Protecting Salmon and Steelhead

Endangered Species Act
Federal Columbia River Power System
2009 Progress Report Summary

December 2010

In May 2008, National Oceanic and Atmospheric Administration (NOAA) Fisheries issued a Biological Opinion (BiOp) on the operation of the dams that make up the Federal Columbia River Power System (FCRPS). The FCRPS projects are operated for multiple purposes including flood control, fish and wildlife, power generation, navigation, irrigation, and recreation. The FCRPS BiOp considered a Biological Assessment and a suite of actions proposed by the Bonneville Power Administration, Bureau of Reclamation, and U.S. Army Corps of Engineers, together referred to as the Action Agencies, to protect salmon and steelhead across their life cycle. It also provided NOAA Fisheries with scientific analysis under the Endangered Species Act (ESA) and an extensive list of Reasonable and Prudent Alternative (RPA) actions to avoid jeopardy to the fish.

Based on the BiOp, the Action Agencies committed to implementing actions to improve the survival of salmon and steelhead listed under the ESA, including the use of spill and surface passage structures at dams, management of water releases from storage reservoirs, expanded control of predators that prey

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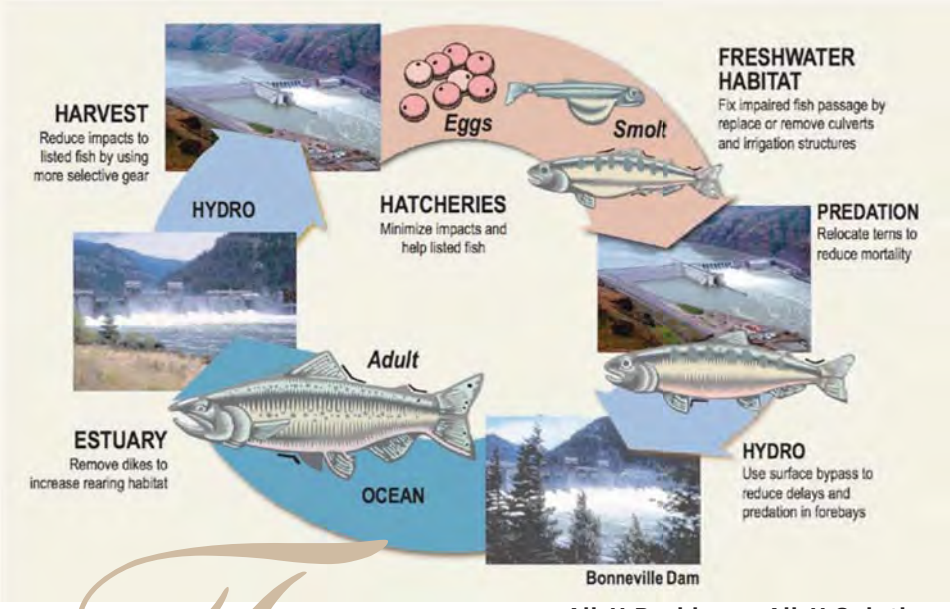

All-H Problems: All-H Solutions

Samples from the 2009 FCRPS BiOp

Throughout the Columbia River Basin, tribal, state, local, and federal parties are working in partnership to protect and restore stocks of salmon and steelhead. Thirteen stocks of these fish are listed as threatened or endangered under the Endangered Species Act (ESA). Many parties in the region are working together to protect and enhance important habitats, improve hatchery and harvest practices, and enhance river conditions for migrating fish. This report summarizes the actions implemented by the Action Agencies in 2009 to protect ESA-listed salmon and steelhead affected by the operation of the Federal Columbia River Power System (FCRPS).[1] It describes the status of Reasonable and Prudent Alternative (RPA) actions being implemented across the fish life cycle for that calendar year. The actions described in this annual report are focused on achieving biological performance standards, achieving programmatic performance targets, and addressing factors that limit certain life stages for specific evolutionarily significant units (ESUs) or

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[1] *The FCRPS includes 14 major dams and power plants on the Columbia and Snake rivers. These dams and power plants are operated as a coordinated system (including with Canada) to meet multiple purposes as authorized by Congress.*

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on young salmon, improvement of tributary and estuary habitat, and implementation of hatchery reforms. The Action Agencies also entered into the Columbia Basin Fish Accords with two states and five tribes to promote regional partnerships and "on-the-ground" implementation. The Action Agencies are responsible for providing annual progress reports detailing the implementation and progress of the RPA.

In 2009, the Obama Administration leadership engaged in a process considering the available science and the views of the court and the parties, and conducted independent scientific review. The Administration determined that the science underlying the 2008 BiOp was sound. However, there were uncertainties in some of the predictions regarding the future condition of the listed species. In light of these uncertainties, the Administration directed taking a more precautionary approach in implementing the RPA by developing the Adaptive Management Implementation Plan (AMIP, at *http://www.salmonrecovery.gov/BiologicalOpinions/FCRPS/2008Biop.aspx)*. The AMIP includes accelerated actions, additional research related to fish status and climate change, and precautionary use of biological triggers and contingency plans in case there is an unexpected, significant fish decline. The AMIP provisions were initiated in 2009.

To review the 2008 FCRPS BiOp in its entirety, go to *https://pcts.nmfs.noaa.gov/pls/pcts-pub/pcts_upload.summary_list_biop?p_id=27149.*

Contents

This report is produced by the "Action Agencies"—the U.S. Army Corps of Engineers Northwestern Division, Bureau of Reclamation Pacific Northwest Region, and Bonneville Power Administration.

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distinct population segments (DPSs) of salmon and steelhead. Adaptive management is the process the agencies use to make adjustments to actions based on new scientific information and to meet biological performance objectives effectively and efficiently.

The full FCRPS 2009 Annual Progress Report, which includes the RPA Summary Table: Actions and Accomplishments, Detailed Description of RPA Action Implementation, and Project Tables for RPA Action Implementation, is available online at *http://www.salmonrecovery.gov*. Previous FCRPS progress reports and information on other salmon and steelhead protection efforts are available on websites listed at the end of this document.

Figure 1. Map of the Columbia River Basin showing action areas, dams, and listed species.

2009 Fish Status and Environmental Conditions

Adult Fish Returns and Trends

One way the Pacific Northwest tracks how well salmon and steelhead are doing is by comparing the number of fish that return each year to spawn. Many dams have fish counting stations where annual index tallies are made of the various species as they swim up the fish ladders. In 2009, more than 1.7 million adult and jack salmon and steelhead were counted as they passed Bonneville Dam. (Jack salmon are young males that mature and return to spawning grounds earlier than others in their age class.) This number exceeds historical averages (i.e., for 2000 and earlier) and is above the 10-year average (Figure 2). Specific adult return and trend information for the species addressed in the BiOp are presented beginning on page 24 of this section.

As shown in Table 1, counts in 2009 of adult steelhead, summer Chinook, coho, and sockeye passing Bonneville Dam exceeded the 10-year average. Spring Chinook and fall Chinook counts were slightly below the 10-year average. In a typical year, about 80 percent of all returning adult salmon are of hatchery origin, though the actual percentage varies by species.

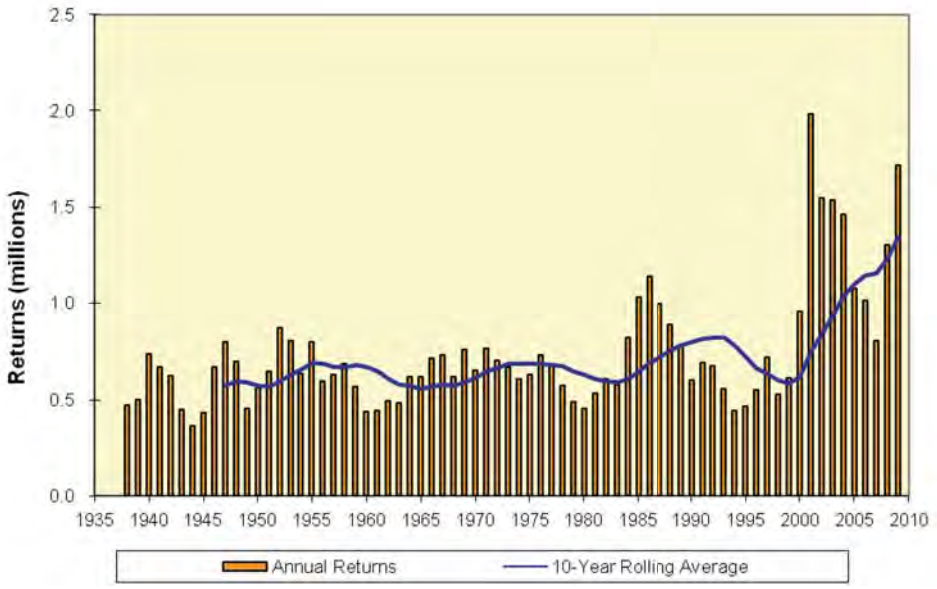


Figure 2. Adult and Jack Salmon/Steelhead Returns at Bonneville Dam, 1938 to 2009 (includes hatchery and natural origin fish).

Table 1. Adult Salmon and Steelhead Returns at Bonneville Dam – 2009 and 10-year Average.

Species	2009	10-year average
Chinook – Total [1/]	699,121	706,153
Spring Chinook [2/]	181,174	185,488
Summer Chinook	119,352	96,002
Fall Chinook	398,595	424,662
Steelhead	604,970	400,485
Sockeye	177,823	94,637
Coho [3/]	234,669	138,812
Chum and Pinks	203	205
TOTALS of all species for period	1,716,786	1,340,732

Period of 10-year average 2000-2009. Data are for daytime counts – 0400 to 2000 PST. All data from U.S. Army Corps of Engineers Fish Passage Report 2009, Table 18b, except as noted below:

[1/] Chinook data are from monthly values in Fish Passage Report 2009, Table 19, except values for 2000-2002 which are from monthly values in Fish Passage Report 2002, Table 18. Values include jacks.

[2/] Assumed Chinook run dates are: Spring = Jan 1–May 31; Summer = June 1–July 31; Fall = Aug 1–Dec 31.

[3/] Includes jacks.

Adult Fish Survival

Survival rates of ESA-listed adult Chinook and steelhead through defined reaches within the FCRPS dipped below adult passage performance standards in 2009 for five of the six stocks that are monitored. (As shown in Figure 3, performance is measured as a 5-year rolling average.) Annually, the Action Agencies use the methodology in the 2008 FCRPS BiOp with annual updates for harvest estimates. Three of the five stocks that fell short of the BiOp performance standard were within 5 percent. However, two stocks — the Snake River spring/summer Chinook salmon ESU and the Snake River steelhead DPS— were significantly outside of the adult performance standard (Figure 3). Because the Snake River stocks are used as surrogates for Snake River sockeye and mid-Columbia steelhead survival, both of these stocks were also below the standard. This discrepancy is likely related to four factors: modifications to operations and structures at the dams to increase juvenile survival that in some instances may also delay adult passage; effects of sea lion predation-related injuries on spring Chinook; additional unquantifiable mortality levels caused by fisheries; and unaccounted levels of straying. Each of these four factors is being addressed through BiOp Research, Monitoring & Evaluation actions. Determining optimal spill levels for all life-cycle stages, modifying operations or structures with known adult passage problems, and managing sea lion predation should help improve adult survival rates in the future. Additionally, the Action Agencies are investigating adding Passive Integrated Transponder (PIT) tag detection capabilities to The

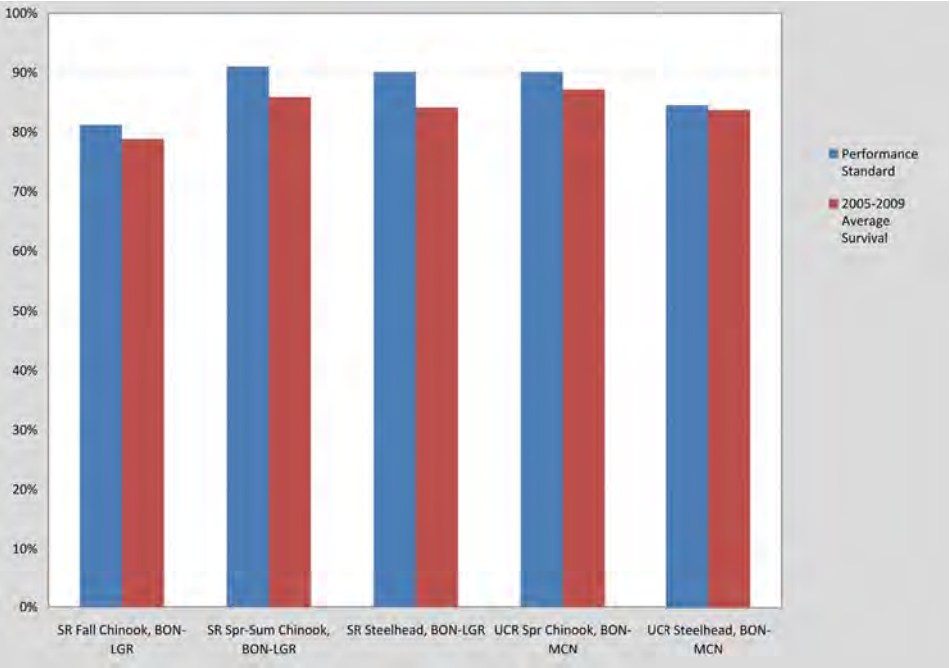
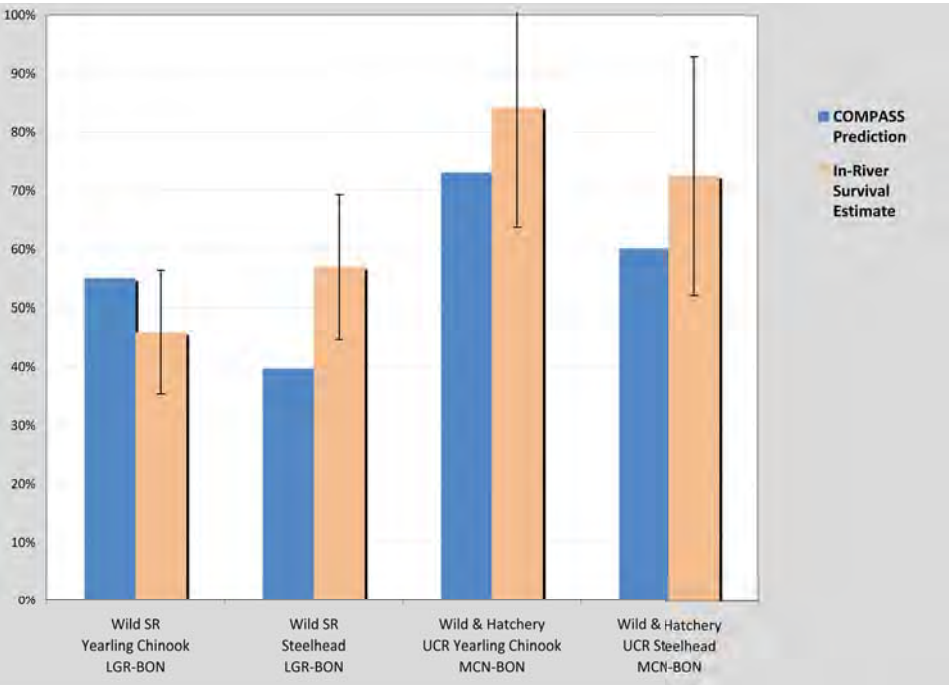


