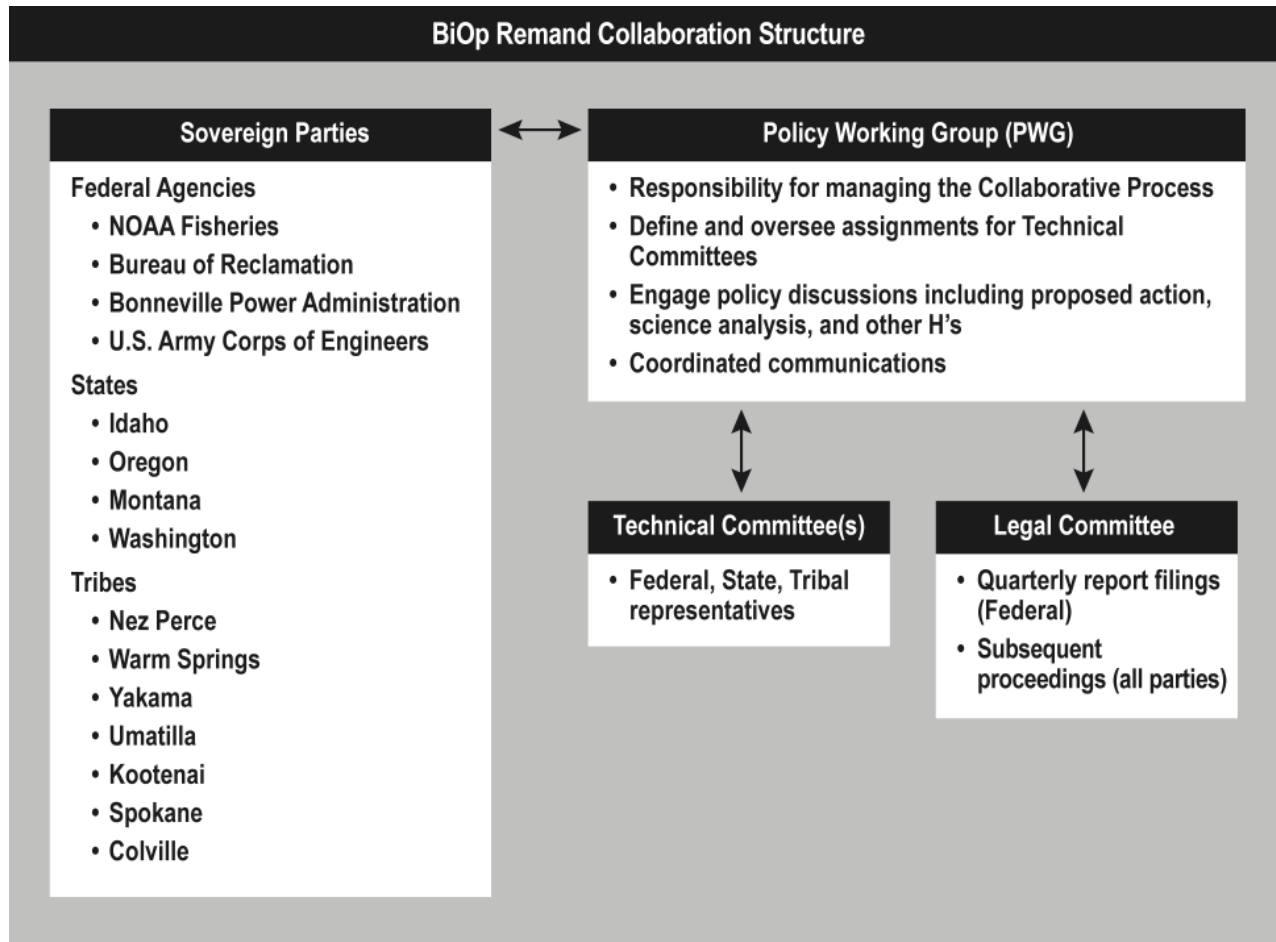


**Figure 3. Overview of strategies and objectives.** Working with the collaboration parties, the action agencies identified biological objectives, strategies and actions for ESUs affected by the FCRPS. The proposed action includes specific commitments for hydro, habitat, hatchery and predation management actions that are designed to improve the survival of the listed stocks and to support a trend to recovery.

## Part 2: The Regional Collaboration Process

The sovereign collaboration was a unique feature of this FCRPS proposed action. Judge Redden’s directions to the federal agencies were to collaborate with states and tribes to develop components of the proposed action, clarify policy issues and reach agreement or narrow disagreement on scientific and technical information. The sovereigns set up a collaboration structure led by a Policy Working Group (PWG), made up of one representative of each of the sovereign parties. The PWG was supported by thirteen technical and policy workgroups.

The remand collaboration structure is shown below:



**Figure 4. Remand collaboration structure.** The proposed action is a culmination of over two years of work, involving more than 150 participants.

While the PWG discussions were confidential, meetings of the technical working groups were open to other parties to the litigation. The PWG also provided ten briefings and discussions with other parties to the litigation at key milestones to keep them informed and to seek their comments. To readily share materials and information, the PWG created a collaborative website, which serves as a resource to over 320 users. There have been over 272 PWG and workgroup meetings involving more than 150 participants.

The PWG adopted a 10-step process, referred to as a “Conceptual Framework,” to guide the collaboration discussions. The framework can be seen as one approach for evaluating the appropriate contribution of the FCRPS toward long-term recovery. It provided a logical path to assess the impacts of the FCRPS and create a comprehensive and strategic plan to address each listed species’ prospects for recovery. It did this through use of a “gap analysis,” analyzing the difference between the current status of the ESU and the biological objective of fully recovering listed fish – a process that is expected to take decades.

Because the FCRPS has the most impact on the ESUs in the Interior Columbia Basin (i.e., these ESUs migrate through the largest number of FCRPS dams on their way to the ocean and back), the framework discussions in the collaboration process focused on Snake River Chinook salmon, steelhead and sock-eye salmon, Upper Columbia Chinook salmon and steelhead and Middle-Columbia River steelhead.

The steps in the framework were:

- Steps 1 and 2 involved examining information on *desired status and current status*, respectively.
- Steps 3 and 4 involved reviewing *survival “gaps” and estimates of the various human impacts* on listed fish.
- Steps 5 and 6 included examination of *all H actions* by the FCRPS and others, including estimated survival benefits and inventories of state implemented projects.
- Steps 7, 8 and 9 related to *research and monitoring, contingencies and oversight* of implementation.
- Step 10 is the inclusion of all of this collaboration information in NMFS FCRPS BiOp.

