

***FINAL Draft***

***Updated Proposed Action***

***for the***

***FCRPS Biological Opinion Remand***

**U.S. Army Corps of Engineers  
Bureau of Reclamation  
Bonneville Power Administration**

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# I. Introduction and Overview

In June 2003, Federal District Court invalidated the *NOAA Fisheries 2000 Federal Columbia River Power System (FCRPS) Biological Opinion (2000 BiOp)* in *National Wildlife Federation vs. National Marine Fisheries Service*. The court found NOAA Fisheries (NOAA) improperly relied on actions that had not undergone Endangered Species Act (ESA) consultation or were otherwise not “reasonably certain to occur.” The court **remanded** the 2000 BiOp to NOAA Fisheries for revisions by early June 2004. In the meantime, the court left the 2000 BiOp in place, and the US Army Corps of Engineers (Corps), Bureau of Reclamation (Reclamation) and the Bonneville Power Administration (BPA), collectively known as the Action Agencies, continue their implementation efforts under the 2000 BiOp.

To lay the groundwork for its new draft BiOp in response to the judicial remand, NOAA Fisheries has revised and updated its jeopardy analysis for listed salmon and steelhead. Based on this new information, the Action Agencies have prepared this Updated Proposed Action for NOAA Fisheries’ consideration. To a large extent, this Updated Proposed Action continues the implementation of many of the actions contained in the 2000 BiOp. It continues to focus on actions that will contribute toward meeting the performance standards described in the 2000 BiOp, but also includes specific actions designed to address the new jeopardy analysis and remand directions from the court.

Since the 2000 BiOp was issued, the region has gathered additional scientific information about the survival benefits affiliated with certain types of actions. For example, NOAA has identified factors that limit ESU survival in the tributaries and the estuary. The 2000 BiOp and the associated Reasonable and Prudent Alternative (RPA) did not identify actions that were needed to avoid jeopardy for each ESUs. NOAA’s updated analysis now includes ESU specific survival needs. In consideration of these analyses, this Updated Proposed Action presents a customized approach to the life-stage needs of each ESU and should lead to a no-jeopardy finding.

This Updated Proposed Action continues most of the uncompleted and on-going actions in the 2000 BiOp. It refines the actions of the RPA into a new set of federal actions based on adaptive management principles. As in the 2000 BiOp, this Updated Proposed Action includes processes to assess and report progress and implementation planning. This Updated Proposed Action will be refined in response to comments received on NOAA’s draft biological opinion and will be resubmitted to NOAA prior to issuance of a Final Biological Opinion.

This document includes the following sections and appendices:

**Section 1 – Introduction and Overview:** A general description of the purpose of this document, including summaries of the Updated Proposed Action and discretionary conservation actions.

The 2000 BiOp included a list of Reasonable and Prudent Alternative (RPA) actions to avoid jeopardy to listed salmon and steelhead. However, it also relied on a performance-based approach, including hydropower survival and population performance standards to be achieved over a 10-year period. As new information became available or experience was gained, the BiOp contemplated that RPA actions would change through adaptive management to ensure progress toward performance standards (2000 FCRPS BiOp, Section 9.1.4). For the past 3 years, the Action Agencies have documented and made adjustments to the initial RPA actions in annual implementation plans and progress reports, and these changes have been reviewed by NOAA Fisheries in their annual findings letters.

**Section 2 – Adaptive Management Framework:** A description of the framework for adaptive management, including performance standards, implementation planning, and progress reporting.

**Section 3 – Updated Proposed Action and Conservation Actions:** A description of our general approach, the biological rationale for our strategies and substrategies, the specific actions to be taken for each ESU and our performance goals and discretionary conservation actions. The conservation actions would be taken beyond the Updated Proposed Action pursuant to the Northwest Power Act and other authorities, which, while not needed to avoid jeopardy under ESA, should provide additional benefits for listed fish.

**Section 4 – Research, Monitoring and Evaluation (RM&E):** Describes studies of action effectiveness and critical uncertainties designed to assess compliance, quality control, and allow adaptive management.

**Section 5 – Conclusion:** Provides the Action Agencies' initial conclusion on avoidance of jeopardy and adverse modification of critical habitat – subject to reevaluation following NOAA Fisheries updated analyses.

## ***A. Summary of the Updated Proposed Action***

Over the years the Action Agencies have built up a comprehensive program of diverse actions to assist the survival of salmon and steelhead. Since we began implementing the 2000 BiOp, we have expanded and further refined our conservation programs to focus on ESA-listed salmon and steelhead. Following is a general summary of important actions included in the Updated Proposed Action.

**Hydrosystem configuration to improve fish passage.** The Action Agencies have already completed a number of reconfiguration projects at federal dams to improve fish passage and survival based on actions identified in the 2000 BiOp. The Action Agencies will continue to implement specific capital improvements, providing funding priority to dams with the lowest passage survival rates. Where feasible, the Action Agencies will pursue removable spillway weirs (RSWs) or similar surface bypass devices. These configuration modifications will result in improved survival at federal dams compared with existing conditions for all ESUs.

**Continue hydrosystem operations to benefit migrating fish.** The Action Agencies will continue to operate federal storage reservoirs so these reservoirs can supplement streamflows and provide spill at mainstem dams to benefit juvenile fish migration consistent with current implementation of the 2000 BiOp as modified through implementation plans. This proposed hydrosystem operation includes both discretionary and nondiscretionary actions.

**Continue fish transportation to improve juvenile survival.** The Action Agencies will continue to collect and transport juvenile fish at Lower Granite, Little Goose, Lower Monumental and McNary dams. We will maximize our use of transportation both in the summer and in the spring when river flows are 85 kcfs or below. The transportation program will be adaptively managed towards improving the survival of affected ESUs.

**Examination of Reduced Summer Spill.** The Corps, BPA and NOAA Fisheries will be exploring further definition of and subsequent exercise of the annual hydrosystem performance measure approach outlined in Section II (Adaptive Management Framework) and/or a revision to the Updated Proposed Action to address summer spill issues in the context of achieving appropriate biological performance.

**Expanded predator control to manage impacts to juvenile fish.** The Action Agencies propose to expand efforts to reduce consumption of juvenile salmon by birds and other fish. Caspian tern management actions could be implemented as early as 2005 (pending completion of environmental review and approval), with resulting juvenile survival improvements as early as 2006. Increased incentives under the Northern Pikeminnow Management Program (NPMP) would also deliver immediate juvenile survival improvements for listed ESUs. The Action Agencies will continue to develop our understanding of the effect of predation on migrating juvenile salmonids. This will enable us to enhance existing predator management programs as well as develop and implement additional predator management actions in order to reduce levels of predation on juvenile salmonids.

**Improve tributary spawning and rearing habitat.** As we have under the 2000 BiOp, we will continue to improve tributary fish habitat by **removing passage barriers** and performing other channel improvements to improve the access to and condition of spawning and rearing areas; **screening diversions** to prevent fish entrainment; **securing instream flows** to provide tributary migration and spawning and rearing flows, and to help maintain water quality such as water temperature; and **protecting and restoring** the ecological functions of riparian areas to support bank and stream channel integrity, water temperatures, and nutrient sources. Based on the NOAA's revised jeopardy analysis, the Action Agencies propose to emphasize habitat improvements for those ESUs that NOAA Fisheries has determined have a survival gap greater than 2 percent. We provide specific commitments in the form of three- and six-year targets for the applicable individual ESUs.

**Improve estuary habitat.** The Corps and BPA will continue to implement projects to protect and enhance habitat along and adjacent to the mainstem below Bonneville Dam and tidal wetlands. However, as in the case of tributary habitat, we are adding a greater focus to these efforts, and propose to implement actions that NOAA agrees will provide survival improvements for listed ESUs.

**Implement hatchery actions.** As long as NOAA considers it to effectively contribute to reducing the risk of extinction, BPA will continue to fund the Snake River Sockeye safety-net program. BPA will also continue to fund the Safety Net Artificial Propagation Program (SNAPP) process identified in the 2000 FCRPS Biological Opinion to develop safety-net contingency plans. If identified as necessary, effective, and feasible through the SNAPP process, we would intervene with artificial production for severely depressed and declining populations. We are not proposing additional hatchery reform actions at this time, but we may consider them in the future as NOAA Fisheries identifies actions as likely to have substantial survival benefits for listed ESUs and/or major populations groups. These actions could be additional or could displace others, consistent with adaptive management.

**Pursue harvest opportunities.** The Action agencies will continue to pursue harvest opportunities as discretionary conservation actions. We will pursue opportunities to reduce harvest impacts on listed species and assess and inventory additional terminal locations above Bonneville Dam that provide potential for reducing ESA impacts from mainstem fisheries.

**Continue to support regional RM&E.** The Action Agencies will continue to invest in studies to help improve our understanding of how various actions affect fish survival to fine-tune future actions and better measure their results. Many of the studies are on the cutting-edge of scientific inquiry and will require multiple years of investigation to provide definitive results.

**Actions taken under the 2000 FCRPS Biological Opinion.** The Action Agencies have been implementing the 2000 FCRPS Biological Opinion for the past four years. Each year the Action Agencies have submitted to NOAA and made publicly available a comprehensive Progress Report on implementation progress and accomplishments. Many of the actions taken since 2000 continue to accrue biological benefits to ESA-listed species and must be considered in evaluating the survival benefits

anticipated from the Updated Proposed Action. These annual progress reports and the comprehensive 2003 Check-In Report detailing programmatic compliance with the 2000 Biological Opinion are incorporated by reference in this Updated Proposed Action.

## B. Summary of Updated Proposed Actions by ESU

Our Updated Proposed Action includes specific commitments for ESUs affected by FCRPS operations. Figure 1 generally represents the NOAA identified relative *survival “gap”*<sup>1</sup> for 2004 and the expected level of survival improvements that would occur under our Updated Proposed Action

ESU	NOAA Reference Operation Relative Survival Gap (%) 2004	Hydrosystem Improvements		Predator Control		Habitat Improvements		Hatcheries
		Config	Operations	Avian	Fish	Tributary	Estuary	
Snake River spring/summer Chinook	1.5	L	VL	L	L	VL	L	N/A
Snake River fall Chinook	12.7	L	VL	L	L	N/A	M	N/A
Snake River sockeye	N/A	N/A	VL	L	L	N/A	N/A	M
Snake River steelhead	0.2	L	VL	M	L	VL	L	N/A
Upper Columbia River spring Chinook	6.6	L	VL	L	L	M	L	N/A
Upper Columbia River steelhead	8.6	L	VL	M	L	M	L	N/A
Mid-Columbia River steelhead	0.0 - 8.8	L	VL	M	L	L	L	N/A
Lower Columbia River Chinook	0.4 - 1.2	VL	VL	L	L	VL	L	N/A
Columbia River chum	0 - 1.4	VL	VL	VL	L	VL	L	N/A
Lower Columbia River steelhead	0 - 0.3	VL	VL	L	L	VL	L	N/A
Lower Columbia River coho	0	VL	VL	L	L	VL	L	N/A
Upper Willamette River Chinook	N/A	N/A	VL	L	L	N/A	N/A	N/A
Upper Willamette River steelhead	N/A	N/A	VL	L	L	N/A	N/A	N/A

Legend	
Very low (VL):	neutral or ancillary survival improvements
Low (L):	< 2% survival improvements
Medium (M):	= 2% - 24% survival improvements
High (H):	= 25% - 100% survival improvements
Very High (VH):	> 100% survival improvements

Figure 1 General Survival Benefits Expected from the Updated Proposed Action

## C. Reclamation’s Conservation Measures

Reclamation is proposing two conservation measures: (1) for Snake River spring/summer Chinook and Snake River steelhead to continue habitat improvement programs in the Upper Salmon, Lemhi, and Little Salmon subbasins and (2) for Mid-Columbia steelhead in the North Fork John Day, Middle Fork John Day, and Upper John Day subbasins, both initiated under the 2000 FCRPS BiOp. As described on p. 4-19 of the *Endangered Species Consultation Handbook*, “conservation measures represent actions ... to further the recovery of species under review. ... The beneficial effects of the conservation measures are taken into consideration for both jeopardy and incidental take analyses.” The scope of Reclamation’s conservation measures is presented for the Snake River spring/summer Chinook, Snake River steelhead and Mid-Columbia steelhead ESUs.

<sup>1</sup> For purposes of this Updated Proposed Action, the survival gap is defined as the difference in survival expected between NOAA’s reference operation and the 2000 BiOp hydrosystem operations. Both absolute and relative percentages for these survival “gaps” are presented in NOAA’s Draft Biological Opinion.

## **D. Related Conservation Actions**

In addition to actions specified in the Updated Proposed Action to address the requirements of the jeopardy analysis for the FCRPS, each Action Agency implements a significant number of actions under their existing authorities that contribute to the conservation of listed species. These actions are not part of the Updated Proposed Action and should not be considered in NOAA's jeopardy analysis. They are referenced herein merely to provide context for the actions proposed to avoid jeopardy. Where specific conservation actions are known to complement actions proposed to avoid jeopardy, they may be described in some detail in the pertinent section of the Updated Proposed Action.

BPA implements an extensive Fish and Wildlife Program authorized by the Northwest Power Act's direction to protect mitigate and enhance fish and wildlife affected by the construction and operation of the FCRPS. This program is guided by the Northwest Power Planning and Conservation Council's (Council) Fish and Wildlife Program. As reflected in each implementation plan and progress report produced under the 2000 BiOp, a majority of the Fish and Wildlife Program actions benefit ESA listed salmon and steelhead while also encompassing the broader set of species affected by the FCRPS. Prior to implementation, BPA will ensure that any actions affecting ESA listed species receive appropriate section 7 ESA coverage.

## **E. Subbasin Planning and Assessment**

Subbasin planning and assessment remains an important component of the Action Agencies' implementation strategy for actions taken to avoid jeopardy as well as for those taken to support recovery of ESA-listed species.

Beginning in 2002, BPA entered into contracts with the Council to develop subbasin plans for the entire Columbia River Basin. Under the contracts, state subbasin planning coordinators were designated in Idaho, Montana, Oregon and Washington. The contract also provides for a subbasin planning template approved by NOAA Fisheries, a regional coordination board, and subbasin work plans. Draft subbasin plans were submitted to the Council in May, 2004 and are undergoing independent scientific review as well as NOAA, U.S. Fish and Wildlife Service, BPA, regional state and tribal fish and wildlife co-manager, and public review. Following necessary refinements to the draft subbasin plans, the Council anticipates adopting plans that meet the standards they have set for adequacy into the Fish and Wildlife Program.

The Action Agencies believe that the guidance given by NOAA on the limiting factors affecting ESUs that are the subject of the FCRPS Biological Opinion are consistent with the subbasin assessments that are the foundation for subbasin plans as well as the NOAA analyses for recovery planning. The Action Agencies anticipate utilizing the adopted subbasin plans that form the basis for NOAA-approved local recovery plans in selecting specific actions to implement the Updated Proposed Action.

## **F. Coordination**

The actions described in this document serve a number of purposes. They explicitly address the Action Agencies' implementation of their obligations for listed salmon and steelhead under the ESA. Agencies will also be implementing these actions pursuant to their obligations under the Northwest Power Act. Regional planning and coordination with the Council, affected tribes, and other regional parties are an integral part of the implementation. Coordination includes independent scientific review and review by regional, state, tribal and federal fisheries



## II. Adaptive Management Framework

The Action Agencies will implement this Updated Proposed Action based on performance, accountability for results, and adaptive management. We will use the best available scientific information to identify and carry out actions that are expected to provide immediate and long-term benefits to ESA-listed fish. We will use implementation planning and progress reporting to inform and signal appropriate adaptations or adjustments to our actions.

Our adaptive management framework includes the following:

- **Goals** that summarize what we want to accomplish to meet our ESA obligations. We will coordinate with the broader recovery efforts in the Columbia Basin.
- **Strategies** that explain the underlying biological rationale for our actions and performance measures.
- **Priorities and programmatic level performance targets** specify implementation actions for the next several years of implementation. We may modify and adjust these over time as needed to achieve overall performance standards and to provide for cost-effective implementation.
- **Biological Performance standards** that provide overall measures of success on a multi-year basis based on adult fish abundance and trends, and adult and juvenile fish survival through the hydrosystem. These may vary depending on environmental and water conditions, ocean survival conditions, harvest, and other factors outside the control of the FCRPS.

Essential to the success of an adaptive management approach is the ability to validate the effectiveness of actions taken and to modify actions based on new information. The Action Agencies are committed to this process and are undertaking a comprehensive monitoring program to determine the effectiveness of actions taken to avoid jeopardy to listed species. All data derived from this extensive monitoring and research program will be made publicly available in coordination with regional database efforts.

### A. *Planning and Reporting*

#### 1. **Implementation Planning and Action Agency Roles and Responsibilities**

The Action Agencies will prepare *implementation plans* to document our specific strategies, priorities, actions, measurable targets, and timetables. In these plans, the Action Agencies will identify ESU-specific targets and actions. We will address both the actions that are essential under this Updated Proposed Action and the conservation actions that are not a requirement for the avoidance of jeopardy but which aid in the recovery of listed species. The Action Agencies will maintain a *BiOp database* to provide project level detail for planning and reporting purposes. This approach would be more efficient and provide the most up to date information about projects to be implemented.

Our implementation plans will identify responsibilities specific to the Action Agencies and will serve to coordinate our efforts with the appropriate regional processes. Those efforts would typically include coordination due to a statutory obligation for the Federal government (BPA/Council), voluntary coordination among Federal agencies (Federal Caucus), and coordination required by the 2000 BiOp, for Federal/non-Federal engagement (Technical Management Team (TMT), System Configuration Team (SCT), Pacific Northwest Aquatic Monitoring Program (PNAMP), etc.).

Concurrent with the release of the remanded BiOp, the Action Agencies intend to execute an inter-agency Memorandum of Agreement (MOA) defining implementation and funding roles and responsibilities to address certainty of implementation.

## **2. Progress Reporting**

We will use the project level detail contained in the Action Agencies' BiOp database to track results and assess our progress in meeting programmatic level performance targets. We will track overall population performance through annual reports of adult abundance and trends in adult abundance for listed ESUs. The results of the progress reports will inform adjustments in future year plans through adaptive management.

The Action Agencies will prepare *annual progress reports* based on our implementation plans. The progress reports will document our ability to achieve ESU-specific performance targets established in our implementation plan strategies and substrategies.

## **3. Comprehensive Evaluations**

The Action Agencies will prepare a more *comprehensive programmatic evaluation* of progress after 2007 and again in 2010. These check-in reports will also serve as the annual progress report for the year in which we present them. This evaluation will primarily focus on the programmatic performance targets to determine whether our cumulative implemented actions remain consistent with the objectives in this Updated Proposed Action or in the case of a jeopardy finding, the RPA. We will also evaluate how our cumulative performance is related to adult population trends and adult and juvenile fish survival through the hydrosystem. The Action Agencies will use these evaluations to adaptively manage and to ensure that performance is achieved. If we determine that course changes are necessary in order to achieve expected performance, we will discuss those with NOAA Fisheries and the regional salmon managers prior to implementation.

## **B. Performance Standards**

As in the 2000 BiOp, performance objectives and measures remain central to the Updated Proposed Action. For the near-term, the specific programmatic performance targets and priorities for each of our hydrosystem, habitat, and predator control actions provide clear but flexible objectives for evaluating the success of our actions. For the long term, adult trends and adult and juvenile survivals through the hydropower system establish useful reference points to determine if we are advancing in our conservation efforts.

The overall FCRPS performance standard (obligation for no-jeopardy) is the estimated difference in survival between the current hydrosystem operations and the NOAA designated reference operations. NOAA Fisheries developed the reference operation for the revised jeopardy analysis under the BiOp remand process. This reference operation describes the estimated survival *potential* of the hydrosystem free of other operational requirements for which the dams were authorized, including flood control, irrigation, power generation, and navigation. The overall goal for our collective actions (i.e., hydrosystem operations, configurations, predator management, habitat improvements, and hatchery actions) is to meet that potential through filling the "gap".

To the extent reasonable, the Action Agencies will address the "gap" by using a combination of hydrosystem operations, configuration modifications, and predator management prior to utilizing offsite actions. Because the Action Agencies operate the dams to meet multiple Congressionally authorized

purposes, the Action Agencies may not address all of the impacts of discretionary operations through operations only. In addition to operational (including juvenile fish transportation) and structural changes at the dams, we will also pursue actions that have potential for survival benefits for targeted ESUs – including our predator control, habitat, or hatchery actions, depending on the ESU. Actions will be commensurate with the size of any remaining part of the “gap” that was not being met through hydrosystem actions.

## **1. Overall Adult Trends**

The overarching performance objective, for the FCRPS as well as other actions in the Columbia Basin, is a stable and improving trend in the numbers of adult fish over multiple years. All of the listed ESUs are exhibiting higher adult returns today than they were when listed in the 1990s and at the time of the 2000 BiOp. Many factors contributed to these fish returns, including the benefits of conservation actions implemented under the 1995, 1998 and 2000 BiOps, the Council’s Fish and Wildlife Program, the Corps’ Columbia River Fish Mitigation (CRFM) program, and the efforts of the tribes, states, and individuals. In addition to improvements to fish passage at mainstem dams, to habitat in the estuary and tributary subbasins, and to hatchery and harvest practices, the current favorable ocean environment has also contributed to this success.

Overall population performance, as exhibited by adult abundance and trends, provides an important context for planning actions to address the FCRPS performance standards. As noted in the Progress Reporting section, the Action Agencies will consider adult abundance and trends for each listed ESU to determine priorities and timing of actions to improve juvenile fish survival. This will include consideration of how much emphasis to place on hydrosystem and predation management actions compared to other non-hydro actions for different ESU’s. Some ESU’s may require greater or more immediate attention, while those that are less at risk may be helped with less aggressive measures (at least in the near-term). This approach makes best use of limited available resources for those ESU’s in greatest need.

## **2. Adult and Juvenile Fish Survival Through the Hydrosystem**

Another benchmark for our actions is adult and juvenile survival through the hydrosystem. We have more direct influence on this outcome. For adult fish, we have largely achieved or exceeded the performance standard identified in the 2000 BiOp (Ruff Memo 6/29/04 to Brian Brown). Because we do not expect the proposed operation will reduce adult passage survival, we will continue that operation and monitor adult passage. We will periodically assess adult survival through the hydrosystem to ensure that adult passage survival continues to be high. Consistent with our adaptive management approach, we will adjust our actions as warranted to ensure implementation of an effective and efficient program.

The system survival standard is the most appropriate measure for ESUs that have a combined management strategy of both transportation and in-river migration. The survival of the transported fraction of the population reflects both direct effects and indirect effects (“D”) associated with the transportation process. In-river survival is useful as a secondary standard, particularly when a higher proportion of fish are left to migrate in-river. In-river survival would be the preferred measurement of performance where transportation is not available or effective as a management tool.

It is neither reasonable nor practical to attempt field measurements of juvenile fish survival for each stock migrating each year (e.g. Bear Valley Creek spring/summer Chinook, Entiat spring Chinook, John Day spring Chinook, etc.). In some cases, PIT-tag sampling limitations make such measurements infeasible or very costly. In other cases, there could be high biological risk or detriment (i.e., adverse impacts to migrating fish) that could exceed the potential benefit of the information collected. In these cases, we

may use surrogates as indicators for some ESUs. For example, estimated survival of a composite of Snake River stocks in the lower Columbia could serve as a surrogate to represent the survival of mid- and lower Columbia stock survival through the same reach (e.g., McNary to Bonneville).

### **3. Hydrosystem Performance Measures**

The FCRPS performance standard is the estimated difference in survival between the current hydrosystem operations and the NOAA designated reference operation (the “gap”)<sup>2</sup>. Hydrosystem performance contributes to the FCRPS standard through the combination of operations and configurations at dams, and in some cases, predation management. Other mitigation actions could provide additional benefits to ESUs, which in combination with survival benefits of actions in the hydrosystem, would further “close the gap.”

The Action Agencies are exploring an approach for developing an annual hydrosystem performance standard. This would provide more flexibility to plan to conditions (e.g., runoff, configurations, predator management, etc.). It would entail pre-season analysis of expected conditions as a basis to determine planned hydrosystem operations and expected survival under such conditions. We would use post-season analysis to estimate survival under actual conditions (and based on any new scientific information). Subsequent annual planning would consider previous years’ performance to ensure adequate progress is being made. This iterative process, graphically shown in **Figure 2** would be repeated annually, with the purpose of developing a suite of actions that will be implemented each year to achieve the longer-term objective of the FCRPS performance standard.

In the pre-season analysis for developing annual operations, we would also consider the effectiveness of configuration improvements and predation management in any given year. While changes in configurations or predator management require more lead-time to put into place, they are important contributors to hydrosystem survival and achievement of the hydrosystem performance standard.

The Action Agencies would coordinate the pre and post-season analysis of juvenile fish passage through the existing Regional Implementation Forum. For those ESUs, if any, where a gap remains between the estimated survival of hydrosystem actions (i.e., the combined effectiveness of operations, configurations, and predator management) and the FCRPS performance standard, the Action Agencies would look to other measures to further close the “gap” (i.e., habitat or hatchery actions). The Action Agencies propose to track the annual survival gap (or gap adjusted for appreciable effect) between the reference condition and the proposed action as a standard that is to be met by the general magnitude of the required offsite program that will need to be demonstrated by qualitative and/or quantitative information to be achieved. The offset benefit estimates, compared to the mean gap, will be tracked at the 3- and 6-year comprehensive evaluation periods, to check that progress is being made toward meeting the mean over the BiOp duration; and to identify any adaptive management needs to increase or decrease out year gap survival requirements to insure that the mean is achieved.

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<sup>2</sup> Please note, the Action Agencies have undertaken numerous mitigation actions since the 2000 BiOp was issued. To the extent these mitigation action contribute to the survival or recovery of the listed species subject this Opinion, the action agencies expect to be credited with such benefits under this Opinion.

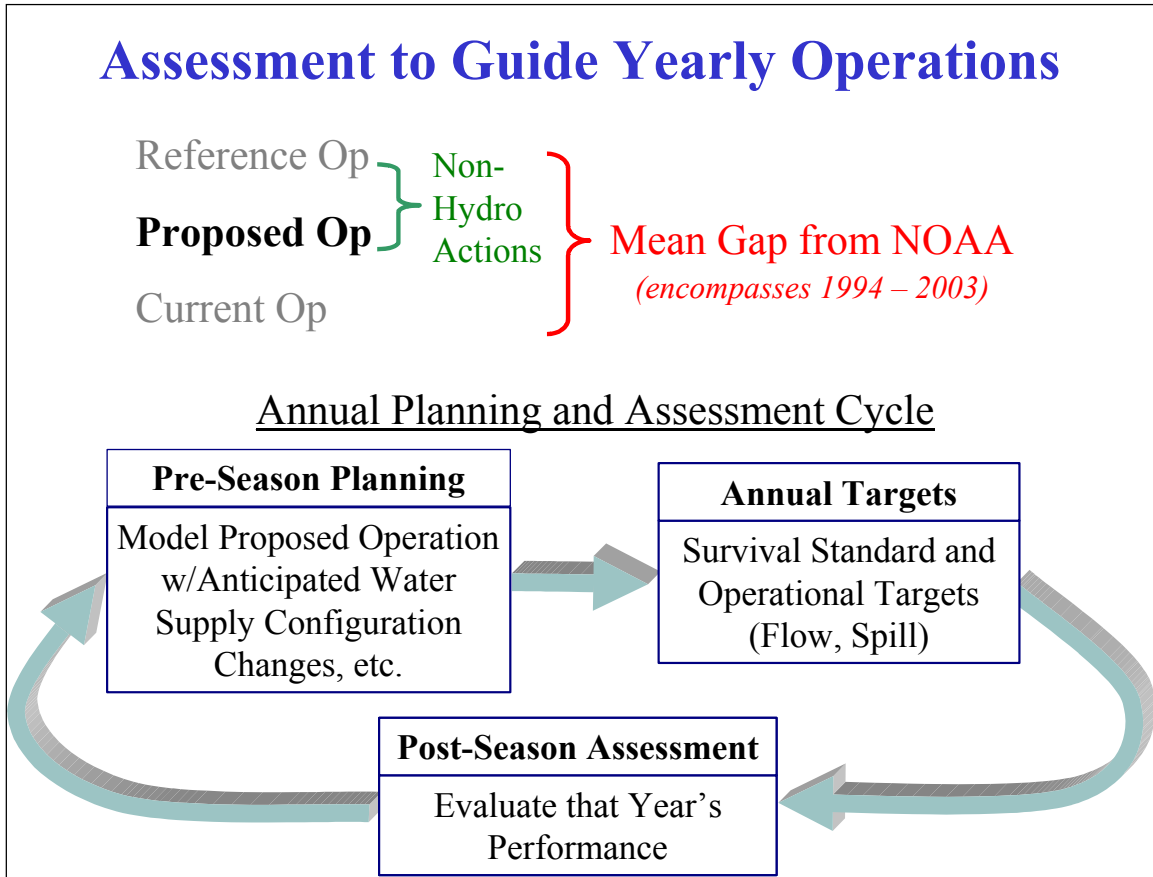


Figure 2 Iterative Process

#### 4. Predator Control Program Performance Measures

Management of piscivorous and avian predation of juvenile salmonids is one of the most effective means of increasing juvenile fish survival. The Action Agencies will aggressively pursue focused measures that reduce predation mortality in the near-term as well as longer term.