Figure 3. 2008 FCRPS BiOp Adult Survival Standard and Summary of Five-Year Rolling Average Adult Survival of Adults that Migrated In-River as Juveniles, Based on PIT Tag Conversion Rates of Snake River (SR) and Upper Columbia River (UCR) ESUs. (BON = Bonneville, MCN = McNary, LGR = Lower Granite)

Figure 4. COMPASS Model Predictions and PIT Tag Estimated In-River Survival for Juvenile Snake River (SR) Wild Spring/Summer Chinook and Steelhead and for Upper Columbia River (UCR) Wild/Hatchery Spring Chinook and Steelhead. Error whiskers indicate 95% confidence intervals. (BON = Bonneville, MCN = McNary, LGR = Lower Granite)



Dalles and John Day dams and adding PIT tag interrogation capability in fisheries above Bonneville Dam to better understand and quantify unexplained losses within those reaches.

Juvenile Fish Survival

Hatchery and wild juvenile salmon and steelhead that migrate to the ocean through the Snake and Columbia rivers can either be transported by barge or truck to below Bonneville Dam or left "in river" to migrate past the dams. Total system survival is a combination of transportation and in-river survival. The percentage of fish that travel in river compared to the percentage transported has ranged from 45 to 90 percent, depending on a number of factors, such as projected river flow volumes, how much spill is provided, and how well fish are attracted to juvenile fish bypass systems. In 2009 less than 50% of the Snake River steelhead and Chinook were transported. Approximately 98 percent of the transported juveniles survive to the point of release below Bonneville Dam. System survival to the Bonneville tailrace (survival of in-river and transported groups combined) was likely about 67% and 72% for wild and hatchery yearling Chinook salmon respectively, and 76% and 81% for wild and hatchery steelhead respectively. Because significant proportions of juvenile Upper Columbia spring Chinook and steelhead are not transported, in-river survival rates are equivalent to system survival rates for these species. Because additional "delayed mortality" may occur after the fish are released, research is being carried out under the BiOp to better understand any delayed effects of transport.

The BiOp established an in-river survival performance metric for Snake River and Upper Columbia River Chinook and steelhead; this metric is intended to provide important information for both the annual adaptive management process and the comprehensive evaluations in 2013 and 2016. The Action Agencies empirically measured in-river survival for 2009 (Lower Granite to Bonneville and McNary to Bonneville) and compared that with the survival estimates derived by running COMPASS modeling (with prospective survival estimates for the actions implemented at the start of the 2009 migration season using 2009 river conditions, fish migration patterns, and dam and transport operations). Figure 4 shows the results of these comparisons. Results indicate that the benefits from the RPA actions implemented to date are likely accruing as expected.

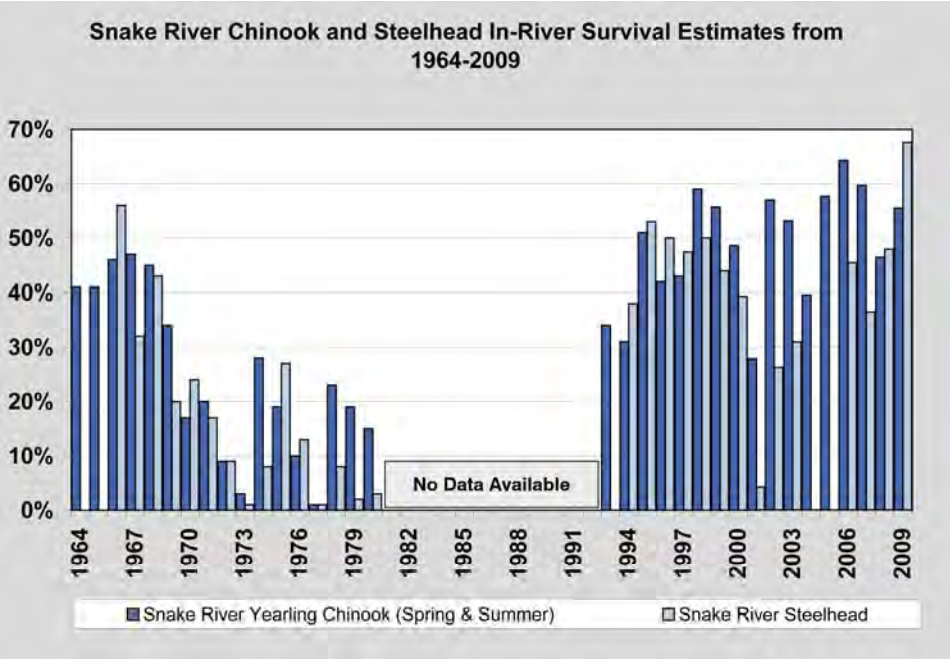


Figure 5. In-River Survival Estimates (Hatchery and Wild Combined) for Snake River Chinook and Steelhead. Steelhead estimates for 2004 and 2005 are unavailable due to lower PIT tag detection efficiency at Bonneville Dam. Survival estimates are not available for 1981 through 1992.

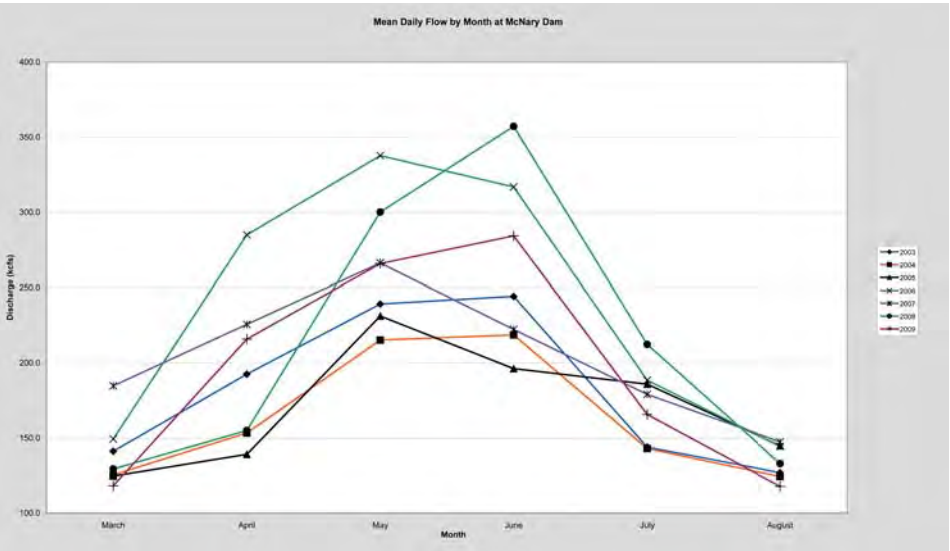


Figure 6. Mean Daily Flow by Month at McNary Dam, 2003-2009.

In-river survival estimates for wild Snake River steelhead, and combined hatchery and wild Upper Columbia River steelhead and spring Chinook were higher than mean estimates developed using the COMPASS model. Wild Snake River Chinook in-river survival estimates were lower than mean COMPASS estimates. These results suggest that steelhead are generally deriving more benefits from recently installed surface flow weirs compared to Chinook. Improvements planned to deter predation near dams (avian wires and egress improvements) are expected to result in additional benefits to all species.

Figure 5 shows the combined in-river survival estimates for hatchery and wild Snake River yearling Chinook salmon and steelhead through the entire hydropower system (Snake River trap to Bonneville Dam tailrace). Chinook survival was slightly above the average for the last 10 years; while steelhead survival the highest estimated in the last 12 years.

In 2009, yearling Chinook salmon and steelhead migration rates through the hydropower system were faster (i.e., in-river travel times shorter) than average, especially for steelhead. These faster rates of travel were likely because of higher water velocities, relatively high spill proportions, and the use of surface passage structures at most projects.

Water Year and Streamflow Summary

The Columbia River Basin experienced average water conditions in 2009. Snake River flow volume was near average throughout April 2009, but it increased to above average for most of May because of late-season thaw of larger-than-average snowpack (Figure 6). In addition, the large influx of cold meltwater made April and May water temperatures the coldest in the Snake River in recent years.

Ocean and Climate Conditions

Columbia River Basin salmon and steelhead abundance is strongly correlated with periods of relatively warm or cold off-coast ocean conditions. In general, warmer conditions are less favorable for salmon and colder conditions are more favorable. Pronounced warm and cold cycles have occurred over most of the past century, lasting approximately 20 to 30 years each (Figure 7). This climate pattern is known as the Pacific Decadal Oscillation (PDO).

A cool PDO regime in place from about 1947 to 1976 was characterized by abundant salmon returns to the Columbia River Basin. The PDO shifted to a warm phase in about 1977, which coincided with a significant decline in Columbia River Basin salmon runs. Although it is not clear yet whether another longer-term shift has taken place or what effects might be associated with climate change, ocean conditions have been variable since about 1999, with relatively brief cool and warm periods.[2]

The National Oceanic and Atmospheric Administration (NOAA) Fisheries Northwest Fisheries Science Center (NWFSC) oversees the Ocean Ecosystem Indicators Project to track specific

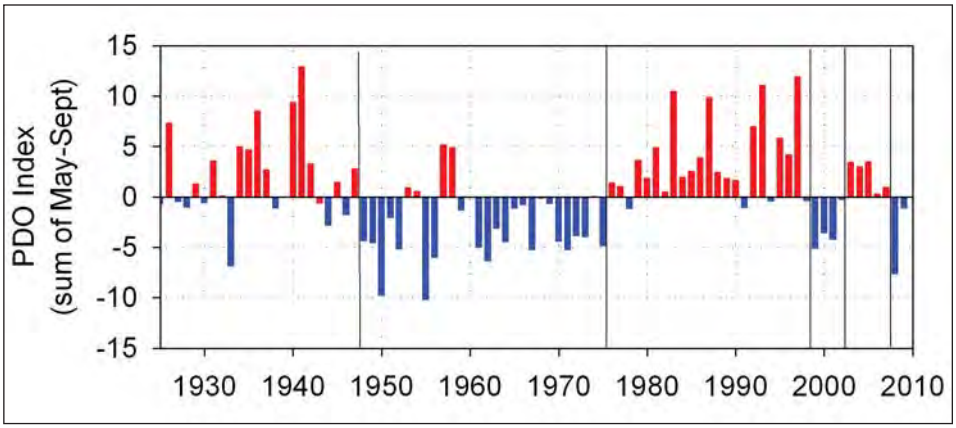


Figure 7. Pacific Decadal Oscillation from 1925 to 2009, Showing Its 20- to 30-Year Cycle.

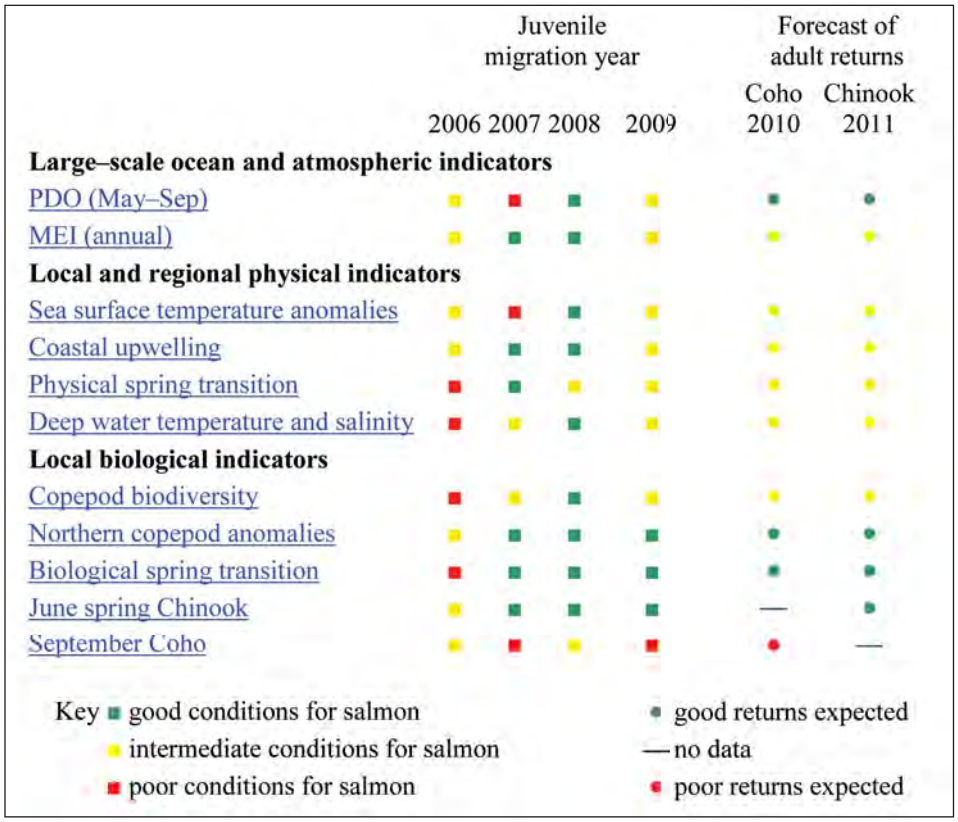


Figure 8. Ocean Ecosystem Indicators of the Northern California Current. Colored squares indicate positive (green), neutral (yellow), or negative (red) conditions for salmon entering the ocean each year. In the two columns to the far right, colored dots indicate the forecast of adult returns based on ocean conditions in 2009

climatic and biological indicators believed to influence the growth and survival of juvenile salmon once they reach the ocean. The NWFSC forecasts coho and Chinook salmon returns based on a survey of a range of ecosystem indicators. Ocean indicators during juvenile migration year 2008 were the best overall since 1999-2000. However, during the second half of 2009 the trend of cool ocean conditions shifted to a warmer regime, likely leading to higher mortality of juvenile salmonids. The NWFSC continued to forecast high Chinook returns in 2010, but it expects those returns to decline in 2011 (Figure 8).[3]

New Climate Change Information

The 2008 BiOp summarized a number of studies, including the Independent Scientific Advisory Board's (ISAB) review of the literature relevant to climate change impacts on Columbia River Basin salmon and steelhead (Climate Change Impacts on Columbia River Basin Fish and Wildlife, Independent Scientific Advisory Board, 2007). Under the RPA, the Action Agencies continued funding and collaborative support to the Washington Department of Ecology in 2009 to contract with the University of Washington Climate Impact Group to develop climate change streamflow scenarios. The Action Agencies are developing additional data sets, such as climate change water supply forecasts and flood control elevations, which will be used in conjunction with the streamflow scenarios developed by the University of Washington to adequately model climate change impacts to the hydrosystem.