Relying on available scientific information and professional judgment, technical workgroups identified potential actions and assessed their possible benefits for inclusion in the proposed action. The habitat workgroup, for example, worked closely with local recovery planners and field experts to test their approaches against actual experience.

## Unresolved Issues

Although there was much agreement, differences of opinion emerged on how to assess some elements of the framework. As the collaboration advanced, it became apparent that complete agreement on the best path forward could not be achieved.

Use and interpretation of science and modeling were at the heart of many of the areas of policy disagreement. Clarifying and understanding the technical details of both salmon biology and complexities involved in operation of the dams and related facilities was also important.

Workgroups were created for the PWG policy issues that remained unresolved, along with possible choices for deliberation. In all, the PWG deliberated on 61 policy issues. For some, they succeeded in narrowing the areas of disagreement. For others, even with scientific data, they continued to have differences. Among the key issues that remained unresolved:

- Hypotheses involving *latent or delayed mortality* attributed to the FCRPS and other factors. The Human Impacts technical group had differing views on the relative effect of hydro and harvest human impacts, particularly the hypotheses about latent or delayed mortality attributable to the hydrosystem. The range of latent mortality estimates hypothesized for the FCRPS was 0-60 percent. When asked to provide input on this issue, the 2007 Independent Science Advisory Board (ISAB) advised that such estimates could not be scientifically verified.
- The *application of the framework steps* themselves, including the application of latent mortality assumptions (low or high) and timing for filling survival gaps (10 years or longer). For the framework analysis, gaps were allocated by H based on human impacts. These differing views result in two different assessments: high framework gaps (assumed high hydro delayed mortality) and low framework gaps (where latent mortality is assumed to be from a mix of natural and “all H” factors).
- The *consideration of dam breaching* as an alternative fish mitigation measure, raising questions of agency authority, biological significance, timing and uncertainty – as well as the potential for adverse biological and other impacts.
- Selection of *priorities for action*, e.g. targeting FCRPS operations and actions to ESUs with the largest survival gaps.
- The appropriate *use of hatchery programs* for the long-term conservation of the ESUs.

Because a unanimous view for all states and tribes was not always achieved, after discussion in the PWG the action agencies made decisions in these areas, supported by the record. We followed the recommendations of the ISAB regarding hypothesized latent mortality – addressing direct, measurable effects of the FCRPS – although not all sovereigns endorse these views.

The action agencies did not include dam breaching in the proposed action because this approach falls outside of our authorities and is by no means “reasonably certain to occur.”

It is also important to note that the action agencies can only take actions within their control, even though other influences may have a big impact on salmon. Harvest levels, climate and ocean conditions – to give the most important examples – are all critical to salmon survival and recovery. The action agencies have no influence on these areas.

The collaboration has contributed to improved understanding among the sovereigns of positions on technical and policy issues. It has added to the breadth of scientific data and knowledge available to understand the condition of the fish and the actions that will be most beneficial for their recovery. The action agencies are proposing to continue this collaboration under the new FCRPS BiOp.

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## **Part 3: The Biological Analysis and ESU Conclusions**

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This proposed action is informed by a comprehensive scientific analysis on the status of the listed Columbia River Basin fish and the factors that limit their recovery.

A Comprehensive Analysis (CA) was prepared in response to Judge Redden’s ruling that the analysis of effects in the 2004 FCRPS BiOp remand be integrated with the analysis of effects for the Upper Snake

River BiOp remand on the listed species and designated critical habitat. While the FCRPS and Upper Snake River projects and facilities are operated independent of each other, these independent actions hydrologically influence flows in the Snake and Columbia Rivers. The CA integrates the effects of the FCRPS and Upper Snake River projects into a quantitative and qualitative biological analysis that considers the prospects for survival and recovery for each ESU or DPS.

## Approach to the Task

The biological objectives for the proposed action are to avoid extinction (i.e., survival) and support a trend to recovery for all ESUs.

The analysis of these biological objectives relies on widely used and commonly accepted salmon and steelhead population “metrics,” as well as new and established analytic tools. Evaluating the many complex human and environmental factors in the basin affecting every life stage of the fish is no simple matter. Uncertainty exists, as with any salmon lifecycle assessment. The action agencies explicitly consider these uncertainties in the CA and address them with a comprehensive research and monitoring program, as well as a carefully considered adaptive management regime.

The biological analysis follows the basic approach used in the 2000 FCRPS BiOp, covering all known factors affecting the lifecycle of listed salmon and steelhead. This includes activities that are in the environmental baseline, as well as the cumulative effects of future federal, state and private actions that are reasonably certain to occur.

The analysis also integrates information developed through Steps 1-6 of the 10-step framework process to look at past, current and prospective actions. The relevant steps in the framework include Goals (Step 1), Current Status (Step 2), Gaps (Step 3), Human Impacts/Limiting Factors (Step 4), Actions and Benefits (Step 5) and Reasonable Certainty (Step 6):

- First, a **base or historical status** of each ESU or DPS was defined, including an assessment of each population based on data developed by the Interior Columbia TRT and used by regional recovery teams, as well as federal, state and tribal fish managers.
- Second, a **current status** was determined by updating the initial base estimates to reflect recent improvements already implemented but not fully reflected in the base conditions – for example, hatchery and hydro improvements.
- Third, an estimate of **prospective status** was developed by adjusting the current condition of the ESU to incorporate survival improvements expected from habitat, hatchery, predation and hydro changes in this plan, as well as actions by others that are reasonably certain to occur. Because this is a lifecycle survival analysis, it necessarily combines all sources of salmon and steelhead mortality in its final conclusions.

The analysis provides a picture of the past, present and expected future environmental status of each ESU. These computations enabled the action agencies to design a portfolio of actions, based on the collaboration work products, that addresses estimated gaps between current and desired status. They provided the information needed to target actions addressing key limiting factors to those populations most in need.