For both piscivorous and avian predation, we can make quantifiable estimates of juvenile fish survival improvements. This provides a common currency relative to the broader hydrosystem or FCRPS performance standards. As described above, annual planning and post-season evaluation will take into account any improvements in predator management over the 2000 BiOp baseline condition (i.e., current survival benefits associated with ongoing predator control).

Performance metrics will include the change in annual predation rates and the resulting change in annual juvenile salmonid survival rates.

#### 5. Habitat Performance Measures

The Action Agencies will provide more certain habitat improvements through our adoption of programmatic habitat metrics. These metrics increase our accountability for specific targets and further define the expected level of effort needed for ESU specific survival improvements. By setting clear,

measurable targets for specific actions, the Action Agencies and NOAA Fisheries should be better able to judge the success of the habitat program to provide life-cycle improvements to each ESU.

### **Tributary Habitat Performance Measures**

The Action Agencies have developed an initial set of performance measures for tributary habitat improvements that are expressed as goals for changes in physical habitat conditions for targeted ESUs. Actions may produce one or more types of habitat improvement. Performance metrics might include, for example, cubic feet per second of water leased or number of miles of spawning and rearing habitat access improved. As we learn more from monitoring programs, we anticipate that we will have a more sophisticated means to measure biological performance and the effectiveness of habitat actions. But it will be several years before we have reliable information from these efforts.

The Action Agencies have adopted physical performance measures to address the limiting factors identified by NOAA in selected subbasins for certain stream-type ESUs and within the constraints of practical considerations and discretionary authorities. We express those performance measures as metrics goals for the four limiting factors of the tributary substrategies and have customized them for each ESU or major population group for an ESU, as appropriate. Basic metric goals are:

- **Streamflow:** cubic feet per second of rate of water leased or purchased and/or conserved
- **Entrainment:** number of screen problems resolved
- **Channel morphology:** miles of access or complexity restored
- **Riparian condition:** miles of riparian habitat protected or enhanced

### **Estuary Habitat Performance Measures**

The primary metrics that the Action Agencies propose to use initially in the estuary are the numbers of acres protected, restored, or enhanced. The estuary habitat initiatives are explained in more detail in the Action Agencies' restoration plan entitled *An Ecosystem-Based Approach to Habitat Restoration Projects with Emphasis on Salmonids in the Columbia River Estuary, Appendix A* (Johnson et al., 2003). The number of acres provides a surrogate measure for progress toward addressing the effects of the FCRPS or estuary habitat actions on survival until the science is developed to measure biologically based metrics.

This measure may be modified as the RM&E program in the estuary provides a better understanding of the impacts of restoration work in the estuary. For example, actions outlined within the Action Agencies' *Plan for Research, Monitoring, and Evaluation of Salmon in the Columbia River Estuary* further address performance indicators and monitored attributes that will assist us in monitoring habitat restoration actions. This monitoring will assist in evaluating potential benefits to salmonids (ocean and stream types) considering factors not presently being evaluated (i.e. species life history diversity). For this potential limiting factor, the monitored performance attributes would include:

- species composition,
- stock population age/size structure,
- stock identity, and,
- temporal presence (the time when juveniles are present).

### **Hatchery Performance Measures**

The performance measure for the hatchery portion of this Updated Proposed Action is the continued operation of the existing safety-net programs for Snake River sockeye salmon (as long as it is determined by NOAA to effectively contribute to reducing the extinction risk of this ESU).

### **C. The Role of Cost Effectiveness**

While comprehensive performance management is critical to successfully achieve ESA goals, long-term management should also be cost-effective. Clearly defined performance standards and biological objectives should be met through cost effective alternatives, so that fish receive the most benefits possible for the region's investment in fish conservation.

The Council's Mainstem Amendments recommend that the Action Agencies evaluate the effectiveness of summer spill and assess whether similar benefits can be provided at less cost. For example, turbine operations offer promise. There may be opportunities to reduce turbine operational costs associated with fish protective measures while providing similar or greater survival benefits than current mode of operations. This is consistent with the Council's mainstem amendments which request that the Action Agencies evaluate turbine operations to optimize survival and cost effectiveness.

The Action Agencies will continue to seek operational and configuration changes that achieve performance standards with greater cost effectiveness. We will continue regional discussions on cost effectiveness initiatives and use the adaptive management framework of this Updated Proposed Action to propose alternative implementation options when an alternative action has been found to achieve equal passage survival at lower cost.

### III. Action Agencies' Approach and Updated Proposed Action

#### A. Action Area

The Action Agencies consider the action area under this Updated Proposed Action to include:

- The portions of the mainstem Snake and Columbia rivers that are affected by the FCRPS. This area is defined as the farthest upstream point at which smolts enter (or adults exit) the Snake and upper Columbia rivers to the farthest downstream point at which they exit (or adults enter) the migration corridor. In the Snake River, the area translates to immediately below Hells Canyon Dam (or wherever a tributary stream meets the Snake River below Hells Canyon Dam) to the confluence of the Snake and Columbia rivers. In the Columbia River, the action area begins immediately below Chief Joseph Dam (or wherever a tributary stream meets the Columbia River below Chief Joseph Dam).
- The estuary and plume, which includes the area immediately off the mouth of the Columbia River influenced by freshwater discharge, up to the limit of tidal influence at Bonneville Dam (approximately river mile 146);
- The 4<sup>th</sup> field HUC subbasins that are the focus of our proposed tributary habitat actions (Methow, Wenatchee, and Entiat subbasins);
- Areas directly and indirectly affected by Reclamation's conservation measures in the Upper Salmon, Little Salmon, Lemhi, Upper John Day, North Fork John Day, and Middle Fork John Day subbasins; and,
- Redfish, Alturas, and Pettit lakes and the tributaries that connect them to the Snake River, due to the activities associated with the safety-net hatchery programs for Snake River sockeye salmon.

#### B. General Approach

The Action Agencies are currently implementing the RPA of the 2000 BiOp. Under this Updated Proposed Action, we would implement the majority of measures in the 2000 RPA without modification and refine some of the more general offsite measures described in the 2000 RPA. This is in response to NOAA's updated jeopardy analysis and Judge Redden's May 2003 order. These refinements are directed toward addressing the survival gaps identified by NOAA in the most biologically effective manner and to increase certainty and focus of implementation.

Consistent with the updated NOAA analysis identifying the FCRPS related survival gaps for individual ESUs, the Action Agencies propose to target the lifestage needs of each ESU.

For *low* survival gaps (less than or equal to 2%), we propose to achieve sufficient survival improvements through hydrosystem configuration and operations and/or predator control actions. For *medium* level survival gaps (between 2 and 24%), we propose to achieve additional survival improvements through targeted habitat and hatchery actions. These *low* and *medium* rankings and associated survival gaps are derived from NOAA Fisheries' guidance for habitat improvement (Kratz et al. 2004). This general prioritization and "stacking" of actions is conceptually displayed in **Figure 3**.



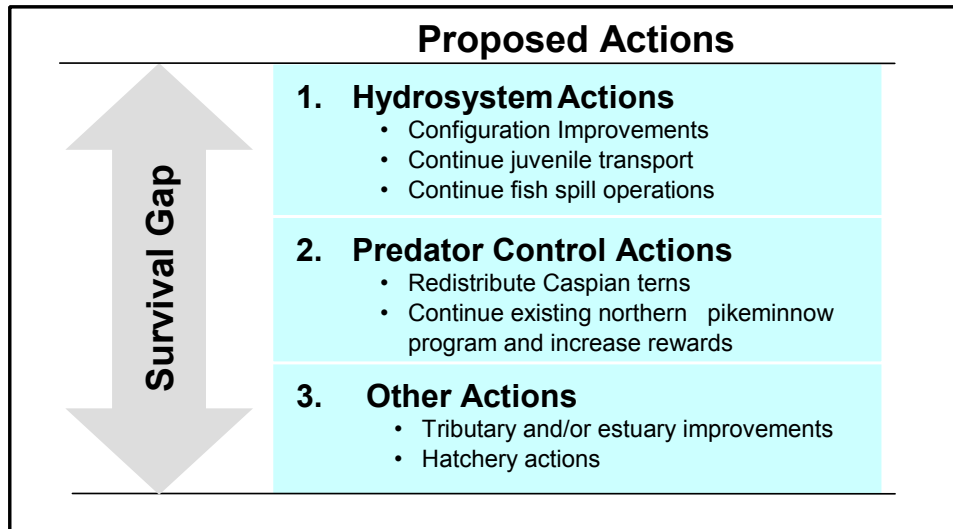


Figure 3 Action Agency general prioritization of actions to fill FCRPS survival gaps

### **C. Continuing or On-going Actions**

While our Updated Proposed Action looks forward in time to describe our future actions, we have already implemented many actions under the 2000 BiOp. These actions have already begun to accrue survival benefits or are expected to soon begin to provide survival benefits for listed ESUs. The Action Agencies have documented these actions in the annual progress reports and the *2003 Check-in Report* prepared under the 2000 BiOp. Because these actions have been implemented under the BiOp, the Action Agencies ask NOAA Fisheries to consider them in evaluating the biological benefits that are now or soon to accrue for purposes of the remanded BiOp. The Action Agencies' progress reports are available at [www.salmonrecovery.gov](http://www.salmonrecovery.gov).

### **D. Strategies and Substrategies**

The Action Agencies will continue to use the strategies and substrategies devised to implement actions under the 2000 FCRPS BiOp. Our published ESA implementation plans lay out these strategies and substrategies and their underlying biological rationale. They will continue to guide our implementation of this Updated Proposed Action and other conservation related actions. We have slightly modified some of the substrategies to align with the recent scientific information and the general approach described in this document and have added strategies and substrategies to promote predator control actions.

These strategies and substrategies are summarized in this section.

#### **1. Hydrosystem Strategies and Substrategies**

The Action Agencies use three hydrosystem strategies and related substrategies.

We propose to continue operating the FCRPS to achieve the hydrosystem performance standards described in the 2000 BiOp. We will specifically operate individual dams as further detailed in the water management plans, implementation plans, the processes afforded through the Regional Forum, and project decision documents.

Reclamation is also consulting on the mainstem affects of the continued operation and maintenance of 19 of its projects in the Columbia River basin. (See Appendix C for details.)

### ***Hydrosystem Strategy 1: Configure Dam Facilities to Improve Juvenile and Adult Fish Passage and Survival***

The Action Agencies have given much attention over the last decade to improving juvenile and adult passage survival through the hydrosystem complex. We have given highest priority to developing and installing additional configuration improvements to increase passage survival rates at mainstem projects.

#### ***Hydrosystem Substrategy 1.1: Mainstem Juvenile Passage Improvements***

Safe and efficient passage of juvenile fish through the hydrosystem is essential to assuring successful perpetuation of all species. The Action Agencies have already made substantial juvenile passage improvements at each FCRPS dam (e.g., surface bypass systems - RSW and corner collector, modifications to existing mechanical bypass systems, relocation of bypass system outfall pipes, minimum-gap turbine runners, extended-length powerhouse intake screens, and spillway deflectors to enable increased spill volumes). We have developed and installed an array of prototype juvenile passage enhancement devices at the eight passage dams. While these devices have been found to incrementally increase juvenile passage survival rates, each dam is unique and poses different juvenile passage challenges. To meet system survival standards, we take into account the cumulative effect of these improvements.

#### ***Hydrosystem Substrategy 1.2: Mainstem Adult Passage Improvements***

Safe and efficient passage of adult fish through the hydrosystem is essential to assuring successful perpetuation of all species. This substrategy will provide adult passage facilities that achieve the adult passage performance standards described earlier. Although the system adult passage survival standard was achieved in 2001 and 2002 and was likely met in 2003 (passage results are incomplete), steps are needed to assure that this performance continues. The adult measures will be directed at investigation and potential correction of conditions that may delay adult migration and/or that improve the passage facilities to assure their continued serviceability and reliability. Adult monitoring facilities (PIT-tag detection) are also needed at each project to facilitate monitoring and evaluation efforts.

#### ***Hydrosystem Substrategy 1.3: Measures That Address Temperature and Dissolved Gas***

The Action Agencies, other federal agencies, states, and tribes have implemented many actions to address water quality in the mainstem Columbia and Snake rivers. Those actions have focused primarily on water temperature and total dissolved gas (TDG), which are influenced by the FCRPS. The Updated Proposed Action manages these water quality attributes to provide optimal passage conditions for listed salmon populations.

In April 2003, we completed a Columbia/Snake River Mainstem System Water Quality Plan, as described in Appendix B of the 2000 BiOp and are implementing the measures outlined in that document.

#### ***Hydrosystem Substrategy 1.4: Project Configuration Research, Monitoring, and Evaluation (RM&E)***

RM&E for configuration and operations and maintenance (O&M) activities provides information necessary to design, build, modify, and operate fish passage facilities; provides baseline information on passage efficiencies and survival through past projects; and provides post-construction evaluation of new

or modified passage facilities. Data from RM&E efforts is also necessary for determining success in meeting hydrosystem performance standards.

### ***Hydrosystem Strategy 2: Manage Water to Improve Juvenile and Adult Fish Survival***

The Action Agencies' goal is to implement water management measures to enhance juvenile and adult survival consistent with other project purposes and available water supply. These measures include system flow objectives for juvenile fish migration, reservoir operations to help meet needs of fish at or near the project, spill for juvenile fish passage, and others.

Each year, the Action Agencies manage a varying amount of natural flow that enters the FCRPS as runoff from precipitation and melting snow pack. Hydrosystem operators use this water to meet multiple purposes, including irrigation, flood control, power production, fish and wildlife, navigation, and recreation. As anticipated in the 2000 BiOp, operators may have to interrupt or adjust water management actions in response to unforeseeable power system, flood control, or other emergencies. They only undertake such emergency actions as a last resort and they only undertake actions needed to respond to the specific emergency condition. During winter power emergencies, for instance, hydrosystem operators may draft water from reservoirs that they otherwise would hold for spring and summer flow augmentation. Once the emergency is past, they replace flow augmentation as soon as and to the maximum extent possible. Similarly, during summer emergencies, the federal hydro operators may draft storage reservoirs below biological opinion draft limits, or reduce bypass spill for fish. Federal operators will manage any power emergencies in accordance with the Regional Forum TMT emergency protocols.

Each fall the Action Agencies prepare an annual Water Management Plan (WMP) that describes proposed hydrosystem fish operations for the upcoming fall/winter, spring and summer passage seasons. The Action Agencies expect to implement most of the water-management measures for fish survival in the BiOps under most water conditions. However, until January of each year, when the National Weather Service and the Action Agencies issue their initial runoff forecasts, we have little information about the actual water supply conditions for the upcoming season. Thus, the Action Agencies prepare seasonal updates (fall/winter and spring/summer) to the WMP that reflect operational priorities based on actual and anticipated water conditions. Each year the TMT reviews and comments on the WMP and the updates. Additionally, the TMT is tasked with in-season management and may make short-term adjustments to hydrosystem operations. Where conflicts occur between BiOp measures, the Action Agencies will resolve them using the priorities recommended in the BiOps. Some detail on these priorities is discussed in the following substrategy discussions.

The Action Agencies will continue to update and annually issue a 5-Year WMP. This plan is a long-range view of hydrosystem operations. It summarizes operations research and other regional initiatives that may lead to hydrosystem operations changes.

The implementation of water management measures is accomplished through in-season operations coordinated through the TMT. Operational strategies for hydrosystem components are described below. (A project-by-project list is provided in **Table 2** of Section III-D, *ESU Specific Actions*.)

In response to the low-water year of 2001 BPA drafted a "Guide to Tools and Principles for a Dry Year Strategy". The draft strategy is largely resource focused and does not address an approach to fish operations in low water years. BPA is exploring options for operational flexibility in dry years and may propose a suite of dry year fish operations for consideration.

### ***Hydrosystem Substrategy 2.1: Reservoir Operations to Improve Fish Survival***

Reservoir operations necessary for improved fish survival and migration conditions through the FCRPS include flow augmentation, limited flow and pool level fluctuations, and cool water temperatures. The annual and 5-year WMPs are the work plans for this substrategy.

### ***Hydrosystem Substrategy 2.2: System Flow Management to Improve Fish Survival***

Coordinated system operations aimed at providing river flows facilitate spawning and redd protection as well as aid fish migration, minimize exposure to predation, and improve water quality. The FCRPS' ability to provide flows for these purposes is commensurate with the available natural water supply.

### ***Hydrosystem Substrategy 2.3: Spill Operations for Project Passage***

Spillways are generally among the safest juvenile fish passage routes past the mainstem projects. This includes both high survival past the dams as well as reduced migration delay in the forebays.

### ***Hydrosystem Substrategy 2.4: Transmission Reinforcements in Support of Flexibility for River Operations***

BPA will continue to work with NOAA to identify and remove transmission system constraints to fish operations if appropriate.

### ***Hydrosystem Substrategy 2.5: Operate to Achieve Maximum Fish Benefits in a Cost Effective Manner***

Hydrosystem operations proposed in the 2000 BiOp were based on the best information then available. Since then, federal agencies and others have completed extensive fish passage research. Where research showed we could increase juvenile and/or adult passage survival rates we have altered BiOp operations accordingly. At times the new operations also reduced operational costs. For example, the Lower Granite RSW enabled improved juvenile spill passage survival rates, reduced total dissolved gas (TDG) levels, and used less water, which increased power generation and revenues. We have also made operational improvements at Bonneville, The Dalles, John Day and Ice Harbor dams since the BiOp was issued. The Action Agencies propose to continue evaluating the fish passage and cost effectiveness of fish operations and expect to propose additional improvements and efficiencies to juvenile or adult passage operations as appropriate.

## ***Hydrosystem Strategy 3: Operate and Maintain Fish Passage Facilities to Improve Fish Survival***

Many of the FCRPS projects incorporated anadromous fish passage facilities, such as fish ladders and bypasses and/or mitigation hatcheries, at the time they were built. Since then, the Action Agencies have updated the original facilities and installed new facilities, such as bypass systems, collection and transport facilities, PIT-tag detection systems, and TDG monitoring equipment.

The Corps' District Offices in Seattle, Walla Walla and Portland coordinate O&M activities at the dams. Each dam has a staff to carry out day-to-day O&M requirements. The Fish Passage Operations and Maintenance Team (FPOM) develop operational priorities and operating criteria that are summarized in the Fish Passage Plan. Project personnel and others involved with river operations and fish passage facilities implement this plan and update it annually (see <http://www.nwd-wc.usace.army.mil/tmt/documents/fpp>).

### ***Hydrosystem Substrategy 3.1: Operation and Maintenance of FCRPS Fish Facilities***

Safe and efficient fish passage depends on properly functioning facilities. Established O&M criteria assure continued proper operations.

### ***Hydrosystem Substrategy 3.2: Non-Routine Maintenance of Fish Passage Facilities***

Safe and efficient fish passage depends on properly functioning facilities. Established O&M criteria assure continued proper operations. As distinct from routine O&M activities, non-routine O&M activities include one-time or very extensive activities.

### ***Hydrosystem Substrategy 3.3: Juvenile Fish Transport Actions to Improve Fish Survival***

The juvenile fish transportation program typically improves juvenile fish survival through the FCRPS when managed in accordance with established operating criteria. Because of the results of recent research the Action Agencies are still evaluating uncertainties concerning the amount and timing of transportation.

### ***Hydrosystem Substrategy 3.4: Operations RM&E***

Monitoring and evaluation of FCRPS fish facilities identified if facilities are operating as intended to improve their performance. Examples of O&M-related RM&E include evaluation of juvenile fish transportation and adult passage at dams.

## **2. Predator Control Strategies and Substrategies**

Predation (piscivorous and avian) is one of the major causes of juvenile fish mortality. The Action Agencies intend to aggressively pursue opportunities to achieve increases in juvenile fish survival from focused measures that reduce predation mortality. In addition, the effects of mammalian predation on adults should be addressed in order to determine if management actions are warranted.

### ***Predation Strategy 1: Redistribute Avian Predation***

Avian predation is one of the factors currently limiting salmonid recovery in the Columbia River Basin. Every year bird species, such as Caspian terns and double-crested cormorants, consume large numbers of migrating juvenile salmonids. Human activities in the Columbia River Basin, some of which are associated with the FCRPS, appear to be related with population increases of avian predators. Therefore, actions may be warranted to reduce avian consumption of juvenile salmon.

#### ***Predation Sub-strategy 1.1: Redistribute Caspian terns nesting on East Sand Island in the Columbia River estuary to habitats located outside of the Columbia River Basin.***

For many of the listed species migrating through the Columbia River estuary, tern predation is considered one of the primary limiting factors affecting juvenile survival (Fresh et al. 2004). Since 1997, researchers have been studying the effect of piscivorous waterbirds on juvenile salmonid survival in the Lower Columbia River. In 1998, scientists estimated that Caspian terns nesting on Rice Island consumed about 12.4 million juvenile salmonids, or approximately 13% of the estimated 97 million out-migrating smolts that reached the estuary during the 1998 migration year (Collis et al. 2003). This research prompted managers to relocate the tern colony to East Sand Island, located approximately 15 miles downstream and near the ocean, which resulted in a successful reduction in predation of juvenile salmonids by approximately 6-7 million fish annually. However, annual predation of juvenile salmonids by terns

nesting on East Sand Island is still substantial; on average, terns consumed 5.9 million smolts annually from 2000 to 2003 (Collis et al. 2003).

***Predation Sub-strategy 1.2: Perform analysis of the double-crested cormorant population in the Columbia River, and evaluate and implement alternatives to manage the cormorant population.***

The double-crested cormorant colony on East Sand Island in the Columbia River estuary is the largest along the Pacific coast (Collis et al. 2000). In 2003, approximately 10,646 breeding pairs were nesting on East Sand Island. Given the birds' feeding habits, it is much more difficult to determine the number of juvenile salmonids they consume. However, based on some preliminary bioenergetics modeling, it appears that cormorants nesting on East Sand Island are consuming equal if not slightly higher numbers of juvenile salmonids as Caspian terns (Roby, pers. comm.); researchers estimated that cormorants nesting on East Sand Island consumed 4.8 million juvenile salmonids in 2003.

Cormorants in the mid-Columbia River have also been showing an increase in numbers. We do not currently have a reliable estimate of the cormorant population in the mid-Columbia River or its impact on salmonids, but the numbers have been increasing. Research of the mid-Columbia cormorant population may be warranted.

***Predation Sub-strategy 1.3: Perform analysis of the Caspian tern population in the Mid-Columbia River, and evaluate and implement alternatives to manage the tern population.***

The only known Caspian tern colony in the mid-Columbia River during 2003 was on Crescent Island, just below the confluence of the Snake and Columbia rivers. The tern colony on Crescent Island consists of 500 – 700 breeding pairs. However, the limited area of suitable tern nesting habitat on Crescent Island and the large colony of California gulls on the island suggest that there is little opportunity for expansion of the tern colony.

The colony of Caspian terns on Crescent Island could have a substantial impact on in-river juvenile salmonids, particularly the upper Columbia River steelhead ESU (Roby, pers. comm.). A 2003 study found their diet consisted of approximately 68% juvenile salmonids, similar to diets of Crescent Island terns during the 2000-2002 breeding seasons (Collis et al. 2003). In 2000 and 2001, terns on Crescent Island consumed an average of 575,000 juvenile salmonids annually.

***Predation Strategy 2: Reduce Piscivorous Predation***

Management of piscivorous predation of juvenile salmonids is one of the most effective means of increasing juvenile fish survival. The Action Agencies intend to aggressively pursue opportunities in the near-term as well as longer-term to achieve increases in juvenile fish survival from focused measures that reduce piscivorous predation.

***Predation Sub-strategy 2.1: Expanded Northern Pikeminnow Management Program***

The Northern Pikeminnow Management Program (NPMP) is a multi-year effort to reduce piscivorous predation on juvenile salmon primarily through public angler-driven system-wide removals of predator-sized northern pikeminnow (*Ptychocheilus oregonensis*). BPA funds the NPMP.

Since program inception in 1990, the NPMP bounty on northern pikeminnow has motivated sports fishermen to remove over 2 million northern pikeminnow throughout the system. This has reduced predation mortality by an estimated 25% (Friesen and Ward 1999), equivalent to over 4 million juvenile

fish not eaten by pikeminnow each year. Currently, the annual harvest rate ranges between approximately 8 and 16 percent of the qualifying northern pikeminnows. In 2001 and again in 2004, BPA increased the reward, which led to significant increases in both catch and exploitation. Preliminary estimates are in the range of 14-18%. (Tom Friesen, ODFW personal communication).

### ***Predation Sub-strategy 2.2: Other Fish Predation***

Smallmouth bass, Walleye and channel catfish are also significant predators of juvenile salmonids. Results from NPMP full indexing in 2004 should update earlier estimates of predation by these non-indigenous species. That new information, combined with existing documentation on bass and walleye predation, should allow the region to begin to pursue options to manage these exotic species. It may be more appropriate to manage these predators on more of a site-specific basis rather than system-wide as in the case of the NPMP.

### ***Predation Strategy 3: Pinniped Predation***

Marine mammal predation has also increased sharply in recent years at Bonneville Dam. Estimates of adult salmonid losses at Bonneville Dam tailrace alone are on the order of 1-2%, primarily of the population of adult migrating spring Chinook (source: Corps).

Lethal and non-lethal deterrence methods are available and utilized in the Northwest (Ballard Locks). Management actions to address marine mammal predation downstream of Bonneville Dam should be scoped and considered for implementation by the appropriate federal agencies.

## **3. Habitat Strategies and Substrategies**

The Action Agencies' Updated Proposed Action refocuses and specifically defines the goals of habitat improvements for each ESU. The types of actions formerly anticipated from RPA Actions 149 through 163 of the 2000 BiOp, as modified by the Action Agencies' implementation plans and by the 2003 *Check-in Report*, were less specific than this Updated Proposed Action. We now have greater certainty about the limiting factors associated with the spawning and rearing habitat of the stream type ESUs and the differential usage of the estuary of the stream type and ocean type ESUs. In concert with NOAA's revised analysis, this has allowed the Action Agencies to customize habitat improvements for each ESU.

The habitat portion of our Updated Proposed Action is directed toward those viable salmonid population (VSP) parameters and limiting factors pertinent to specific ESUs and their subsets of populations or major population groups. We note that the ESA standard is focused on the listed population or ESU as a whole. We address those factors pertinent to the life-stage needs of tributary and/or estuary spawning and rearing habitats that affect the ESUs and/or population groups.

The Updated Proposed Action describes habitat actions in terms of the two major habitat strategies, tributary and estuary, and related substrategies. For certain stream type ESUs, it focuses on actions that address limiting factors in specified subbasins. For ocean type ESUs in the estuary, it focuses on those habitat modifications that will address limiting factors. We note that not all of NOAA Fisheries' potential limiting factor issues are within the discretionary authorities of the Action Agencies. For example, local and state governments have made regulatory land use and water appropriations decisions. Even when they affect habitat conditions, the Action Agencies cannot address that limiting factor.

Available science cannot quantify the increased survival attributable to each habitat action for each ESU. We expect to learn from the effectiveness monitoring program described in Section IV of this document. As these data become available, we may seek to enhance the immediate effects of our actions through

shifting the emphasis from one limiting factor to another or changing from an activity that addresses a certain limiting factor to another that addresses the same limiting factor. We would use our implementation plans to reflect any shifts and to refine the targets of our programs.