As of December 2009, there was no significant new scientific information, studies or observations that fell outside of the range of climate conditions considered in the 2008 BiOp.

[2] *For more information, see the Pacific Northwest Climate Impacts Group website at http://cses.washington.edu/cig/.*

[3] *See the Northwest Fisheries Science Center's Ocean Ecosystems Indicators website at: http://www.nwfsc.noaa.gov/research/divisions/fed/oeip/a-ecinhome.cfm.*

Implementation Overview

The Action Agencies have established implementation strategies and actions using the "All-H" approach—hydropower, habitat, hatchery, and harvest, plus predator management—to work toward salmon and steelhead recovery in the Columbia River Basin. Work performed is summarized below. Detailed descriptions can be found in the RPA action implementation portion of this Annual Progress Report.

Hydropower

Under the hydropower strategy, the Action Agencies implemented juvenile and adult dam passage modifications, operational improvements for spill and transport of juvenile fish, water management operations, and operational and maintenance activities aimed at improving juvenile passage survival and adult returns. These actions are focused on achieving higher juvenile dam survival performance standards, as well as overall system survival and in-river survival.

Improvements for Fish at the Dams

Most salmon and steelhead in the Columbia River Basin encounter one or more hydroelectric dams as they migrate to and from the ocean. Fish passage systems provide various routes of passage to help salmon and steelhead get past the dams. Over the past several decades, juvenile fish survival past the dams has improved dramatically.

Juvenile fish pass dams by many routes: through the turbines, through juvenile bypass systems, through spillways, or by collection and transport in barges or trucks. Turbine passage is often considered to be the least desirable juvenile route of passage. As a result, juvenile bypass systems, spill, and other surface passage routes are used to divert the vast majority of migrating fish past the turbines. Depending on location, time of year, and species, about 76 to 99 percent of the juvenile fish use these non-turbine routes. Juvenile dam survival estimates of 86 to 99 percent have been demonstrated at Snake and Columbia River dams, with survival rates at most of the dams in the upper 90 percent range. The BiOp includes dam survival performance standards (through all passage routes) of 96 percent for spring migrating fish and 93 percent for summer migrating fish. These standards may have been met at some dams and for varied seasons, but significant improvements are also under way. In 2009, the agencies continued to make improvements to fish passage. Key accomplishments are noted below.

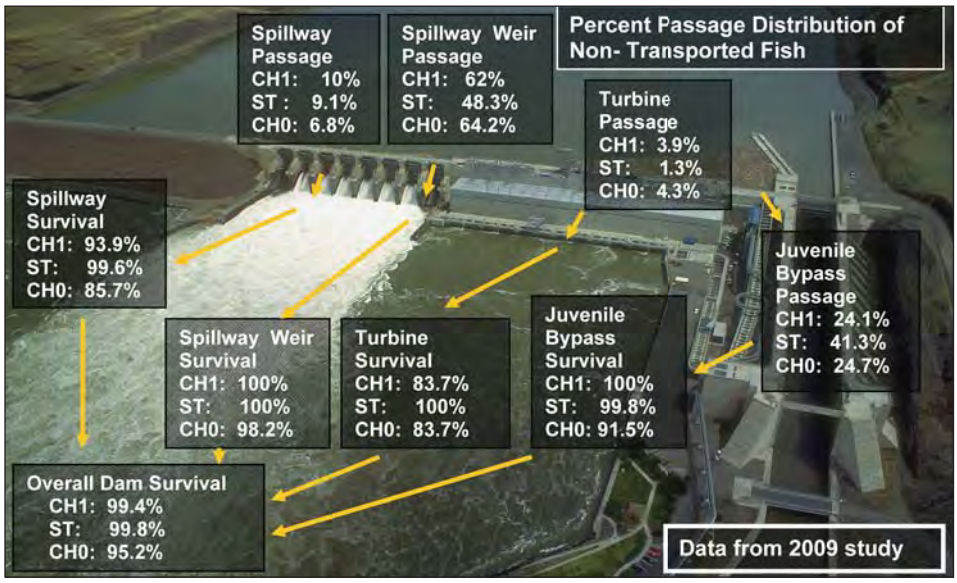


Figure 9. Little Goose Dam — 2009 Route-Specific Passage and Survival Estimates for Yearling and Subyearling Chinook and Juvenile Steelhead. CH0 = subyearling Chinook. CH1 = yearling Chinook. ST = steelhead. BiOp performance standards are 96% survival for yearling Chinook and steelhead, and 93% for sub-yearling Chinook. Overall dam survival estimates for Little Goose Dam in the 2009 study were 99.4% for yearling Chinook, 99.8% for steelhead, and 95.2% for subyearling Chinook.

Spill and Surface Passage

Fish passage through the spillway is widely recognized as one important way to get juvenile fish to pass the dams quickly. Water is "spilled" through spillway openings rather than being routed through turbines to generate power or for other purposes. The Action Agencies' hydro operations include spring and summer spill to help juvenile salmon and steelhead pass the lower Columbia and Snake River dams. In 2009, consistent with the court-ordered 2009 Spring and Summer Fish Operations Plans, spill levels from 2008 were repeated with only those modifications necessary to accommodate new structures and/or to conduct essential research.

Surface passage structures are used in addition to conventional spillways to provide more natural river passage conditions, improve juvenile fish survival, reduce juvenile fish passage delay, improve water quality, and make more efficient use of spill. Most juvenile salmon tend to travel in the upper 10 to 20 feet of the water column as they migrate downstream to the ocean. When approaching the dams, juvenile fish need to dive to depths of 50 to 60 feet to access passage routes such as a spillbay opening or a guidance screen that will guide them into a juvenile bypass channel. Surface passage structures such as spillway weirs and the Bonneville corner collector provide downstream migrating fish with more surface-oriented routes of dam passage, thereby reducing passage delay and improving survival.

In 2009, a spillway weir was installed and tested at Little Goose Dam. This project was a key milestone in the Action Agencies' commitment to install surface passage and achieve performance standards at all Snake River and Columbia River dams. Surface passage has now been installed at all Snake and Columbia River dams, and the Action Agencies are continuing to evaluate surface passage technology at several of the dams. The Little Goose spillway weir was an effective passage route for juvenile fish and appeared to help exceed performance standards. Dam passage survival estimates were 99.4 percent for yearling Chinook, 99.8 percent for steelhead, and 95.2 percent for subyearling Chinook (Figure 9). Results for other projects which were evaluated in 2009 are presented in Section 3.

Juvenile Bypass Systems

Juvenile fish screened bypass systems are in place at seven of the eight lower Columbia and Snake River dams. These bypass systems guide fish away from turbines by means of submerged screens installed in the turbine intakes. As fish travel with flow into the turbine intakes, the guidance screens guide the fish up through channels in the dam, routing them away from turbines. The fish are then either passed back to the river below the dam (bypassed) or loaded into barges or trucks for transport downstream past the remaining dams.

In 2009, modifications to the juvenile bypass system at Bonneville Powerhouse II continued to be evaluated following completion in 2008. The Little Goose bypass outfall relocation was initiated in 2008 and completed in 2009.

Fish Transportation and Barging

Juvenile fish transportation is an ongoing program that collects fish from juvenile bypass facilities at Lower Granite, Little Goose, Lower Monumental, and McNary dams and transports them by either barge or truck to release sites below Bonneville Dam.

The timing and conditions for fish transportation are determined based on annual research comparing adult returns to the spawning grounds of transported fish versus fish that migrated in-river. In general, fish survive better migrating in-river in early April, but they survive better when transported during lower-flow conditions in mid to late May. Also, steelhead generally exhibit higher survival, compared to Chinook salmon, when transported during the spring migration.

In 2009, transportation began on May 1 at Lower Granite Dam, May 6 at Little Goose Dam, and May 8 at Lower Monumental Dam. Transportation of juvenile fish at McNary Dam began on July 16. Approximately 16.7 million juvenile salmon and steelhead were collected at transport locations in 2009, with about 8.7 million fish being transported to below Bonneville Dam. Based on PIT tag data, NOAA Fisheries estimated that 40 percent of wild Snake River yearling Chinook and 38 percent of hatchery Snake River yearling Chinook were transported in 2009, while 46 percent of wild Snake River steelhead and 43 percent of hatchery Snake River steelhead were transported that year (Figure 10). Of the fish transported, over 99 percent were transported by barge, and just under 1 percent were trucked.

Water Management and Flow Operations

In addition to fish passage at the dams, operators manage storage reservoirs to enhance fish survival. River flows are augmented with water released from upstream storage dams to help juvenile migration and adult spawning, and to cool water temperatures.

Water managers recognize that available storage—water that actually can be managed—is limited relative to total annual runoff in the Columbia River Basin. Specific operating plans are used at individual reservoirs to provide salmon flows, protect resident fish, manage flood risks, and serve other authorized purposes.

In the fall 2008, the Action Agencies updated the annual Water Management Plan to incorporate any changes to the operating plans from the previous year. Both the storage projects and the run-of-river mainstem lower Columbia River and Snake River projects were operated under the plan to aid juvenile fish passage. (Storage projects are the Libby, Hungry Horse, Albeni Falls, Grand Coulee, and Dworshak projects, while run-of-river projects are Bonneville, The

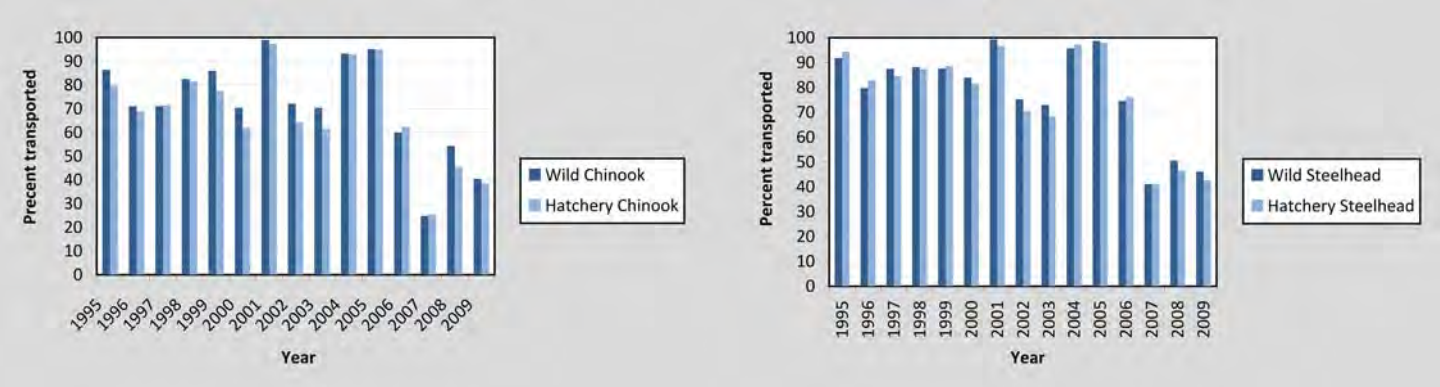


Figure 10. Estimated Percent of Yearling Chinook Salmon and Steelhead Transported to Below Bonneville Dam by Year (1995-2009)[4].

[4] *Faulkner, J. R., S. G. Smith, W. D. Muir, D. M. Marsh, J. G. Williams. 2010. Survival Estimates for the Passage of Spring-Migrating Juvenile Salmonids through Snake and Columbia River Dams and Reservoirs, 2009. Report by National Marine Fisheries Service to the U.S. Department of Energy, Bonneville Power Administration, Division of Fish and Wildlife, Seattle, Washington, Contract 40735, Project No. 199302900, 117 p.*

Dalles, John Day, McNary, Ice Harbor, Lower Monumental, Little Goose, and Lower Granite dams.)

The Action Agencies coordinated with Canada and entered into an agreement on operation of treaty storage for non-power uses for the period December 15, 2008, through July 31, 2009. Under this agreement, 1 million acre-feet (MAF) of flow augmentation water was stored in Mica Reservoir during January 2009. All flow augmentation storage under this agreement was released by July 31, 2009. The Action Agencies stored 444 thousand acre-feet (kaf) into non-treaty storage, primarily in January and early February 2009, bringing the U.S. account to 88 percent of full on September 30, 2009.