## Metrics and Special Considerations in the Biological Analysis

Following guidance provided by NMFS, the FCRPS action agencies examined multiple indicators of the biological status of listed fish. The goal, briefly, is to use these indicators, or “metrics,” to determine whether individual populations of salmon and steelhead are growing or declining in size. Populations that appear to be declining are targeted for actions intended to improve their status and reverse long-term declines in population size. Because each metric has its own particular strengths and weaknesses, NMFS’ guidance provided that no single metric would constitute a “bright line test.” Rather, the entire spectrum of quantitative and qualitative considerations would be used to assess population status and, ultimately, inform a jeopardy decision based on a qualitative assessment of the ESU’s likely future status.

The action agencies rely primarily on four metrics to evaluate the status of populations within each listed ESU. They are:

- **abundance trend**, or annual change in natural-origin spawners
- **productivity**, expressed as recruit per spawner (R/S), or average number of natural-origin progeny produced per natural- and hatchery-origin spawner (a conservative approach to productivity measurement)
- **population growth rate**, or lambda, the median annual change in total number of natural-origin fish on the spawning grounds. This was the primary metric used in the 2000 FCRPS BiOp.
- **quasi-extinction risk**, based on short-term quasi-extinction probability modeling. Results from this modeling approach are used to help assess near-term (24-year) extinction risk.

In addition, the action agencies have also considered a fifth metric that was developed as part of the remand collaboration:

- **conceptual framework gaps**, or long-term recovery gaps where an FCRPS “portion” has been identified using a range of values. This provides a range of estimated survival improvements, depending on assumptions about latent mortality, deemed by the collaboration to be the FCRPS’ share of long-term regional recovery goals.

These five metrics explore different, but related facets of fish status and prognosis for the future. No single metric tells the whole story. But collectively, they paint a picture of how the ESUs are doing, which populations are in need of more targeted actions, and how the benefits of completed and future actions by the FCRPS and others stack up.

A few aspects of the analysis should be clarified:

**Qualitative considerations:** Most of the quantitative analysis (metrics) of biological effects is based on hydro, habitat and certain categories of hatchery actions implemented by the FCRPS action agencies. Most importantly, the quantitative metrics are almost all associated with individual populations within an ESU. The current and expected future status of an ESU is necessarily determined qualitatively – based in part on the quantitative information developed for the individual populations that make up the ESU. The numbers alone cannot tell the whole story.

Certain aspects of the population-level benefits were considered qualitatively. For instance, the benefits provided by most safety net and conservation hatcheries, future hatchery reforms, completed and reasonably certain to occur habitat actions by others and completed habitat actions by other federal agencies that have undergone section 7 consultation are generally not included in the numerical analysis. Instead, these additional benefits to listed fish are considered qualitatively. In addition, habitat actions that have been implemented and those that will be implemented under the new FCRPS BiOp will continue to contribute benefits for the fish well beyond the 10-year time frame of the actions.

**Recovery metrics:** Generally, a population would be deemed to be “trending toward recovery” if average population growth rates (or productivities) are expected to be greater than 1.0. This indicates that the population is, on average, increasing in size over a given period of time.

While populations that are at low levels of abundance can experience brief spurts of very high productivity in favorable environmental conditions, these periods of higher productivity at low abundance are relatively brief. As a population grows, average productivity will generally decline, stabilizing at about 1.0. This biological analysis considers estimates of *long term* average growth rate (or productivity) and the survival improvements it would take (all other things being equal) to change a long term average growth rate from <1.0 to >1.0. A population that persists with an average growth rate about 1.0 over an extended period of time is, by definition, a population whose size is increasing. It is, in short, on a trend toward recovery.

**ESU level “roll up”:** The quantitative analysis is done at the population level, although ESA determinations are made at the ESU level. ESU-level determinations in the analyses are made qualitatively by “rolling up” the population information based on the available quantitative and qualitative information. An ESU as a whole can show a trend towards recovery even if some populations within the ESU do not. This is because not all populations within an ESU have the same timeline or likelihood for attaining full recovery.

**Spatial structure and genetic diversity:** The primary quantitative considerations in the biological analysis are abundance and productivity. However, conserving and rebuilding salmon and steelhead populations involves more than achieving abundance and productivity goals. Accordingly, NMFS has developed a Viable Salmonid Population concept (VSP) which lays out four key characteristics for evaluating population status: abundance, productivity (or population growth rate), biological diversity and population spatial structure. It must be stressed that the ability to significantly improve either a species’ biological diversity or its spatial structure and distribution is limited within the timeframe of the action agencies’ proposed action. That said, the biological analysis is informed by consideration of the VSP parameters and VSP risk ratings developed by the relevant TRTs.

**Key uncertainties:** The range of uncertainty around the metrics used in the CA is quite large. As noted above, the CA explicitly considers this uncertainty, generally expressing it in the form of confidence intervals or standard errors associated with the point estimates used in the biological analysis. In addition to the uncertainties in the data, the analysis and the proposed action attempt to address a key environmental uncertainty: the potential effects of future climate change on Columbia River Basin salmon and steelhead populations.

A number of reports have recently addressed the potential effects on listed fish of climate change in the Pacific Northwest and the Columbia River Basin. The action agencies recognize that climate change

could pose an additional threat to the survival and recovery of ESA-listed species during the term of the FCRPS BiOp, and consequently we have taken steps to ensure that the implications of these potential changes for ESA-listed salmon and steelhead are considered. To a significant extent, the proposed action address potential impacts of climate change with provisions for dry years, predator management and habitat protection and improvements. In addition, under the action agencies' adaptive management approach and through contingencies, we will continually monitor and assess potential climate change impacts on hydrological and fish conditions and provide a mechanism to implement actions if appropriate.

Ocean conditions have a significant impact on salmon productivity. Pacific Northwest salmon populations are most productive during periods of relatively low ocean water temperatures and strong near-shore ocean upwelling in the spring and summer. Periods of poor ocean productivity are closely linked to poor salmon returns. The biological analysis takes a relatively pessimistic view of future ocean conditions, thus its approach is conservative.

## Conclusions from the Comprehensive Analysis

Using the biological analysis and incorporating the implementation of historical, current and prospective actions, the action agencies have analyzed the prospective status of each of the interior ESUs.

Based on our assessment of the FCRPS and Upper Snake River actions and analysis of effects, considering the present and future human and natural context, the action agencies conclude that the net effects of the proposed actions, including the existence and operations of the dams with the proposed mitigation, meet or exceed the objectives of doing no harm and contributing to recovery with respect to the ESUs affected by the operation of the FCRPS.

An overview of these findings excerpted from the CA is summarized below.