Finally, our habitat proposal accounts for the varying level of survival improvements that can be anticipated over time. Some types of actions to address certain limiting factors have nearly immediate life-stage survival improvements. As appropriate, the Action Agencies address a mix of both near-term and long-term actions but emphasize those that yield near-term survival benefits. For example, reducing mortality related to entrainment immediately increases survival whereas riparian improvements take a longer time to show survival improvement. We identify the near-term and long-term actions related to the limiting factors below.

In addition to improving juvenile survival, our habitat improvement projects in the estuary will provide opportunity for individuals of all ESUs to utilize different habitats on their migration to the ocean and help to maintain the other VSP criteria of diversity and spatial structure. While the direct benefits to the population levels cannot be quantified, we consider it important to the long-term health and viability of salmon and steelhead to maintain diversity in life history and distribution. Our rationale for habitat actions is included in Appendix A.

### ***Habitat Strategy 1: Habitat Protection and Improvement in the Tributaries***

NOAA has provided information developed by the Technical Recovery Teams (TRTs) and the Council's subbasin assessments and plans to describe the potential for habitat improvements for each population and major population group for each ESU. However, the science that would allow us to quantify and predict juvenile survival improvements from specific habitat projects or types of habitat projects is still in its infancy. Thus, NOAA evaluated the potential for survival improvements from habitat actions in qualitative rankings of low, medium, and high potential. NOAA also identified for each ESU, population, and major population group the important VSP parameter(s) to be addressed and the habitat limiting factors associated with the tributary spawning and rearing areas.

The Action Agencies propose to address limiting factors for these ESUs that spawn in the tributaries:

- Upper Columbia River spring chinook,
- Upper Columbia River steelhead.

The four limiting factors affiliated with spawning and rearing habitats that the Action Agencies will address for tributary habitat improvements are:

- streamflow,
- entrainment,
- channel morphology, and,
- riparian condition.

These limiting factors define the substrategies for tributary habitat improvements. For clarity, these substrategies have been renamed from our prior BiOp implementation plans to reflect the names of the limiting factors. A description of the general approach the Action Agencies used to guide development of the tributary habitat proposed action is presented in Appendix B.



The Action Agencies considered NOAA's primary limiting factors for ESUs in each subbasin, evaluated those limiting factors in consideration of the Action Agencies' respective authorities for implementation<sup>3</sup>, and selected habitat improvement actions that consider both near-term and longer-term improvements

### *Tributary Habitat Substrategy 1.1 Streamflow*

The Action Agencies will continue to increase water quantity on non-Federal lands in the tributaries that provide important spawning and rearing habitat for the selected stream-type ESUs. Streamflow improvements have near-term survival impacts. We will address streamflow limiting factors through site-specific opportunities which may include:

- Lease and acquire stream flows.
- Initiate and continue instream flow evaluation studies.
- Replace headgates.
- Increase streamflows.
- Continue implementing streamflow and instream water transaction programs.

This substrategy is consistent with the Pacific Coast Salmon Recovery Fund (PCSRF) *In-stream Flow Projects* metric category.

### *Tributary Habitat Substrategy 1.2 Entrainment*

NOAA identified entrainment of adults and juveniles by water diversions as a potential limiting factor in some subbasins. Addressing entrainment has near-term effects on reducing mortality. The region has made significant progress to alleviate the historic entrainment problem by installing or retrofitting screens to current NOAA's specifications. Some work remains to be done in some subbasins, and the Action Agencies will address entrainment where it is needed.

This substrategy is consistent with the PCSRF *Fish Screening Projects* metric category.

### *Tributary Habitat Substrategy 1.3 Channel Morphology*

The Action Agencies will continue to improve fish passage on non-Federal lands in selected subbasins by removing obstructions to spawning and rearing habitat including diversions, culverts, and other migration barriers. This substrategy also includes actions that would improve stream connectivity with floodplains and side channels. Most channel morphology activities have near-term survival improvement effects.

This substrategy is consistent with the PCSRF *Fish Passage Improvement Projects* and *Instream Structural Projects* metric categories.

### *Tributary Habitat Substrategy 1.4 Riparian Protection and Riparian Enhancement*

This substrategy focuses on improvements to riparian buffers by protecting and enhancing riparian habitat buffers on non-Federal lands. Types of actions to address this substrategy may include acquisition of easements or other protective interests in land, riparian treatment and fencing, and streambank stabilization projects. Riparian protection and enhancement actions accrue benefits over a longer period of time and have long-term survival improvement effects.

This substrategy is consistent with the PCSRF *Land Acquisition/Lease/Easement Projects* and *Riparian Habitat Improvement Projects* metric categories.

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<sup>3</sup> For example, a suggested habitat improvement potential is flood plain development restrictions. That type of action would require local zoning restrictions and is clearly beyond the authority of the Action Agencies. These and similar types of actions are not included in this Proposed Action.

### **Tributary Habitat Conservation Actions**

As we did under the 2000 BiOp, the Action Agencies will continue to use their existing programs and other discretionary authorities to support additional habitat improvements initiatives and measures in the Columbia River Basin accessible to listed anadromous species. The Action Agencies will provide support for these programs that may be in areas outside the geographic boundaries of the jeopardized ESUs or outside the action area of this implementation plan, but which also conserve or enhance the spawning and rearing habitat of populations of the listed ESUs. Prior to implementation, the Action Agencies will ensure that such actions have undergone appropriate section 7 consultations. BPA will continue to implement its integrated Fish and Wildlife Program consistent with the Council's Fish and Wildlife Program. This would include a wide range of projects that promote habitat conservation and improvements. Reclamation and the Corps will continue to use their discretionary authorities to provide technical assistance to others for stream habitat improvements.

Reclamation will use its current technical assistance program to provide habitat improvements to address certain limiting factors in the Lemhi, Upper Salmon, Little Salmon Rivers, North Fork John Day, Middle Fork John Day, and Upper Mainstem John Day subbasins in Idaho and Oregon as *conservation measures*.

### **Habitat Strategy 2: Habitat Protection and Improvement in the Estuary**

Scientists generally believe that estuaries provide a protected and food-rich environment for juvenile salmon growth and allow the transition between the fresh and salt-water environments for both juveniles and adults. The 2000 FCRPS BiOp included RPA actions calling for habitat work and RM&E efforts in the estuary to help offset impacts of the FCRPS. The Action Agencies and others in the region developed a comprehensive estuary restoration program to inventory, protect and restore key habitats. The program includes a major monitoring, analysis and research program to evaluate progress toward rebuilding the productivity of the system over the long term. This program is outlined in more detail in the Action Agencies' restoration plan, entitled *An Ecosystem-Based Approach to Habitat Restoration Projects with Emphasis on Salmonids in the Columbia River Estuary, Appendix A* (Johnson et al., 2003). This restoration plan identifies five elements – protection, conservation, enhancement, restoration and creation – which are addressed in this strategy.

NOAA's final Technical Memorandum, *Role of the Estuary in the Recovery of Columbia River Basin Salmon and Steelhead: An Evaluation of the Effects of Selected Factors on Population Viability*, dated June 2004, and the guidance document *Mitigating the Effects of FCRPS Operations*, dated July 1 2004 indicate the potential benefits of estuary habitat improvements are likely to be greatest for ocean type salmonids such as Snake River fall Chinook, Lower Columbia River chum, Lower Columbia River Chinook, and Lower Columbia River steelhead. These documents indicate a *very low to low* potential to benefit the other listed ESUs (stream type) by improving habitat in the estuary. However, species life history diversity hypotheses set forth in *Salmon at River's End: The Role of the Estuary in the Decline and Recovery of Columbia River Salmon* and the June 2004 technical memorandum indicate that some stream type salmonids may also benefit from habitat improvements in the estuary. As addressed elsewhere in this document, there is also some potential to benefit these stream type ESUs through predation management actions.

The two estuary habitat restoration projects proposed by the Action Agencies are within the Action Agencies' authorities and are anticipated to address predation, and habitat to differing levels. These projects will provide some increase in juvenile salmonid shallow water habitat that would benefit all listed ESUs, with the greatest habitat benefit to those ESUs expressing ocean type life histories that use the estuarine environment for longer periods of time. Finally, as the habitat restoration projects listed are

intended to expand and improve juvenile salmon shallow water habitat, this increase and improvement in rearing habitat is believed to provide refuge for some of the ESUs, thereby increasing survival and decreasing predation. As with habitat enhancement, the predation decrease is expected to provide a larger benefit for ocean type salmonids using the lower river and estuary for longer periods of time.

Additional projects are expected to be identified based on research and regional coordination and developed following the Action Agencies Restoration Plan, providing greater benefits in the future.

### *Estuary Habitat Substrategy 2.1: Protect Estuary Habitat*

This substrategy includes estuary projects that would secure a property interest through land acquisition, lease, or easement. Metrics tracked for these types of projects include:

- the number and location of acres protected,
- the term of protection, and,
- the riparian miles protected.

The Action Agencies are attempting to acquire ownership or development rights to intact patches of habitat or critical areas in need of further restoration treatments.

As the estuary studies continue to improve our understanding, the Action Agencies will be better able to target the amount and types of habitat that would help avoid jeopardy and better quantify the biological benefits of these actions. Ultimately, our goal is to implement actions that provide the greatest and most efficient biological benefit to listed ESUs.

Habitat conservation is geared toward the goal of increasing the potential for natural processes to work for the benefit of multiple species and can be a critical component of a larger restoration plan, limiting harmful impacts of conventional management practices and complementing other measures to help boost the site's potential for self maintenance. Examples of habitat conservation incentives include financial support for the implementation of riparian setbacks, the addition of riparian buffer strips, integrated pest management, and off-stream livestock watering techniques. The Action Agencies' restoration plan includes additional discussion of protection and conservation strategies and applications.

This substrategy is consistent with the PCSRF *Land Acquisition/Lease/Easement Projects* metric category.

### *Estuary Habitat Substrategy 2.2: Estuarine Habitat Improvement*

This substrategy includes a suite of habitat actions – estuary habitat enhancement, creation, and restoration – that are described in the Action Agencies restoration plan (Johnson et al, 2003). These actions will be tracked in the Federal Caucus' Habitat Team (FHT) and Pacific Coast Salmon Recovery Fund (PCSRF) metrics as *estuarine improvement projects*. The metrics include the location and number of acres protected, enhanced or restored, the number of acres opened or created, and the number of acres where invasive species control measures are applied.

**Enhancement.** Habitat *enhancement* entails the improvement of a targeted ecological attribute and/or process. Several groups are implementing enhancement projects to improve different elements of the ecosystem including: riparian plantings and fencing; tide gate or culvert replacement; invasive species removal; and stream bank stabilization.

**Restoration.** Like habitat enhancement projects, *restoration* projects can take place in a variety of ways. According to the working definition, restoration means the return to a previously existing ecological condition. This can involve more intense modification and manipulation of site conditions than

enhancement. As a result, *restoration* projects typically require more careful planning, design, and maintenance than enhancement projects. For example, we can gain miles of habitat by reconnecting tidal channels that have been cut off by tidewaters, dike construction, and placement of fill material for land-use activities. Reconnecting these areas through the removal of tide gate structures, dike breaching, and or culvert installation into a roadbed, however, can increase the risk of flooding landowners that were previously protected by these structures. Therefore reconnecting tidal channels may require a combination of strategies, such as acquisition and enhancement. At sites where reconnection is not possible, self-regulating tide gates should be considered.

**Creation.** Habitat *creation* involves constructing or placing habitat features that did not exist previously, but which attempt to mimic conditions of an intact, functioning ecosystem. Tidal channel excavation is an example of a habitat creation strategy intended to replicate the natural structure and function of an intact channel in close proximity to the project site. Another is the placement of dredged material intended to create marsh or other habitat. Because of the uncertainty about the potential ecological gain from a habitat creation strategy, it needs to be accompanied by a strong effectiveness-monitoring component.

As the estuary studies continue to improve our understanding, the Action Agencies will target and implement actions that would help avoid jeopardy (establish amount and types of habitat) and better quantify the biological benefits of these actions. Our goal is to implement actions that provide the greatest biological benefit to listed ESUs.

#### **4. Hatchery Strategies and Substrategies**

As with the habitat actions, the scope and priority for hatchery actions depends upon the difference, or “gap”, between survival achieved through the proposed action and the reference operation. We have revised our hatchery strategies to focus on the biological priorities indicated by the updated NOAA analyses under the BiOp remand.

##### ***Hatchery Strategy 1: Implement a Safety-net Program as an Interim Measure to Avoid Extinction***

A number of listed salmon and steelhead populations in the Columbia Basin may be at particularly depressed levels, with some facing a high risk of extinction. A safety-net project designed to intervene with artificial production techniques may be appropriate to prevent extinction of these populations while the factors responsible for the population decline are addressed.

##### ***Hatchery Strategy 2: Reduce Potentially Harmful Effects of Artificial Production to Aid Recovery through Hatchery Reform***

###### ***Hatchery Substrategy 2.1: Develop Hatchery and Genetic Management Plans (HGMPs)***

Hatchery operations and hatchery-origin fish may have negative impacts on listed stocks of salmon and steelhead. The HGMP development process will allow us to determine qualitatively whether a hatchery or facility can contribute to recovery of a listed species through the modification of existing practices or facilities.

###### ***Hatchery Substrategy 2.2: Fund and Implement Hatchery Reform Actions***

Reducing negative impacts of artificial propagation through hatchery reform actions may increase survival of listed populations. Examples of potential reforms from the 2000 BiOp include producing fish

derived from locally-adapted stocks to the extent feasible and appropriate, and employing hatchery practices that reduce unwanted straying of hatchery fish.

## **5. Harvest Strategies and Substrategies**

Harvest reform measures have the potential for immediate benefits to listed ESUs, including enabling continued tribal and non-tribal harvest of stronger stocks. The Action Agencies harvest strategies seek to improve adult life-stage survival through measures that will directly or indirectly reduce the take of listed species in the near-term and will advance harvest reforms, for application over the longer term.

### ***Harvest Strategy 1: Fishery Effort Reduction Programs***

Harvest reductions produce immediate increases in spawning escapement, thereby reducing the near-term risks of extinction more quickly and certainly than other conservation actions.

Under this strategy, the Action Agencies would continue to pursue opportunities for reducing harvest impacts on listed species consistent with the 2000 BiOp related conservation recommendations. These opportunities may include agreements that reimburse commercial harvesters for reducing their catch or for not fishing – thus, creating increased abundance that can be passed through other fisheries to the spawning grounds.

### ***Harvest Strategy 2: Potential Alternative/Terminal Fishing Locations***

Fisheries can be located in areas that minimize the harvest of non-target stocks to the extent possible, subject to various constraints. Terminal fisheries can in some cases provide alternative harvest opportunities to mixed stock fisheries.

Under this strategy, the Action Agencies would address potential alternative/terminal fishing locations depending on interest from fisheries managers.

### ***Harvest Strategy 3: Develop Fishing Techniques to Enable Fisheries to Target Non-listed Fish While Reducing Harvest-related Mortality on ESA-listed Species***

The most likely and immediate source of relief from tight harvest restrictions lies in achieving greater catch selectivity, either through use of more selective fishing gear or by expanding fishing opportunities in known-stock, terminal areas (All-H Paper, Vol. 2, pg. 38, 39, 48). We can determine mortality rates on fish released from live capture gear and hold them within acceptable levels.

## E. ESU Specific Actions

Based on the strategies and substrategies previously described, this section includes the Action Agencies' Proposed Actions to benefit specific ESUs. These actions would contribute to filling the ESU specific survival "gaps" identified in NOAA's revised jeopardy analysis. Also included in this section are our Conservation Actions that would benefit ESUs, but are not part of the Updated Proposed Action and should not be included in NOAA's jeopardy analysis.

### 1. Proposed Actions That Would Benefit Multiple ESUs

The actions described in this section generally benefit all ESUs.

Figure 4 displays the Action Agencies array of actions that contribute to filling the survival "gaps" for most or all of the listed ESUs affected by the FCRPS.

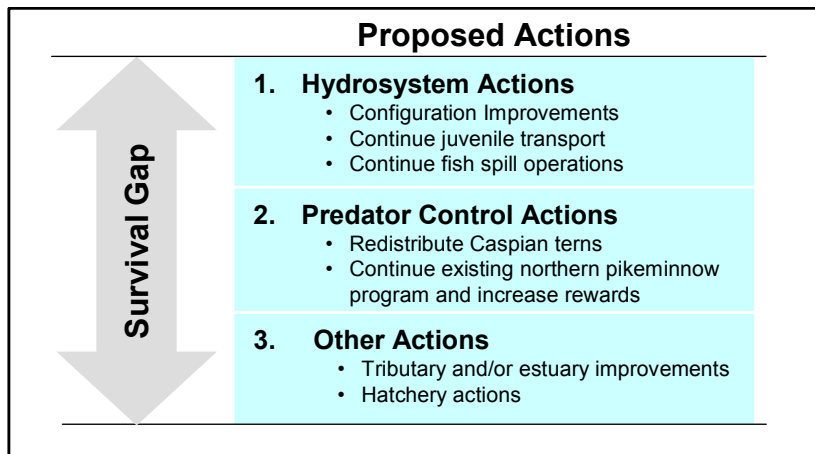


Figure 4 Proposed actions to benefit multiple ESA-listed ESUs

#### Hydrosystem Actions

The following major actions have varying potentials to affect listed ESUs in the Columbia River Basin. We note that the population effects to various ESUs vary widely and may change due to various actions. We would expect the impact to specific stocks to vary inversely with the total distance traveled to that point and the potential for specific stocks to be transported. For example, a change in spill at Bonneville Dam has the potential to impact Snake River juvenile fall Chinook. However, because few fish are left inriver to migrate, the impact of the change is not the same as it might be for lower Columbia River coho.

Table 1 summarizes the specific ESUs benefited by the following groups of actions.

**Table 1. ESUs Benefitted by Proposed Hydrosystem Actions**

	FLOW OPERATIONS	SPILL & PASSAGE - LOWER COLUMBIA	SPILL & PASSAGE - LOWER SNAKE	CONFIGURATION IMPROVEMENTS - LOWER COLUMBIA	CONFIGURATION IMPROVEMENTS - LOWER SNAKE	JUVENILE FISH TRANSPORTATION
Upper Columbia Spring Chinook	x	x		x		x
Upper Columbia Steelhead	x	x		x		x
Snake River Spring/Summer Chinook	x	x	x	x	x	x
Snake River steelhead	x	x	x	x	x	x
Snake River Sockeye	x	x	x	x	x	x
Snake River Fall Chinook	x	x	x	x	x	x
Mid-Columbia Steelhead	x	x		x		x
Lower Columbia Chinook	x	x		x		
Lower Columbia Steelhead	x	x		x		
Columbia River Chum	x	x		x		
Upper Willamette Chinook	x					
Upper Willamette Steelhead	x					
Lower Columbia Coho	x	x		x		

The dates provided below for the hydrosystem actions, including studies, development and implementation are planning dates and may change based upon the results of on-going research and regional coordination. Any changes will be coordinated through the annual Implementation Planning process. Most of the actions described below will occur within the 2004-2010 period. The operations will continue, as described, through 2014 and the planned construction and evaluation of improved bypass systems such as removable spillway weirs (see RSW and BSG, below) will continue until 2014.

**Flow Operations.** Operations for the delivery of water through the FCRPS will benefit all of the listed ESUs.

**Spill and Passage Operations in the Lower Columbia.** Lower Columbia River spill and passage operations will benefit all fish originating upstream of Bonneville Dam and those fish that use the mainstem for spawning and rearing downstream of Bonneville Dam. Considering TDG, the spill operations may also include a minor impact to the Willamette stocks as well.

**Spill and Passage Operations in the Lower Snake.** Lower Snake River spill and passage operations will benefit all fish originating upstream of Ice Harbor dam and those fish that use the mainstem for migrating, spawning and rearing downstream of Ice Harbor. Considering TDG, the spill operations may also include a minor impact to the upper and mid-Columbia stocks as well.

**Configuration Improvements.** The Corps will complete the extended submerged intake screen systemwide letter report and implement recommended improvements, as coordinated with NOAA Fisheries. Configuration modifications of the lower Columbia River dams will benefit all fish originating upstream of Bonneville Dam. Because adult chum salmon migrated upstream of Bonneville in 2003, this stock was also included. Configuration modifications of the lower Snake River dams will benefit all fish originating upstream of Ice Harbor Dam.

The Corps will complete investigation of fish performance and engineering issues including improved porosity-control panel and panel connection design, debris handling, vertical barrier screen (VBS), gatewell cleaning and inspection measures for Bonneville, John Day and John Day dams and implement them, as appropriate.

**Juvenile Fish Transportation.** The juvenile fish transportation operations will benefit all stocks of fish originating from upstream of Lower Monumental in the spring and from upstream of McNary Dam in the summer.

**Mainstem Juvenile Passage Improvements.** The Action Agencies will continue to evaluate and make capital improvements to improve fish passage survival rates as guided by the 2000 BiOp RPA actions. We will generally give schedule and funding priority to improvements at dams where the passage survival rates are lowest. To accomplish this, the Action Agencies will develop comprehensive passage improvement plans for each passage dam. These plans will guide future configuration investments and help hydrosystem operations meet the hydrosystem passage survival targets and standards included in the 2000 BiOp (see Tables 9.2-3, 9.7-5 and Table D4 of the 2000 BiOp).

Below we summarize major improvements at each dam that we are considering or anticipating as Key Alternatives Under Development. We are still developing passage plans and evaluating alternatives. Thus, at this point we generally cannot specify the ultimate configuration (and related operational) recommendations at each project. We will compare biological effectiveness and costs to determine the optimum configuration and operation at each project that will contribute to achievement of performance requirements.

### Key Alternatives Under Development

#### **Bonneville Dam**

- 1<sup>st</sup> Powerhouse surface bypass
- 1<sup>st</sup> Powerhouse FGE, bypass and outfall relocation
- 2<sup>nd</sup> powerhouse FGE

We will continue to consider the 1<sup>st</sup> powerhouse alternatives to provide additional improvement to passage conditions. With continued 2<sup>nd</sup> powerhouse priority and current BiOp spill levels these could provide a modest survival improvement for spring/ summer chinook and steelhead migrants. These alternatives also have the potential to allow reduction of spill levels while maintaining current passage survival for all ESUs. For 2004 operations, the existing standard length screens were pulled and fish now pass through the turbines (with a priority for operating the new MGR turbines) or the existing sluiceway.

**1<sup>st</sup> Powerhouse surface bypass (sluiceway improvements).** The Corps began to evaluate sluiceway passage efficiency and survival in 2004. We are investigating improvements in the sluiceway as a lower



cost surface bypass alternative to bypass system improvements and deep-slot surface bypass. At the time of release of the Bonneville Decision Document, only a preliminary calculation of potential benefits for spring/ summer chinook based on assumptions was conducted. As reported in that document, a combination of survival and efficiency improvements in higher flow years could provide a small 0.2% project survival improvement. As indicated, evaluations of the current sluiceway passage parameters are just getting underway and better survival and efficiency data is forthcoming. (2007)

**1<sup>st</sup> Powerhouse FGE, bypass system improvements and outfall relocation.** The Corps has been evaluating this alternative in parallel with surface bypass alternatives over several years. Designs for the bypass improvements and outfall relocations have been completed and could be implemented quite quickly. Prototype extended length screen tests have shown potential fish guidance efficiency (FGE) improvements from 39% existing to 72% for spring/summer chinook, 41% existing to 85% for steelhead, and 9% existing to 35% for fall chinook. As reported in the Bonneville Decision Document, when combined with an improvement in survival to 98% through this route from 90% for the first two ESUs, the alternative is estimated to have the potential to provide a project survival improvement of between 0.3% and 0.6% for spring/summer chinook, 0.4% and 0.7% for steelhead based on a weighted average flow year, with higher values in high and medium flow years. For fall chinook with a route specific survival improvement from 82% to 98%, project survival was estimated to improve 0.0% to 0.3% only in high flow years. We will also investigate and construct as warranted vertical barrier screen cleaning and gatewell debris removal facilities and real time gatewell flow mechanisms. (2010)

**2<sup>nd</sup> Powerhouse FGE and bypass improvements.** This alternative has the potential to provide a small increment of survival benefit for all migrants. The Corps continued to test a prototype of the guidance modifications in 2004, which now is being tested with the new corner collector operational. The analysis presented in the Bonneville Decision Document reports a potential 0.1% to 0.3% project survival improvement for all ESUs, with FGE improvements from 48% existing to 60% for spring/summer chinook and steelhead and 28% existing to 40% for fall chinook. The effect of the new corner collector operation on guidance into the bypass system may be an important factor in determining the benefit of this alternative (2008).

The Corps and BPA will assess and implement where feasible, less-intrusive, PIT-tag interrogation methods at Bonneville dam. The Corps is also considering other passage improvements at Bonneville, including full flow PIT-tag reading capability, which is anticipated to help reduce stresses and thereby potentially benefiting juvenile passage issues such as “extra” mortality (2007). Concerns with orifice passage at the 2<sup>nd</sup> Powerhouse is also an issue that has been raised and we will investigate orifice passage improvements (2010).

#### **The Dalles Dam**

Additional spillway modifications  
Forebay guidance device  
Sluiceway guidance efficiency  
Sluiceway outfall relocation  
Adult PIT Tag Detectors

**Adult PIT Tag Detectors.** Adult PIT tag detectors are being considered for The Dalles to facilitate evaluation of unaccounted losses in the lower river. (2014 as warranted)

**Additional spillway modifications.** With the addition of the spillwall at The Dalles Dam in 2004, we anticipate that survival of juvenile salmonids passing the spillway could be as high as 98%. If spillway survival estimates from 2004 research indicate that spillway survival is less than 98%, we will likely pursue other spillway improvements to achieve the targeted 98% spillway survival. Current baseline passage efficiency for the spillway under 2000 BiOp spill is 86%, with a remaining 8% passing through

turbines and 6% passing through the sluiceway during the spring. During summer with 2000 BiOp spill; passage estimates are 74% for the spillway, 19% for turbines and 7% for the sluiceway. Assuming a spillway survival rate of 98% with the passage distribution estimates listed above, overall project survival could increase by as much as 4% for both spring and summer migrants (2007).

**Forebay guidance device.** If spillway modifications to improve spillway survival are unsuccessful, reducing spill below 2000 BiOp levels is an alternative that might help improve spillway egress and reduce injury, thereby improving spillway survival. One potential drawback to reducing spill at The Dalles is that a corresponding reduction in spillway passage would likely occur. One alternative that could help maintain spill passage, yet allow spill levels to be reduced is a forebay guidance device. A behavioral guidance structure (BGS) placed in the forebay at Lower Granite Dam demonstrated that approximately 80% of downstream migrants that may have otherwise passed through turbines or the juvenile bypass system were diverted by the BGS to either surface bypass collector or spillway routes. A similar structure placed in The Dalles forebay may be used to maintain or improve project survival under reduced spill scenarios. Outlined below are possible theoretical survival benefits that a forebay guidance structure may provide under existing or reduced spill scenarios (2007).

- *30% Spill Scenario with Forebay Guidance Device:* Assuming a spring fish passage efficiency (FPE) of 76% (spill passage = 61%, turbine passage = 24%, and sluice passage = 15%,) then applying an 80% forebay guidance device diversion factor (as estimated at Lower Granite) FPE during the spring with 30% spill and a forebay guidance device could be as high as 92.2%, resulting in an overall project survival increase of up to 2% for spring migrants. During the summer, assuming an FPE of 64%, (spill passage = 54%, turbine passage = 36%, and sluice passage = 10%,) then applying an 80% forebay guidance device diversion factor (as estimated at Lower Granite) summer FPE with 30% spill and a forebay guidance device could be as high as 90.8%, resulting in an overall project survival increase of up to 3% for summer migrants.
- *20% Spill Scenario with Forebay Guidance Device:* Assuming a spring FPE of 52.9% (spill passage = 24%, turbine passage = 47.1%, and sluice passage = 28.9 %, (assuming same sluice/turbine proportion as 30% spring spill)) then applying an 80% forebay guidance device diversion factor (as estimated at Lower Granite) spring FPE with 20% spill and a forebay guidance device could be as high as 84.8%, resulting in an overall project survival increase of up to 5% for spring migrants. During the summer, using an estimated FPE of 40.7% (spill passage = 24%, turbine passage = 59.3%, and sluice passage = 16.7 %, (assuming same sluice/turbine proportion as 30% summer spill)) then applying an 80% forebay guidance device diversion factor (as estimated at Lower Granite) summer FPE with 20% spill and a forebay guidance device could be as high as 84.8%, resulting in an overall project survival increase of up to 2% for summer migrants.