In 2009, the Bureau of Reclamation (Reclamation) provided 487 kaf of flow augmentation water from the upper Snake River above Brownlee Reservoir in accordance with the NOAA Fisheries 2008 Upper Snake River Irrigation Projects BiOp. For more information see the December 1, 2009, Annual Progress Report for Reclamation's 2009 Salmon Flow Augmentation Program.

Water Quality

Fish passage spill operations may result in the generation of total dissolved gas (TDG) supersaturation in the Columbia and lower Snake rivers at levels above 110 percent, the current state and federal water quality standards. The states of Washington and Oregon have exceptions to these standards as long as the elevated TDG levels provide for improved fish passage through the spillway without causing more harm to fish populations than would occur through other passage routes. The U.S. Army Corps of Engineers (Corps) monitors TDG levels in the river and adjusts spill patterns and spill rates to stay within acceptable levels. There are instances when TDG levels are greater than state TDG standards resulting from either voluntary spill for fish passage or involuntary spill. In 2009, there were 116 gauge-day instances associated with voluntary spill for fish. There were 192 gauge-day instances resulting from (1) high river flows that forced involuntary spill, (2) Bonneville Power Administration (BPA) load requirements lower than actual powerhouse capacity, or (3) outage of hydro power equipment.[5]

To help manage water temperatures in the lower Snake River in the summer, cold water is released from Dworshak Dam on the Clearwater River from early July through mid-September. The tailwater temperatures at Lower Granite Dam through the augmentation season only exceeded 68 °F for a few hours (15 hours) at the end of July and early August. For a more thorough discussion of how the system was operated in 2009, see the annual "Annual TDG and Temperature Report" links at *http://www.nwd-wc.usace.army.mil/tmt/wqnew/*.

Kelt Management

BPA and the Corps completed the 2009 Kelt Management Plan and released it for comment in December. The 2009 version of the Kelt Management Plan was a synthesis of previous research on kelt migration studies through the hydrosystem as well as kelt reconditioning efforts. The 2009 Kelt Management Plan also discussed research efforts that began in 2009 as well as kelt-specific operations outside of the normal spill season at Bonneville Dam and The Dalles Dam. To facilitate increased efforts in the kelt research program, BPA and the Corps also designed and began construction on an expanded temporary kelt handling facility at Lower Granite Dam.

BPA funded the Columbia River Inter-Tribal Fish Commission (CRITFC) to prepare a Master Plan for kelts, which will provide the detail on the reconditioning topic in the broader Kelt Management Plan. The Master Plan will focus on kelt collection and reconditioning at various locations. CRITFC has subcontracted portions of this project to the University of Idaho. The Kelt Master Plan, which will apply to reconditioning Snake River kelts, is part of a three-step technical review process required by the Northwest Power and Conservation Council (NPCC) for artificial propagation projects, particularly those that affect natural populations and involve construction of capital facilities.

Evaluations of the potential benefit of providing surface passage early in the spring for outmigrating steelhead kelts continued with a second year of estimating passage through the ice and trash sluiceway at The Dalles Dam. The corner collector at Bonneville Dam was also opened early based on kelt counts in the juvenile bypass system. This ongoing research will help inform decisions regarding the long-term operations of surface passage routes for kelt outmigration.

Predator Management

Four main predator species are a major cause of mortality of ESA-listed fish in the Columbia River system. Populations of Caspian terns and double-crested cormorants, which eat large numbers of migrating juvenile fish, have increased over the last two decades in the Columbia River Estuary. These two species are also present in the mid-Columbia region. Among fish, northern pikeminnow are voracious consumers of juvenile salmon and steelhead. California sea lions are known to consume substantial numbers of adult spring Chinook salmon and winter steelhead below Bonneville Dam. Predation by bass is also a concern.

Federal and state agencies are cooperating in efforts to reduce predation on listed species. Programs to redistribute Caspian terns currently nesting in the estuary, deter and block sea lions from Bonneville Dam fish ladders, and reduce the northern pikeminnow population through a sport-reward program have been successful in decreasing the loss of adult and juvenile salmon to predation. In 2009, the Action Agencies continued efforts to control specific predators and improve survival of juvenile fish.

Caspian Terns and Double-Crested Cormorants

Caspian terns and double-crested cormorants consumed an estimated 17.5 million, or about 15 percent of all, juvenile Chinook and steelhead

[5] *[number of TDG gauges] x [number of days in spill season, April 3 through August 31]*

Double-Crested Cormorant

estimated to reach the estuary during the 2009 outmigration. The federal agencies have been addressing growing populations of Caspian terns and double-crested cormorants nesting in the estuary as well as those in the mid Columbia River that prey on juvenile salmon.

Recent efforts to redistribute Caspian terns from Rice Island, in the Columbia River Estuary, to East Sand Island, nearer to the ocean, were successful in reducing predation rates. As intended, the relocation shifted the terns' diet away from juvenile salmon toward a more diverse diet of predominantly marine fish species. (At Rice Island, juvenile salmon made up 75 to 90 percent of the terns' diet.)

In 2009, the East Sand Island tern colony consumed approximately 6.4 million juvenile salmon (*http://www.birdresearchnw.org/CEDocuments/Downloads_GetFile.aspx?id=391157&fd=0*). In comparison, in 1999, the colony consumed about 15 million salmon when located at Rice Island. Approximately 12,087 pairs of Caspian terns nested on East Sand Island in 2009, about 10 percent more than in 2008 (Figure 11).

In 2009, the Corps continued carrying out the Caspian Tern Management Plan with the construction of a second new island at Summer Lake Wildlife Area (east of the Cascades in south central Oregon) for tern relocation before the nesting season. This allowed the managed nesting habitat area on East Sand Island to be reduced to 3.5 acres. Construction of new islands continued during the summer of 2009 with the creation of an additional one-half acre island at Summer Lake, as well as three new islands in the Klamath Basin at the Tule Lake and Lower Klamath National Wildlife Refuges. As of the end of 2009, no Caspian terns had nested on the island created in 2008 at Fern Ridge Reservoir, while nearly 700 breeding pairs were attracted to the Island constructed in 2008 at Crump Lake. At all of the islands constructed or enhanced through the tern management plan, social attraction, tern decoys, and tern colony sounds were used in spring 2009 to attract terns.

In 2009, East Sand Island had the largest double-crested cormorant colony in western North America. This consisted of about 12,087 breeding pairs that consumed an estimated 11.1 million juvenile salmonids, mostly sub-yearling Chinook salmon. By comparison, in 1989, the cormorant nesting population on East Sand Island totaled only about 100 pairs. As a result of the growing consumption by cormorants, in 2009 the federal agencies accelerated development of a Double-crested Cormorant Management Plan using techniques similar to the current Caspian Tern Management Plan.

Caspian terns and double-crested cormorants are also responsible for most avian predation losses along the mid Columbia River. On Crescent Island in the McNary Pool, 349 breeding pairs of Caspian terns (the lowest number since monitoring began in 1997) consumed an estimated 360,000 juvenile smolts. The largest Caspian tern colony on the Columbia Plateau in 2009 (486 nesting pairs) was on Goose Island in Potholes Reservoir. PIT tag recoveries at this site indicate that around 15.5 percent of Upper Columbia steelhead passing Rock Island Dam in 2009 was consumed by Caspian terns from Goose Island. In 2009, 310 nesting pairs of cormorants were found on Foundation Island, and 810 nesting pairs were observed at the north end of Potholes Reservoir. Both of these colonies have declined somewhat over the last four years. An estimated 200 to 400 cormorants overwintered on the lower Snake River with juvenile salmonids consisting of about 13 percent of their diet.

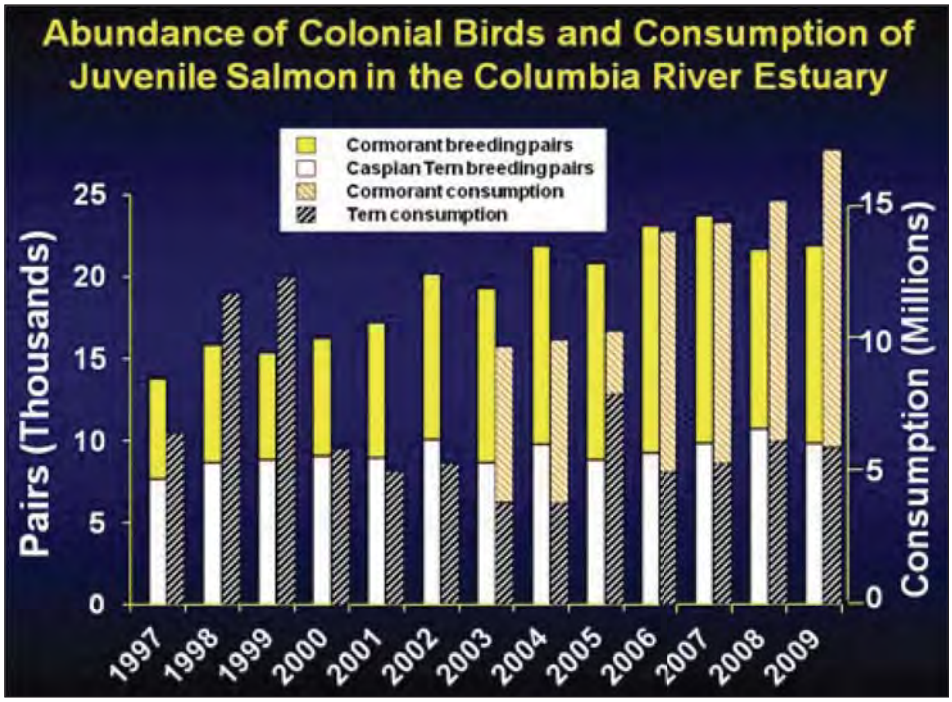


Figure 11. Abundance of Colonial Birds and Consumption of Juvenile Salmon in the Columbia River Estuary. Source: Columbia Basin Fish and Wildlife Authority, Status of Fish and Wildlife Resources in the Columbia River Basin - 2010. http://sotr.cbfwa.org/RES_Downloads.cfm?mnu=RES

Northern Pikeminnow

Northern Pikeminnow

Large northern pikeminnow are voracious consumers of juvenile salmon. Since 1990, BPA has funded the Northern Pikeminnow Management Program (NPMP) to reduce the numbers of larger pikeminnow and improve survival of juvenile salmon. The NPMP relies on private-sector fishing efforts to provide the majority of the catch of northern pikeminnow. In 2009, the BPA reward for the catch of this predator was sustained at a higher-tiered monetary level initiated in 2005. This reward structure helps sustain the higher catches and, in 2009, resulted in the highest harvest rate of pikeminnow since program inception.

In addition, program managers reinstated a dam-angling program component for the first time since 2001. This program provided two fishing crews that focused on the forebay and tailrace sections of the Bonneville and Dalles dams—areas not accessible to the general fishing public. Also in 2009, evaluation crews were able to tag 80 percent more pikeminnow than in 2008, to better evaluate the benefits of predator management. The NPMP has removed more than 3.3 million pikeminnow from the Columbia River since 1990. Evaluation indicates that, as a result, pikeminnow predation on juvenile salmon has declined 38 percent In that time, saving 4 to 6 million juvenile salmon annually that otherwise would have been eaten by this predator.

California Sea Lions at Bonneville Dam

In recent years, California sea lions, which are protected under the Marine Mammal Protection Act (MMPA), have been observed swimming more than 140 miles up the Columbia River to Bonneville Dam to prey in increasing numbers on adult spring Chinook salmon, winter steelhead, and white sturgeon. Generally arriving from mid to late February and leaving by the first week in June, these male sea lions are gaining weight in preparation for the summer mating season.

Corps biologists began gathering data on sea lion presence and predation at the dam in 2001, when six California sea lions were documented. In 2002—the first full season of monitoring—30 sea lions were counted. In 2004, 101 sea lions were counted, and in 2005 the number was estimated at 87 or more. From 2006 to 2008, the number increased from 72 to 84. Not all sea lions counted were at the dam at the same time; usually about 30 were present on any one day. The number of fish eaten by sea lions has increased every year from 2006 to 2009 (Table 2). In 2002, the expanded consumption estimate was 1,010 adult salmon and steelhead that would otherwise have passed Bonneville Dam from January 1 through May 31. In 2009, the expanded consumption estimate was 4,489 adult salmon and steelhead (Table 2, Figure 12). Stellar sea lion numbers and salmon consumption nearly doubled in 2009. For more information, see http://www.nwd-wc.usace.army.mil/tmt/documents/fish/2009/sea_lion_hazing2009.html.

The Corps has implemented a variety of sea lion deterrents, from physical barriers to non-lethal harassment. Sea lion exclusion devices were installed at Bonneville Dam to prevent sea lions from entering the fish ladders through the 12 primary fishway entrances. Corps biologists also coordinated with U.S. Department of Agriculture personnel and boat-based crews from the Oregon Department of Fish and Wildlife, Washington Department of Fish and Wildlife (WDFW), and CRITFC on all sea lion harassment activities at Bonneville Dam. In addition, the Action Agencies supported CRITFC in conducting monitoring and non-lethal harassment efforts to deter marine mammal predation downstream of the dam.

In 2009, under the MMPA nuisance sea lion removal authority, the states removed 14 California sea lions (in addition to the 11 removed in 2008). Even with the removal of 25 targeted

Year	Bonneville Dam salmonid passage (Jan. 1-May 31)	Expanded salmonid consumption estimate		Adjusted salmonid consumption estimate	
		Estimated consumption	% of run (Jan. 1 to May 31)	Estimated consumption	% of run (Jan. 1 to May 31)
2002	284,733	1,010	0.4 %	-	-
2003	217,185	2,329	1.1 %	-	-
2004	186,804	3,533	1.9 %	-	-
2005	82,006	2,920	3.4 %	-	-
2006	105,063	3,023	2.8 %	3,401	3.1 %
2007	88,474	3,859	4.2 %	4,355	4.7 %
2008	147,543	4,466	2.9 %	4,927	3.2 %
2009	186,060	4,489	2.4 %	4,960	2.7 %

Table 2. Consumption of Salmonids by California Sea Lions, Steller Sea Lions, and Harbor Seals at Bonneville Dam, From Surface Observations Conducted Between 2002 and 2009. Total salmonid passage counts include all adult salmonids that passed Bonneville Dam from January 1 through May 31. "Expanded" estimates correct for the fact that observers are not present at all times. "Adjusted" estimates further correct to account for catch events where the prey species could not be identified.