### Snake River Spring and Summer Chinook Salmon

The focus for Snake River Spring/Summer Chinook salmon is on hydro improvements and habitat restoration in tributaries to address key limiting factors. For populations that are presently being supplemented with hatchery production, the recovery goal contemplates a transition from hatchery to natural production as natural fish recover.

This ESU is likely to survive based on the analysis and considerations articulated in the Observations Section of the CA. The framework analysis indicates that the proposed action fills most gaps at the high and low ends of the framework range for four of the five major population groups (MPGs). And for populations in the Middle Fork Salmon MPG that are not estimated to meet the Framework criteria, the gaps at the low end of the range (which we believe is the appropriate

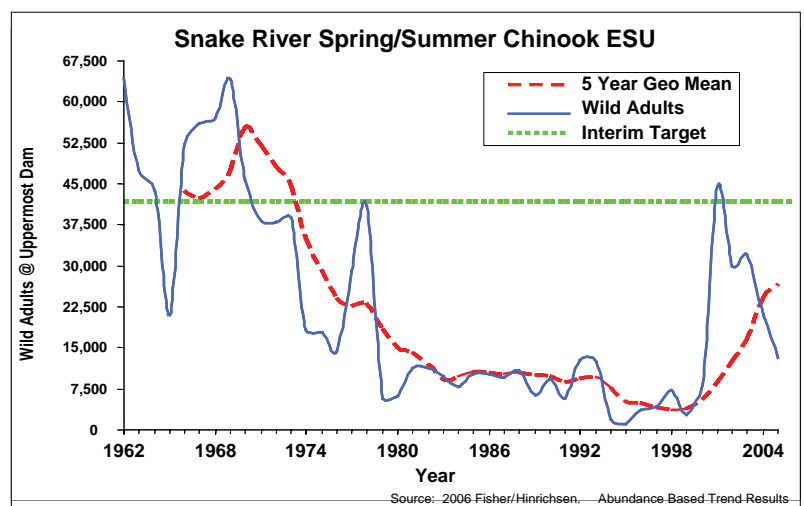


Figure 5. Spring Summer Chinook abundance trends



comparison) are negligible. By and large, we conclude that the proposed action is “in the ball park” with respect to the framework approach, providing a positive indication of the proposed action’s expected effects on this ESU’s prospects for recovery. Nearly all of the populations in this ESU more than satisfy the recovery criteria. For example, of the 23 populations for which recruit-per-spawner estimates are available, 20 are expected to exceed the  $R/S > 1.0$  criterion. The mean expected future  $R/S$  estimate for all 23 of those populations is 1.53. A Chinook salmon population with average  $R/S$  productivity of 1.53 would be expected to triple in size in just under 12 years (assuming density independent, linear growth.)

## Snake River Steelhead

It is not possible to fully evaluate the effects of the proposed action for most individual populations in this DPS. While the DPS as a whole is likely to survive based on the preponderance of A-run populations, the likelihood appears to be that B-run populations will continue to decline unless mortality is further reduced through additional management actions in one or all of the four Hs (hydro, habitat, harvest and hatcheries.)

Given the high degree of uncertainty regarding the status of this DPS – particularly the B-run populations – a comprehensive research and monitoring effort to better understand status and limiting factors, combined with targeted improvements in tributary habitat, seems the best course.

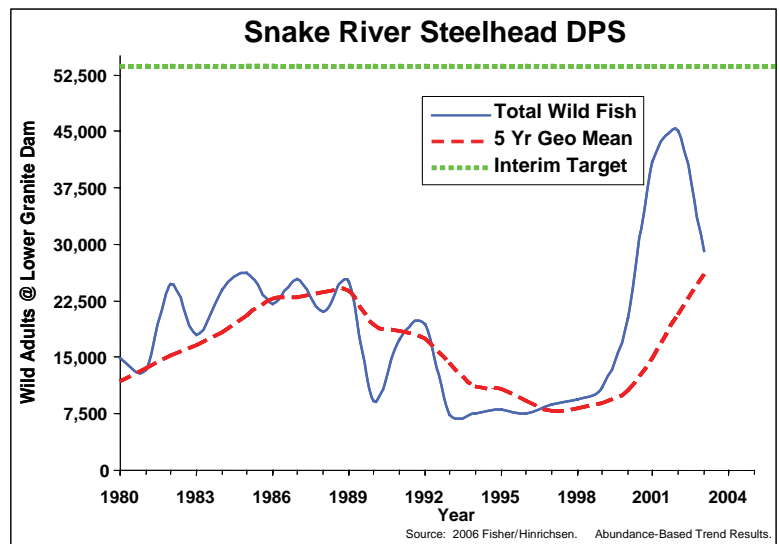


Figure 6. Snake River Steelhead abundance trends

## Upper Columbia River Spring Chinook Salmon

Upper Columbia River Spring Chinook salmon migrate through multiple federal and public utility dams to reach the ocean and hydro improvements will continue to be a focus. Existing and legacy hatchery impacts are a factor and degraded habitat has limited natural production potential, so actions also focus on hatchery reform and repair of habitat. A program to reintroduce spring Chinook salmon in the Okanogan River is proposed to increase diversity and abundance.

The results of the analysis suggest that 24-year extinction is a low likelihood for all three populations in this ESU. The prospective effects analysis indicates that  $R/S$  productivity is likely to be  $> 1.39$  for the Entiat and Methow populations, and about 1.14 for the Wenatchee population after the effects of the action are realized.

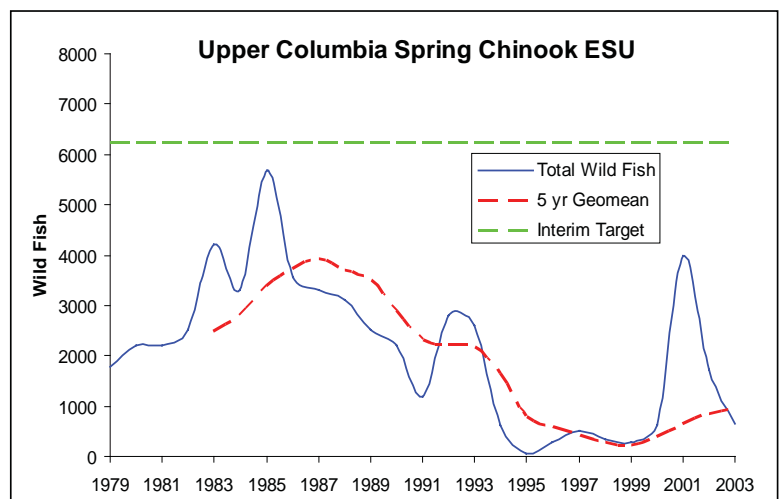


Figure 7. Upper Columbia Spring Chinook abundance trends

The framework analysis indicates that the proposed action more than fills both the high and low framework gaps, providing a positive indication of the proposed action’s effects on this ESU’s prospects for recovery.