**Sluiceway modifications.** Increasing the passage efficiency of the sluiceway, either by modifying gate entrance configurations or increasing overall sluiceway capacity (or a combination of both), may also offer project survival benefits at The Dalles Dam. Using current spring passage estimates of 86% spill passage, 8% turbine passage, and 6% sluice passage, and route specific survival estimates of 94% spillway survival, 84% turbine survival, and 95% sluiceway survival, increasing sluiceway passage efficiency by 5% and decreasing turbine passage by 5%, could increase project survival by up to 1% under 2000 BiOp spill (2010).

**Sluiceway outfall relocation.** Project survival could increase by as much as 1% assuming a sluiceway survival of 99% could be achieved by moving the sluiceway outfall downstream under 2000 BiOp spill and assuming spring passage estimates of 86% spill passage, 8% turbine passage, and 6% sluice passage (2010).

**Adult PIT Tag Detectors.** Adult PIT tag detectors are being considered for John Day to facilitate evaluation of unaccounted losses in the lower river. (2010)

**John Day Dam**

Surface bypass (skeleton bays or RSW)  
Extended length screens  
Bypass system outfall  
Turbine passage  
Fish Ladder Improvements  
Adult PIT Tag Detectors

The Action Agencies are evaluating these alternatives in conjunction with spill level options to optimize fish passage efficiencies and survival through the project. Improved and/or more efficient guidance as well as tailrace egress and predation issues need to be addressed. Recent data suggest that survival through turbines at this project is very low. These measures have the potential to reduce turbine entrainment. Turbine operational improvements also have potential to increase project survival at this dam. In addition to these alternatives, provision of full-flow PIT tag monitoring capability, as discussed in the Bonneville section, is planned.

**Adult PIT Tag Detectors.** Adult PIT tag detectors are being considered for John Day to facilitate evaluation of unaccounted losses in the lower river. (2010)

**Surface bypass skeleton bays / RSW /Behavioral Guidance Device.** The concept of these alternatives is to divert a proportion of turbine-bound fish to the spillway. None of the structures have been tested at John Day Dam. It is assumed that none of these alternatives alter spillway survival from that of the baseline, but some combination will increase spill passage efficiency (SPE) and FPE. Using route-specific survival estimates collected under the 2000 BiOp spill operation for yearling Chinook (spill S = 97.1%, turbine S = 79.9%, JBS S = 96.5%) and a 24-hour spill operation for subyearling Chinook (spill S = 95%, turbine S = 72%, JBS S = 92%) and 2003 passage distribution estimates as the baseline, the survival increase for skeleton bay or RSW was estimated based on a range of SPE from 70% to 80%. Yearling Chinook dam survival increases range from 0.7% to 1.2% with implementation of RSW(s) or skeleton bay surface bypass. subyearling Chinook dam survival increases from 1.5 to 3.3% (2010).

**Extended Length Screens.** Based on FGE estimates from 2002 fyke net studies and using route-specific survival estimates collected between 2000 and 2003 (same estimates as used above), extended length screens are estimated to increase dam survival by 0.7% for yearling Chinook and 2.6% for subyearling Chinook.

**Juvenile bypass system (JBS) outfall egress improvement.** The analysis for this alternative assumes that JBS survival can be increased to 98% for spring and summer juvenile migrants by relocating the outfall or altering tailrace hydraulics to improve egress from the JBS outfall. Under this alternative, dam survival is estimated to increase by 0.5% for yearling Chinook and 0.6% for subyearling Chinook (testing 2006; implementation 2007/2008).

**Tailrace egress improvements for turbine passed fish.** This alternative could include either a spillway divider wall (a wall dividing the powerhouse from the spillway) or turbine operation improvements, or a combination. All other baseline inputs remaining equal to the above alternatives, dam survival would increase by 1.3% for yearling Chinook and 5.1% for subyearling Chinook if turbine survival can be increased to 90% through egress improvements (testing 2006; implementation 2007/2008).

Provision of additional turbines in the skeleton bays, alone or in combination with the above alternatives has also been suggested and will be given consideration, as a possible alternative to improve tailrace egress issues.

**Fish Ladder Improvements.** The Action Agencies will use information from previous and ongoing investigations regarding the problem of adult steelhead holding and jumping in John Day fish ladders. South ladder improvements have been successfully implemented and a proposed course of action is being investigated for the north ladder. (2010 as warranted)

### **McNary Dam**

Powerhouse modernization  
RSW(s)  
Behavioral guidance structure  
Juvenile Fish Facility Improvements  
Improvements to the spillway

**Powerhouse Modernization.** Evaluation of juvenile passage effects and opportunities for improvement will be a significant consideration in developing a long term plan to enhance power production at this project and improve direct and indirect turbine passage survival. Given a conservative estimate, direct turbine survival is anticipated to increase by 1 to 2%. The additional survival benefits anticipated with improvements to the tailrace hydraulic environment will not likely be achieved without a change in the current level of spill (both voluntary and involuntary) at McNary Dam (2010).

**RSW and BGS.** The RSW already in operation at Lower Granite is estimated to have a passage effectiveness of 7:1 (6:1-8:1) and route specific survival estimate of 98 % (96 –100%). Two RSWs will be considered for this project to enhance spillway passage survival under reduced spill levels that result from powerhouse modernization, and/or to reduce costs of passage. At Lower Granite the RSW has been shown to pass similar numbers of juvenile spring migrants with less spill and thereby lower levels of gas entrainment than current 2000 BiOp (gas cap) spill and with reduced forebay delay. The application of two RSW at McNary spillway are anticipated to have passage effectiveness of 3.5:1, and route specific survival is estimated to remain 98% over a range of flows. Guided by results from tests at Lower Granite, a BGS may be considered in conjunction with RSW's to assess their potential contribution to effective fish passage and survival. Based on studies conducted at Lower Granite, the BGS efficiency is estimated to be 78.00% (60%-90%) for yearling Chinook and steelhead at McNary. No subyearling Chinook are spilled in the proposed summer operation at McNary.

**Juvenile Fish Facility Improvements.** Bypass improvements to the juvenile fish facility include relocation of the outfall pipe to improve egress conditions at the release site for juvenile salmon (2007). Combined survival improvements under the proposed operation for bypassed fish is expected to increase 2.5% for Snake and Columbia River Chinook and steelhead. Subyearling chinook are transported and are not bypassed to the tailrace. We will also investigate and construct as warranted vertical barrier screen cleaning and gatewell debris removal facilities and real time gatewell flow mechanisms. (2010)

**Improvements in Spillway Survival.** Construction of a powerhouse divider wall was evaluated to provide a 0.5% total spillway survival benefit for yearling chinook and steelhead at McNary Dam due to increased egress conditions in the tailrace. (2010)

**Changes In Project Survival.** Analysis of the proposed operation with all combined construction improvements at McNary Dam is estimated to increase project survival by 1.1% for yearling Chinook, 1.1% for steelhead, and 1.6 % for subyearling Chinook.

The relative benefits of in-river versus transport passage strategies will be a key consideration in recommendations to implement these improvements and their uses in future project operations. The Major System Improvements Analysis process will be the avenue for reaching recommendations for configuration and operations at this project.

**Ice Harbor Dam**

Improvements to the spillway  
Behavioral guidance structure  
Powerhouse Improvements

Spillway improvements tests in 2004 continue to evaluate spillway operations to assess causal mechanisms for injury and survival issues to assess what, if any, additional measures in addition to the RSW will be recommended. The RSW is under construction at this project and will be in operation in 2005. Tests will continue after installation to confirm any potential recommendations. After initial testing of the effectiveness of the RSW in 2005, and guided by results from tests at Lower Granite, evaluation of the benefit of installation of a BGS at this project will be conducted. BGS efficiency at Ice Harbor is estimated to be similar to the level of performance documented at Lower Granite, 78% (60%-80%).

**Spillway Improvements.** Improvements for spillway survival under evaluation include adding divider walls with an assumed 0.5% increase in spillway survival (2008-2009 as warranted), and modification or relocation of spillway deflectors have potential to increase spill survival by 3% (2010 as warranted).

**Powerhouse Improvements.** Items under evaluation include extended length screens which divert greater number of fish away from turbines and are assumed to increase current FGE values by 12% based on the change in FGE documented at Little Goose and Lower Granite after the implementation of extended screen for all species increasing yearling Chinook and Steelhead FGE to 82%, and subyearling Chinook 66%, respectively. The analysis for the reference alternative assumes an improvement of 1% increase in survival for a change in turbine operation based on biological testing, and a 2% improvement in total turbine passage (direct and indirect survival) with construction of a divider wall.

**Change in Project Survival.** Analysis of the proposed operation with all combined construction improvements at Ice Harbor dam is estimated to increase project survival by 1.4% for both Snake River yearling Chinook and Snake River steelhead, and 0.9 % for Snake River subyearling Chinook. .

**Lower Monumental Dam**

RSW  
BGS  
Improvements to the spillway  
Powerhouse Improvements

**RSW and BGS.** See the discussion under McNary, above, regarding potential RSW and BGS measures and project operations. RSW passage survival is estimated to be 98% (96-100%) and have passage effectiveness of 7:1 for all species. The BGS guidance efficiency at Lower Monumental is estimated to be similar to the level of performance documented at Lower Granite, 78% (60-80%) for Snake River yearling Chinook and steelhead. No Snake River subyearling Chinook are spilled under the proposed summer operation at Lower Monumental.

**Spillway Improvements.** Improvements for spillway survival under evaluation include adding divider walls to improve tailrace egress (2010 as warranted). This is assumed to provide a 0.5% increase in spill survival for yearling Chinook and steelhead. Other improvements to the spillway, including modification or relocation of spillway deflectors, have been estimated to provide a 1% survival benefit to yearling Chinook and steelhead passing through the spillway. Subyearling Chinook are not spilled in the summer

under the proposed operation.

**Improvements to the Juvenile Fish Facility.** Because all fish entering the juvenile fish facility are transported under the proposed operation no fish are bypassed to the tailrace in spring or summer.

**Powerhouse Improvements.** Items under evaluation include extended length screens which divert greater number of fish away from turbines and are assumed to increase current FGE values by 12% based on the FGE benefit documented at Little Goose and Lower Granite, resulting in an increase in FGE for Snake River yearling and subyearling Chinook to 61% (57-92%), and Snake River steelhead to 94% (70-100%), respectively. The analysis for the proposed alternative assumes an improvement of 1% increase in survival for biological index testing which may lead to operational changes on turbines, a 2% improvement in total turbine passage (direct and indirect survival).

**Changes in Project Survival.** Analysis of the proposed operation with all combined construction improvements at Lower Monumental dam is estimated to increase project survival by 2% for Snake River yearling Chinook, 1.4% for Snake River steelhead, and 1% for Snake River subyearling Chinook.

**Little Goose Dam** RSW  
BGS  
Powerhouse Improvements

**RSW and BGS.** See the discussion under McNary, above, regarding potential RSW and BGS measures and project operations. Spillway passage survival would not be expected to change with construction of an RSW and passage effectiveness is estimated to be 7:1 for all species. The BGS guidance efficiency at Little Goose is estimated to be similar to the level of performance documented at Lower Granite, 78% (60-80%) for Snake River yearling Chinook and steelhead. No subyearling Chinook are spilled in the proposed summer operation at Little Goose.

**Spillway Improvements.** No new information exists since the spill survival estimates were developed for the 2000 BiOp. The current estimated spillway survival value for Little Goose is 100%; thus construction items associated with improving spillway survival not estimated to provide a benefit.

**Improvements to the Juvenile Fish Facility.** Because all fish entering the juvenile fish facility are transported under the proposed operation no fish are bypassed to the tailrace in spring or summer.

**Powerhouse Improvements.** The analysis for the proposed alternative assumes an improvement of 1% increase in survival for all species as result of biological index testing which may lead to operational changes on turbines. A 2% improvement in total turbine passage (direct and indirect survival) for all species is estimated with the construction of a divider wall.

**Changes in Project Survival.** Analysis of the proposed operation with all combined construction improvements at Little Goose dam is estimated to slightly increase project survival for Snake River yearling Chinook steelhead and increase project survival by 1% for Snake River subyearling Chinook due to the projected turbine improvements. RSW operation is project survival neutral in this analysis, however there is a lack of information on spill survival at Little Goose Dam. The current spill survival estimate is 100% (2000 BiOp, best professional judgment).

**Lower Granite Dam** BGS  
Spillway Improvements  
Powerhouse Improvements

**BGS.** The BGS guidance efficiency at Lower Granite has been evaluated and estimated to have guidance efficiency of 78% (60-80%) for all species. Implementation of a BGS with the RSW at Lower Granite will divert 28% of the Snake River yearling chinook and 30 % of the Snake River steelhead from transport to passage through the RSW for an in river passage migration. No Snake River subyearling Chinook are spilled under the proposed summer operation at Lower Granite.

**Spillway Improvements.** Improvements for spillway survival under evaluation include modification or relocation of spillway deflectors with potential to increase spillway survival by 0.5% for yearling Chinook and steelhead (2010 as warranted).

**New Juvenile Fish Facility.** Because all fish entering the juvenile fish facility are transported under the proposed operation no fish are bypassed to the tailrace in spring or summer. Transportation improvements are discussed below.

**Powerhouse Improvements.** The analysis for the proposed operation assumes a turbine survival improvement of 1% (direct and indirect) for all species if operations are changed in response to biological index testing.

**Change in Project Survival.** Analysis of the proposed operation with all combined construction improvements at Lower Granite dam is estimated to increase project survival by 0.8% for Snake River yearling Chinook, 0.6% for Snake River steelhead, and 1.0% for Snake River subyearling Chinook.

#### **Chief Joseph Dam**

#### **Spillway Deflectors**

Installation of spillway deflectors is underway with completion planned for 2007/2008. Spillway performance would be evaluated by 2009 and results included in the SYSTDG model by 2010.

#### **Transportation**

#### **Modified Initiation of Transport**

#### **Additional Barges**

#### **New and Improved Juvenile Fish Facilities**

The Action Agencies propose to continue increased summer barging through August 15. Continued research and monitoring will provide information to develop a long-term transport program to benefit summer migrating species. We are planning research to examine the effect of transport on both ESA listed and non-listed juvenile fall Chinook. We will adaptively manage activities with consideration of in-season fish migration conditions and research results and, the transportation strategy that best contributes toward achievement of the total system survival performance standard.

**Modified Initiation of Transport.** The Action Agencies will continue to collect and transport juvenile fish at Lower Granite, Little Goose, Lower Monumental and McNary dams. However, rather than beginning transport in accordance with the 2000 BiOp and the associated NOAA Fisheries Section 10 permit, we would not initiate transportation in the lower Snake River until temperatures, as measured at the Lower Granite forebay TDG monitor, exceeded 9°C for 2 consecutive days or April 15, whichever would come first. In lieu of transport, fish would be bypassed back to the river through what is believed to be the least intrusive PIT tag detection routes and allowing for some level of smolt monitoring. Results of McNary transportation studies with upper Columbia Chinook and steelhead may result in proposed modifications to spring transport at that facility.

Using the smolt index at Lower Granite as reported for 1994-2003 (Columbia River Dart), a change in the initiation of transport to begin collection about April 15 has the potential to affect on average 3.3% (range 0.1- 6.3%) of the Snake River yearling Chinook run (all stocks combined) and an average 2.1% (range

0.1-5.1%) of the juvenile steelhead run (all stocks combined). A potential change in SARs of possibly 50% (-40% to +400%) could be realized for spring/summer Chinook but little to no increase would be expected in steelhead survival (-46% to +35%). These estimates are based on weekly SAR data from a NOAA-Fisheries memo (from Paul Wagner to Jim Ruff June 18, 2004).

The water temperature criterion is based on the analysis reported in Anderson et al 2004 that showed the benefits to in river passage versus transport reversed at water temperatures about 9°C. While the proportion of fish that would be bypassed if the water temperature reaches 9°C prior to April 15, this operation is expected to benefit both species.

Improvements to increase adult salmon returns through the juvenile fish transportation process are being evaluated. These improvements include additional barges, a new juvenile fish facility at Lower Granite and improvements to the juvenile fish facilities at Little Goose, Lower Monumental and McNary Dams.

**Additional Barges.** Post release survival of juvenile fish transported to the estuary are anticipated to increase in direct response to the addition of barges because of the improve holding conditions provided by the reduction to holding densities and the ability to maintain mixed species separation. Additional barges are also anticipated to increase the flexibility of the operation process to allow for optimization of the barge release timing and location. This flexibility will allow releases to be designed to take advantage of outgoing tidal cycles and to avoid areas of heavy avian predation through nighttime releases and release locations that result in migration paths that avoid eddies near avian colonies. New barges are estimated to increase “D” is estimated to increase by .05 [0-0.10] for yearling Chinook, and steelhead and .03. [0-.07] for subyearling Chinook).

**New and Improved Juvenile Fish Facilities.** Improvements to the juvenile fish facilities at Lower Granite include a new unpressurized transport pipe, a new dewatering structure, the addition of species separation, increased raceways capacity and additional direct barge loading capabilities. The cumulative effects of these modifications are expected to reduce stress and injury caused by the collection and holding process. Reduction to chronic stress and suppressed immune functions will increase long-term survival probability. For Snake River yearling Chinook, steelhead and subyearling Chinook transported from Lower Granite, the change to differential delayed mortality is estimated to increase “D” by .025 (0-.05), .01 (0-0.02), and 1% (0-2%), respectively (2010).

Improvements to the juvenile fish facilities at Little Goose, Lower Monumental and McNary Dams vary among projects but are focused on improvements to species separation, reduced holding densities, improved barge loading and expanded direct loading capabilities. Survival improvements estimated for the fish transported from each of these projects are 1% (0-2%) yearling Chinook, 1% (0-2%) for steelhead and 0.75% (0-1.5%) subyearling Chinook.

**Total Transport Survival.** The anticipated benefits of the proposed improvements to the transport program is expected to increase total transport survival including differential delayed mortality by 5.1% for yearling Chinook, 5.1% for steelhead, and 4.6% for fall chinook.

It should be noted that implementation of the maximum enhancements at all the projects directs 46.4% of the yearling chinook and 47.4% of the steelhead from transport to in river passage. This change is a direct result of an implementation of RSWs and BGSs at all the transport projects. As a consequence the total system survival **decreases** by 1.7% for yearling chinook and **decreases** by 2.6% for steelhead. Although transport survival increases with the planned transport improvements, the resulting survival of the fish redirect from transport to in river passage is insufficient to make up the difference in survival. Total system for subyearling chinook is estimated to **increases** by 3.2% if transport actions are implemented.



**Mainstem adult passage improvements.** We have already installed several adult configuration improvements recommended in the 2000 BiOp, and include the others in this Proposed Action.

**Spillway Tailrace Erosion.** The Action Agencies are developing plans to evaluate and monitor tailrace erosion in response to voluntary spill for juvenile fish passage. The current operations are substantially different than the spillways were originally designed for. (2005)

**Measures that Address Temperature and Dissolved Gas.** The Action Agencies will continue development and implementation of water quality improvement measures to enhance juvenile and adult fish survival and mainstem spawning habitat. This includes actions as identified in the comprehensive Columbia/Snake River water quality plan that will make further progress towards meeting water quality standards for TDG and water temperature. This includes completing the water temperature portion of the plan to reflect new TMDL information. Other measures would include continued water quality monitoring in the mainstem rivers, performing the necessary quality assurance and control to ensure accurate measurements and sharing this information on a real-time basis. Other measures would include performing and developing the necessary modeling efforts (including SYSTDG) in both the proposed action area and adjoining areas to make the best in-season management decisions for operating the river.

We have recently installed spillway flow deflectors to reduce total dissolved gas levels at most mainstem dams and plan to install end bay deflectors at Little Goose Dam. At various projects, we will consider spillwalls to reduce TDG supersaturation of powerhouse flows and to increase survival of juvenile migrants. Spillwalls may be necessary concurrent with spill reducing measures such as RSW's. RSWs, BGSs, or similar devices also can reduce gas entrainment through reduced spill while maintaining or improving juvenile passage survivals. We will continue research to determine water temperature effects on both juvenile and adult salmonids and implement solutions where appropriate.

**Project Configuration RM&E.** The Action Agencies will continue a wide range of hydrosystem RM&E studies to evaluate and improve juvenile and adult fish passage survival. This includes research on the effectiveness of spill passage operations, survival through various passage routes, structural improvements and post-construction evaluations. We plan biological index testing of families of turbines at the projects to evaluate opportunities to modify turbine operations for the benefit of fish passage survival.

**Implementation projections.** With some notable exceptions, such as the McNary Modernization Project and certain transport studies carried out under O&M, the bulk of the actions or alternatives described in the previous paragraphs are accomplished with funds provided through annual Congressional appropriations for the Columbia River Fish Mitigation Project (CRFMP). The ultimate combination of configuration and operational alternatives remains to be determined through ongoing development of the alternatives, additional RM&E, life-cycle cost estimates and Regional prioritization considerations. However, based on a preliminary analysis of potential configuration scenarios and assuming future funding levels would be similar to current levels it is anticipated that the above actions could be completed within the next 10 to 12 years. The survival improvement estimates above suggests that passage improvements at The Dalles, John Day and McNary dams combined with transport improvements would provide the most significant survival benefit under current BiOp operations. With continuing current funding levels, and based on preliminary cost data and prioritization of actions at those projects, it is estimated that improvements at these projects could be completed by 2010.

Several configuration changes that focus on improved surface bypass, including RSWs, are planned for design and construction based on the strong regional support for this passage route. Examples include planned installation of an RSW at Ice Harbor in 2005; potential installation at Lower Monumental and

Little Goose in 2007 and 2008, or McNary in 2008 and 2009; and a behavioral guidance structure at The Dalles in 2007 to improve guidance through the forebay to the spillbays being used. Actual construction of these features and schedules will be dependent on results of on-going research, regional collaboration and prioritization, and future appropriations. While the order of construction and final configuration may vary, surface bypass improvements are expected to be in place at the eight lower mainstem dams in the next 10 years.

**Reservoir Operations.** The Action Agencies will annually implement several FCRPS project operations to benefit fish at or near a given project or its reservoir. These reservoir operations vary by project and include the following:

- minimum recommended project outflows for listed resident fish,
- limited outflow fluctuations to avoid stranding fish,
- lower Snake River reservoirs maintained at or above their minimum operating pool (MOP),
- John Day pool levels in the summer that would allow for irrigation pool, and
- flow augmentation draft and cool water releases to improve downstream water quality.

These high priority operations are summarized in **Table 2**, however, they are subject to annual adjustment and coordinated through the TMT process, as described previously. The Action Agencies will real time make hourly turbine and spill bay operation data available to NOAA Fisheries on a web site during the juvenile passage season. This information will be presented with the same lag time as total hourly generation data.

**Table 2. Project Specific Operations included in the Proposed Action**

FCRPS Project	Proposed Action Operation
Libby	<ul style="list-style-type: none"> <li>• Use interim variable flow (VARQ) flood control criteria.</li> <li>• Variable December 31 flood control curve based on runoff forecast.</li> <li>• Operate to achieve 75% chance of reaching upper rule curve (URC) elevation by about April 10.</li> <li>• Refill by about June 30 each year.</li> <li>• Draft to meet salmon flow objectives during July-August w/draft limit of 2439 ft. by August 31 unless modified to meet the mainstem amendment operation.</li> <li>• Operate to provide tiered sturgeon volumes for spawning/recruitment</li> <li>• Operate to provide bull trout minimum flows</li> <li>• Provide even or gradually- declining flows during summer months (minimize double peak).</li> <li>• Negotiate with Canada annually to try to implement a storage exchange.</li> <li>• Limit spill to avoid exceeding Montana State TDG standards of 110%.</li> </ul>
Hungry Horse	<ul style="list-style-type: none"> <li>• Use interim VARQ flood control criteria.</li> <li>• Maintain minimum flows for bull trout with a sliding scale based on the forecast.</li> <li>• Minimum flows of 3200-3500 cfs at Columbia Falls and 400-900 cfs in the South Fork Flathead River.</li> <li>• Operate to achieve 75% chance of reaching URC elevation by about April 10.</li> <li>• Refill by about June 30 each year.</li> <li>• Draft to meet salmon flow objectives during July-August with a draft limit of 3540 ft. by August 31 unless modified to meet the mainstem amendment operation.</li> <li>• Provide even or gradually-declining flows during summer months (minimize double peak).</li> <li>• Limit spill to maximum of 15% to avoid exceeding Montana State TDG standards of 110%.</li> </ul>
Albeni Falls	<ul style="list-style-type: none"> <li>• Use standard flood control criteria.</li> <li>• Operate to provide kokanee spawning conditions (winter pool levels)</li> </ul>
Grand Coulee	<ul style="list-style-type: none"> <li>• Use standard flood control criteria.</li> <li>• Operate to achieve 85% chance of reaching URC elevation by about April 10.</li> <li>• Refill by about June 30 each year.</li> </ul>

FCRPS Project	Proposed Action Operation
	<ul style="list-style-type: none"> <li>• Draft to meet salmon flow objectives during July-August with variable draft limit of 1278-1280 ft. by August 31.</li> <li>• Include irrigation withdrawal pumping into Banks Lake; operate Banks Lake up to 5 ft. from full pool during August to meet flow target.</li> </ul>
Chief Joseph	<ul style="list-style-type: none"> <li>• Until deflectors are operational, continue to implement the spill generation swap between Chief Joseph and Grand Coulee according to the guidelines established by the WQT to minimize TDG in the mid-Columbia.</li> </ul>
Dworshak	<ul style="list-style-type: none"> <li>• Use standard flood control criteria; shift system flood control to Grand Coulee in below average water years, if possible.</li> <li>• Minimum flows approximately= 1,300 cfs. Goal to be within State of Idaho TDG water quality standards.</li> <li>• Refill by about June 30 each year.</li> <li>• Draft to meet salmon flow objectives during July-August with draft limit of 1520 ft. by August 31.</li> <li>• Regulate outflow temperatures to attempt to maintain water temperatures at Lower Granite tailwater at or below 68° F.</li> <li>• Maximum project discharge for salmon flow augmentation to be within State of Idaho TDG water quality standards</li> </ul>
Lower Granite to Ice Harbor	<p>Operate at minimum operating pool (MOP) elevation from April 10 until small numbers of juvenile migrants are present unless adjusted in the short-term by TMT – except for Lower Granite – operate at MOP until TMT determines enough natural cooling has occurred in the Lower Granite forebay, generally after October 1. .</p> <ul style="list-style-type: none"> <li>• Configure fish passage facilities and conduct fish passage operations to achieve the juvenile passage survival rates assumed in the 2000 BiOp (Tables 9.2-3, 9.7-5 and Table D4).</li> <li>• Spill in accordance with the 2000 BiOp (RPA action 54 and Table 9.6-3) unless modified by implementation planning and adaptive management decisions.</li> <li>• Collect fish and transport at Lower Granite, Little Goose and Lower Monumental dams; provide fish spill in years when seasonal average flows are greater than 85,000 cfs during spring months.</li> </ul>
McNary to Bonneville	<ul style="list-style-type: none"> <li>• Operate John Day pool at the lowest elevation that continues to allow irrigation from April 10 through September 30.</li> <li>• Configure fish passage facilities and conduct fish passage operations to achieve the juvenile passage survival rates assumed in the 2000 BiOp (Tables 9.2-3, 9.7-5 and Table D4).</li> <li>• Spill in accordance with the 2000 BiOp (RPA action 54 and Table 9.6-3) unless modified by implementation planning or adaptive management decisions.</li> <li>• Collect fish and transport during the summer at McNary unless modified through implementation planning or adaptive management decisions.</li> </ul>

**System Flow Management.** Each year, the Action Agencies will provide coordinated water releases from the FCRPS storage projects for system purposes, to provide mainstem flow augmentation and improve system water quality. The Action Agencies will continue to use the following BiOp-based priorities for flow management:

- Operate reservoirs to meet independent reservoir operation objectives from Hydrosystem Substrategy 2.1.
- Operate storage projects to be at their flood control elevation on or about April 10 (the exact date to be determined during in season management) to increase flows for spring flow management.
- Refill the storage projects by approximately June 30 to provide summer flow augmentation.
- Provide fall and winter tailwater elevations/flows for chum salmon spawning and incubation.
- Identify opportunities to shift system flood control from Brownlee and Dworshak reservoirs to Lake Roosevelt.