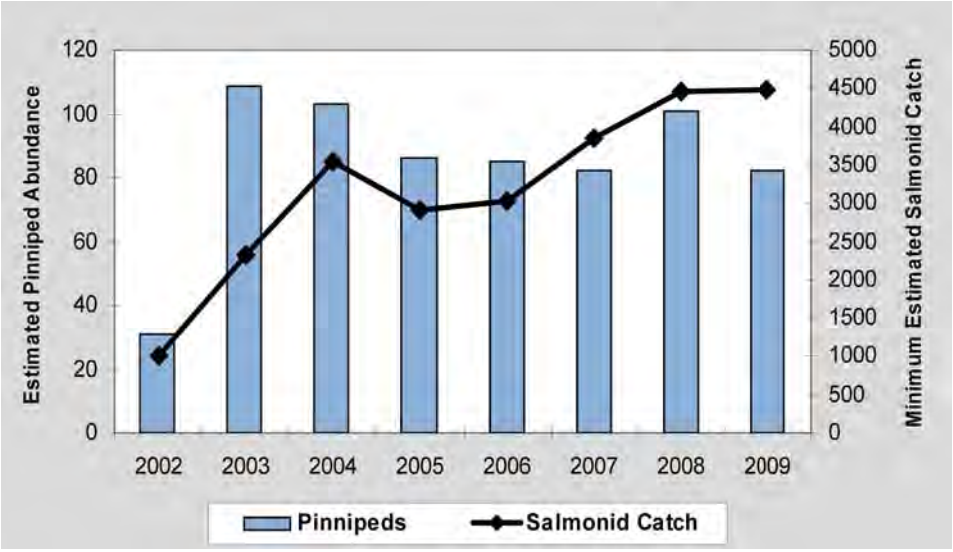


Figure 12. Estimated Minimum Number of Adult Salmonids Consumed by Pinnipeds and Estimated Total Number of Pinnipeds Seen at Bonneville Dam January 1–May 31, from 2002 to 2009. In 2005, regular observations did not start until March 18. Pinnipeds observed included California sea lions, Steller sea lions, and harbor seals. Source: 2009 Field Report: Evaluation of Pinniped Predation on Adult Salmonids and Other Fish in the Bonneville Dam Tailrace
http://www.nwd-wc.usace.army.mil/tmt/documents/fish/2009/2009_Pinniped_Report.pdf

California sea lions, the numbers of salmon being consumed remained high. Had those sea lions not been removed, however, up to 1000 additional salmon may have been consumed over the last two years.

Habitat Protection and Improvement Actions

Columbia River habitat, both estuary and tributary, is important to salmon in their complex life cycle. Each year, the Action Agencies spend tens of millions of dollars under the RPA and the Columbia Basin Fish Accords to implement actions that improve the quantity and quality of habitat used by salmon in the estuary and tributaries. In coordination and partnership with tribes and federal, state, and local parties, the Action Agencies are increasing the volume of water in streams, installing or retrofitting fish screens at water diversions to keep fish safely out of irrigation canals, reconnecting side channels and floodplains to add complex and diverse habitats, removing barriers to fish passage, and acquiring easements or other protective interests for riparian areas along tributaries.

Tributary Habitat

In 2009, the Action Agencies continued to expand an already significant tributary habitat program and took steps to target key factors known to limit the survival of specific salmon and steelhead populations. The expanded program uses up-to-date biological information to target habitat actions to fish populations with the greatest biological need, combined with the advice of local expert panels which identify and prioritize the most biologically appropriate actions for those populations. In addition to these ongoing population-focused efforts, the Action Agencies maintained or expanded their current overall level of effort for other anadromous fish populations.

Projects to protect, improve, or restore critical fish habitat employ different approaches targeted to the specific limiting factors found in the individual watersheds. The following sections summarize Action Agency accomplishments in 2005 to 2009 and provide specific examples of the work completed in 2009. For perspective, we also show cumulative accomplishments from 2005 through 2009. While this report emphasizes completed work, there are also many additional tributary habitat projects underway for completion by 2012.

Increasing Water Quantity and Quality through Water Transactions

Fish can perish from the combined effect of naturally low summer flows and water withdrawals for human uses. One of the most effective and immediate steps the Action Agencies may take to improve fish habitat is to lease or purchase water rights or install water efficiency improvements to increase the amount of water in streams. This in turn provides immediate improvements to salmon and steelhead survival by reducing thermal stress and providing higher quality habitat for spawning and juvenile rearing. Since 2005, the Action Agencies acquired instream water to conserve or protect close to 240,000 acre-feet and 1,200 cubic feet per

BPA has supported work by the Washington Water Trust and Colville tribe to increase flows in Salmon Creek and help enhance steelhead passage to 14 miles of stream. Before, above left. After, above right.

Photos. Snake River Chinook and steelhead in the Lemhi watershed benefitted from over 1,800 acre-feet of water and summer passage when irrigators collaborated on multiple water transactions.

second (cfs) of water in the Columbia River Basin (Figure 13).

The primary mechanism BPA uses to increase water quantity is through the Columbia Basin Water Transactions Program (CBWTP). One highlight from this program in 2009 was the agreement to provide up to 29.9 cfs (equivalent to 700 acre-feet) of instream flow to Salmon Creek in the Okanogan subbasin to improve passage for threatened Upper Columbia River steelhead. The purposes of this water acquisition project are to rewater 4.3 stream miles in Salmon Creek by increasing flows and to enhance other fish passage efforts by the Colville tribe under their Fish Accord, that provide steelhead access to 14 miles of habitat along the creek.

For 2009, water transaction highlights also included seven permanent conservation agreements and an annual diversion reduction agreement in the Lemhi watershed to increase flows and provide upstream and downstream passage at a critical passage point for Snake River steelhead and Snake River spring/summer Chinook populations. By working with multiple landowners, the Idaho Department of Water Resources developed agreements to secure over 1800 acre-feet of water annually and increase flows to 25-35 cfs during the summer to ensure fish passage.

This collaborative effort to combine multiple water transactions in the Lemhi has helped create a viable passage corridor for steelhead and Chinook, and it marks the initial set of BPA-supported water transactions through the CBWTP and the Fish Accord with Idaho. The cumulative effect of these water transactions is resulting in improved habitat conditions for salmon and steelhead in the basin.

Improving Habitat Complexity

Salmon evolved in streams with multiple channels that meandered and flooded seasonally. These processes created complex habitats that provided important rearing areas for juvenile salmon and steelhead, as well as cool-water refuges during the heat of summer. Human development has changed the nature of most of the Columbia River Basin's river systems, depriving salmon of some of these habitat attributes.

An important component of the Action Agencies' habitat program involves funding actions and providing technical assistance to improve channel complexity by reconnecting side channels and, where feasible, increasing floodplain function to improve instream habitat conditions. The Action Agencies have improved more than 100 miles of stream since 2005, with nearly 12 miles completed in 2009 (Figure 14)

One example of this type of work involved the placement of boulders and large wood within the West Fork Neal Creek, in Hood River County, Oregon. Seventy-five logs were placed at six sites in the wetted stream channel of West Fork Neal Creek and its floodplain. Fifty-five of these logs were harvested from adjacent Hood River County lands as whole trees with rootwad attached. The remainder of the logs were cut logs transported to the project area to be used in the uppermost treatment sites. Ten boulders were harvested on site and used as ballast for the cut logs. These boulders and large wood will help increase holding, spawning, and rearing habitat for ESA-listed winter steelhead, Coho salmon, and resident trout.

Improving and Protecting Riparian Areas to Improve Water Quality

Riparian habitat—the streamside environment—makes a major contribution to water quality and juvenile salmon survival. Although actions to improve and restore degraded riparian habitat can take years to yield results, they are nonetheless an essential element of a strategy to improve salmon habitat. Because these actions can help moderate stream temperatures, they are an important hedge against the longer-term effects of climate change, which are expected to cause stream temperatures to increase seasonally throughout the Columbia River Basin.

Riparian habitat can be protected through land purchases or conservation easements, which aim to reduce adverse land use impacts. In many instances, plantings or natural revegetation can reestablish a viable riparian zone by providing shade and other benefits for the stream. Since 2005, the Action Agencies have improved more than 5,000 acres and protected nearly 47,000 acres. In 2009, BPA funded projects to improve nearly 1,900 acres of riparian vegetation, protected through lease or purchase more than 9,300 acres of riparian habitat, installed fencing along 27 stream miles, and improve or relocate about 3.6 miles of roads in riparian areas. These projects are expected to provide habitat benefits that will help keep water cool and clean for ESA-listed populations (Figure 15).

For example, in 2009, BPA funds were used to re-contour the stream channel and plant seven miles of vegetation along the South Fork Salmon River in Idaho. The riparian planting work included clump planting, seeding, and straw and rock placement to reduce erosion.

As the riparian vegetation from these projects matures over time, it will help shade and cool the stream water and

provide opportunities for recruitment of the large woody debris needed for habitat complexity.

Reducing Fish Entrainment at Irrigation Diversions

The Action Agencies have been funding projects to replace, improve, and install fish screens at irrigation diversions to prevent fish from becoming trapped in or entrained into irrigation ditches. The fish screens, which are designed according to state and federal criteria, keep fish in the streams (i.e., out of irrigated fields) and thus provide immediate improvements to juvenile fish survival. Fish entrainment is also reduced by consolidating irrigation diversions and replacing instream diversions with groundwater wells, allowing water to be diverted for irrigation and reducing or eliminating entirely the need for an associated fish screen. In 2009, the Action Agencies addressed fish entrainment at five locations and installed more than 60 fish screens.

Improving Access to Spawning and Rearing Habitat

Human development has restricted access to significant portions of the historical range of Columbia River Basin salmon and steelhead in many Columbia River tributaries. Many of these blockages can be fixed with negligible economic impact, providing a big biological boost to fish. Since 2005, the Action Agencies have improved access to approximately 845 miles of instream habitat for anadromous fish (Figure 16).

In 2009, the Action Agencies funded projects that opened nearly 265 miles of fish habitat. One example of this type of work involved the removal of a culvert in Salt Creek, Idaho, on the South Fork Salmon River. The existing culvert was acting as a migration barrier to Chinook, steelhead, bull trout, and westslope cutthroat. Replacing the culvert with a bridge opened 3.6 miles of fish habitat.

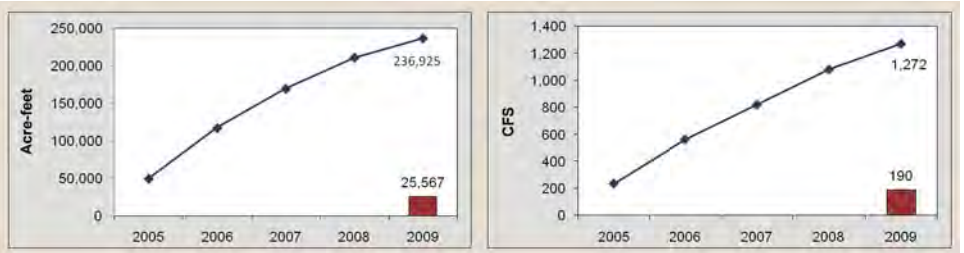


Figure 13. Water Protected, in Acre-Feet and Cubic Feet per Second of Flow, 2005-2009.

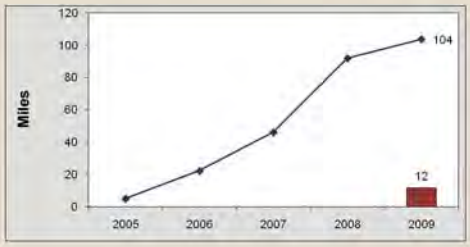


Figure 14. Miles of Stream with Complexity Improvements, 2005-2009

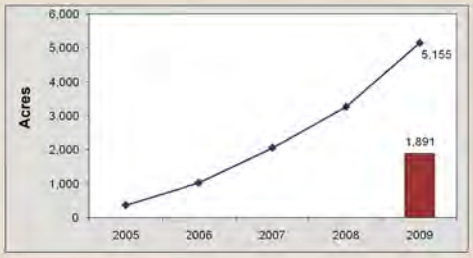


Figure 15. Acres of Habitat Improved, 2005-2009. Note: Improvement measures include creating, connecting, or realigning channels; conducting controlled burns; planting; practicing no-till farming; removing mine tailings and invasive plant species; enhancing floodplains; or restoring wetlands.

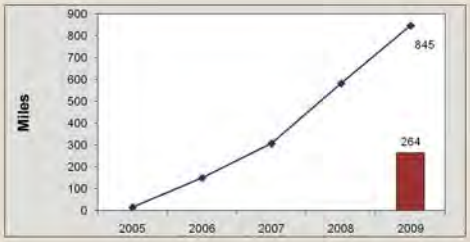
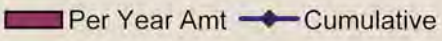


Figure 16. Miles of Habitat Made Accessible, 2005-2009



Estuary Habitat Actions

Fish from throughout the Columbia River Basin use the Columbia River Estuary for varying amounts of time during all months of the year. The estuary's diverse habitats provide food and refuge for juvenile salmon for rearing and migrating as they make their critical transition from fresh water to salt water. Adult salmon returning to the Columbia River also must pass through the estuary.

In 2009, the Action Agencies entered into a Memorandum of Agreement with the state of Washington and expanded funding to implement on-the-ground projects to address biological priorities and key factors that limit fish survival in the estuary. Project types included the protection and restoration of remaining high-quality, off-channel habitats, reduction of invasive plants, and protection and restoration of riparian and wetland areas. In 2009, the Action Agencies completed seven on-the-ground habitat projects in the estuary, with another nine projects in the planning and development phase.

One of the estuary habitat projects implemented by the Action Agencies in

Replacement of a culvert on Salt Creek with a bridge (above right) opened 3.6 miles of habitat.