## Upper Columbia River Steelhead

Hydrosystem survival, hatchery practices and habitat degradation are key limiting factors for this ESU. Hydro actions, water acquisitions and other habitat improvements will be implemented. Hatchery reforms are expected to correct generations of interbreeding of hatchery and native stocks.

Our analysis indicates that this DPS is likely to survive in the near term. We expect that ongoing and improved hatchery supplementation practices will lead to an increase in population productivity that, when combined with improvements in survival in the other Hs, should significantly improve the longer-term status of this DPS. However, it could take decades to reverse the significant declines in natural productivity resulting from past hatchery practices and other human impacts. The framework analysis indicates that the proposed action more than fills both the high and low framework gaps, providing a positive indication of the proposed action’s effects on this DPS’s prospects for recovery.

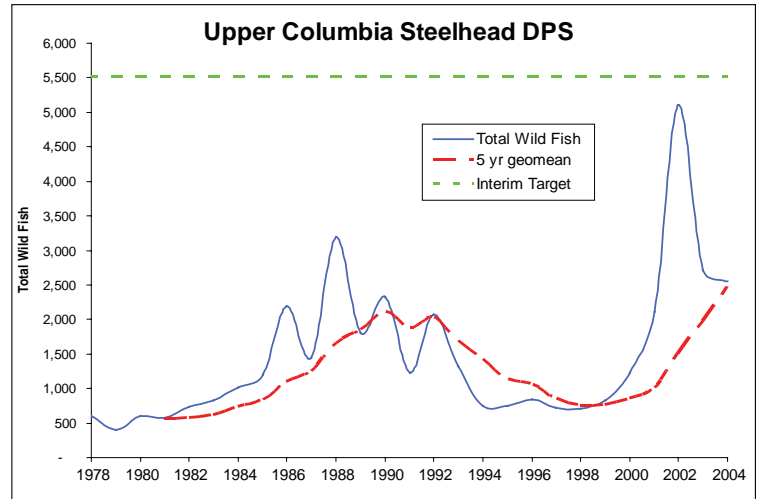


Figure 8. Upper Columbia Steelhead abundance trends

## Snake River Fall Chinook Salmon

Continued hydro improvements and effective fish transportation will continue to be important for this ESU. Supplementation programs have helped to increase the number of natural spawners from several hundred to several thousand. Harvest impacts on this ESU are significant; the combined ocean and freshwater harvest rate has been between 35 to 45 percent for the last six years. Finally, quantity and quality of estuary habitat is especially important to fall Chinook juvenile salmon that over-winter below Bonneville Dam.

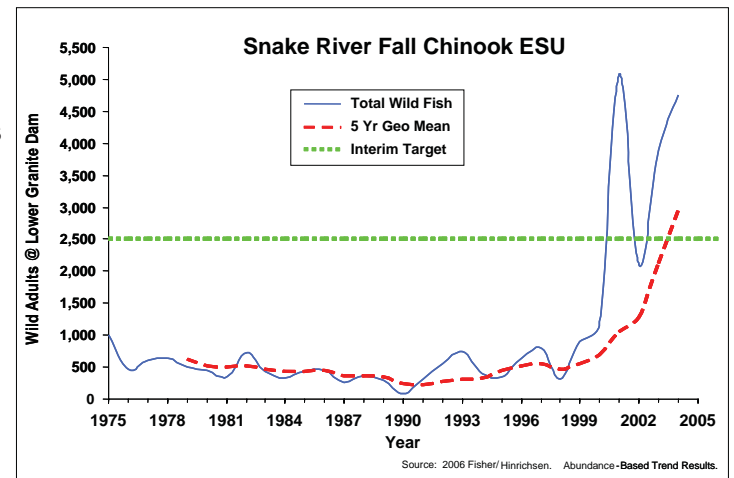


Figure 9. Snake River Fall Chinook abundance trends

All three metrics of productivity indicate that this population is replacing itself and growing. Moreover, extinction risk for this population is low. Although this population will never return to historic abundance because of the loss of habitat from the construction of the privately-owned Hells Canyon Complex of dams in the late 1950s, it is expected that this population will continue to grow until the currently avail-

able habitat is fully utilized. As noted above, abundance over the most recent five-year period in the Interior Columbia Basin TRT dataset exceeds the interim recovery target for this ESU.

## Middle Columbia River Steelhead

Fish passage through one to four mainstem Columbia River dams, land uses in the tributaries, and three hatcheries in need of improved practices affect this ESU. The proposed action include continued improvements at the dams, habitat restoration and hatchery reform.

The DPS as a whole is likely to survive based on the preponderance of populations at low extinction risk at all QETs. The three populations with moderate to high risk levels show positive recent abundance trends, which are expected to continue and improve based on the estimated effects of the action. R/S productivity is also expected to be greater than 1.0 for these populations, suggesting that despite the modeled risk levels, these populations are likely to survive in the near term. Based on the estimates of remaining gaps summarized in Table 10-7 of the CA, all 15 populations for which there is adequate data are expected to meet the criteria. The results of the framework analysis support this view.