**Spill and Passage Operations.** The Action Agencies will provide spill and operations of passage facilities at certain FCRPS projects, depending on runoff conditions, to provide better project passage for juvenile fish while avoiding high TDG supersaturation levels or adult fallback problems. The Action Agencies will continue to evaluate and optimize spill passage survival to meet the hydrosystem performance standards identified in the 2000 BiOp.

The Action Agencies will continue to consider the following to establish spill priorities:

- **Spread the Risk.** Under average or above-average spring runoff conditions, spill at both transport and non-transport projects will “spread the risk” between transportation and in-river migration. Under low-flow conditions and during the summer outmigration, we would spill only at non-transport projects to enable maximum transportation.
- **Dissolved gas management.** We will provide specific spill levels for juvenile fish passage at each project, not to exceed established TDG levels (either the 110 percent TDG standard, or as modified by state water quality waivers, up to 120 percent TDG). Additionally, we will manage spill on a system basis according to a priority list. In high runoff conditions, this distributes spill across the region and prevents dissolved gas supersaturation “hotspots.”
- **Adult salmon fallback and delay.** We will limit spill for juvenile fish passage to reduce adult fish fallback and delay.
- **Passage survival research.** We will continue spill-related research in order to evaluate juvenile passage survival, spill effectiveness in relation to spill levels and duration, effect of spill on juvenile fish retention in forebays and tailraces, tailrace egress, and effect of spill on adult fallback. In some cases, we may modify normal spill operations to support such research.

The Water Management Plans, prepared by the Action Agencies through the NOAA Fisheries Regional Forum, will continue to be the work plans for these actions.

**Transmission Reinforcements.** The Action Agencies will continue to evaluate transmission system capabilities and transmission constraints on 2000 BiOp recommended fish operations. If new transmission constraints to fish operations are identified, the Action Agencies will coordinate transmission system improvements with NOAA.

**Operation and Maintenance of FCRPS Fish Facilities.** The Action Agencies will continue to follow the criteria included in the Corps’ Fish Passage Plan. We will update this plan annually through the Fish Passage O&M Subcommittee. We will coordinate with NOAA Fisheries to reconcile comments on ways to reduce take. Routine operations and maintenance activities we are planning at each of the FCRPS dams include operating and maintaining fish passage facilities, debris control, O&M of mitigation fish hatcheries, and avian predation abatement.

**Non-Routine Maintenance of Fish Passage Facilities.** The Action Agencies will continue the following non-routine O&M activities at each of the mainstem FCRPS dams with fish passage facilities:

- Acquire fish facility spare parts – projects will continue to acquire the necessary spare parts to minimize facility outages due to equipment failures.
- Rehabilitate adult fish counting systems – rehabilitation needs will be reviewed at each project and plans will be developed for necessary work.
- Provide to NOAA Fisheries real-time data on turbine and spillway settings.
- Implement preventative maintenance programs to ensure the long-term reliability of fish passage facilities.
- Continue the program to identify and remove obstructions in turbine units that may injure fish.

**Operations RM&E.** The Action Agencies will continue to conduct RM&E to provide information on juvenile fish transportation and delayed mortality.

The Action Agencies propose to continue increased summer barging through August 15. Continued research and monitoring will provide information to develop a long-term transport program to benefit summer migrating species. We are planning research to examine the effect of transport on both ESA listed and non-listed juvenile fall Chinook. Activities will be adaptively managed with consideration of in-season fish migration conditions and research results and, the transportation strategy that best contributes toward achievement of the total system survival performance standard.

### ***Predator Control Actions***

**Caspian Tern redistribution.** We will implement Caspian tern management actions to effect redistribution of terns from the Columbia River estuary in order to reduce predation of juvenile salmonids in a manner consistent with the preferred plan in the Record of Decision (ROD) once it is signed for the joint Corps/USFWS/NOAA Environmental Impact Statement (EIS) on Caspian tern management. In the draft EIS, the currently identified preferred alternative (Alternative C) relies on habitat management and social attraction at alternate nesting locations to reduce the tern colony in the Columbia River estuary. In conjunction with this increase of suitable habitat outside of the Columbia River Basin, the Corps would reduce the available habitat at East Sand Island from 6 acres to 1 to 1-1/2 acres. This proposed habitat acreage on East Sand Island (1 to 1-1/2 acres) was selected to reduce tern predation in the estuary on juvenile salmonids to a level that would increase salmonid population growth rates ( $\lambda$ ) (Good et al. 2004) while maintaining a viable tern population in the estuary. Under the scenario laid forth in the preferred alternative, the Caspian tern colony in the Columbia River estuary would be reduced from an average population of 9,085 nesting pairs (2000 – 2003) to 2,500 – 3,125 nesting pairs – paring predation by approximately 4 million juvenile salmonids annually. This estimate is based on an average annual per capita consumption rate of 327 juvenile salmonids per tern (Collis et al. 2003) and the assumption that there is a linear relationship between the number of terns nesting on East Sand Island and the number of juvenile salmonids consumed, which was supported in Good et al. 2004. Achieving the reduced population objective established by the currently identified preferred alternative reduces future annual consumption to an estimated 1.63 – 2.03 millions smolts from an annual average of 5.9 million.

The selection of this alternative is contingent on the completion of the final EIS and the issuance of the ROD, which is expected to occur in January/February 2005. If selected, implementation of this management measure to redistribute the Columbia River estuary Caspian tern colony could begin in FY05 and could begin producing results in FY06. All management actions will be coordinated with the USFWS and the entities currently managing the areas proposed for alternate nesting locations.

In addition to continuing research efforts on Caspian tern predation rates on salmonids in the Columbia River estuary, we will monitor and evaluate the response to the proposed management action.

***Species/ESUs Affected:*** The Caspian tern nesting period extends from early April through the end of July. Reducing tern predation rates has the potential to benefit the majority of the listed and non-listed yearling salmonids as well as some subyearling salmonids that migrate through the Columbia River estuary during the Caspian tern-nesting period, which begins in early April and continues to the end of July. This would include the following ESUs:

- Snake river Spring/summer Chinook Salmon,
- Snake River Fall Chinook Salmon,
- Upper Columbia River Spring Chinook Salmon,
- Upper Willamette Chinook Salmon,
- Lower Columbia River Chinook Salmon,

- Snake River Steelhead,
- Upper Columbia River Steelhead,
- Mid-Columbia River Steelhead,
- Upper Willamette Steelhead,
- Lower Columbia River Steelhead,
- Snake River Sockeye Salmon, and
- Lower Columbia River Coho Salmon.

Caspian terns nesting on in the estuary have little to no effect on Columbia River Chum Salmon (D. Roby, personal comm.).

**Biological Benefit:** Given current research limitations, it is difficult to determine the ESU-specific benefits that would result from this action. In general, the relocation of the majority of the tern colony would result in an approximately 67% reduction in predation rates and an estimated 4% increase in juvenile salmonid survival. Steelhead and coho salmon are most heavily affected by Caspian tern predation (Collis et al. 2003, Ryan et al. 2003, Roby et al. 2003) and are, therefore, most likely to benefit from the relocation. Good et al. (2004) determined that the reduction in the East Sand Island tern colony to 2,500 – 3,125 pairs would result in a 1% or greater increase in lambda (population growth rate) for Snake River, Upper Columbia River, Middle Columbia River and Lower Columbia River steelhead ESUs. Therefore, we would rank this action as having *medium* potential to mitigate for hydropower effects. We have initiated and will continue research to better determine species/ESU-specific effects of tern predation in the estuary and the Updated Proposed Action.

The selection of this alternative is contingent on the completion of the final EIS and the issuance of the ROD. If selected, the Action Agencies could begin implementation of this management measure in FY05. Our three-year goal is to develop four acres of offsite tern habitat, which would enable the Corps to reduce the available habitat on East Sand Island by approximately two acres. By the end of year six, the Action Agencies plan to have completed the implementation of the management action (approximately 8 acres of offsite habitat created and 1- to 1-1/2 acres of suitable nesting habitat remaining on East Sand Island). Our performance metric will be annual Caspian tern predation rates on juvenile salmonids and the resulting juvenile salmonid survival rates. In addition to these management goals, we will continue and expand our research efforts.

**Double-crested Cormorant analysis.** Management efforts directed toward double-crested cormorants nesting in the Columbia River estuary can achieve additional gains – perhaps comparable to those associated with Caspian tern management. Intensive research efforts in 2005 could lead to an EIS, developed in conjunction with USFWS. Research into cormorant predation on juvenile salmonids, management measures to disperse the population, and an in-depth analysis of the regional double crested cormorant population (range, population dynamics, status) will support completion of the NEPA requirements to implement future management actions in 2008 – 2009, with implementation of management measures beginning in 2010.

**Species/ESUs Affected:** The double-crested cormorant nesting period begins in late April and continues to the end of August. Reductions in cormorant predation rates have the potential to benefit the majority of the listed and non-listed yearling salmonids as well as some subyearling salmonids that migrate through the Columbia River Estuary during that time. This would include the following ESUs:

- Snake river Spring/summer Chinook Salmon,
- Snake River Fall Chinook Salmon,
- Upper Columbia River Spring Chinook Salmon,
- Upper Willamette Chinook Salmon,

- Lower Columbia River Chinook Salmon,
- Snake River Steelhead,
- Upper Columbia River Steelhead,
- Mid-Columbia River Steelhead,
- Upper Willamette Steelhead,
- Lower Columbia River Steelhead,
- Snake River Sockeye Salmon, and,
- Lower Columbia River Coho Salmon.

Double-crested cormorants nesting in the estuary have little to no effect on Columbia River Chum Salmon (D. Roby, personal comm.).

There are a small number of resident double-crested cormorants (less than 1000 on East Sand Island) in the Columbia River estuary, but given their low number researchers do not believe that they have a significant impact on juvenile salmonids outside of the breeding period (K. Fisher, personal comm.).

**Biological Benefit:** Until we select a management alternative, it is difficult to determine the potential benefit. However, in the next 3 years we will continue research efforts to better understand cormorant predation on juvenile salmonids and initiate studies investigating the regional double-crested cormorant population and potential management measures to disperse that population. By the end of 2010, we plan to have completed the environmental documentation associated with potential cormorant management measures. Once management actions are implemented, our performance metric will be annual double-crested cormorant predation rates on juvenile salmonids and the resulting juvenile salmonid survival rates.

**Caspian tern analysis.** We will continue our ongoing research to determine the impact of Caspian tern predation on salmonids at Crescent Island, including better estimates of the species/ESU-specific impacts of tern predation. These efforts are aimed at developing a better estimate of predation rates. We estimate that two additional years of basic research, adjusting PIT-tag recovery rates for off-colony deposition, will be required. This research will enable NOAA Fisheries to establish whether management of the Caspian tern colony on Crescent Island is warranted. If it is, management alternatives and their implementation will be determined in conjunction with the USFWS, which is responsible for the management of Crescent Island.

**Species/ESUs Affected:** The Caspian tern nesting period begins in early April and continues to the end of July. Reductions in tern predation rates have the potential to benefit the majority of the listed and non-listed yearling salmonids as well as and some subyearling salmonids that migrate near Crescent Island during that time. This would include the following ESUs:

- Snake river spring/summer Chinook salmon,
- Snake River fall Chinook salmon,
- Upper Columbia River spring Chinook salmon,
- Snake River steelhead,
- Upper Columbia River steelhead,
- Mid-Columbia River steelhead, and,
- Snake River sockeye salmon.

Radio-tagged terns have been located foraging in the Columbia River both upstream and downstream from Crescent Island, in the Snake River from the confluence with the Columbia to Ice Harbor Dam, in the Walla Walla River, and in the Burbank Slough (Collis et al. 2003).

**Biological Benefit:** Until it is determined that management is warranted and a management alternative is selected, it is difficult to determine the potential benefit of this action. However, if management is deemed necessary, our three-year goal is to have begun the environmental review associated with potential management alternatives and to have begun implementation of a tern management plan on Crescent Island. Our performance metric will be annual Caspian tern predation rates on juvenile salmonids and the resulting juvenile salmonid survival rates. By the end of 2010, we plan to have completed the implementation of the management plan.

**Expanded Northern Pikeminnow Management.** The Action Agencies propose to reduce the number of larger, predatory pikeminnow throughout the mainstem Columbia and Snake rivers to increase survival of outmigrating juvenile salmon and steelhead. There is a direct relationship between numbers of pikeminnow removed and reduced juvenile losses; similarly, there is a direct relationship among rewards, angler participation, and catch of pikeminnow. Since northern pikeminnow removals began in 1990, evaluation of the implementation of various removal fisheries within the NPMP has resulted in the estimate of a 24% reduction in juvenile salmonid losses due to pikeminnow predation (Ward 1999). This results in the annual additional survival of approximately 4 million smolts due to the Action Agencies commitment toward this program. Average exploitation rates (the percentage of the targeted size fish annually removed) in the NPMP, notwithstanding the program heavy-up in 2001/2004, have averaged approximately 12% for the last 6 years. If exploitation rates can be sustained through incentive measures and other site-specific activities, then after a ramp-up period, it should be feasible to model estimates of the increased exploitation rate's affect on reduction in predator mortality. This increase above the baseline, once estimated and quantified, would be above and beyond the base implementation since issuance of the 2000 BiOp. Therefore, the marginal benefit of any increase in exploitation rate resulting from increases in program incentives should be separate and above base-period benefits.

The scope of the Updated Proposed Action includes a general increase in the reward structure in the Sport-Reward Fishery similar to that of 2001 and 2004 to provide system-wide enhancement and benefit to all ESUs. In addition, through other enhancements in the reward structure, we will achieve increased emphasis in the Sport Reward Fishery in Little Goose and Lower Granite reservoirs to benefit listed Snake River Chinook. Specific improvements include:

- A general increase in the reward structure for the Sport-Reward component of the NPMP
- Increased number of tagged fish to enhance the estimation and evaluation of the NPMP
- Reservoir specific enhancement measures to address "hot spots" of salmonid predation which could include contracting for site-specific removals within project boat restricted zones (BRZ).

**Species/ESUs Affected:** The benefits of pikeminnow removals benefit all listed and non-listed yearling and sub-yearling salmonids that use the mainstem Columbia and Snake Rivers as outmigration corridors. The benefit is largest for subyearling migrants.

**Biological Benefit:** The northern pikeminnow alone is responsible for the loss of approximately 8% of the juvenile salmonid migrants in the FCRPS (2000 BiOp at page 9-106). We estimate that the cumulative effects of the NPMP have reduced pikeminnow predation on juvenile salmonids by 24%, or approximately a 2% reduction in the 8% estimate. A 3-5% absolute increase in the exploitation rate could be expected to reduce system mortality by approximately an additional .64%. This has a **medium** potential to fill the FCRPS survival "gap". The NPMP heavy-up for 2004 will mark the first season that we have incorporated the action into longer-term implementation. After 3-4 continuous seasons with significantly higher exploitation rates relative to the baseline, the benefit associated with additional removals should be discernable and quantifiable.

**Other Fish Predation.** The Action Agencies propose the addition of focused pikeminnow removals at Bonneville, The Dalles and John Day dams/ forebay and tailrace boat restricted zones. Based upon



results of 2004 full evaluation of the NPMP, we could use these specific removals within project/reservoir boat restricted zones to test removals of other non-indigenous predators – specifically smallmouth bass (*Micropterus dolomieu*). If tests are successful in 2005, then the Action Agencies will seek to scope possible continuation and/or expansion of test removals into a management action.

Some of these species already support recreational fisheries. So, if we do seek to expand the current NPMP to include other program components targeting non-indigenous predators, we will coordinate and seek acceptance both with the management agencies responsible for these species of fish and the general public.

**Biological Benefit:** It is likely that development and implementation of non-indigenous predator management would not result in biological benefit measured on a system-wide scale. Therefore, the performance metric used to measure benefit would be specific to the local removals. Site-specific removals could have positive affect on reservoir mortality and/or passage survival, proportional to the relative density of the stock within a particular reach. (For instance, smallmouth bass management in Lower Granite reservoir will have a disproportionate benefit on Snake River subyearling Chinook pool mortality but no benefit to sockeye).

Our three-year goal is to have completed the required environmental documentation associated with potential management alternatives by the end of 2007, and to have begun implementation of a smallmouth bass management plan by 2008. By the end of 2010, we plan to have completed the implementation of the management plan. We will need to develop measurement and crediting mechanisms associated with site-specific removals of non-indigenous predators during the three-year performance metric goal period.

### **Estuary Habitat Actions**

All ESUs pass through the estuary and utilize it to some extent. Therefore, the estuary habitat actions are listed here as benefiting all ESUs rather than listed by ESU.

Given the limiting factors and NOAA's updated jeopardy analysis, the Action Agencies propose to focus the estuary program to improve survival of Snake River fall Chinook juveniles. While the Action Agencies' estuary habitat program will focus on Snake River fall Chinook, there will be benefits to the other ESUs, with the greatest benefits for ocean type. ESUs expressing primarily ocean-type life strategies are Chum salmon, Lower Columbia River steelhead, Lower Columbia River chinook, and Lower Columbia River coho (proposed for listing). The estuary habitat actions will also benefit ESUs expressing primarily stream-type life strategies by providing opportunities to maintain or increase diversity and spatial structure/distribution.

As noted in *Habitat Improvements as Offsite Mitigation for FCRPS Operations: A Qualitative Assessment* (Kratz et al. 2004), the greatest opportunity to affect ocean type ESUs is by restoring lost shallow water, low velocity and vegetated habitat (eg. emergent marsh). Therefore, the Action Agencies estuary program will focus on habitat restoration for the ocean type ESUs. Subsequent discussion with NOAA indicates the greatest potential to benefit Snake River fall Chinook may lie in improving side channel and off-channel habitat in the upper estuary, above Portland. The proposed Sandy River project occurs in this zone. Action effectiveness monitoring associated with the estuary projects will help to improve our understanding of the value of these habitats to this and other ESUs and could lead us to an increased emphasis on habitat work in the upper estuary.

Based on NOAA's June 2004 final Technical Memorandum, *Role of the Estuary in the Recovery of Columbia River Basin Salmon and Steelhead: An Evaluation of the Effects of Selected Factors on Population Viability*, the major estuarine-related factors that potentially limit salmonid population

viability include ocean conditions and climate change (which control other factors), water flow, access to and quality of habitats, sediment, salinity, temperature, toxics, predators (e.g. terns, cormorants, northern pikeminnow), and hatchery and harvest practices. Although it would be useful to evaluate the role of each of these factors, analyses in the final Technical Memorandum were limited to a subset of these nine potential limiting factors, using the following criteria: (1) a significant change in the ESU was evident, (2) the factor could potentially affect population viability, and (3) there were quantitative data available that could be used to analyze the affect of the factor within the time that had been allotted.

Based on these criteria, NOAA focused on water flow, availability of salmon habitats, toxics, and predation (primarily Caspian terns) in the estuary portion of the offsite mitigation analysis. Of these potential limiting factors, predation is addressed separately. The Action Agencies have no regulatory authority over toxics and have limited ability to address this factor under existing authorities and programs. Although the Actions Agencies do not have specific authorities to reduce toxins, the restoration projects could enhance water quality locally, and collectively improve water quality within the estuary to some minor degree.

Under the 2000 BiOp, the Corps and BPA prepared an estuary action plan (entitled *Action Plan to Implement the Federal Columbia River Power System Biological Opinion in the Columbia River Estuary*) and an estuary restoration approach (entitled *An Ecosystem-Based Approach to Habitat Restoration Projects with Emphasis on Salmonids in the Columbia River Estuary*). The Action Agencies will continue to implement actions based on these plans directed at providing biological benefit to ESA-listed fish. Based on the NOAA-Fisheries Final Technical Memorandum, *Role of the Estuary in the Recovery of Columbia River Basin Salmon and Steelhead: An Evaluation of the Effects of Selected Factors on Population Viability*, the immediate focus will be to protect, restore and enhance shallow water and wetland habitats in the Crims Island area and the mouth of the Sandy River, as these were given the highest priority by NOAA Fisheries. The types of activities proposed under this action are outlined in the report *An Ecosystem-Based Approach to Habitat Restoration Projects with Emphasis on Salmonids in the Columbia River Estuary*. This report identifies five strategies for the implementation of scientifically sound habitat projects to address the potential limiting factors identified for the estuary. As noted in the tributary section, the science that would allow quantification of survival improvements as a result of habitat projects is not fully developed; particular uncertainty exists for the estuary.

Two key habitat restoration projects the Action Agencies have identified and are currently implementing or pursuing are listed below. Additional projects will be identified based on research and regional coordination and developed following the Action Agencies Restoration Plan.

### **Estuary Protection.**

**Crims Island** – Protected 473 acres and will restore 208 acres of intertidal marsh and riparian forest. The project area offers a number of opportunities for tidal channel; marsh and riparian habitat restoration that would benefit federally listed salmonids, Columbian white-tailed deer and several species of waterfowl, among other species. Restoration of sub-tidal channels and intertidal marsh habitat would be the principal action to benefit salmon. Sub-tidal channel and intertidal marsh habitat restoration would require excavation of sediments to attain the proper elevations. Excavated material would be disposed of on adjacent lands currently used for grazing. Riparian forest habitat would be developed on the disposal sites and other areas of pasture, and would provide habitat for Columbia white-tailed deer and an additional source of detritus for aquatic invertebrates as well as cover and eventual large woody debris recruitment. Neotropical migratory birds would also benefit from riparian habitat restoration. Section 7 consultation with NOAA has been completed. Additional information on the project can be found in BPA project proposal # 200300800 and the Integrated Feasibility Report and Environmental Assessment for the project. *Scheduled completion: 2006*

### **Estuary Enhancement/restoration.**

**Sandy River** – The project is located at the confluence of the Sandy and Columbia rivers just north of I-84, and east of the Troutdale airport. The project is part of the Columbia River Gorge National Scenic Area in Multnomah County, Oregon. Under this project, the Action Agencies would restore 90 acre of native hardwood riparian forest and 20 acres of seasonally wet slough within the Sandy River Delta. This project is part of a long-term effort to restore the 1,500 acres of the Sandy River delta. The project will restore 90 acres of native hardwood riparian forest and 20 acres of a seasonally wet slough in the Sandy River Delta to complete a 250-acre block of regionally scarce floodplain habitat. Section 7 consultation with NOAA has been completed for portions of this work. Additional information on the project can be found in BPA project proposal # 199902500. *Scheduled completion: 2007.*

### **Estuary RM&E.**

There is considerable uncertainty over the use of the estuary and plume by juvenile salmon and steelhead. The Action Agencies on-going RM&E program and monitoring of habitat projects will help to determine the use and benefits to different ESUs. It will still be difficult to quantify benefits given the difficulties in tracking juveniles throughout the estuary and distinguishing estuary effects by ESU or populations.

To develop the potential to improve ESA-listed salmon populations, the Corps and BPA will continue the program to protect and enhance tidal wetlands and other key estuary habitats. Because much is unknown at this time about salmonid use of the estuary and Columbia River, the approach includes concurrent research, planning and restoration activities. This approach will allow important on-the-ground recovery efforts to assist in salmon recovery to proceed while research and planning efforts occur to better inform future actions.

Examples of RM&E that will help in this adaptive process are the absolute growth and variability of juvenile salmon in the estuary to allow definition of carrying capacity limitations at present, or restored population levels. Precise estimates of growth are needed from juvenile salmon of different life-history types corresponding to a range of residence times in the estuary.

The Action Agencies have identified several critical uncertainties in the estuary that will be pursued through the continuation of the Estuary RM&E Program:

- Determine the significance of the lower river and estuary, including the plume, to listed salmonid Evolutionary Significant Units;
- Determine the highest priority habitat types for restoration in the lower Columbia River and estuary; and,
- Develop a method to assess whether the offsite mitigation program involving habitat restoration in the estuary is working.

The first two uncertainties are being addressed through the existing research program. The Cumulative Effects Program presently funded through the Corps' CRFM Project will address the third uncertainty. Additionally, hypotheses outlined in the *Salmon at River's End* report (species life history diversity, connectivity, etc.) need to be thoroughly tested and empirical data developed to insure sound science is directing the restoration program.

Research in Oregon's coastal Salmon River is in progress by the U. S. Forest Service and Oregon Department of Fish and Wildlife. It is known that some salmonids use estuarine marsh channels as nursery habitats. Removal of tide gates and dikes has been a primary focus of recovery efforts in the Salmon River estuary because such "passive" restoration methods offer the most cost-effective means for returning significant quantities of wetland habitat to estuaries. Ongoing research in the Salmon River

estuary is providing information about the responses of estuarine-rearing salmonids and prey resources to wetland restoration. Work such as this will help to inform our continuing efforts in the Columbia River estuary.

As the estuary studies continue to improve our understanding, the Action Agencies will be better able to target and implement actions that would help avoid jeopardy (establish amount and types of habitat) and provide more certainty of the biological benefits of these actions. Ultimately, the goal is to implement actions that provide the greatest biological benefit to listed ESUs. After 3 years of implementing the RM&E program, the Action Agencies will reevaluate the results and revise the actions as appropriate

## **Hatchery Actions**

### **Safety-Net Artificial Propagation Program (SNAPP)**

BPA will continue to fund the SNAPP process identified in the 2000 FCRPS Biological Opinion to develop safety-net artificial propagation contingency plans for populations at risk of extinction. SNAPP is targeted on populations in the Snake River steelhead and spring/summer chinook salmon ESUs. If identified as necessary, effective, and feasible through the SNAPP process, we would intervene with artificial production for severely depressed and declining populations.

### **Hatchery Reform Conservation Actions**

The Action Agencies are relying on the HGMP development process to identify hatchery reform actions that would reduce the negative impacts of hatchery operation on listed stocks. Phase I HGMPs were completed in July 2003. The Action Agencies completed draft Phase II HGMPs in March 2004 and most Phase III HGMPs are expected to be completed by late summer 2004. Due to legal issues, the Phase III HGMPs for hatchery programs in Washington State may not be completed until early 2005. As the Phase III HGMPs are completed, they will be submitted to NOAA Fisheries for review and approval.

The Action Agencies will consider funding and implementing additional reform actions that NOAA Fisheries identifies as likely to have substantial survival benefits for listed salmon and steelhead ESUs and/or populations. To guide implementation of these measures, we will develop a multi-agency implementation plan for reform actions in NOAA-approved Phase III HGMPs. In the *2004/2004-2008 Implementation Plan*, the Action Agencies proposed the following prioritization criteria for implementation to achieve the greatest biological benefits as rapidly as possible:

- The hatchery program considered for reform must be one that is funded by BPA, i.e., it must be an artificial propagation program at a Lower Snake River Compensation Plan (LSRCP), Reclamation, Corps, or Council Fish and Wildlife Program hatchery facility
- Based on best available science and professional judgment, NOAA Fisheries must reasonably expect the reform action to have a biological benefit to a listed population or populations. Those actions with the greatest certainty to provide biological benefits or reduce biological risks will be given highest priority.
- We will give priority to hatchery reform actions that benefit the weakest ESUs or populations in greatest need of survival improvement.
- We will consider cost-effectiveness of the actions. If two or more actions are expected to achieve similar biological benefits, the lower cost action will receive higher priority.

To implement priority hatchery reform efforts, the Action Agencies will coordinate closely with federal, state, and tribal operators of the hatchery facilities, the *US v. Oregon* process, and subbasin planning, as well as the Council's planned Artificial Production Review Implementation process.

**Action Agency Targets:** Performance standards for specific reform actions will be incorporated into the HGMPs during HGMP development.

## 2. Snake River Spring/Summer Chinook

In addition to the actions described below, survival improvements for this ESU will be gained through hydrosystem configuration changes, juvenile transportation, and avian and pikeminnow predator control, and estuary habitat actions that are identified in the *Updated Proposed Actions that Benefit Multiple ESUs* section.

Figure 5 displays the array of actions that the Action Agencies propose to fill the survival gap for this ESU.