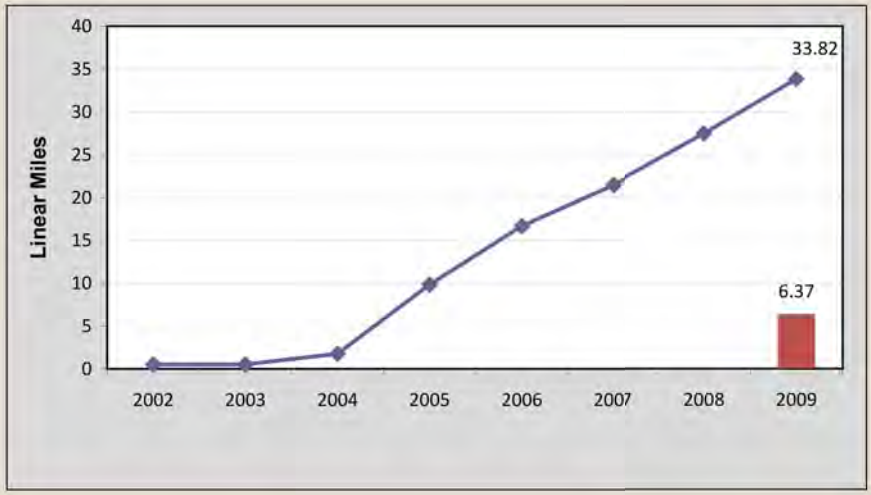


Figure 17. Estuary Riparian Areas Improved 2002-2009. Improvement measures include fencing, native riparian plantings, removal of invasives, and increasing complexity by adding large woody debris.

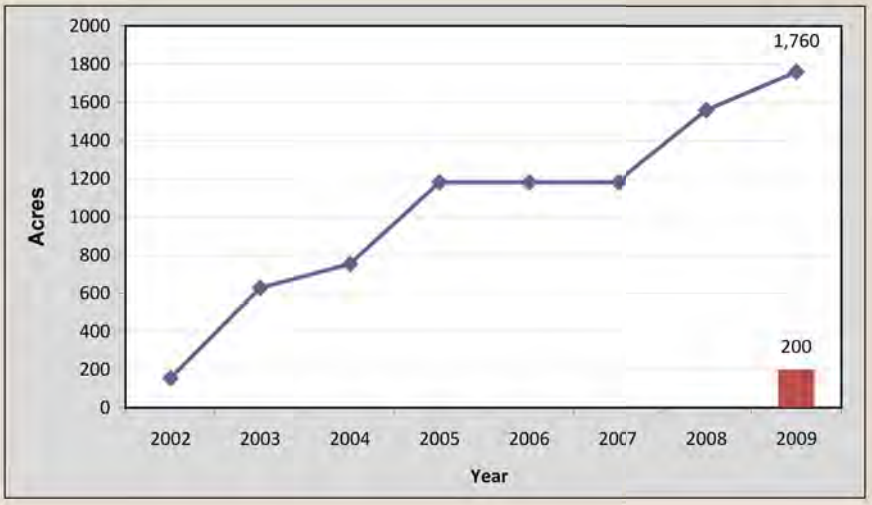


Figure 18. Estuary Habitat Acquired, 2002-2009. Habitat acquired includes land acquisitions for future restoration activities.

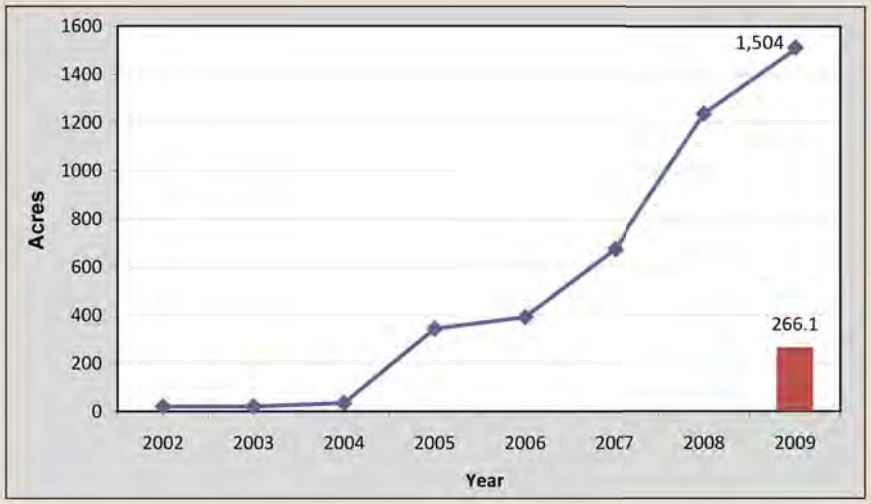


Figure 19. Estuary Floodplain Improved, 2002-2009. Improved access includes breaching or lowering dikes and levees, installation of fish passage structures, and enhancing floodplains for juvenile salmon benefit.

2009 was the Grays River Restoration Project. The objective of this project is to restore habitat-forming processes to enhance salmon and steelhead populations in the Grays River, a Columbia River tributary. The major components of this project included planning, design, installation, and monitoring of five engineered logjams (ELJ) that aid in rejuvenating historical channel and floodplain processes. Additional restoration measures included reforesting the riparian corridor to enhance future large woody debris recruitment and investigation of conservation activities within ecologically critical areas. Monitoring was integrated with restoration activities to evaluate restoration effectiveness and allow for adaptive management of future restoration treatments as well as other degraded watersheds in the lower Columbia River.

In 2009, LCREP carried out a NOAA Fisheries-funded pile structure removal pilot project, with monitoring provided by the Corps of Engineers, leading to a report on the feasibility of assessing the effects of removal projects. The Corps started the contracting process for a study to identify which pile dike structures were still needed to meet its navigation requirements. The Corps also determined that, because its pile structures were congressionally authorized, additional process may be

Table 3. Summary of Estuary Habitat Metrics, 2009.

Action	Metric
Improve and Restore Streams/Channels	6.34 linear miles
Plant/Maintain Native Vegetation	241 acres
Remove Invasive Plant Species	25 acres
Restore Riparian Wetland Areas	1 acre
Restored riparian forest habitat	210 acres
Restored backwater shallow water habitat	87 acres
Land Acquisition (Future restoration actions will be implemented on land acquisitions.)	200 acres

required before removal can occur. As a result, near-term emphasis turned to removal of pile fields. The Action Agencies, with LCREP and others, worked on planning for pile field removal pilot projects, and three pile fields were identified as possible pilot project candidates.

Table 3 summarizes the estuary habitat metrics accomplished in 2009 with Action Agency funding assistance. Figures 17, 18, and 19 show cumulative improvements since 2002.

Projects for future implementation are now being identified using emerging tools such as the Columbia River Estuary Ecosystem Classification System (CREEC). CREEC is being developed by scientists from the University of Washington and the United States Geological Survey, and is scheduled for completion in 2012. CREEC will help local experts, planners, and project managers strategically identify and select restoration and protection projects in the estuary that provide the highest benefits for the 13 listed ESUs in the Columbia River.

Hatchery Actions

The Action Agencies continue to fund an extensive existing hatchery program as offsite mitigation for the federal dams, including conservation hatcheries for listed fish, while preparing for scientifically based hatchery reforms throughout the Columbia River Basin. BPA funded the Hatchery Scientific Review Group (HSRG) process in 2009 to help the HSRG to complete its comprehensive review and analysis of all Columbia River Basin hatchery programs and prepare its final reports with recommendations for hatchery reform. The Action Agencies' strategy is to ensure that FCRPS mitigation hatchery programs are aiding conservation and not impeding recovery of salmon ESUs or steelhead DPSs by reforming hatchery operations to reduce the genetic and ecological effects on ESA-listed salmon and steelhead.

The Lower Snake River Compensation Program and WDFW staff continued planning for specific hatchery reform actions to transition the Tucannon River and Touchet River steelhead hatchery programs from Lyons Ferry Hatchery broodstock to local broodstock. The Winthrop National Fish Hatchery continued a pilot program to evaluate longer-term rearing of juvenile steelhead that would be required to transition to

Figure 20. Anadromous fish hatcheries funded by the Action Agencies, including anadromous/resident fish safety-net hatcheries.

a locally adapted steelhead broodstock in the Methow River — a key initiative aimed at addressing one of the factors limiting the productivity of this Upper Columbia River steelhead population.

The Action Agencies also continued to fund safety-net programs to reduce the extinction risk of at-risk populations of ESA-listed Snake River sockeye salmon and Snake River spring/summer Chinook. One of those programs, the Snake River Sockeye Salmon Captive Broodstock Program, preserves this critically imperiled species. The program has produced hundreds of thousands of progeny from remnants of the wild stock. The progeny are raised in carefully managed hatcheries and released into their natural habitats to spawn or migrate downstream. Since 1999, 1,838 adults from the program have returned to Redfish Lake. In 2009, 833 adults returned to the Stanley Basin, eclipsing the 2008 return of 650 adults. The 2009 return was the largest recorded annual return since 1956.

The BiOp calls for the Action Agencies to expand the program to produce between 500,000 and 1 million smolts annually. Throughout 2009, BPA worked with the state of Idaho and Idaho Department of Fish and Game (IDFG) to identify and begin the acquisition process for a hatchery property with adequate water quantity and quality to achieve the expanded production level.

The Action Agencies continued to fund hatchery conservation programs for Upper Columbia, Mid-Columbia, and Snake River steelhead to preserve and rebuild genetic resources and assist in promoting recovery of these DPSs. During 2009, BPA continued funding two projects – one to recondition Columbia and Snake River steelhead Kelts and increase spawner abundance of these threatened DPSs, and another project aimed at reintroducing Columbia River chum salmon in lower Columbia River tributaries below Bonneville Dam and increasing the abundance of this threatened ESU.

Harvest

The overall harvest objective for all ESUs is to improve adult life-stage survival. Harvest of ESA-listed fish species in the Columbia River Basin is managed primarily through state and federal agencies—other than the Action Agencies—and tribes. However, the Action Agencies have supported the identification and implementation of approaches or conservation measures to reduce the effects of harvest on ESA-listed species. In 2009, the Action Agencies continued funding the initial evaluation of several types of live-capture fishing gear that can be used to selectively harvest marked hatchery fish while allowing ESA-listed wild fish to escape unharmed. The main gear type tested in 2009 was the purse-seine in the upper Columbia River below the mouth of the Okanogan River.

Research, Monitoring, and Evaluation

The Action Agencies implement an extensive research, monitoring, and evaluation (RME) program that focuses on maximizing performance of management actions. The RME program is implemented through the NPCC's Fish and Wildlife Program, the Corps' Anadromous Fish Evaluation Program, and Reclamation's technical assistance activities, and it is coordinated with RME activities of other regional agencies. The Action Agencies work closely with the Pacific Northwest Aquatic Monitoring Partnership – a forum for coordinating state, federal, and tribal aquatic habitat and ESA-listed salmon and steelhead monitoring programs; the Columbia Basin Fish and Wildlife Authority; and the state and tribal constituents. The objective is to collaboratively advance a regionally coordinated approach to fish and habitat status monitoring, action effectiveness research, critical uncertainty research, and data management. The RM&E approaches and implementation planning receive oversight and direction through the review of the Action Agency, NPCC, and NOAA Fisheries' BiOp RM&E Workgroup. Additional recommendations on RM&E needs and priorities for fish population monitoring and for hatchery and habitat effectiveness monitoring have been provided by state and tribal fish management agencies through development of the Columbia River Basin Anadromous Salmonid Monitoring Strategy (ASMS).

In 2009, programmatic performance was tracked through project implementation and compliance monitoring, while biological and environmental performance was tracked and evaluated through status monitoring, action effectiveness research, and critical uncertainty research. Performance standards were monitored to ensure accountability and adherence to proposed actions.

The Action Agencies implemented RME projects within nine strategic areas:

- Fish population status monitoring
- Hydro RME
- Tributary habitat RME
- Estuary and ocean RME
- Harvest RME
- Hatchery RME
- Predation and invasive species management RME
- Coordination and data management
- Project implementation and compliance monitoring

Fish Population Status Monitoring

For fish population status monitoring, the Action Agencies continue to monitor the status of ESA-listed fish and enhance the existing status monitoring performed by regional fish management agencies. The ASMS provides a comprehensive strategy for high-precision adult spawner and juvenile productivity monitoring programs for one population per each Major Population Group for each listed ESU or DPS. Supplemental fish population status information is also obtained through multiple hatchery and habitat effectiveness research and monitoring.

Hydro RME

Hydro RME studies were conducted on the juvenile fish transportation program, turbine survival, water temperature, and juvenile and adult dam passage survival and passage efficiency. The

Action Agencies expanded coverage in detecting PIT-tagged fish and improved the ability to evaluate new and alternative fish passage operations and technologies. The Action Agencies tagged more than 2.3 million smolts in 2009.

Tributary Habitat RME

Tributary habitat conditions and limiting factors were evaluated through state of the art "Intensively Monitored Watersheds", which quantify the relationships between habitat conditions and fish productivity. The expansion of habitat status and trend monitoring to support the habitat evaluations for fish habitat condition and climate change for one population per major population group was integrated into the ASMS and will be reviewed by the Independent Scientific Review Panel (ISRP) before implementation in 2010.

Estuary and Ocean RME

Estuary and ocean studies were conducted to evaluate fish performance and life history diversity relative to various habitat areas and key environmental attributes. The bathymetry and topography of the estuary continued to be mapped. Work was also continued on development of the CREEC and on an index of habitat connectivity. The effects of individual habitat actions were assessed and a methodology for estimating the cumulative effects of habitat projects was further developed. Critical uncertainty research was conducted on the importance of different tidal, freshwater, estuary, plume, and nearshore ocean environments, as well as development of a hydrodynamic numerical model to evaluate contemporary and future habitat changes caused by climatic and anthropogenic effects, and to describe the temporal and spatial features of the Columbia River Estuary and plume that are important for salmon in relation to ocean conditions. Early ocean migration and survival studies continued to be implemented and refined.