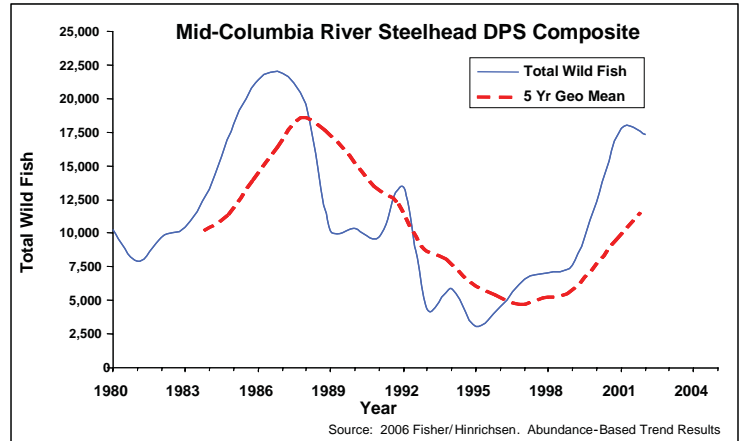


Figure 10. Mid-Columbia River Steelhead abundance trends

## Snake River Sockeye Salmon

Since this ESU was listed, no adults have returned to spawn in some years. In the listing decision, NMFS noted that the ESU may already be extinct. Based on extrapolated data, estimated harvest impact on Snake River Sockeye is 4.5 percent/similar to other Snake River ESUs. Current abundance levels are better, at about 30 fish per year, but the ESU exists primarily due to a captive broodstock or safety net program. The next step in the effort to recover this ESU is a substantial expansion of the captive broodstock program. The action agencies will continue the safety net program through the period of the new BiOp. We will enhance current broodstock by expanding the program capacity to produce between 500,000 and one million smolts to determine whether higher numbers of smolt production may be necessary for meaningful adult returns.

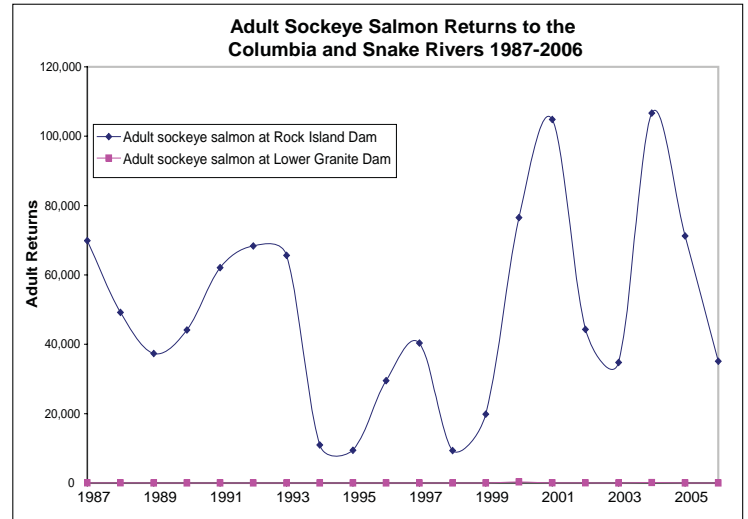


Figure 11. Mid-Columbia River Steelhead abundance trends

As a contingency, if the experimental expanded smolt program fails to meet performance standards, the action agencies will fund implementation of other alternative actions, including reintroduction of Snake River sockeye salmon into Wallowa Lake or establishment of a Snake River sockeye hatchery program below Bonneville Dam that would serve as an “egg bank.”

In addition, the action agencies will explore the feasibility of truck transport of a number of returning sockeye adults from Lower Granite Dam to natural or artificial spawning locations in the Stanley Basin. If feasible, the transportation plan will be developed and serve as guidance for implementation activities.

## **Lower River ESUs**

These ESUs are currently threatened by a broad suite of habitat and ecological factors. Because they do not migrate through the eight federal dams on the Columbia and Lower Snake Rivers, the proposed operation of the FCRPS has a limited impact on these populations, and there is limited potential to improve their status with improvements to FCRPS dams. With the diverse impacts affecting these ESUs, their future status depends on a coordinated effort by many federal and non-federal parties through recovery plan implementation.

The remand collaboration did not develop a method analogous to the framework for assessing the appropriate contribution of FCRPS effects to recovery of Lower Columbia and Willamette River ESUs. In contrast to the interior ESUs where good long-term data sets are available on most populations, data for listed fish in the Lower Columbia and Willamette Rivers are severely limited and subject to a high degree of uncertainty. In particular, a high incidence of hatchery fish has confounded the ability to make accurate assessments of natural population abundance and productivity for many of these listed ESUs.

Significant actions are being implemented both by the FCRPS action agencies and by other local and regional entities to address threats to Lower Columbia listed fish. These actions should further reduce the risk of extinction and improve populations within these ESUs, improving the prospects for their recovery.

## **Assessment of Designated Critical Habitat**

Critical habitat refers to the features of the salmon and steelhead's habitat, such as important spawning and rearing habitat and safe passage through migration corridors that are essential to its survival. Many factors, both human caused and natural, have contributed to the decline of salmon and steelhead over the past century, as well as the conservation value of essential features or primary constituent elements of designated critical habitat. Salmon habitat has been altered through activities such as urban development, logging, livestock grazing, hydropower dams, agriculture and other human activities.

In evaluating the effects of the FCRPS proposed action on designated critical habitat in the mainstem, the FCRPS action agencies considered hydro configuration and operations, fish facility operation and maintenance, water management, improved physical habitat conditions in the estuary and predator management. In tributary habitat, the analysis considered water acquisitions to improve stream flow, screening of water diversions, improved fish passage and access, improved instream habitat and improved riparian conditions.

The evaluation of the likely effects of the FCRPS proposed action on the essential features of designated critical habitat was largely qualitative in nature. The evaluation concluded that, although there is room for improvement, habitat appears to be functioning well enough to support survival and recovery of the listed salmon stocks. This partly reflects the action agencies' efforts to improve mainstem fish passage (through spill and RSWs) and the regionwide effort by multiple parties to improve salmon habitat.

## **Part 4: Details of the FCRPS Proposed Action**

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The lifecycle analysis yielded a comprehensive set of measures that addresses all stages of the salmon and steelhead lifecycle. These measures, as described in the conclusions above, are specifically targeted to the needs of each ESU. This Part summarizes the actions at a higher level.

Using an “all-H” approach, the proposed action includes objectives, strategies, specific actions and commitments in six areas: hydrosystem, habitat (tributary and estuary), hatcheries, harvest, predation management and research, monitoring and evaluation (RM&E.) A 10-year commitment of the action agencies, the benefits of this proposed action will extend over the span of the new FCRPS BiOp and beyond. As new research and monitoring identifies the areas of greatest biological need and key limiting factors, the biological priorities across ESUs and populations in this proposed action will be adjusted, based on performance standards.

### **Hydrosystem Improvements**

The proposed action provides four strategies to improve fish survival through the FCRPS. These focus on commitments for water and flow management; dam modifications; implementation of spill and fish transportation; and operation and maintenance of facilities for fish and fish passage.