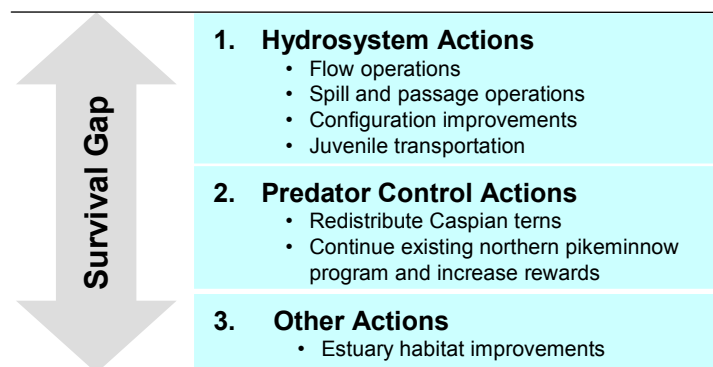


Figure 5 Updated Proposed Actions to benefit Snake River spring/summer Chinook

### ***Tributary Habitat Conservation Measure***

Reclamation is proposing, as a conservation measure, to continue a tributary habitat technical assistance program which was instituted under the 2000 BiOp (RPA Action 149) in three subbasins of the Salmon River drainage. This conservation measure is intended to meet a greater increment of overall survival for Snake River spring/summer chinook during their spawning and rearing life stages than is required to avoid jeopardy to the species; consequently, it is formulated to partially meet recovery standards for this ESU as defined by the regulatory guidance in the Endangered Species Consultation Handbook (USFWS and NOAA Fisheries, p. 4-19). Absent this conservation measure, Reclamation would be required to withdraw from its current participation in tributary habitat improvements in the Lemhi, Upper Salmon, an Little Salmon Rivers basins due to a lack of funding authority. It is important to note that this is a Bureau of Reclamation conservation measure and does not imply or expect any level of participation by the other Action Agencies.

NOAA Fisheries analysis of the survival effects on Snake River spring/summer Chinook attributable to the hydro Updated Proposed Action shows that that proposed hydro action, in itself, would create only a very low “survival gap”. The total survival change needed for the ESU averages 0.2 percent which is considered to require a qualitative improvement estimate of “very low.” The Action Agencies propose to fill this gap with hydrosystem configuration, transportation, and predation actions. Additional actions to improve survival may be considered to be over and above the jeopardy standard and are, thus, directed more toward ESU recovery efforts.

NOAA Fisheries evaluated the likelihood of improving species survival through habitat improvements through an analytical approach that considered the four VSP criteria of abundance, productivity, diversity and distribution. NOAA performed a qualitative evaluation of trends in population status and associated tributary habitat condition and considered the potential to address identified habitat limitations sufficiently to elicit a response in population status. Qualitative rankings of high, medium, or low were

assigned to population and habitat parameters based on the magnitude of the observed or potential change.

For Snake River spring/summer Chinook, NOAA concluded that there is a medium level of “intrinsic potential” to improve spawning and rearing habitat in the three subbasins of this conservation measure. Reclamation considered the primary limiting factors identified by NOAA Fisheries for each subbasin and evaluated formulating a habitat improvement program that attempted to address those limiting factors considering the limitation of Reclamation authorities. Reclamation does not have, and does not anticipate having, authority to address riparian habitat protection or enhancement actions. Reclamation can provide technical assistance to solve engineering issues affiliated with channel morphology but currently does not have authority to fund the construction of such projects. Authority to fund construction of instream projects has been introduced in the Congress. Reclamation can consider leasing or acquiring instream flows in compliance with state water law. In consideration of these authority limitations, this conservation measure is formulated to allow Reclamation to continue its current technical assistance program in the three selected subbasins, but cannot promise that authority to go beyond that program is forthcoming with any certainty.

Considerable investigations have been performed to identify the habitat limiting factors in the Little Salmon, Lemhi, and Upper Salmon Rivers basins and to assess the opportunities for improvement. We will not reiterate those findings here. However, in developing this conservation measure, Reclamation considered NOAA’s recent analysis of potential habitat improvement measures and practical constraints in all three subbasins. In addition, opportunities were verified by contacting local knowledgeable individuals and organizations, reviewing the considerable information made available by the recently drafted Council subbasin plans, and consulting other state and local documents. Those habitat limiting factors, opportunity analyses, and Reclamation’s discretionary authority were considered in developing a tributary habitat conservation measure which focuses on three of the limiting factors: entrainment, channel morphology, and streamflow. We also considered on-going programs by other entities and formulated a conservation measure which does not duplicate those other effects.

The conservation measure for improving Snake River spring/summer Chinook juvenile survival production in the Lemhi, Upper Salmon, and Little Salmon subbasins is shown by metrics measurement and goals. Goals are established for 3 years after adoption of NOAA’s revised Biological Opinion.

**Table 3. Conservation Measure, Snake River Spring/Summer Chinook Salmon,**

<b>Limiting Factor</b>	<b>Metric Measurement</b>	<b>3-Year Metric Goal</b>
<u>Entrainment</u>	a. Number of screens addressed <sup>4</sup>	10
<u>Instream flow projects</u> <sup>5</sup>	a. Cubic feet per second (cfs) of water protected for instream flows	20
<u>Channel Morphology</u> <sup>6</sup>	a. Miles of access restored	54
	b. Miles of complexity restored	0.25

<sup>4</sup> Fish entrainment at screens may be addressed through adding new screens, modifying existing screens to meet current criteria, or eliminating the diversion through replacement wells or other means.

<sup>5</sup> Instream flow projects include lease or purchase of streamflow, water conservation projects which yield actual “wet water” instream which may be secured through state water law. Not counted in this metric are gaging stations or other water measurement initiatives or investigations which may be necessary to support the evaluation and protection of instream flows for fish.

<sup>6</sup> Channel morphology projects include Access projects which provide fish passage at structures or conditions that create migration barriers including diversion dams, culverts, low flow channels, etc. Stream Complexity Restoration projects include side channel connectivity, flood plain connectivity, channel reconfiguration, large woody debris placement, etc.

### 3. Snake River Fall Chinook

In addition to the actions described below, survival improvements for this ESU will be gained through hydrosystem configuration changes, juvenile transportation, avian and pikeminnow predator control, and estuary habitat actions that are identified in the *Updated Proposed Actions that Benefit Multiple ESUs* section.

Figure 6 displays the array of actions that the Action Agencies propose to fill the survival “gap” for this ESU.

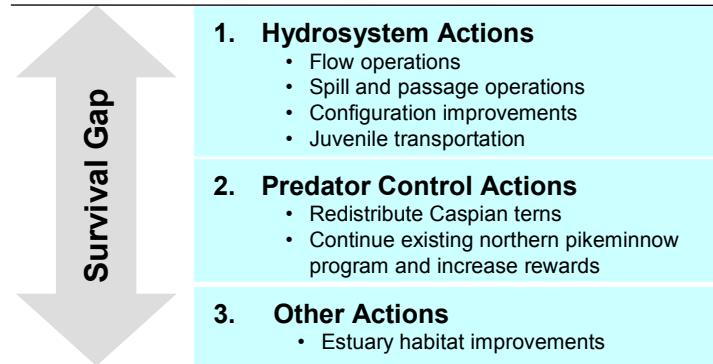


Figure 6 Updated Proposed Actions to benefit Snake River fall Chinook

#### ***Estuary Habitat Actions***

The estuary habitat actions described in the *Updated Proposed Actions that Benefit Multiple ESUs* section include shallow water habitat, freshwater marsh, and restored access to floodplains and side channel areas. These projects will help offset historical habitat losses and primarily benefit Snake River fall Chinook, and other ocean-type ESUs. Recent information provided verbally from NOAA indicates the greatest potential to benefit Snake River fall Chinook may lie in improving side channel and off-channel habitat in the upper estuary, above Portland. The Sandy River project occurs in this zone. We will improve our understanding of the value of these habitats to this and other ESUs through action effectiveness monitoring associated with these projects. This improved understanding could lead us to an increased emphasis on habitat work in the upper estuary.

#### ***Tributary Habitat Actions***

Based on NOAA’s intrinsic potential analysis and a review of possible projects within our authorities, the Action Agencies were unable to identify any tributary habitat opportunities that could be implemented for Snake River fall Chinook.



#### 4. Upper Columbia River Spring Chinook

In addition to the actions described below, survival improvements for this ESU will be gained through hydrosystem configuration changes, avian and pikeminnow predator control, and estuary habitat actions that are identified in the *Updated Proposed Actions that Benefit Multiple ESUs* section.

Figure 7 displays the array of actions that the Action Agencies propose to fill the survival “gap” for this ESU.

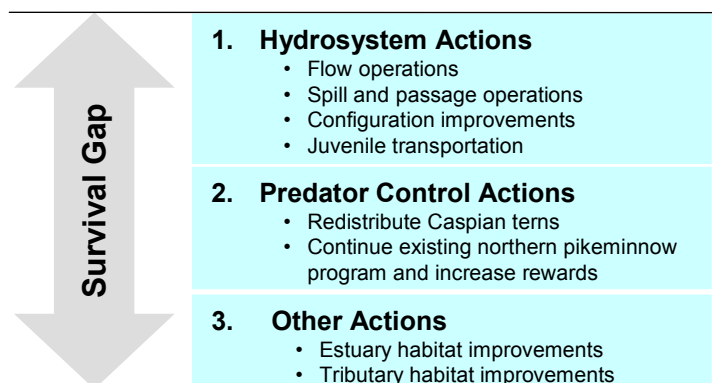


Figure 7 Updated Proposed Actions to benefit Upper Columbia River spring Chinook

#### ***Tributary Habitat Actions***

According to the updated NOAA Fisheries analyses, the estimated survival gap for in-river survival of this ESU through four Columbia River FCRPS dams and reservoirs is about 1 percent. The total survival change needed for the ESU averages -3.2 percent, with a qualitative estimate of “medium” (from 2 to 24 percent) improvement needed. The Action Agencies consider the survival change needed for Upper Columbia Spring Chinook to be in the lower range of medium. To fill that gap, the Action Agencies propose a tributary habitat program to improve overall survival for the ESU during its spawning and rearing life stages.

As stated earlier, NOAA Fisheries evaluated the likelihood of improving species survival through habitat improvements through an analytical approach that included the four VSP criteria of:

- abundance,
- productivity,
- diversity, and
- distribution.

NOAA performed a qualitative evaluation of trends in population status and associated tributary habitat condition and considered the potential to address identified habitat limitations sufficiently to elicit a response in population status. Qualitative rankings of high, medium, or low were assigned to population and habitat parameters based on the magnitude of the observed or potential change.

For Upper Columbia spring Chinook, NOAA concluded that there is a *medium potential* to improve spawning and rearing habitat in the three subbasins of this Updated Proposed Action. A summary of NOAA’s analysis of the potential to increase populations, identification of anthropogenic limiting factors,

identification of the ecological improvement potential, and adjusted improvement potential based on practical constraints is summarized in Table 4.

**Table 4. NOAA Summary of Upper Columbia Spring Chinook (Yearlings)**

Population	Index of Potential to Increase Population <sup>7</sup>	Primary Anthropogenic Limiting Factors <sup>8</sup>	Ecological Intrinsic Potential <sup>9</sup>	Intrinsic Potential Summary (practical constraints) <sup>10</sup>
Wenatchee	Very High	Medium—Channel morphology, flood plain connectivity, flows	Medium	Medium
Entiat	Very High	High—Channel morphology	Medium	Medium
Methow	Very High	Medium—Flows, entrainment, channel morphology, water temperatures	Medium	Medium

Upper Columbia spring Chinook spawn and rear in a limited number of tributaries to the upper Columbia River below Chief Joseph Dam. These tributaries rise along the eastern slope of the Cascade Range and include populations of the ESU in the Wenatchee, Entiat, and Methow. Actions to improve spawning and rearing habitat in all three of these tributaries (or subbasins) are included in this Updated Proposed Action.

Considerable investigations have been performed to identify the habitat limiting factors in the Wenatchee, Entiat, and Methow subbasins and to assess the opportunities for improvement. We do not reiterate those findings here. However, NOAA’s recent analysis of potential habitat improvement measures and practical constraints in all three subbasins (Kratz et al. 2004) was considered in developing this Updated Proposed Action. In addition, we verified opportunities by contacting local knowledgeable individuals and organizations, reviewing the considerable information made available by the Council’s recently drafted subbasin plans, and consulting other state and local documents. (See Appendix B).

**Wenatchee Subbasin.** NOAA Fisheries’ analysis showed that channel morphology, including flood plain connectivity and flows are the primary anthropogenic limiting factors in the Wenatchee subbasin. We include a significant increase of habitat condition associated with channel morphology. However, the flow improvement potential identified by NOAA Fisheries focuses on large streamflow increases in the lower Wenatchee River. Although low flows in this area limit some of the habitat potential, they do not form a migration barrier to other areas of the subbasin. Based upon practical constraints, there is little likelihood that flows could be significantly enhanced in that reach. Most upstream areas appear to have sufficient fish flows; but additional flow needs, if any, need to be confirmed by IFIM studies. Those studies are currently ongoing. Also, to provide greater assurance that the appropriate level of survival improvements accrue in the Wenatchee subbasin, the Action Agencies are proposing a habitat improvement action to address two additional limiting factors, 1) entrainment, and 2) riparian enhancement and protection. NOAA did not identify these primary anthropogenic limiting factors, but the Action Agencies believe they would yield survival improvements. Based on the Action Agencies’ analysis, the total proposed habitat improvements in the Wenatchee subbasin would meet the level of intrinsic potential needed to improve habitat conditions and juvenile survival.

<sup>7</sup> Based upon an analysis of base period (historic) average annual redd counts and recent average annual redd counts.

<sup>8</sup> Anthropogenic limiting factors include instream flows, channel morphology (barriers, connectivity, condition of bed, sedimentation, etc.), entrainment (lack of fish screens), riparian condition, water quality including water temperature, etc.

<sup>9</sup> Ecological Improvement Potential is the anticipated qualitative response to improve population status by addressing limiting factors that resulted from anthropogenic management actions.

<sup>10</sup> An adjustment of the Ecological Improvement Potential based upon practical constraints which may limit the ability to address limiting factors including legal, social, political, or economic constraints.

**Entiat Subbasin.** NOAA identified channel morphology to be a primary anthropogenic limiting factor in the Entiat subbasin and considered the lower, channelized, section of the Entiat to be of particular importance. Therefore, the Updated Proposed Action includes several morphology projects in the lower reach of the river including some opportunities to improve stream complexity and channel connectivity. We also anticipate that other channel morphology improvement projects will be implemented in other reaches of the subbasin.

**Methow Subbasin.** NOAA identified the primary anthropogenic limiting factors in the Methow as flows, entrainment, channel morphology, and water temperatures. The Updated Proposed Action considers those habitat limiting factors and NOAA’s opportunity analyses to identify tributary habitat improvements for the Methow subbasin. Virtually all diversions in the Methow basin have been screened; consequently, our Updated Proposed Action focuses on implementing channel morphology projects. We also propose to implement some limited streamflow improvements and riparian protection and enhancement opportunities actions.

**Summary—Upper Columbia Spring Chinook Updated Proposed Action**

The survival improvements anticipated in the Wenatchee, Entiat, and Methow subbasins will fulfill the “medium” habitat improvement potential. This Updated Proposed Action is expected to exceed NOAA’s identified survival gap.

To confirm that the survival improvement goals are achieved, the Action Agencies will implement a habitat effectiveness monitoring program in the Methow subbasin. The program will inform the Action Agencies and NOAA about the survival effects of habitat improvement projects for this ESU. As our knowledge and understanding increases, we may modify the habitat goals associated with each limiting factor if a different mix of limiting factor goals would improve results.

Specific performance metrics and associated targets for improving Upper Columbia Spring Chinook juvenile survival production in the Wenatchee, Entiat, and Methow subbasins is shown in Table 5. Metrics measurements and goals are established for 3 years after this Updated Proposed Action is adopted and cumulative goals for 6 years after adoption.

**Table 5. Updated Proposed Action, Upper Columbia Spring Chinook, Wenatchee, Entiat, and Methow Subbasin**

Limiting Factor	Metric Measurement	Metric Goal in three years	Cumulative Metric Goal in six years
<u>Entrainment</u> <sup>11</sup>	a. Number of screens addressed	5	10
<u>Instream flow projects</u> <sup>12</sup>	a. Cubic Feet per Second (cfs) of water protected for instream flows	12 cfs	40 cfs
<u>Channel Morphology</u> <sup>13</sup>	a. Miles of access restored	60 miles	105 miles
	b. Miles complexity restored	5 miles	10 miles

<sup>11</sup> Fish entrainment at screens may be addressed through adding new screens, modifying existing screens to meet current criteria, or eliminating the diversion through replacement wells or other means.

<sup>12</sup> Instream flow projects include lease or purchase of streamflow, water conservation projects which yield actual “wet water” instream which may be secured through state water law. Not counted in this metric are gaging stations or other water measurement initiatives or investigations which may be necessary to support the evaluation and protection of instream flows for fish.

<sup>13</sup> Channel morphology projects include Access projects which provide fish passage at structures or conditions that create migration barriers including diversion dams, culverts, low flow channels, etc. Stream Complexity Restoration projects include side channel connectivity, flood plain connectivity, channel reconfiguration, large woody debris placement, etc.

Limiting Factor	Metric Measurement	Metric Goal in three years	Cumulative Metric Goal in six years
<u>Riparian Protection/Enhancement</u> <sup>14</sup>	a. Number of miles protected	4 miles	12 miles
	b. Number of miles enhanced.	6 miles	12 miles

## 5. Upper Willamette River Chinook

This ESU does not have a survival gap associated with the FCRPS. However, survival improvements for this ESU will be gained through hydrosystem flow operations, predator control, and estuary habitat actions that are identified in the *Updated Proposed Actions that Benefit Multiple ESUs* section.

Figure 8 displays the array of actions proposed by the Action Agencies that would improve the survival of this ESU.

<p><b>1. Hydrosystem Actions</b></p> <ul style="list-style-type: none"> <li>• Flow operations</li> <li>• Spill and passage operations</li> <li>• Configuration improvements</li> <li>• Juvenile transportation</li> </ul>
<p><b>2. Predator Control Actions</b></p> <ul style="list-style-type: none"> <li>• Redistribute Caspian terns</li> <li>• Continue existing northern pikeminnow program and increase rewards</li> </ul>
<p><b>3. Other Actions</b></p> <ul style="list-style-type: none"> <li>• Estuary habitat improvements</li> </ul>

Figure 8 Updated Proposed Actions to benefit Upper Willamette River Chinook

## 6. Lower Columbia River Chinook

Survival improvements for this ESU will be gained through hydrosystem configuration changes, predator control, and estuary habitat actions that are identified in the *Updated Proposed Actions that Benefit Multiple ESUs* section.

Figure 9 displays the array of actions that the Action Agencies propose to fill the survival gap for this ESU.

<p><b>Survival Gap</b></p>	<p><b>1. Hydrosystem Actions</b></p> <ul style="list-style-type: none"> <li>• Flow operations</li> <li>• Spill and passage operations</li> <li>• Configuration improvements</li> </ul>
	<p><b>2. Predator Control Actions</b></p> <ul style="list-style-type: none"> <li>• Redistribute Caspian terns</li> <li>• Continue existing northern pikeminnow program and increase rewards</li> </ul>
	<p><b>3. Other Actions</b></p> <ul style="list-style-type: none"> <li>• Estuary habitat improvements</li> </ul>

Figure 9 Updated Proposed Actions to benefit Lower Columbia River Chinook

<sup>14</sup> Riparian protection projects include acquisition of riparian easements or purchases. Riparian enhancement projects include streambank stabilization and riparian treatments such as fencing or reconstruction.

## 7. Snake River Steelhead

In addition to the actions described below, survival improvements for this ESU will be gained through hydrosystem configuration changes, juvenile transportation, avian and pikeminnow predator control, and estuary habitat actions that are identified in the *Updated Proposed Actions that Benefit Multiple ESUs* section.

Figure 10 displays the array of actions that the Action Agencies propose to fill the survival gap for this ESU.

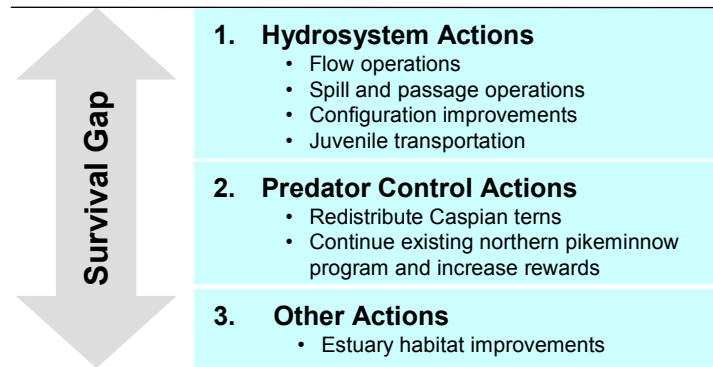


Figure 10 Updated Proposed Actions to benefit Snake River steelhead

### ***Tributary Habitat Conservation Measure***

Reclamation is proposing, as a conservation measure, to continue a tributary habitat technical assistance program which was instituted under the 2000 BiOp (RPA Action 149) in the Lemhi, Upper Salmon, and Little Salmon subbasins of the Salmon River drainage as described earlier for the Snake River spring/summer chinook ESU. It is important to note that this is a Reclamation conservation measure and does not imply or expect any level of participation by the other Action Agencies.

NOAA Fisheries analysis of the survival effects on Snake River steelhead attributable to the hydrosystem Updated Proposed Action shows that the proposed hydro action, in itself, would create only a low survival gap. The total survival change needed for the ESU averages 0.4 which is considered to require a qualitative improvement estimate of “low”. The Action Agencies propose to fill this gap with hydrosystem configuration, transportation, and predation actions. Additional actions to improve survival may be considered to be over and above the jeopardy standard and are, thus, directed more toward ESU recovery efforts.

Snake River steelhead spawn and rear in the same major tributaries as spring/summer chinook plus steelhead utilize the Clearwater River basin and some Hells Canyon tributaries. NOAA Fisheries identified 25 populations in 6 major population groups for this ESU. As with spring/summer chinook, this conservation measure was not formulated to address all the major population groups but does include technical assistance for habitat improvements in subbasins that contain two of those major population groups.

For Snake River steelhead, NOAA Fisheries determined that the Lemhi and Upper Salmon River subbasins were considered to have a medium level of habitat improvement potential based upon practical constraints whereas the Little Salmon River was considered to have a very low habitat improvement potential. Reclamation considered the primary limiting factors identified by NOAA Fisheries for each

subbasin and evaluated formulating a habitat improvement program which attempted to address those limiting factors considering the limitation of Reclamation authorities as described earlier for the Snake River spring/summer Chinook ESU.

Considerable investigations have been performed to identify the habitat limiting factors in the Little Salmon, Lemhi, and Upper Salmon Rivers basins and to assess the opportunities for improvement. We will not reiterate those findings here. However, in developing this conservation measure, Reclamation considered NOAA’s recent analysis of potential habitat improvement measures and practical constraints in all three subbasins. In addition, opportunities were verified by contacting local knowledgeable individuals and organizations, reviewing the considerable information made available by the recently drafted Council subbasin plans, and consulting other state and local documents. Those habitat limiting factors, opportunity analyses, and Reclamation’s discretionary authority were considered in developing a tributary habitat conservation measure which focuses on three of the limiting factors: entrainment, channel morphology, and streamflow. We also considered on-going programs by other entities and formulated a conservation measure that does not duplicate those other effects.

Most of the potential projects with willing non-Federal participants which were identified would benefit both Snake River spring/summer Chinook Salmon and Snake River steelhead. Although steelhead tend to utilize habitat higher in the river systems than chinook, much of those high spawning and rearing streams are located on lands administered by the U.S. Forest Service which is formulating its own programs to improve habitat. To avoid duplication of effects, Reclamation is focusing on habitat improvement programs for the three selected limiting factors which are lower in the subbasin systems and which will improve survival for both ESUs. Therefore, the conservation measure metrics goals are identical for both species.

The conservation measure for improving Snake River steelhead juvenile survival production in the Lemhi, Upper Salmon, and Little Salmon subbasins is shown in Table 6 by metrics measurement and goals. Goals are established for 3 years after adoption of this revised Biological Opinion.

**Table 6. Conservation Measures, Snake River Steelhead**

<b>Limiting Factor</b>	<b>Metric Measurement</b>	<b>3-Year Metric Goal</b>
<u>Entrainment</u>	a. Number of screens addressed <sup>15</sup>	10
<u>Instream flow projects</u> <sup>16</sup>	a. Cubic feet per second (cfs) of water protected for instream flows	20
<u>Channel Morphology</u> <sup>17</sup>	a. Miles of access restored	54
	b. Miles of complexity restored	0.25

<sup>15</sup> Fish entrainment at screens may be addressed through adding new screens, modifying existing screens to meet current criteria, or eliminating the diversion through replacement wells or other means.

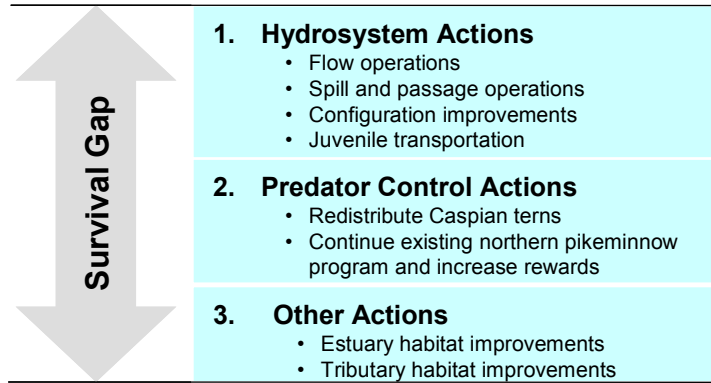
<sup>16</sup> Instream flow projects include lease or purchase of streamflow, water conservation projects which yield actual “wet water” instream which may be secured through state water law. Not counted in this metric are gaging stations or other water measurement initiatives or investigations which may be necessary to support the evaluation and protection of instream flows for fish.

<sup>17</sup> Channel morphology projects include Access projects which provide fish passage at structures or conditions that create migration barriers including diversion dams, culverts, low flow channels, etc. Stream Complexity Restoration projects include side channel connectivity, flood plain connectivity, channel reconfiguration, large woody debris placement, etc.

## 8. Upper Columbia River Steelhead

In addition to the actions described below, survival improvements for this ESU will be gained through hydrosystem configuration changes, and avian and pikeminnow predator control, and estuary habitat actions that are identified in the *Updated Proposed Actions that Benefit Multiple ESUs* section.

Figure 11 displays the array of actions that the Action Agencies propose to fill the survival gap for this ESU.



**Figure 11 Updated Proposed Actions to benefit Upper Columbia River steelhead**

### ***Tributary Habitat Actions***

According to NOAA Fisheries, the total survival change needed for Upper Columbia River Steelhead averages 3.8 percent, with a qualitative estimate of “medium” improvements needed. The Action Agencies consider this 3.8 percent gap to be in the lower range of “medium”.

Upper Columbia steelhead spawn and rear in a limited number of tributaries to the upper Columbia River below Chief Joseph Dam. These tributaries rise along the eastern slope of the Cascade Range and include populations of the ESU in the Wenatchee, Entiat, Methow, and the Okanogan. Actions to improve spawning and rearing habitat in three of these tributaries (or subbasins) are included in this Updated Proposed Action. The Okanogan subbasin steelhead population was assigned a low potential for habitat improvements.

Passage at Salmon Lake Dam was identified as the major habitat improvement project in the Okanogan subbasin. However, there is low certainty that the Action Agencies could obtain measurable results toward improving passage at this dam. Studies and Congressional authority that would be required to improve passage at this dam is unlikely to occur for several years—well beyond the term of this BiOp.

For Upper Columbia steelhead, NOAA concluded that there is a medium level of intrinsic potential to improve spawning and rearing habitat in the Wenatchee and Methow Rivers subbasins and a low to medium level of intrinsic potential in the Entiat. A summary of NOAA’s analysis of the potential to increase populations, identification of anthropogenic limiting factors, identification of the ecological improvement potential, and adjusted improvement potential based on practical constraints is summarized in Table 7.