Harvest RME

Harvest investigations linked to FCRPS interests included feasibility studies for Zone 6 harvest PIT tag recoveries to help refine upstream adult survival rates. Selective fishing methods and gear were evaluated. Support was continued for coded-wire tagging and recovery operations needed to assess the survival, straying, and harvest rates of specific hatchery fish stocks. Further work was advanced on genetic stock identification techniques.

Hatchery RME

Regional coordination of a hatchery action effectiveness program was initiated. The relative reproductive success (RRS) studies of hatchery-origin fish compared to natural-origin fish continued to be assessed for several ESA-listed salmon and steelhead populations. Hatchery studies also continue to assess the effects that hatchery programs and implemented reform actions have on native populations.

Predation and Invasive Species Management RME

Predation RME studies were conducted to evaluate and monitor the Northern Pikeminnow Management Program, avian predation rates on juvenile salmon in the lower Columbia River, and predation rates of California sea lions on adult salmon below Bonneville Dam. Completion of the stock assessment for double-crested cormorants occurred in 2009, and management plans for avian predation and other predation on juvenile salmonids were further advanced. Continued monitoring on the effectiveness of predation management actions were implemented as a component of most predator management projects.

Coordination and Data Management, Project Implementation and Compliance Monitoring

The Action Agencies continued to coordinate RME planning and implementation through the Corps' Anadromous Fish Enhancement Program and the project planning and review efforts of the NPCC's Fish and Wildlife Program. Through the Action Agencies' participation and leadership in regional coordination forums, they continued their support for standardization and coordination of tagging and monitoring efforts and data management. Regional coordination to support the ASMS resulted in a regional strategy for fish status VSP monitoring, habitat action effectiveness and hatchery action effectiveness. It also initiated the development of a data management strategy to support data exchange that will, in turn, support the BiOp and recovery of salmonids.

2009 Accomplishments

WHAT ARE OUR GOALS AND STRATEGIES?	WHAT ARE OUR KEY INITIATIVES?	WHAT ARE OUR KEY ACCOMPLISHMENTS?
HYDROSYSTEM		
Increase the survival rates of fish passing through mainstem dams: • Configure dam facilities to improve juvenile and adult fish passage survival • Manage water to improve juvenile and adult fish survival • Operate and maintain fish passage facilities to improve fish survival	• Operate and maintain adult fish ladders and other fish facilities • Guide juvenile fish away from turbines • Improve passage routes through the dams for juvenile fish to achieve 96 percent dam survival for spring Chinook and steelhead and 93 percent dam survival for subyearling fall Chinook • Manage available water to improve conditions for migrating fish • Transport juvenile fish in barges or trucks past dams in a spread-the-risk approach • Track migrating fish with PIT detection systems • Implement kelt management and reconditioning to improve steelhead productivity	• Water Management, Fish Passage, and Water Quality Plans completed and followed. • The Dalles Dam ▪ Completed first year of construction of extended-length spillwall to improve tailrace conditions. (Construction of spillwall was completed in 2009-2010 maintenance season.) • John Day Dam ▪ Completed second year of post-construction evaluation of two prototype spillway weirs; similar to 2008 results, turbine entrainment was reduced by 50% or more from the baseline. ▪ Continued to develop and improve avian deterrence systems in the tailrace to reduce the high level of juvenile fish predation by birds observed in 2008. • Ice Harbor Dam ▪ Completed the design of a turbine unit to improve juvenile survival and reduce fish passage injury, and solicited a contract for procurement. • Lower Monumental Dam ▪ Completed second year of post-construction evaluation of a spillway weir installed in 2008. Estimates of relative concrete survival for spring migrants exceeded the performance standard, while the estimate for summer migrants was slightly below (92.9%) • Little Goose Dam ▪ Installed and completed a first year post-construction evaluation of a spillway weir. Relative concrete survival estimates exceeded the performance standard for spring and summer migrants. ▪ Completed the installation of a full-flow PIT detector in the juvenile bypass system. ▪ Completed the relocation of the juvenile bypass system outfall. • Kelt Management ▪ Continued development of the Kelt Management Plan, including a synthesis of past migration and reconditioning research and discussion of future directions. ▪ Completed second year evaluation of the potential benefit of providing surface passage routes early in the spring for outmigrating steelhead kelts at The Dalles Dam ice and trash sluiceway. ▪ Opened the corner collector at Bonneville Dam one week early (i.e., April 3). Ongoing research will help inform decisions regarding the long-term operations of surface passage routes for kelt outmigration. ▪ Constructed expanded kelt holding facilities at Lower Granite Dam.

2009 Accomplishments

WHAT ARE OUR GOALS AND STRATEGIES?	WHAT ARE OUR KEY INITIATIVES?	WHAT ARE OUR KEY ACCOMPLISHMENTS?
PREDATOR MANAGEMENT		
Reduce the number of juvenile fish consumed by predators: • Redistribute avian predators • Reduce fish predation • Manage sea lion predation	• Provide alternative Caspian tern habitat in the Western Region to encourage redistribution (began in 2008, will complete around 2012) • Gradually reduce tern habitat in the Columbia River estuary, after alternative habitat is provided in other locations; reduce annual juvenile salmonid consumption by Caspian terns in the estuary to approximately 2.5 million fish • Provide incentives to reduce the number of large northern pikeminnow in the Columbia River • Address presence of sea lions below Bonneville Dam • Monitor predation by sea lions below Bonneville Dam • Initiate further baseline research and development of a future draft environmental impact statement to determine whether double-crested cormorant management is warranted	• Created two one-half acre islands at Summer Lake Wildlife Area for alternative habitat for Caspian tern nesting before the nesting season. • Reduced managed habitat for Caspian tern nesting on East Sand Island to 3.5 acres. • 700 Caspian tern breeding pairs nested on the Crump Lake island in 2009. • After the nesting season, four additional islands were constructed, one at Summer Lake and three in the Klamath Basin. • Continued development of a Cormorant Management Plan, including baseline research and potential management techniques to reduce increasing cormorant predation on juvenile salmon. • Installed a new avian wire array in the tailrace at John Day Dam to reduce the high level of juvenile fish predation by birds observed in 2008, but anchor failures limited effectiveness. Improved array was designed in 2009 for installation in spring 2010. • Continued hazing of sea lions below Bonneville Dam and installed sea lion exclusion devices (SLEDs) at Bonneville Dam. • Monitored sea lion abundance, predation, and distribution and the effectiveness of deterrent activities below Bonneville Dam. • Removed more than 147,000 northern pikeminnow from the Columbia River in 2009; reduced their predation of juvenile salmon by about 40 percent since 1990. • Increased northern pikeminnow tagging for evaluative purposes by nearly 80 percent over previous years.

2009 Accomplishments

WHAT ARE OUR GOALS AND STRATEGIES?	WHAT ARE OUR KEY INITIATIVES?	WHAT ARE OUR KEY ACCOMPLISHMENTS?
HABITAT		
Improve tributary and/or estuary habitat used by salmon for spawning or rearing: • Protect and improve tributary habitat based on biological needs and prioritized actions • Improve juvenile and adult fish survival in estuary habitat	Tributary • Increase streamflow via water acquisitions • Address entrainment through screening • Provide fish passage and access • Improve mainstem and side-channel habitat conditions • Protect and enhance riparian conditions Estuary • Acquire, protect, and restore • off-channel habitat • Restore tidal influence and improve hydrologic flushing • Restore floodplain reconnection by removing or breaching dikes or installing fish-friendly tide gates • Remove invasive plants and weeds; replant native vegetation • Protect and restore emergent wetland habitat and riparian forest habitat • Restore channel structure and function • Develop and implement a piling and pile dike removal program	Tributary • Protected more than 190 cubic feet per second (cfs) and 25,000 acre-feet of streamflows throughout tributaries in the Columbia River Basin • Addressed fish entrainment in five locations and installed over 60 fish screens • Improved or opened access to nearly 265 miles of spawning and rearing habitat • Improved nearly 1,900 acres of riparian habitat and increased the complexity of more than 10 miles of streams used by anadromous fish • Leased or purchased more than 9,300 acres of riparian habitat, and improved or relocated more than 3.6 miles of roads located in or along riparian areas Estuary • Improved and restored 6.34 linear miles of stream/channels • Planted and maintained 241 acres of native vegetation • Removed invasive plant species from 25 acres • Restored one acre of riparian/wetland • Restored 210 acres of riparian forest habitat • Restored 87 acres of backwater shallow water habitat • Funded acquisition of 200 acres of land for protection and/or restoration
HATCHERIES		
Use hatcheries to address the biological priorities of ESA-listed salmon and steelhead: • Implement safety-net programs to avoid extinction • Implement conservation hatchery programs to build genetic resources and assist with promoting recovery • Reduce potentially harmful effects of artificial production	• Intervene with artificial production techniques to avoid extinction of fish populations facing a high risk of extinction • Use artificial production techniques to build genetic resources and abundance of listed populations at low levels. • Modify hatchery practices or facilities, if needed, to reduce or eliminate detrimental genetic and ecological effects on listed populations	• Funded safety-net hatchery programs that reduced the extinction risk of populations of Snake River sockeye, and spring/summer Chinook. • Funded conservation hatchery programs for populations of Upper Columbia River spring Chinook salmon and steelhead, Mid-Columbia River steelhead, Snake River steelhead, and Columbia River chum salmon. • Action Agency-funded hatchery operators continued to develop updated Hatchery Genetic Management Plans (HGMP) that will be submitted to NOAA Fisheries for ESA consultation. In 2009 HGMPs for Leavenworth, Entiat and Winthrop hatcheries were submitted to NOAA Fisheries.

2009 Accomplishments

WHAT ARE OUR GOALS AND STRATEGIES?	WHAT ARE OUR KEY INITIATIVES?	WHAT ARE OUR KEY ACCOMPLISHMENTS?
RESEARCH, MONITORING AND EVALUATION		
Provide information needed to support planning and adaptive management and demonstrate accountability. The Action Agencies are undertaking RME through project implementation and compliance monitoring, status monitoring, action effectiveness research, and critical uncertainties research in nine strategic areas.	Implement RME in nine strategic areas: • Fish population status monitoring • Hydro RME • Tributary habitat RME • Estuary and ocean RME • Harvest RME • Hatchery RME • Predation and invasive species management RME • Coordination and data management • Project implementation and compliance monitoring	• The Action Agencies worked with regional fish and wildlife agencies and tribes to develop the Columbia Basin Anadromous Salmonid Monitoring Strategy, which identifies monitoring projects that meet RPA requirements for fish population status monitoring and habitat and hatchery action effectiveness research. BPA implemented 60 projects to monitor status of selected fish populations' viability attributes related to FCRPS actions and supported annual population status assessments. • BPA implemented 23 projects to monitor and evaluate fish survival, migration characteristics, and river conditions within the FCRPS to support findings of improved hydro system survival. • BPA and Corps implemented 29 projects to monitor and evaluate the effects of configuration and operation of the FCRPS. • BPA and Corps implemented 21 projects to investigate critical uncertainties related to hydropower operations and investigated new technologies. • BPA and Reclamation implemented 52 projects to monitor and evaluate tributary habitat conditions and limiting factors and evaluated the effectiveness of tributary habitat actions. • BPA and Corps implemented 10 projects to monitor and evaluate estuary and nearshore ocean fish performance, migration characteristics, and environmental conditions. • BPA and Corps implemented seven projects to monitor and evaluate the effects of habitat actions in the estuary. • BPA and Corps implemented 10 projects to investigate critical uncertainties related to the estuary and ocean. • BPA implemented 47 projects for select harvest investigations; including genetic stock identification, linked to FCRPS interests. • BPA and Corps implemented 57 projects to monitor hatchery management effectiveness and investigated critical uncertainties related to hatcheries. • BPA and Corps implemented eight projects to monitor and evaluate piscivorous, avian, and marine mammal predation and the effectiveness of management actions. • BPA and Reclamation implemented 12 RME projects to facilitate coordination activities between other federal, state, and tribal agencies to support implementation of the RME work group recommendation report through standardization of methods and protocols and implement BiOp monitoring needs. • BPA and Reclamation implemented nine projects focused on archiving information in appropriate data management systems to support BiOp assessments. • The Action Agencies implemented RME action tracking systems to better support NOAA Fisheries data needs. This alignment supports comprehensive implementation monitoring and the evaluation of ecological and fish response suites of habitat actions.

Overview by Species

The following summaries primarily describe abundance and abundance trends at the species or ESU level as of December 2009. Species-level status is determined based on a review of population-level status and includes consideration not just of abundance, but also productivity, spatial structure, and diversity. These are the attributes of a viable salmonid population. The following section includes a brief review of some of the population-level information in the 2008 FCRPS BiOp, which contains a much more thorough review of the status of independent populations within each ESU. Figures 21 through 27 display natural spawners only (with the exception of sockeye populations, which are sustained through a captive broodstock program).[6]

Snake River Fall Chinook Salmon

The Snake River fall Chinook salmon ESU was listed under the ESA as a threatened species in 1992. This ESU is composed of only one extant population, which spawns and rears in the mainstem Snake River and in the lower reaches of its major tributaries below Hells Canyon Dam. It is estimated that 85 percent of the ESU's historical spawning habitat was lost as a result of construction of the privately owned Hells Canyon Dam complex, which blocks all fish passage.

The most recent 10-year average return of natural-origin fish (through 2008) is estimated to be 2,540 adults. The most recent four-year average return is 2,307 adults (Figure 21). Estimates of natural-origin adult abundance were not available for 2009.

Returns of natural-origin Snake River fall Chinook salmon have trended upward since 1990. The FCRPS BiOp considered trends of natural-origin adults based on two time periods with differing management actions and climate: 1977-2004 and 1990-2004. Although abundance trends were positive for both periods, productivity measured as returns-per-spawner (R/S – a measure of productivity) were positive only for 1990-2004. These estimates represent average survivals during the periods in question and do not fully reflect survival improvements resulting from more recent hydrosystem improvements and other management changes.