#### **What’s New for the Hydrosystem PA?**

##### **Water and Flow Management**

Better defined operating commitments for water management; the Montana operation for listed resident fish; commitments regarding Canadian storage priorities, negotiation and coordination; reporting velocity equivalents for flow levels; clarifications of what occurs in fish emergencies; a dry water year provision; coordination of forecasting.

##### **Juvenile Dam Passage**

Specific and higher juvenile dam survival performance standards; major investments in surface passage improvements at the lower river dams which affect all upriver ESUs or DPSs; and additional spillway and powerhouse improvements designed to improve survival, depending on the dam.

##### **Spill and Transportation**

Continued interim implementation and evaluation of 2006 court-ordered summer spill at collector projects to determine appropriate management strategies for Snake River fall Chinook; manage duration of Snake River summer spill to match fish run timing.

### **Tributary and Estuary Habitat Actions**

The proposed action provides two strategies for habitat: one for the tributaries, where the focus is on individual ESUs, and one for estuary actions, which benefit all ESUs, with a focus on specific areas of biological priority. For tributary actions, the primary types of actions – linked to limiting factors – include:

- increase streamflow through water acquisitions
- address entrainment through screening
- provide fish passage and access
- improve mainstem and side channel habitat conditions
- protect and enhance riparian conditions
- improve water quality

The collaboration compiled an inventory of possible habitat projects identified in draft recovery plans and subbasin plans. This provides a menu of projects from which to select. Funding commitments are specified in three cycles, for 2007-2009; 2010-2012; and 2013-2017.

## **What's New for the Habitat PA?**

### **2007-2009 – Tributary and Estuary Habitat Improvements**

Specific projects and categories of projects have been identified for 2007-2009 implementation based on biological priorities and limiting factors for each ESU. Expanded actions will be implemented in 2008 and 2009 based on the biological analysis.

### **2010-2017 – Tributary and Estuary Habitat Improvements**

Starting in 2010, BPA will further increase its funding commitment for all ESUs to approximately \$45 million per year. This increase will be allocated according to “gaps” in biological performance of populations where tributary and estuary habitat is a limiting factor and habitat potential exists. Specific projects will be identified based on biological priorities and criteria in three-year cycles, drawing upon the extensive menus of recovery plan actions.

## **Hatcheries**

The overall objectives for FCRPS mitigation hatchery programs are first, to ensure that they do not impede recovery and second, to use them affirmatively to reduce extinction risk and promote recovery. New commitments will include new programs for Snake River sockeye salmon, Upper Columbia spring Chinook salmon, Upper Columbia and Snake River steelhead and Snake River spring/summer Chinook salmon, as well as certain future reforms for existing hatchery programs.

## **What's New for the Hatchery PA?**

### **Existing Hatcheries**

Adoption of programmatic criteria for funding decisions on mitigation programs for the FCRPS that incorporate best management practices. These are designed to lessen negative effects on ESA-listed ESUs and DPSs and to ensure hatchery mitigation programs funded by the FCRPS do not impede recovery. The action agencies are undertaking reform actions in cooperation with hatchery operators to achieve the FCRPS hatchery objective.

### **Safety Net and Conservation Hatcheries**

Significant expansion of Snake River Sockeye Salmon Program and development of performance standards, exploration of options for transportation of returning adult sockeye salmon from Lower Granite Dam to the Stanley Basin; steelhead productivity improvements through kelt reconditioning, Okanogan steelhead local broodstock and kelt programs; Upper Columbia River spring Chinook salmon (Methow composite stock) reintroduction in Okanogan River; development of a mechanism or procedure to identify Snake River steelhead populations that may be a safety-net program; construction and operation of the Northeast Oregon Hatchery project contingent on a NMFS-approved management plan; and assessment of Columbia River chum salmon habitat potential and development of reintroduction strategies in selected lower Columbia River tributaries.

## **Predation Management**

The action agencies will pursue strategies to reduce mortality from predators of ESA-listed juvenile and adult fish focused on natural and introduced fish, birds and marine mammals.

## **What's New for the Predation Management PA?**

### **Fish Predation**

Focused pikeminnow removals at The Dalles and John Day dams forebay and tailrace boat restricted zones will be tested and evaluated in the 2007 field season; studies of other piscivorous predators.

### **Bird Predation**

Moving ahead with plans for dispersing Caspian tern population to locales outside of the Columbia River Basin to substantially reduce predation losses in the Columbia River estuary. Management efforts directed toward populations of double-crested cormorants nesting in the Columbia River estuary and in the mid-Columbia River and Caspian terns nesting in the mid-Columbia.

### **Marine Mammal Predation**

Continued efforts to deter predation by marine mammals at and near Bonneville Dam

## Harvest Management Strategies

Harvest management affects the survival and recovery of listed fish, but the action agencies do not participate in regional harvest forums and have no control over harvest allocations. The proposed action includes some approaches to help manage “bycatch,” or the take of listed fish that can occur with harvest of healthy stocks.

### What’s New for Harvest?

#### Fishery Conservation Effectiveness Programs

Action agencies will assist in the development of a plan to add PIT-tag detections in mainstem Columbia River fisheries.

#### Selective Fisheries Pilot

Undertaken in 2007, this project of the Colville Tribes will develop fishing techniques and evaluate alternative/terminal fishing locations to help limit harvest of listed stocks.

## Enhanced Funding Commitments

Total annual funding for the region’s federally-funded fish programs has increased significantly since the 2000 BiOp. Based on the federal agencies “salmon cross-cut budget,” salmon-related expenditures by the Corps have gone from \$102.7 million per year in 2001 to \$115.6 million in 2006; by Reclamation have gone from \$20.5 million per year in 2001 to \$40.5 million in 2006; and by BPA have gone from \$183.5 million per year in 2001 to \$238 million in 2006, including Columbia River Basin Fish and Wildlife Program funding. These budgets add cumulatively to the body of improvements to benefit fish. Most of these expenditures are directly and indirectly paid by the region’s electric ratepayers.