**Table 7.** Upper Columbia River Steelhead (Yearlings)

<b>Population</b>	<b>Range of System Survival</b>	<b>Index of Potential to Increase Population<sup>18</sup></b>	<b>Primary Anthropogenic Limiting Factors<sup>19</sup></b>	<b>Ecological Intrinsic Potential<sup>20</sup></b>	<b>Intrinsic Potential Summary (practical constraints)<sup>21</sup></b>
Wenatchee		Medium to High	Medium-High—Barriers, channel morphology including flood plain connectivity, flows	Medium	Medium
Entiat		Low to Medium	Medium—Channel morphology, flows	Medium	Low to Medium
Methow		High	Medium—Irrigation, sedimentation, barriers, large woody debris, riparian vegetation, and flows	Medium	Medium

In developing this Updated Proposed Action, the Action Agencies considered NOAA’s recent analysis of potential habitat improvement measures and practical constraints in all three subbasins. In addition, we verified opportunities were verified by contacting local knowledgeable individuals and organizations, reviewing the considerable information made available by the Council’s recently drafted subbasin plans, and consulting other state and local documents. (See Appendix B).

The limiting factors identified for Upper Columbia steelhead in each of the subbasins are similar to those identified for the Upper Columbia Spring Chinook. The Action Agencies considered those similarities and selected an identical suite of habitat improvements for both ESUs in each subbasin. We will not reiterate these analyses here but refer the reader to the discussion of each subbasin’s conditions under the section on Upper Columbia Spring Chinook. Although steelhead tend to utilize habitat higher in the river systems than chinook, much of those high spawning and rearing streams are located on lands administered by the U.S. Forest Service, which is formulating its own programs to improve habitat. To avoid duplication of effort, the Action Agencies are focusing on habitat improvement programs for the four selected limiting factors that are lower in the subbasin systems and will improve survival for both ESUs. Therefore, our metrics goals are identical for both ESUs.

The survival improvements that can be anticipated from the Updated Proposed Action in the Wenatchee, Entiat, and Methow subbasins will fulfill the improvement potential anticipated to meet a qualitative requirement of “medium” habitat improvement potential.

To confirm that the survival improvement goals are being achieved, the Action Agencies are implementing an effectiveness monitoring program in the Methow subbasin. The effectiveness monitoring findings will inform the Action Agencies and NOAA about the expected survival effects of

<sup>18</sup> Based upon an analysis of base period (historic) average annual redd counts and recent average annual redd counts.

<sup>19</sup> Anthropogenic limiting factors include instream flows, channel morphology (barriers, connectivity, condition of bed, sedimentation, etc.), entrainment (lack of fish screens), riparian condition, water quality including water temperature, etc.

<sup>20</sup> Ecological Improvement Potential is the anticipated qualitative response to improve population status by addressing limiting factors that resulted from anthropogenic management actions.

<sup>21</sup> An adjustment of the Ecological Improvement Potential based upon practical constraints which may limit the ability to address limiting factors including legal, social, political, or economic constraints.



the habitat improvement projects for this ESU. In future years, the Action Agencies will consider modifying the emphasis of the habitat goals associated with each limiting factor if we find that a better mix of limiting factor goals would yield better results.

The Updated Proposed Action for improving Upper Columbia River steelhead juvenile survival production in the Wenatchee, Entiat, and Methow subbasins is shown in Table 8 by metrics measurement and goals. We have established goals for 3 years after adoption of this Updated Proposed Action and cumulative goals for 6 years after adoption.

**Table 8.** Updated Proposed Action, Upper Columbia Steelhead, Wenatchee, Entiat, and Methow Subbasins

<b>Limiting Factor</b>	<b>Metric Measurement</b>	<b>Metric Goal in three years</b>	<b>Cumulative Metric Goal in six years</b>
<u>Entrainment</u> <sup>22</sup>	a. Number of screens addressed	5	10
<u>Instream flow projects</u> <sup>23</sup>	a. Cubic Feet per Second (cfs) of water protected for instream flows	12 cfs	40 cfs
<u>Channel Morphology</u> <sup>24</sup>	a. Miles of access restored	60 miles	105 miles
	b. Miles complexity restored	5 miles	10 miles
<u>Riparian Protection/Enhancement</u> <sup>25</sup>	a. Number of miles protected	4 miles	12 miles
	b. Number of miles enhanced.	6 miles	12 miles

NOAA Fisheries rated the Okanogan subbasin steelhead population as having low potential for tributary habitat improvements. They also identified fish passage at Salmon Rapids Dam as a major limiting factor in the subbasin, but studies and Congressional authority required to improve passage is unlikely before adoption of NOAA’s revised Biological Opinion.

<sup>22</sup> Fish entrainment at screens may be addressed through adding new screens, modifying existing screens to meet current criteria, or eliminating the diversion through replacement wells or other means.

<sup>23</sup> Instream flow projects include lease or purchase of streamflow, water conservation projects which yield actual “wet water” instream which may be secured through state water law. Not counted in this metric are gaging stations or other water measurement initiatives or investigations which may be necessary to support the evaluation and protection of instream flows for fish.

<sup>24</sup> Channel morphology projects include Access projects which provide fish passage at structures or conditions that create migration barriers including diversion dams, culverts, low flow channels, etc. Stream Complexity Restoration projects include side channel connectivity, flood plain connectivity, channel reconfiguration, large woody debris placement, etc.

<sup>25</sup> Riparian protection projects include acquisition of riparian easements or purchases. Riparian enhancement projects include streambank stabilization and riparian treatments such as fencing or reconstruction.

## 9. Mid-Columbia River Steelhead

In addition to the actions described below, survival improvements for this ESU will be gained through hydrosystem configuration changes, avian and pikeminnow predator control, and estuary habitat actions that are identified in the *Updated Proposed Actions that Benefit Multiple ESUs* section.

Figure 12 displays the array of actions that the Action Agencies propose to fill the survival gap for this ESU.

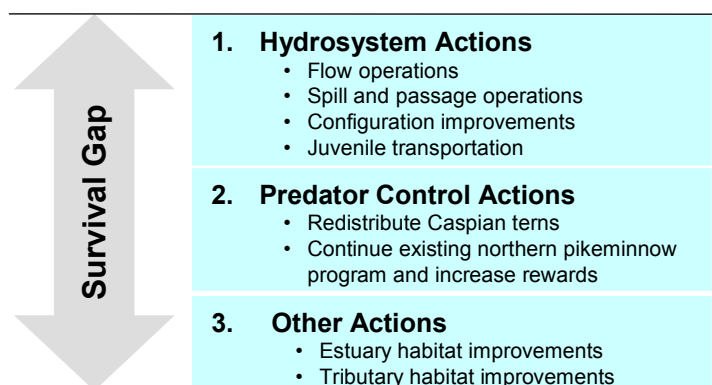


Figure 12 Updated Proposed Actions to benefit mid-Columbia River steelhead

### ***Tributary Habitat Conservation Measure***

Reclamation is proposing, as a conservation measure, to continue a tributary habitat technical assistance program which was instituted under the 2000 BiOp (RPA Action 149) in three subbasins of the John Day River drainage. This conservation measure is intended to meet a greater increment of overall survival for Mid-Columbia steelhead during their spawning and rearing life stages than is required to avoid jeopardy to the species; consequently, it is formulated to partially meet recovery standards for this ESU as defined by the regulatory guidance in the Endangered Species Consultation Handbook (USFWS and NOAA Fisheries, p. 4-19). Absent this conservation measure, Reclamation would be required to withdraw from its current participation in tributary habitat improvements in the Upper John Day, Middle Fork John Day, and North Fork John Day subbasins due to a lack of funding authority. It is important to note that this is a Bureau of Reclamation conservation measure and does not imply or expect any level of participation by the other Action Agencies.

NOAA Fisheries analysis of the survival effects on Mid-Columbia steelhead populations that pass through three of the mainstem Columbia River dams and attributable to the hydro Updated Proposed Action shows that that proposed hydro action, in itself, would create only a low “survival gap” in the short term and a improvement in the longer term. The total survival change needed for these populations averages -0.6 percent in the short-term which is considered to require a qualitative improvement estimate of “low.” The Action Agencies propose to fill this gap with hydrosystem configuration, transportation, and predation actions. Additional actions to improve survival may be considered to be over and above the jeopardy standard and are, thus, directed more toward ESU recovery efforts.

NOAA Fisheries evaluated the likelihood of improving species survival through habitat improvements through an analytical approach that considered the four VSP criteria of abundance, productivity, diversity and distribution. NOAA performed a qualitative evaluation of trends in population status and associated tributary habitat condition and considered the potential to address identified habitat limitations sufficiently to elicit a response in population status. Qualitative rankings of high, medium, or low were

assigned to population and habitat parameters based on the magnitude of the observed or potential change.

For the populations of Mid-Columbia steelhead, NOAA concluded that there is a high level of “intrinsic potential” to improve spawning and rearing habitat in the three subbasins of this conservation measure. Reclamation considered the primary limiting factors identified by NOAA Fisheries for each subbasin and evaluated formulating a habitat improvement program that attempted to address those limiting factors considering the limitation of Reclamation authorities. Reclamation does not have, and does not anticipate having, authority to address riparian habitat protection or enhancement actions. Reclamation can provide technical assistance to solve engineering issues affiliated with channel morphology but currently does not have authority to fund the construction of such projects. Authority to fund construction of instream projects has been introduced in the Congress. Reclamation can consider leasing or acquiring instream flows in compliance with state water law. In consideration of these authority limitations, this conservation measure is formulated to allow Reclamation to continue its current technical assistance program in the three selected subbasins, but cannot promise that authority to go beyond that program is forthcoming with any certainty.

Considerable investigations have been performed to identify the habitat limiting factors in the three John Day subbasins included in this conservation measures and to assess the opportunities for improvement. We will not reiterate those findings here. However, in developing this conservation measure, Reclamation considered NOAA’s recent analysis of potential habitat improvement measures and practical constraints in all three subbasins. In addition, opportunities were verified by contacting local knowledgeable individuals and organizations, reviewing the considerable information made available by the recently drafted Council subbasin plans, and consulting other state and local documents. Those habitat limiting factors, opportunity analyses, and Reclamation’s discretionary authority were considered in developing a tributary habitat conservation measure which focuses on three of the limiting factors: entrainment, channel morphology, and streamflow. We also considered on-going programs by other entities and formulated a conservation measure that does not duplicate those other effects.

The conservation measure for improving Mid-Columbia steelhead juvenile survival production in the North Fork John Day, Middle Fork John Day, and Upper John Day subbasins is shown in Table 9 by metrics measurement and goals. Goals are established for 3 years after adoption of NOAA’s revised Biological Opinion.

**Table 9. Conservation Measure, Mid-Columbia Steelhead**

<b>Limiting Factor</b>	<b>Metric Measurement</b>	<b>3-Year Metric Goal</b>
<u>Entrainment</u>	a. Number of screens addressed <sup>26</sup>	30
<u>Instream flow projects</u> <sup>27</sup>	a. Cubic feet per second (cfs) of water protected for instream flows	7 cfs
<u>Channel Morphology</u> <sup>28</sup>	a. Miles of access restored	24 miles
	b. Miles of complexity restored	3 miles

## 10. Upper Willamette River Steelhead

This ESU is not jeopardized by the FCRPS. However, survival improvements for this ESU will be gained through avian predator control and estuary habitat actions that are identified in the *Updated Proposed Actions that Benefit Multiple ESUs* section.

Figure 13 displays the array of actions proposed by the Action Agencies that would benefit this ESU.

<p><b>1. Hydrosystem Actions</b></p> <ul style="list-style-type: none"> <li>• Flow operations</li> </ul>
<p><b>2. Predator Control Actions</b></p> <ul style="list-style-type: none"> <li>• Redistribute Caspian terns</li> <li>• Continue existing northern pikeminnow program and increase rewards</li> </ul>
<p><b>3. Other Actions</b></p> <ul style="list-style-type: none"> <li>• Estuary habitat improvements</li> </ul>

**Figure 13 Updated Proposed Actions that would benefit Upper Willamette River steelhead**

<sup>26</sup> Fish entrainment at screens may be addressed through adding new screens, modifying existing screens to meet current criteria, or eliminating the diversion through replacement wells or other means.

<sup>27</sup> Instream flow projects include lease or purchase of streamflow, water conservation projects which yield actual “wet water” instream which may be secured through state water law. Not counted in this metric are gaging stations or other water measurement initiatives or investigations which may be necessary to support the evaluation and protection of instream flows for fish.

<sup>28</sup> Channel morphology projects include Access projects which provide fish passage at structures or conditions that create migration barriers including diversion dams, culverts, low flow channels, etc. Stream Complexity Restoration projects include side channel connectivity, flood plain connectivity, channel reconfiguration, large woody debris placement, etc.

## 11. Lower Columbia River Steelhead

In addition to the actions described below, survival improvements for this ESU will be gained through hydrosystem, predator control, and estuary habitat actions that are identified in the *Updated Proposed Actions that Benefit Multiple ESUs* section.

Figure 14 displays the array of actions that the Action Agencies propose to fill the survival “gap” for this ESU.

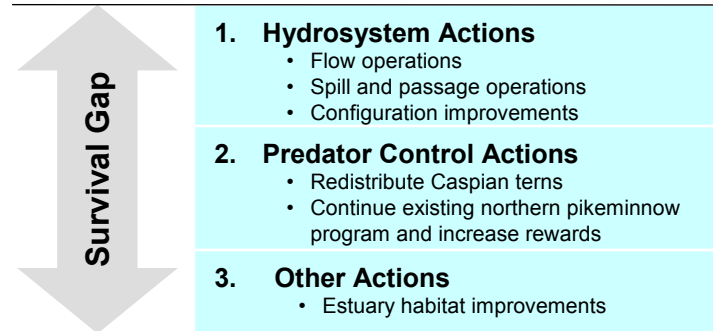


Figure 14 Updated Proposed Actions to benefit Lower Columbia River steelhead

## 12. Columbia River Chum

Survival improvements for this ESU will be gained through hydrosystem, pikeminnow predator control (Caspian terns nesting in the estuary have little to no effect on Columbia River chum), and estuary habitat actions that are identified in the *Updated Proposed Actions that Benefit Multiple ESUs* section.

Figure 15 displays the array of actions that the Action Agencies propose to fill the survival gap for this ESU.

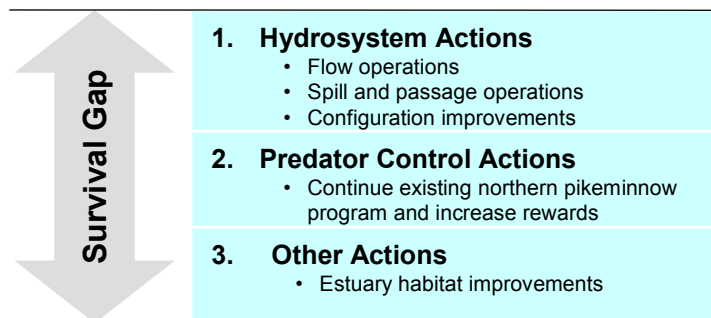


Figure 15 Updated Proposed Actions to benefit Columbia River chum

### 13. Snake River Sockeye

In addition to the actions described below, survival improvements for this ESU will be gained through hydrosystem, predator control, and estuary habitat actions that are identified in the *Updated Proposed Actions that Benefit Multiple ESUs* section.

Figure 16 displays the array of actions that the Action Agencies propose to fill the survival “gap” for this ESU.

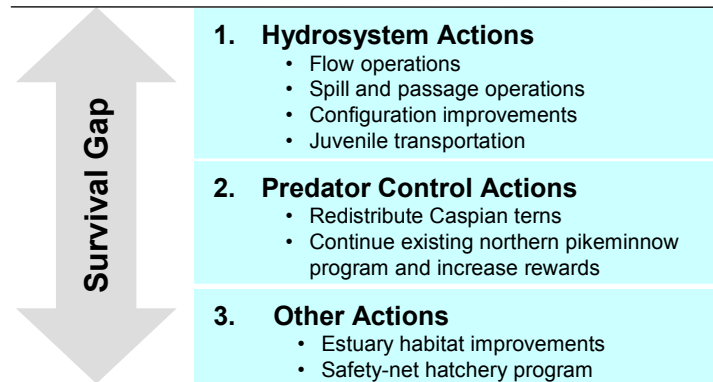


Figure 16 Updated Proposed Actions to benefit Snake River sockeye

#### **Hatchery Actions**

**Safety-net Hatcheries:** The Action Agencies believe that the past and continuing operation of this safety net program is essential to preventing extinction of this ESU. BPA will continue to fund the Safety-net Program for the Snake River (Redfish Lake) sockeye with the following projects if NOAA Fisheries determines it to be an effective and essential contribution to reducing the risk of extinction for this ESU:

- Redfish Lake Sockeye Captive Broodstock Program (two projects)
- Genetic Analysis of *Oncorhynchus nerka*
- Sockeye Salmon Habitat and Limnological Research

## 14. Lower Columbia River Coho

The Lower Columbia River coho is proposed for listing under the ESA. Survival improvements for this ESU will be gained through hydrosystem predator control, and estuary habitat actions that are identified in the *Updated Proposed Actions that Benefit Multiple ESUs* section.

Figure 17 displays the array of actions that the Action Agencies propose to fill the survival “gap” for this ESU.

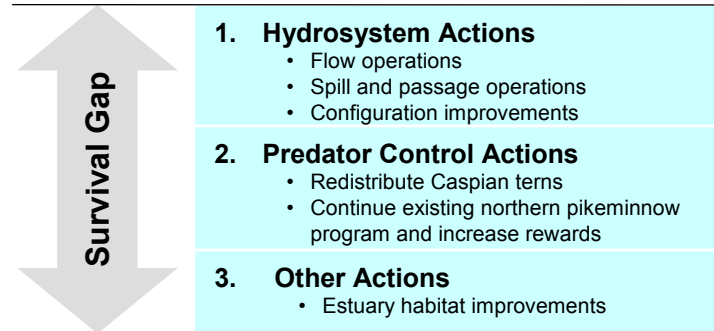


Figure 17 Updated Proposed Actions to benefit Lower Columbia River coho

## **IV. Research, Monitoring, and Evaluation (RM&E)**

The Action Agencies will focus their updated Updated Proposed Action on RM&E needed to assess and maximize performance of our Updated Proposed Actions for hydro and non-hydro actions. Beyond our Updated Proposed Action for RM&E, as part of our conservation actions for contribution to regional recovery efforts, we will continue to participate in the development, coordination, and implementation of a comprehensive RM&E program that is integrated with the BPA funded Columbia Basin F&W Program, the Corps' Anadromous Fisheries Evaluation Project (AFEP) program, Reclamation's appropriated technical assistance activities, and RM&E activities of other Federal Caucus agencies. This RM&E program will be coordinated with region state and tribal entities and results, as available, will be included in the annual progress reports.

The Action Agencies RM&E Updated Proposed Actions under the BiOp remand are integrated with conservation actions within our overall strategy descriptions and rationales, however specific actions are separated out under the headings of "Updated Proposed Actions" and "Conservation Actions."

### ***RM&E Strategy 1: Status Monitoring***

**Rationale for BiOp and Recovery Measures:** Regional monitoring of status information such as adult and juvenile fish abundance, distribution, and survival, or environmental conditions that have been identified as key measures of fish performance is needed for an effective performance based approach. Under this strategy, the Action Agencies will continue to work collaboratively with NOAA and other Federal Caucus agencies, the states and the tribes to participate in a regionally developed network of status monitoring programs. Together these regional agency programs will provide the information needed to determine and track the status of ESA populations and their environment (including assessment of performance measures and standards).

The Action Agencies' primary responsibility for status monitoring will be within the hydrosystem corridor. The Action Agencies will also participate in the further development and networking of other agencies' regional monitoring programs outside of the hydrosystem. The Action Agencies will continue to implement tributary and estuary habitat pilot status-monitoring projects, participate in regional coordination activities, and implement policies that support a comprehensive and compatible network of regional programs.

A regional network of status monitoring programs will need to cover hydro corridor, tributary, and estuary habitat components of all ESA listed populations in an integrated approach that includes a landscape level classification framework. The Action Agencies will coordinate and further develop the tributary habitat component through the PNAMP, pilot projects in the Upper Columbia Basin - John Day subbasin, and potentially a third pilot area within a high priority habitat action area, and the Columbia Basin Fish and Wildlife Authority (CBFWA) Collaborative Systemwide Monitoring and Evaluation Project. We will coordinate and further develop the hydrosystem corridor component through the Corps' AFEP. The estuary component will be coordinated and further developed through implementation of the estuary RM&E Plan in the lower Columbia River below Bonneville Dam.

- The regional, multi-agency network of status monitoring programs needs to be integrated with action effectiveness and critical uncertainty research strategies. An integrative conceptual model will be developed to help link the various monitoring and research efforts and further define the regional monitoring network. This work will be coordinated with development of a regional data network and associated data management pilot projects as part of the data management strategy of the Updated Proposed Action.



### ***RM&E Status Monitoring Substrategy 1.1: System Level Monitoring***

This substrategy identifies status-monitoring actions that are focused at the entire system or are process oriented. Under this substrategy the Action Agencies will continue to develop and implement pilot projects for tributary and estuary habitat status-monitoring, implement the Action Agencies' hydrosystem status-monitoring program, participate in regional coordination activities (such as PNAMP), and implement policies that support regional status-monitoring programs.

#### **Updated Proposed Actions:**

- Implement and maintain the Columbia River Basin PIT Tag Information System. Expand the system to systematically plan PIT Tag efforts in the pilot study basins such that production and survival can be estimated throughout the system for wild and hatchery fish.
- Implement fish harvesting incidental mortality monitoring with a focus on Columbia Basin fisheries.
- Fund marking of hatchery releases from Action Agency funded facilities in accordance with marking guidelines provided by NOAA Fisheries, to enable monitoring of hatchery-origin fish in natural spawning areas and the assessment of status of wild populations.

#### **Conservation Actions:**

- Implement pilot projects that support a regionally coordinated program for aerial and satellite imagery data.
- Implement a landscape change analysis pilot project using satellite imagery.
- Continue development and implementation of new fish detection and tagging techniques.

### ***RM&E Status Monitoring Substrategy 1.2: Tributary Monitoring***

This substrategy includes status-monitoring actions within tributary habitats. Under this substrategy the Action Agencies will work collaboratively with NOAA and other Federal Caucus agencies, the states and the tribes to develop a regional network of status-monitoring programs covering fish populations and environmental conditions in the tributaries. To support this effort the Action Agencies will participate with other regional federal, state, and tribal agencies to support the PNAMP coordination efforts on tributary habitat and fish population status monitoring.

#### **Updated Proposed Action:**

- Implement status monitoring pilot projects within the Upper Columbia action area to further advance the methods and information needed for assessing the status of fish populations and their environment.
- Monitor John Day subbasin adult steelhead spawning and juvenile migration timing, abundance, and rearing densities.

#### **Conservation Measure:**

- The Action Agencies will work with NOAA to implement pilot projects for tributary habitat status monitoring in the John Day subbasin and potentially one other action area (to be determined yet) to further advance the methods and information needed for assessing the status of fish populations and their environment.

#### **Conservation Actions:**

- Work with the USFWS to further define status monitoring requirements for resident fish and integrate these monitoring requirements with the NOAA Fisheries/Action Agency RM&E Plan.

- Implement the Columbia Basin Fish and Wildlife Authority (CBFWA) Collaborative Systemwide Monitoring and Evaluation Project (CSMEP) and collaborate with state, tribal and federal fish agencies on monitoring designs and sampling protocols.
- Inventory tributary status monitoring work in the Columbia River Basin.
- Assess the feasibility of remote monitoring approaches to quantify adult steelhead in select tributaries.

### ***RM&E Status Monitoring Substrategy 1.3: Hydro System Corridor Monitoring***

This substrategy includes status-monitoring actions that are focused on the hydrosystem corridor.

**Updated Proposed Action:** The Action Agencies will continue to implement adult and juvenile migration status monitoring within the hydro corridor and improve upon these capabilities to provide dam specific and system level passage survival information for ESA listed species.

Hydrosystem corridor status monitoring actions include:

- Conduct annual Smolt Monitoring Program (SMP) at seven mainstem Snake and Columbia River dams.
- Monitor wild Snake River spring/summer Chinook salmon smolt migrations.
- Monitor smolt condition relative to biological and environmental conditions.
- Monitor adult returns with the PIT tag detection system.
- Provide in-season statistical support, real-time run predictions, and annual review of run-timing predictions.
- Monitor emergence, growth, migration timing, and survival of Snake River fall Chinook.
- Obtain accurate counts of fall Chinook salmon redds upriver of Lower Granite Dam.
- Produce digital maps of the riparian areas, wetland features, and stream channel boundaries for mainstem streams.
- Complete downstream migrant kelt assessment to determine magnitude of passage, contribution to population diversity and growth, and potential actions to provide safe passage.

Additional status monitoring for hydro corridor configuration is listed below. This work will continue to be developed and coordinated through the AFEP and in coordination with the Regional Forum SCT.

#### **Bonneville Dam**

- Estimate total project and route-specific juvenile survival and fish passage efficiency for the new Bonneville 2<sup>nd</sup> powerhouse corner collector and juvenile bypass system, spillway, and 1<sup>st</sup> powerhouse sluiceway for spring and summer species.
- Complete analysis of adult fallback and make recommendations on potential improvements for passage.

#### **The Dalles Dam**

- Characterize stilling basin hydraulic conditions, estimate direct plus indirect survival and injury rates, and estimate juvenile fish travel paths through the forebay and stilling basin. Evaluate fish passage efficiency for all routes of juvenile passage.

#### **John Day Dam**

- Estimate project and route specific survival rates, fish passage efficiency and spill passage efficiency, forebay retention time, and tailrace egress for juvenile passing through John Day Project.

### **McNary Dam**

- Estimate project and route specific juvenile survival rates.
- Evaluate adult passage, including kelts, associated with RSWs as warranted

### **Ice Harbor**

- Estimate project and route specific juvenile survival rates.
- Monitor spillway injury and mortality for juvenile fish.
- Evaluate adult passage, including kelts, associated with RSWs

### **Lower Monumental**

- Estimate project and route-specific juvenile survival rates.
- Evaluate adult passage, including kelts, associated with RSWs as warranted

### **Little Goose**

- Evaluate adult passage, including kelts, associated with RSWs as warranted

### **Lower Granite**

- Estimate passage efficiency and survival of subyearling Chinook with removable spillway weir.
- Evaluate adult passage, including kelts, associated with RSWs

### **Hydrosystem**

- Complete analysis to assess unaccounted loss and delay of radio tagged fish to develop a strategy for integrating information from adult pit tag monitoring to the baseline studies for adult survival.
- Evaluate fish ladder temperatures.
- Evaluate the potential improvements to juvenile PIT tag detections associated with high volume flumes (e.g., Bonneville corner collector, spillways and turbines).

### ***RM&E Status Monitoring Substrategy 1.4: Estuary/Ocean Plume Monitoring***

This substrategy focuses on estuary/ocean status monitoring actions. Under this substrategy Action Agencies will work collaboratively with NOAA and other Federal Caucus agencies, the states and the tribes to develop a program to monitor estuary and plume conditions and juvenile salmon growth and survival.

The Final Draft of the Action Agencies' *Plan for Research, Monitoring, and Evaluation of Salmon in the Columbia River Estuary* (Plan) was produced in July 2004. The Plan identifies the Columbia River estuary as a key element of the basin-wide research, monitoring, and evaluation effort developed for the 2000 Biological Opinion for the operation of the FCRPS. During up and downstream migrations, all the listed anadromous ESU's use the estuary in varying degrees ranging from a conduit to the ocean to extended juvenile rearing strategies that may contribute substantially to their success in the ocean.

The estuary RME plan contains four elements:

1. Establishes RME goals and objectives for salmon-related activities in the estuary;
2. Develops performance indicators and monitored attributes that are responsive to the objectives;
3. Identifies methods to obtain and analyze data on the monitored attributes; and
4. Uses project and program level assessments to make recommendations as part of a phased action plan for estuary RME.

The information from status monitoring, both estuary-wide and reference site monitoring, and action effectiveness research will be summarized in periodic reports. In this complex adaptive management process program evaluation will include adjusting program objectives and methodologies based on new information.

The complexity in identifying performance standards is well documented in the NOAA Fisheries estuary documents; *Salmon at Rivers End*, 1999, and the NOAA Technical Memorandum; *Role of the Estuary in the Recovery of Columbia River Basin Salmon and Steelhead: An Evaluation of Selected Factors on Population Viability*, May 2004. The former offered that we do not know if the estuary is limiting at all for salmon. The more recent paper proposed factors that NOAA Fisheries believes can potentially affect salmonid population viability, and addressed a subset. These are; water flow, availability of salmon habitats, toxics, and predation (primarily Caspian terns).