The proposed action reflects further funding increases across all four Hs, predation management and RM&E over the 2007-2017 time period, but with an increased emphasis on demonstrating biological benefits, on the ground results and accountability for the funding spent. Among the expenditures the action agencies are committing to during 2007-2017:

- \$70-80 million per year from the Corps’ Columbia River program for dam modifications, survival evaluations and predator management actions.
- \$45 million per year commitment from BPA for tributary and estuary habitat; \$450 million over ten years, with additional funds from the Corps and the Reclamation. BPA annual funding commitments for habitat projects averaged about \$21 million between 2000 and 2006 with an increase to approximately \$37 million for 2007 to 2009.
- Almost \$35 million over the BiOp period to fund new hatchery facilities and another \$5 million per year to fund new hatchery facility related expenses, reconditioning of Upper Columbia steelhead kelt and assessment of habitat potential for chum reintroduction below Bonneville Dam. This is in addition to current expenditures of approximately \$11 million per year for operations and maintenance of safety-net and conservation hatcheries and \$35 million per year for other FCRPS mitigation hatchery programs.



- An increase from \$3 million to \$3.7 million per year to expand the Northern Pikeminnow Management program and reduce predation on juvenile salmon.
- \$75 million per year for RM&E at the outset, with a goal to move some of this to “on the ground” actions over time.

In addition to these expenditures by the action agencies, other federal funding programs are contributing to salmon and steelhead improvements. Since 2000, NMFS’ Pacific Coast Salmon Recovery Fund (PCRSF) has granted \$355.8 million to Northwest states and tribes to undertake salmon restoration and conservation activities. Based on the “salmon cross-cut budget,” other federal agencies – including the Departments of Agriculture and the Interior as well as the Environmental Protection Agency – have invested over \$950 million since 2000 in a recovery program that benefits Northwest salmon and steelhead.

## **State and Other Partnerships**

Successful federal recovery actions depend on working in a broader regional partnership with states and tribes, moving with the fish across geographic boundaries. State and other funding for salmon and watershed restoration has also contributed significant improvements that benefit listed fish, as well as other species.

- In Washington, the Salmon Recovery Board has awarded over \$171 million in grants for 731 projects throughout the state. Grant applicants have contributed another nearly \$101 million, bringing the total investment to nearly \$272 million since 2000.
- Under the Snake River Basin Adjudication Settlement Agreement, approximately \$60 million of Idaho and federal funding will be used to improve habitat conditions in Idaho.
- Several private and public utilities are committed to major expenditures for habitat and passage improvements as part of ESA and licensing agreements for their dams.

## **Part 5: Adaptive Management and Oversight**

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The action agencies’ proposal is supported by a strong network of programs and organizations already in place. Independent scientific panels ensure that the best available science is used. The Council and the Regional Forum apply their scientific knowledge to actions in the areas of hydro operations, habitat, hatcheries, research and monitoring and harvest.

This network of independent checks and balances, planning and coordinated action has increased dramatically in the last decade, as summarized below:

<p>1995-1999</p>	<ul style="list-style-type: none"> <li>• NMFS established the Regional Implementation Forum to facilitate inter-governmental discussion and decisions on operation of the hydro system and its physical modification for fish passage under the 1995 FCRPS BiOp.</li> <li>• The Council and NMFS established the ISAB to foster a scientific approach to fish and wildlife recovery related to the programs of NMFS, the Council and the tribes.</li> <li>• In the same year, the Council appointed the Independent Scientific Review Panel to ensure independent scientific review of the numerous fish and wildlife projects proposed each year for BPA funding.</li> <li>• The TRTs were established by NMFS in 1999 to make recommendations to the agency regarding appropriate biological recovery goals that would satisfy the ESA’s requirements for delisting.</li> </ul>
<p>2000-2005</p>	<ul style="list-style-type: none"> <li>• The Council adopted its amended Fish and Wildlife Program, establishing a basinwide vision for fish and wildlife, biological objectives and action strategies. The 2000 Program addressed habitat, hatchery, hydro and harvest impacts on fish and wildlife, ESA-listed and healthy stocks.</li> <li>• NMFS issued a new BiOp on operation of the federal system, with a finding that the system did jeopardize the existence of the listed stocks in the basin. It identified a “Reasonable and Prudent Alternative” with 199 actions that the action agencies needed to undertake to mitigate for the hydrosystem.</li> <li>• Federal agencies also established a Federal Caucus and released a Basinwide Recovery Strategy to restore ESA-listed fish. The strategy outlines specific federal government actions to improve hatcheries and restore salmon habitat and proposes additional actions for tribal, state and local government.</li> <li>• NMFS issued a revised FCRPS BiOp. It defined commitments to improve riparian areas as well as boost fish passage and survival at the dams. RSWs were a major innovation utilized to accomplish this. This opinion was invalidated by the federal court in 2005.</li> <li>• The Council completed a locally led watershed planning effort, resulting in 58 separate “subbasin plans” for tributary watersheds or mainstem segments of the Columbia River. The plans form a foundation for ESA recovery plans in the region.</li> </ul>

To address uncertainties and manage risks, the action agencies' proposal also includes the following key elements:

- **performance standards at multiple levels** (ESU, population, individual dams) demonstrating a commitment to achieve results in this plan and continue achieving results in the future
- **research, monitoring and evaluation**, a comprehensive program to address the status of the fish, effectiveness of actions and critical uncertainties
- **annual implementation plans**
- **annual progress reports and comprehensive evaluations/check-ins** at 2012 and 2015 to ensure accountability for results over the BiOp term
- **adaptive management and continued collaboration with states and tribes**, including a regional oversight group to allow for continued dialogue between sovereign governments and with other parties to make timely adjustments where needed, based on the best available information
- **“All-H” contingencies** if performance standards are not met

## Conclusion

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The Columbia River Basin salmon recovery effort is one of the largest single environmental projects in the world. More than \$600 hundred million a year in federal and ratepayer funds are invested in salmon and steelhead recovery (not including lost revenues from reduced power sales).

Future funding commitments will significantly increase under this proposed action. The collaboration and comprehensive lifecycle analyses helped the action agencies fashion a suite of actions and commitments, including performance standards, to place salmon and steelhead on a trend to recovery over the next decade.

But while the current focus is on the FCRPS, ensuring sufficient abundance of salmon and steelhead to sustain healthy natural stocks and provide for harvest is a challenge that reaches beyond the federal hydro system. Recovery will require a concerted effort and an “all-H approach” from federal agencies, states, tribes, local governments and private landowners. Through continued collaboration triggered by this remand, the action agencies will advance long term recovery of salmon and steelhead through substantial past, present and future investments in actions that protect salmon.