There are clearly estuary actions with a high probability of benefiting salmon and addressing the NOAA Fisheries proposed factors. These are addressed in this Updated Proposed Action. Performance standards will be developed and monitored as actions are implemented in the adaptive management process concurrent with identifying which factors may be limiting for salmon viability

## ***RM&E Strategy 2: Action Effectiveness Monitoring and Research***

**Rationale for Updated Proposed Actions and Conservation Actions:** The objective of this strategy is to assess the effects of hydrosystem and non-hydro actions on fish production, survival, fish condition, and habitat condition in a quantitatively rigorous approach. This information will be critical to assessments of the expected benefits of hydro system and off-site actions and their relative priority for implementation. This research requires well-designed experiments, with treatment areas, controls and adequate replication. The Action Agencies will continue to refine and implement habitat action effectiveness research through implementation of pilot studies and coordination through the PNAMP. The habitat effectiveness studies will be integrated with status monitoring, and critical uncertainties research as part of the broader comprehensive RM&E Program called for in the Federal Caucus' *All-H Strategy* and the Council's Fish and Wildlife Program.

Under the action effectiveness monitoring and research strategy, the Action Agencies expect to implement the Updated Proposed Action and conservation actions in coordination with other regional federal, state, and tribal agencies to achieve the following outcomes:

- Effectiveness research that provides an understanding of the general magnitude and relative effectiveness of different categories of tributary and estuary habitat actions on the productivity of anadromous fish under different limiting conditions.
- Effectiveness research that quantifies the effect of hydro system fish passage improvement actions on the survival of juvenile and adult anadromous fish.
- Effectiveness research identifying the effects of changes in hatchery or harvest management practices on ESA listed anadromous fish.
- Effectiveness research that identifies the effect of selective fishery and reduced incidental take harvest methods.

### ***RM&E Substrategy 2.1 Action Effectiveness Research: Hydrosystem***

This substrategy focuses on hydro system related action effectiveness research.

**Updated Proposed Action:** The Action Agencies will continue to fund studies to advance the understanding of the effectiveness of flow augmentation, spill, transportation, predator control, and

changes in system configurations on fish survival, fish condition and habitat for each of the ESUs. Ongoing AFEP research projects will continue to support this work as a primary objective.

Hydrosystem action effectiveness research projects include:

- Study the effect of summer flow augmentation on water temperature, water velocity, and juvenile fall Chinook salmon migratory behavior and survival in Lower Granite Reservoir.
- Determine juvenile fish-transportation effectiveness through evaluation of: (1) survival and adult return rates of juvenile salmon transported compared to in-river migrating fish; (2) post-release losses and barging strategies that minimize post-release mortality; (3) benefits of trucking juvenile salmon; (4) late-season transportation at McNary Dam; and (5) evaluate D of transported fish relative to in-river migrants.
- A comprehensive evaluation of Snake River fall Chinook transportation is planned to begin when RSWs or other surface oriented passage is provided at the Snake River collector dams to provide more favorable inriver passage conditions (2007/2008). This study will follow initial determination of related life history attribute considerations influencing transportation success and passage timing through the FCRPS.

Additional effectiveness research projects related to hydro system configuration are listed below. This work will continue to be developed and coordinated through the AFEP and in coordination with the SCT.

#### **Bonneville Dam**

- Evaluate the effect of improvements to the screen bypass system and determine level of implementation if appropriate.

#### **The Dalles Dam**

- Evaluate adult delay and fallback with new spill patterns developed with respect to the installation of the spillway training wall.
- Evaluate the prominence of smallmouth bass in the tailrace of The Dalles and the effectiveness of approaches to reduce the potential for predation on juvenile salmonids.

#### **John Day Dam**

- Evaluate the potential to improve fish guidance efficiency at John Day Dam. Assess injury and survival with new vertical barrier screens installed.

#### **McNary Dam**

- Evaluate effectiveness of spring/summer Chinook, fall Chinook and steelhead juvenile fish transportation.

#### **Hydrosystem**

- Initiate a turbine passage survival study to develop a strategy for rehabilitation of existing turbine units, develop turbine operating guidelines to improve fish survival and conduct studies to support Ice Harbor turbine replacement.
- Evaluate the effects of changes in fish ladder temperature.
- Evaluate the behavior of fish in the forebay of The Dalles Dam to determine the feasibility of a physical guidance device for the forebay and assist in design of a device to improve fish passage efficiency.
- Evaluate the effects of different entrance designs on the behavior of juvenile fish (e.g., The Dalles sluiceway, Bonneville corner collector, Lower Granite RSW).
- Report on water temperature effects on adult salmonids between McNary and confluence of Clearwater.

### ***RM&E Substrategy 2.2 Action Effectiveness Research: Habitat***

This substrategy focuses on tributary and estuary habitat related action effectiveness research. The RM&E work will be guided by the tributary status and action effectiveness research section of the joint NOAA/Action Agency RM&E plan and the associated Upper Columbia monitoring strategy. Metrics will be analyzed and physical and biological responses in pilot project annual reports in 3-year progress reports. This research will help identify the general magnitude and relative effectiveness of different categories of tributary habitat actions and their combined contribution toward meeting any gap deficiencies.

The Action Agencies will implement action effectiveness research through pilot studies in key basins where the research will contribute to the overall goal of understanding how to meet the hydrosystem survival gap most efficiently. The Action Agencies will concentrate on four types of tributary actions in the Action Area: entrainment, instream flow, channel structure, and riparian habitat. These actions affect the primary limiting factors for salmonids in the Action Area: direct mortality, water supply, food supply, temperature, sedimentation, and cover. The action agencies will assess the limiting factors on a periodic basis in those subbasins to ensure that the tributary actions are addressing the correct factors.

The Action Agencies will concentrate action effectiveness research in a series of intensively monitored watersheds. The research will attempt to assess the response of juvenile salmon natural productivity to a suite of habitat actions. The assessment will use reference and treatment watersheds or in treatment watersheds before and after assessments of physical attributes and fish natural productivity in the treatment watershed to assess quantitatively the effects of the habitat actions. The physical and biological attributes and sampling protocols will be developed and tested through the PNAMP and the pilot studies. The results of the monitoring activity will be reported annually.

The Action Agencies chose the Upper Columbia pilot study to support the tributary habitat Updated Proposed Action for Upper Columbia spring chinook and Upper Columbia steelhead because: (1) The Upper Columbia ESUs have the largest hydrosystem survival gap and some populations with the lowest productivity in the Columbia River Basin, (2) the State of Washington has made a large commitment toward fish research and monitoring through the State's Regional Technical Team with funding from the Salmon Recovery Fund Board; (3) there is significant involvement with tribes in the upper Columbia; (4) there is an opportunity to develop a significant habitat restoration program by combining efforts with the Mid-Columbia HCP programs; (5) there is substantial local community support for habitat restoration and monitoring; (6) the key limiting factors of hatchery influence, water supply, channel connectivity and riparian cover have been identified.

The Action Agencies have initiated pilot studies in the John Day basin that will continue to inform Reclamation's proposed conservation measure for Mid-Columbia steelhead, and these studies will continue for the duration of that conservation measure. The John Day pilot study is important because (1) the John Day basin is represented by several populations of the Mid-Columbia steelhead; (2) there is an opportunity to build quickly on past research in the basin to develop answers to key management questions; (3) there is little influence of hatchery fish in the basin; (4) the key limiting factors of water supply, temperature, and sediment have been identified; (5) the basin has key sites where fish traps can be cloated effectively; and (6) the information from the research is likely to be transferable to other ESUs.

The Action Agencies will continue to work with NOAA to develop tributary population goals and metrics. The Action Agencies will develop a conceptual framework to associate tributary actions with physical and biological metrics with the goal of periodically demonstrating quantitatively the success of the actions toward the achievement of population goals and offsetting the hydrosystem survival gap.

**General Structure of Tributary Habitat Action Effectiveness Research.** The Action Agencies propose the development and implementation of an effectiveness-monitoring program to confirm the benefits of tributary habitat actions. The overall hierarchical structure of BiOp tributary restoration action effectiveness monitoring program will be a set of nested monitoring efforts that together addresses the question of change in juvenile salmonid productivity (e.g., stage specific survival, smolts/female, fish condition). The program will consist of broad-scale *project implementation and compliance monitoring* whereby all projects implemented will be assessed annually. Of those, a subset – with paired, untreated control reaches - will be assessed for *reach-scale biological and physical effects* to demonstrate that the project implementation results in local physical and biological changes (approximately 25% of projects outside of Productivity Monitored Watersheds (PMWs) and Intensively Monitored Watersheds (IMWs), but within the Action Area, and all projects within PMW and IMWs). Of those projects that are assessed for reach-scale impact, subsets will be assessed for *population level salmonid productivity effects* in one of two ways: as *PMWs* assessed only at the mouth of the watershed and as *IMWs*, where the assessment is done at the base, plus throughout the watershed with EMAP-style spatial sampling. This system of nested monitoring efforts is an efficient distribution of effort. When coordinated with the design and implementation of the tributary restoration actions, it is expected to yield the information necessary to rigorously quantify the biological benefit of habitat actions. The individual components of the program are presented in more detail below.

**Project Implementation and Compliance Monitoring.** For the Action Area, all tributary restoration projects that fall into the 4 Updated Proposed Action types (entrainment, instream flows, channel morphology, and riparian protection/enhancement) will be monitored for implementation (was the project completed as planned) and compliance (does it continue to work in future). This will consist of a one-time implementation confirmation to ensure that the project was implemented as designed and on-going compliance monitoring to ensure that the projects' designed intent is still being achieved (e.g., screens in place and functioning as designed). The temporal frequency and performance metrics for compliance monitoring will be project specific, but will in general be rapid annual assessments requiring minimal data collection.

**Reach-scale biological and physical impact.** For the Action Areas, a sub-set of the restoration actions will be assessed for reach-scale biological and physical habitat impacts. This will occur only in IMW's and PMW's. This assessment will be done in a Before-After-Control-Impact context using biological and physical indicators appropriate to the project type and spatial scale. The "before" and "control" components are necessary to confirm the impact of the project in time and space. The control area is most relevant if located immediately adjacent to the action. The temporal scale of sampling will be appropriate for the action type, and may be less than annual.

**Population level salmonid productivity effects.** For the Action Area, restoration actions grouped by watersheds will be assessed for the population scale biological impact on the productivity of juvenile salmonids. This assessment will be done in a Before-After-Control-Impact context using one or more traditional indicators of juvenile productivity (e.g., stage specific survival, smolts per female, fish condition). The watersheds included in this component will be smaller than true demographic units (e.g., Interior Columbia TRT defined populations), but large enough to encompass most of the tributary rearing phase, with minimal immigration/emigration during monitoring period. The spatial design for the population level productivity assessments will depend on the distribution of projects, size of watersheds, and expected effect size of each action such that the number of sites per subbasin will be determined so that the productivity impact can be detected in five years with a reasonable degree of confidence. The assessments will be done annually at two fundamentally different levels of effort: Productivity Monitored Watersheds and Intensively Monitored Watersheds.

**Productivity Monitored Watersheds.** Productivity Monitored Watersheds will be assessed for the effects of actions on fish productivity by sampling only at the mouth of the watershed (see Figure 18). The question being addressed is: in total, and without knowing the direct mechanism, is the juvenile productivity different between watersheds with restoration actions of the type implemented by the Action and those without? To quantify the response, watersheds will be compared to nearby “control” watersheds with similar fish monitoring but no habitat actions.

**Intensively Monitored Watersheds.** In addition to the productivity monitored watersheds, Intensively Monitored Watersheds will be assessed for population fish productivity impacts in the Upper Columbia, John Day, and potentially one other site yet to be determined. IMWs will be accomplished by sampling throughout a watershed with a spatially balanced sampling scheme. The design of IMWs will be consistent and further informed by similar efforts within NOAA managed PCSRF IMW projects and information gained from ongoing pilot study efforts in the Wenatchee and John Day.

Tributary action effectiveness research is expected to be implemented on the following schedule:

- 1) Intensively monitored restoration activity watersheds and controls will be monitored and all metrics recorded annually. Metrics will be analyzed and physical and biological responses reported at three and five years after the BiOp is signed.
- 2) By the end of year 2 (Dec 2006) all three levels of monitoring will be in place (project tracking year 1, reach-scale monitoring year 2, population productivity effects, year 2)
- 3) In year 3, and each year thereafter, integration of all three levels to assess if anticipated improvements are being achieved.

**Tributary Updated Proposed Action:**

- The Action Agencies will work with NOAA to implement a tributary habitat effectiveness project in the Upper Columbia through the program as outlined above.
- Tributary action effectiveness efforts will be coordinated with other Federal Caucus agencies, the states and the tribes through the Upper Columbia Basin Monitoring Strategy and PNAMP.

**Estuary Updated Proposed Action:**

- The effects of estuary habitat improvements will be addressed through implementation of the Action Agencies’ *Plan for Research, Monitoring, and Evaluation of Salmon in the Columbia River Estuary* and a new pilot project in the lower Columbia below Bonneville. This action effectiveness research will develop an understanding and quantification of the effect of habitat improvement actions on juvenile salmon in the Columbia River estuary and plume.

**Conservation Measure:**

- The Action Agencies will work with NOAA to implement a tributary habitat effectiveness project in the John Day subbasin and potentially one other study area to be determined yet.

**Conservation Actions:**

- Work with PNAMP participating agencies to advance the development and/or adoption of standardized, compatible protocols for sampling designs and data collection for evaluating the effectiveness of management actions.
- Work with PNAMP as necessary and feasible to develop reach specific research and monitoring to assess the effectiveness of specific actions.
- Work with PNAMP participating agencies to identify of a regional network of Intensively Monitored Watersheds and reach specific studies for action effectiveness research with agency specific responsibilities identified for key components of the network.



- Continue implementation of nutrient enhancement effectiveness studies.
- Work with the Nez Pierce Tribe to evaluate how effective road removal, culvert replacement, riparian restoration, and stream channel restoration actions are for improving stream habitat quality and salmonid populations in the Upper Clearwater.
- Evaluate effectiveness of restoration projects for producing long-term watershed improvements; use data and trends developed to provide guidance for subbasin planning and future land management decisions.

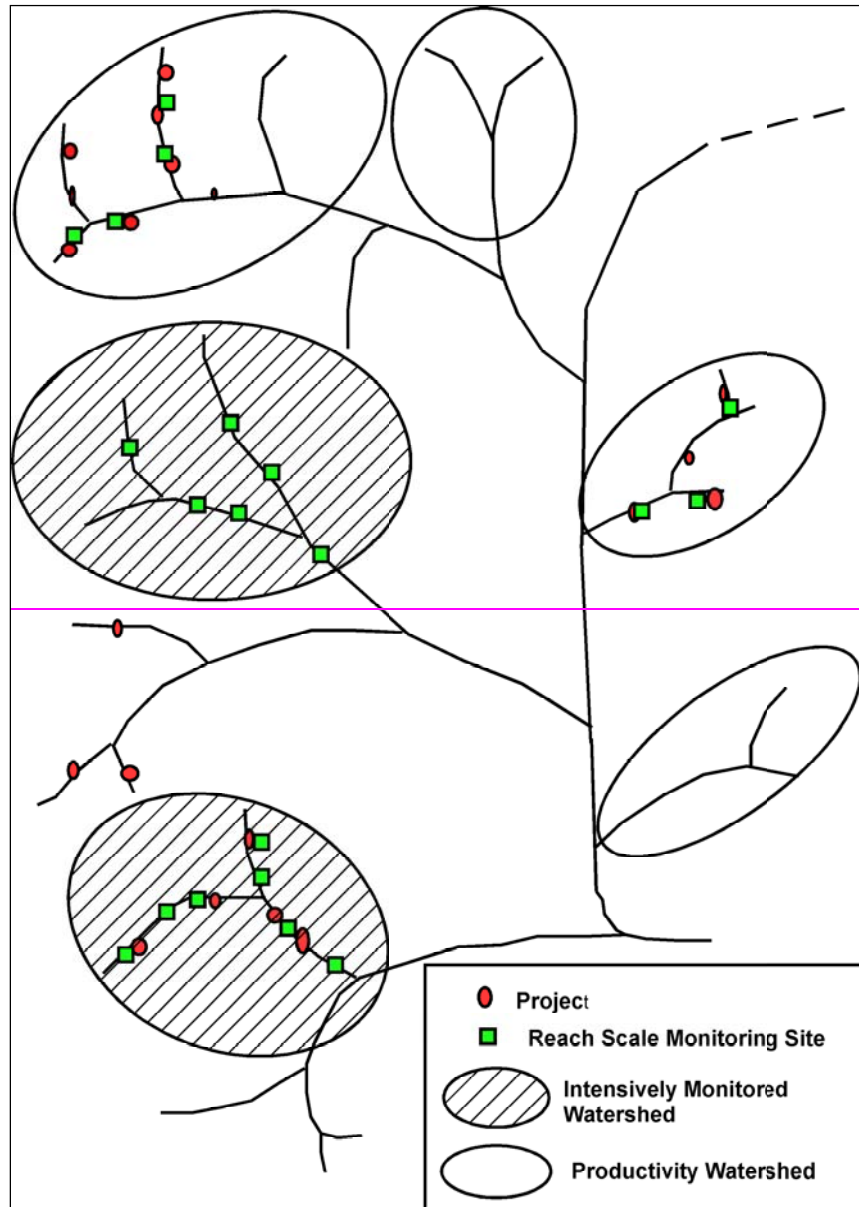


Figure 18 Sampling of PMWs.

*RM&E Substrategy 2.3 Action Effectiveness Research: Hatchery*

This substrategy focuses on hatchery related action effectiveness research.

**Updated Proposed Action:** The Action Agencies will continue to fund hatchery RM&E to determine whether safety-net hatchery programs contribute to recovery of targeted populations of salmon and steelhead.

**Conservation Actions:**

- Estimate ecological and genetic impacts of hatchery fish on wild populations.
- Develop a framework for evaluating risks and benefits of hatchery reforms and supplementation
- Evaluate the effectiveness of hatchery supplementation
- Evaluate the effectiveness of reconditioning steelhead kelts and reproductive success of kelts

***RM&E Substrategy 2.4 Action Effectiveness Research: Harvest***

This substrategy would focus on harvest related action effectiveness research if an ESA program is identified.

**Conservation Action:** The Action Agencies will continue to develop and implement a biologically sound harvest monitoring program, including research on non-retention mortalities. We will also continue research on the effectiveness of harvest strategies that are consistent with treaty reserved fishing rights.

***RM&E Substrategy 2.2 Action Effectiveness Research: Predation Control***

This substrategy focuses on action effectiveness research for piscivorous and avian predator control actions.

**Updated Proposed Action:**

**Expanded Northern Pikeminnow Management Program.** The juvenile salmon survival benefits associated with an increased incentive program will be estimated by modeling the additional removals in the same way that we have evaluated and estimated the cumulative benefits of the NPMP to date. We would apply an appropriate northern pikeminnow consumption rate on juvenile salmonids (temporally and spatially) to the number of additional northern pikeminnow removed (temporally and spatially) to determine “number of smolts” not eaten. This will indicate potential incremental benefit of increased removals, assuming no significant inter- or intra-specific compensation.

**Other Fish Predation.** Action effectiveness monitoring is contingent upon future program adoption and development.

**Caspian Tern Redistribution.** In addition to continuing research efforts on Caspian tern predation rates on salmonids in the Columbia River estuary, we will monitor and evaluate the response to the proposed management action.

**Cormorant Management.** Action effectiveness monitoring is contingent upon future program adoption and development.

***RM&E Strategy 3: Critical Uncertainties Research***

**Rationale for Updated Proposed Action and Conservation Actions:** There are critical areas of uncertainty in biological assessments of the survival conditions and the needed survival improvements for ESA listed fish populations. Critical uncertainties include the magnitude of delayed differential mortality of transported smolts (D) and the extent of extra mortality and its causes. Critical uncertainties are related to the assessment methods and data required to evaluate future population performance and needed

survival improvements. Projects under this strategy are associated with BiOp actions that address large, systematic research needs and improvements in analytical methods required for more robust and confident assessments of population status and needed survival improvements for each ESU.

**Updated Proposed Action:** The Action Agencies will continue to fund studies to address the following critical uncertainties.

- Uncertainty of in-river juvenile migration survival.
- Relative survival difference of in-river versus transported fish.
- Effect of ocean entry timing.
- Delayed mortality related to hydro system passage.
- Uncertainty of different dam passage histories relative to health and delayed mortality.
- Extra mortality and its causes.

**Conservation Actions:**

- Reproductive success of hatchery fish relative to wild fish.
- Effect of hydro system flow modifications on the estuary.
- Relationships among time of ocean entry, physical and biological characteristics of the estuary and plume environments and adult return rates.
- Salmonid use of the estuary.
- Restoration potential of Snake River fall chinook salmon spawning habitat.
- Effects of sea lions on adult salmonids immediately below Bonneville Dam.

#### ***RM&E Strategy 4: Project Implementation Monitoring***

**Rationale for Updated Proposed Action and Conservation Actions:** Project implementation and compliance monitoring are necessary to determine how well management actions are implemented. All projects should have explicit deliverables and should be evaluated to determine how well these deliverables were met. From a biological perspective, this monitoring will help to distinguish between actions that did not work and actions that were not implemented successfully. This tracking will also assist in the programmatic crediting of actions. In addition, it is essential for designing and managing action effectiveness research to know what kind of projects are being implemented within the study areas and where they are located.

**Updated Proposed Action:**

- Adopt a standardized set of reporting protocols for project deliverables that are consistent with PCSRF reporting metrics and include GIS spatial coordinates for habitat projects. These reporting protocols will be coordinated with other regional entities for consistency in regional tracking of projects and project deliverables.
- Develop and implement a compliance-auditing program that evaluates the success of achieving and maintaining habitat project deliverables. This will be implemented by randomly selecting at least 25 percent of proposed habitat improvement projects that are part of the Updated Proposed Action for compliance evaluations to ensure that habitat projects are being successfully implemented.
- Develop and maintain a database system for project tracking and progress reporting.

#### ***RM&E Strategy 5: Data Management System***

**Rationale for Updated Proposed Action and Conservation Actions:** The key objectives of a regionally coordinated data management effort includes: (1) support for monitoring and evaluation and scientific research efforts; (2) access to biological data; (3) integration and free exchange of information.

The Action Agencies will continue to work with regional federal, state and tribal agencies to establish a coordinated information system network to support the RM&E program and related performance assessments. The coordination of this development will occur primarily through participation in the Northwest Environmental Data-network (NED) workgroup, the PNAMP data group and the RME pilot studies in the Wenatchee, John Day, Upper Salmon, and estuary.

**Updated Proposed Action:** The Action Agencies will implement data management pilot projects in the Upper Columbia (Wenatchee, and possibly the Entiat, Methow), the John Day subbasin and a third pilot area within a high priority habitat action area, and the lower Columbia estuary.

**Conservation Actions:** The Action Agencies will work collaboratively with NOAA and other Federal Caucus agencies, the states and the tribes to develop a regional data management network for fish population and habitat data needed to support status monitoring, action effectiveness research and critical uncertainty research. The Action Agencies will participate in this regional effort through the implementation of data management pilot projects, continued development and maintenance of data bases supporting the Action Agencies' hydrosystem status-monitoring program, participation in regional coordination activities on data management, and implementation of policies that supports the strategy of a regional data network.

### ***RM&E Strategy 6: Regional Coordination***

**Rationale for Proposed Action and Conservation Actions:** Appropriate levels of coordination will help maximize the amount and quality of RM&E across the region within limited budgets.

#### **Conservation Actions:**

- The Action Agencies will coordinate the development and implementation of their RM&E projects with other federal, state, and tribal programs and will take advantage of the current monitoring data and overlapping monitoring programs.
- Status monitoring and tributary habitat action effectiveness RM&E coordination will primarily occur through the PNAMP.
  - Work with regional entities as a partner in the PNAMP to develop common monitoring design and sampling protocols that will be identified as standard monitoring project requirements.
  - Develop common status and effectiveness monitoring designs and sampling protocols in the Wenatchee, John Day, and a third pilot area within a high priority habitat action area that are consistent and compatible with regional level development of these same protocols through PNAMP.
  - Identify a regional network of status monitoring programs for fish and watershed conditions with agency specific responsibilities for key components of the network.
  - Identify a regional network of Intensively Monitored Watersheds and reach specific studies for action effectiveness research.
  - Develop common metrics and protocols for programmatic level and site-specific tracking of habitat enhancement and fish production projects across the region.
- Hydrosystem RM&E will continue to be coordinated through the Corp's AFEP and the staff of NOAA Fisheries' hydrosystem branches.
- Hatchery and harvest RM&E coordination will continue to occur through the Council's Fish and Wildlife Program, in the sense that all projects funded through the program will be subjected to evaluation by the ISRP and CBFWA.

- Regional coordination of the estuary/ocean RM&E will continue to occur through the CBFWA and ISRP reviews of Council's Fish and Wildlife Program project proposals. Review and planning of research projects will also occur through the Corps' AFEP program.

## **V. Conclusion**

### **A. Avoidance of Jeopardy**

This Updated Proposed Action for the operation of the FCRPS responds to the judicial remand related to the 2000 BiOp, the revised jeopardy analysis prepared by NOAA Fisheries, and the status of current biological information and actions continuing under the 2000 BiOp. It includes the framework and measures in the 2000 BiOp that the Action Agencies can implement with their resources through their own staffs or through contracts. It does not rely on actions by other federal or non-federal entities, unless the Action Agencies commit to contract to achieve completion of such actions. The Updated Proposed Action also adds greater focus and specificity, consistent with these recent developments and directives.

The Updated Proposed Action relies first and foremost on operation of the hydrosystem and continuing improvements of FCRPS dams and facilities. Modest, or low, survival improvements are expected from these actions, since most of the larger improvements that are possible have already been implemented. These actions benefit all ESUs. Second, the Updated Proposed Action includes expanded predator control programs designed to increase both juvenile and adult survival. Again, this part of our avian and northern pikeminnow proposal is expected to benefit all ESUs, and to provide another increment of improved survival. For most ESUs, the Action Agencies believe that these two types of actions – hydrosystem operations and dam modifications and expanded predator control – should be sufficient to avoid jeopardy.

For ESUs that have a larger need based on the preliminary jeopardy analysis (Upper Columbia spring Chinook and steelhead, Snake River fall Chinook, and certain Mid-Columbia runs), the Updated Proposed Action includes tributary and estuary habitat improvements. In keeping with the Court ruling, these actions are described in detail as to ESU, location, and metrics for accomplishment. In keeping with NOAA's analysis of habitat potentials, our proposal targets key limiting factors in tributaries and the estuary. For these ESUs, the Action Agencies believe that the additional habitat actions should be sufficient to avoid jeopardy.

Finally, this hierarchy of focused action is held together through a carefully defined program of research, monitoring and evaluation. Over time, this information will be used to adjust our actions through annual implementation plans, based on performance measures and adaptive management. Every three years, we will "check in" on our cumulative performance to make sure we are on track and meeting our commitments. In this way, we will keep our progress current and effective. The proposed research and performance standards, annual implementation plans and progress reports, and three year check-ins will collectively assure that we continue to avoid jeopardy and adverse effects to critical habitat as we implement the Updated Proposed Action.

The actions described in this document serve a number of purposes. They explicitly address the Action Agencies' implementation of their obligations for listed salmon and steelhead under the Endangered Species Act. However, agencies will also be implementing these actions pursuant to their obligations under the Northwest Power Act. As a result, regional planning and coordination with the Council, affected tribes, and other regional parties underlie our proposals.

## **B. Critical Habitat**

Critical habitat has been designated for 3 ESUs that are the subject of the FCRPS BiOp (Snake River Sockeye, Snake River Spring/Summer Chinook and Snake River Fall Chinook). The 2000 FCRPS BiOp found that the reasonable and prudent alternative of that opinion did not adversely modify critical habitat for these ESUs (NOAA 2000 FCRPS BiOp 9-283, 9-287). The Action Agencies have been implementing the 2000 RPA as documented in annual implementation plans and progress reports and NOAA's findings on these compliance documents have remained consistent with the conclusion in the 2000 FCRPS BiOp that the action does not adversely modify critical habitat.

The essential features of the areas designated as critical habitat for these species are: 1) substrate (especially gravel for spawning); 2) water quality; 3) water quantity; 4) water temperature; 5) water velocity; 6) cover/shelter; 7) food; 8) riparian vegetation; 9) space; and 10) migration conditions. (58 FR 68543, published on December 28, 1993).