[6] *Abundance charts in this report show ESU-level abundance from 1990 until the most recent available observation, consistent with the 2008 BiOp's "short-term" trend estimation period. The exception is the Middle Columbia Steelhead DPS, which is represented by the Yakima River Major Population Group. Estimates are of naturally produced adult returns provided by NOAA Fisheries. Trend lines are shown where the 1990-present trend is statistically significant (p<.05). The trend estimation method is taken from Good et al. (2005).*

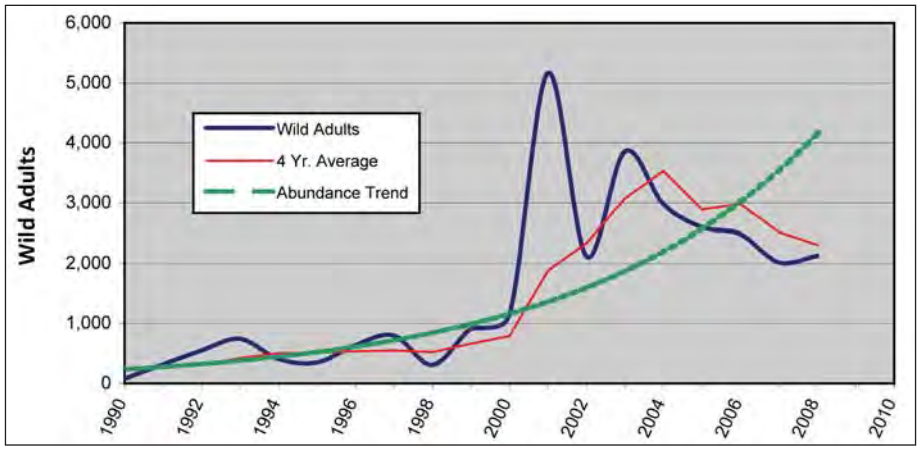


Figure 21. Returns of Naturally Produced Adult Snake River Fall Chinook Salmon at Lower Granite Dam, 1990-2008.

Snake River Spring/Summer Chinook

The Snake River spring/summer Chinook salmon ESU was listed under the ESA as a threatened species in 1992. The ESU is composed of 28 extant populations in five major population groups. The populations in this ESU spawn and rear in the tributaries of the Snake River between its confluence with the Columbia River and the Hells Canyon Dam.

The most recent 10-year average return of natural-origin Snake River spring/summer Chinook salmon was 19,367 adults. The most recent four-year average return was 12,040 adults (Figure 22). An analysis of adult returns from 1990-2009 indicates that the ESU-level trend in abundance was positive during this period, though the trend was not statistically significant.

The FCRPS BiOp considered population-level information based on adult returns from 1984-1986 through 2003-2005. Population-level abundance trends of natural-origin adults during this time period were generally positive. However, recruit-per-spawner productivity estimates were generally negative. These estimates represent average survivals during the periods in question and do not fully reflect survival improvements resulting from more recent hydrosystem improvements and other management changes.

Table 4 summarizes the tributary habitat metrics completed since 2005 with Action Agency support in areas used by Snake River spring/summer Chinook.

Snake River Sockeye Salmon ESU

The Snake River sockeye salmon ESU was listed under the ESA as endangered in 1991. The ESU includes all anadromous and residual sockeye in the Snake River Basin, as well as the artificially propagated fish from the Redfish Lake Captive Broodstock Program. This species was thought by

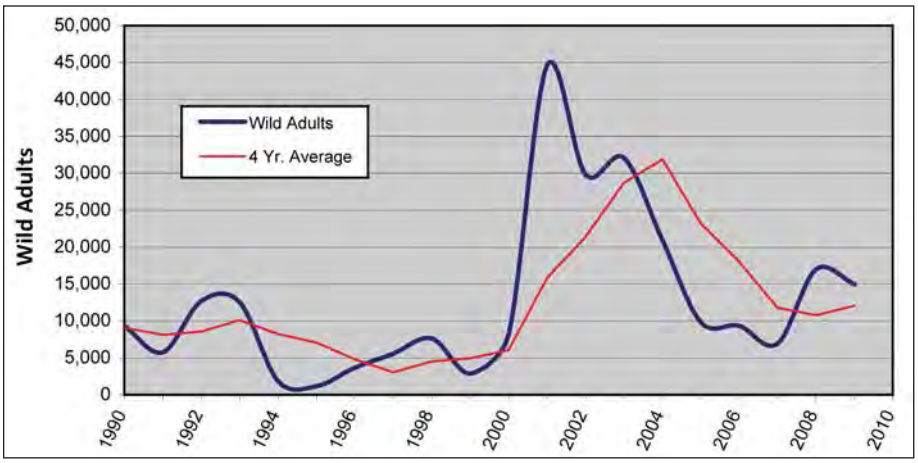


Figure 22. Returns of Naturally Produced Adult Snake River Spring/Summer Chinook Salmon at Lower Granite Dam, 1990-2009. The ESU-level trend in abundance was positive during this period, though the trend was not statistically significant and therefore is not displayed on this graph.

Table 4. Snake River Spring/Summer Chinook Tributary Habitat Improvement Metrics, 2005-2009

Metric	2009	2005-2009
Acre-feet/year of water protected	4623	48007
Acres improved	280	1744
Acres protected	221	1067
Water flow protected (cfs)	58	464
Miles of enhanced or newly accessible habitat	87	277
Miles of improved stream complexity	4	13
Miles protected	12	44
Screens installed or addressed	10	39

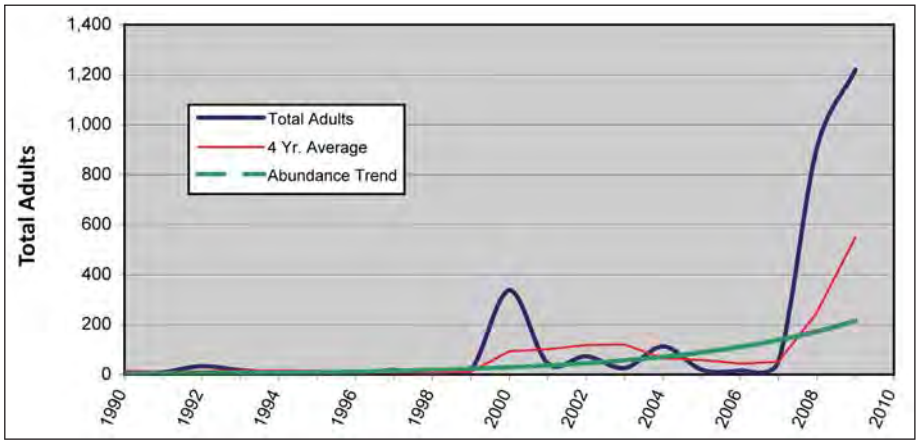


Figure 23. Returns of All Snake River Sockeye Salmon at Lower Granite Dam, 1990-2009.

some to be functionally extinct at the time of its listing. It had suffered from significant long-term harvest pressures, a state-sponsored fish eradication program that eliminated it from three of its natal lakes, private dams with little or no fish passage, construction of the federal dams on the lower Snake River, and a major detrimental ocean/climate shift in the mid 1970s.

An experimental captive broodstock program was initiated at the time of listing in an effort to forestall complete extinction in the near term and to preserve the species' remaining genetic diversity. The program has achieved its original purpose and is now being expanded to help support recovery.

The average annual adult return from the captive broodstock program between 1991 and 1999 was 11 fish. The average return from 2004 to 2007 was 50 fish. 2008 and 2009 saw extraordinary returns of 907 and 1,219 fish, respectively, as counted at Lower Granite Dam (Figure 23). These were the largest sockeye returns since fish counts began at Lower Granite Dam in 1975. The Northwest Fisheries Science Center attributed the increased numbers in 2008 to favorable ocean conditions and an increase in smolt releases from the captive broodstock program (Factors Affecting Sockeye Salmon Returns to the Columbia River in 2008, by NOAA-NWFSC, 2009).

Snake River Steelhead DPS

The Snake River steelhead distinct population segment (DPS) was listed as threatened in 1997. The DPS is composed of 24 individual populations in five major population groups. Steelhead of the Interior Columbia River Basin, and especially the Snake River DPS, are commonly referred to as either A-run or B-run. These designations are based on migration timing, age, and size at return. There is only marginal information regarding the status of most individual populations of Snake River steelhead, but it is believed that B-run steelhead spawn almost entirely in the Clearwater and Salmon rivers, while A-run steelhead occur throughout the Snake River Basin.

The most recent 10-year average return of natural-origin Snake River steelhead was 25,109 adults (2000-2009). The most recent four-year average return was 21,050 adults (Figure 24). An analysis of adult returns

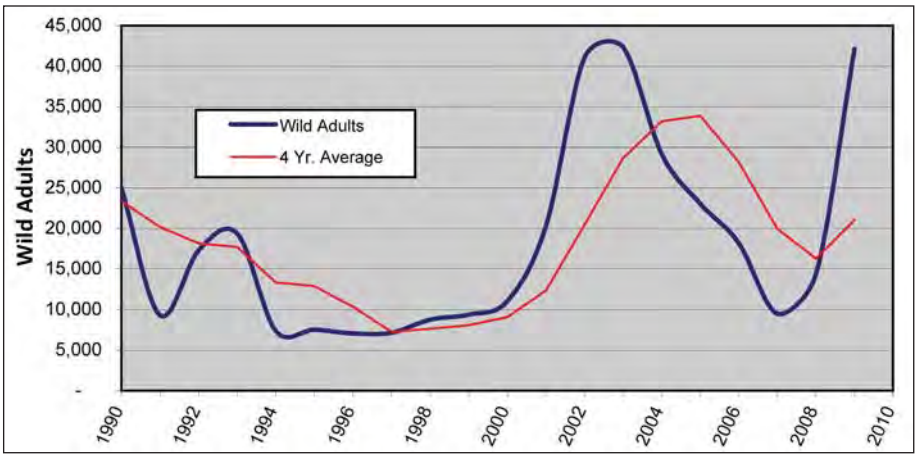


Figure 24. Returns of Naturally Produced Adult Snake River Steelhead at Lower Granite Dam, 1990-2009. DPS-level trend in abundance was positive during this period, though the trend was not statistically significant, and therefore is not displayed on this graph.

Table 5. Snake River Steelhead Tributary Habitat Metrics, 2005-2009

Metric	2009	2005-2009
Acre-feet/year of water protected	4623	48007
Acres improved	448	2314
Acres protected	221	1068
Water flow protected (cfs)	58	464
Miles of enhanced or newly accessible habitat	96	304
Miles of improved stream complexity	4	43
Miles protected	12	44
Screens installed or addressed	10	39

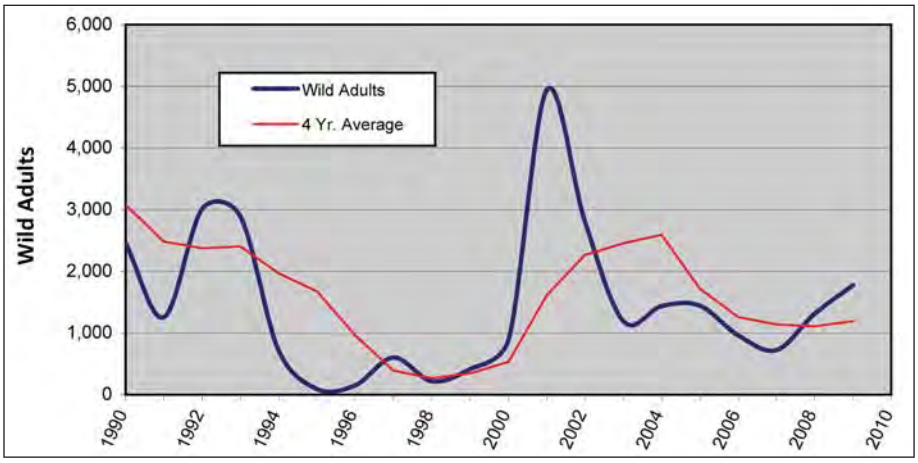


Figure 25. Returns of Naturally Produced Adult Upper Columbia River Spring Chinook Salmon at Rock Island Dam, 1990-2009. ESU-level trend in abundance remained generally flat during this period, though the trend was not statistically significant, and therefore is not shown on this graph.

from 1990-2009 indicates that the DPS-level trend in abundance was positive during this period, though the trend was not statistically significant.

For most populations in this DPS, the 2008 FCRPS BiOp applied "average" A-run and B-run population profiles, based on counts of returning adults at Lower Granite Dam. Based on these profiles, the BiOp concluded that most individual A-run populations in the DPS have trended upward since 1990, while B-run populations have not. Recruit-per-spawner productivity estimates have been positive for A-run populations generally over the 20-year period, but not for most B-run populations. These estimates represent average survivals during the periods in question and do not fully reflect survival improvements resulting from more recent hydrosystem improvements and other management changes.

Table 5 summarizes the tributary habitat metrics completed since 2005 with Action Agency support in areas used by Snake River steelhead.

Upper Columbia River Spring Chinook Salmon

The Upper Columbia spring Chinook salmon ESU was listed as endangered in 1999. The ESU consists of three extant populations in one major population group. These populations spawn and rear in the mainstem Columbia River and its tributaries between Rock Island Dam and Chief Joseph Dam (a barrier to upstream migration).

The most recent 10-year average return of natural-origin Upper Columbia River spring Chinook salmon was 1,748 adults (2000-2009). The most recent four-year average return was 1,193 adults (Figure 25). An analysis of adult returns from 1990-2008 indicates that the ESU-level trend in abundance was slightly positive during this period, though the trend was not statistically significant.

The FCRPS BiOp considered population-level information based on adult returns from 1984 through 2003. The BiOp concluded that 1990–2003 abundance trends for the Wenatchee River and Entiat River populations were generally stable, while the Methow River population saw a slight decline over that period. During the 1984-2003 base period analyzed in the

BiOp, these populations failed to replace themselves. These estimates represented average survivals during the periods in question and do not fully reflect survival improvements resulting from more recent hydrosystem improvements and other management changes.

Table 6 summarizes the tributary habitat metrics completed since 2005 with Action Agency support in areas used by Upper Columbia River spring Chinook.

Upper Columbia River Steelhead

The Upper Columbia River steelhead DPS was listed as endangered in 1997 but was recently relisted as threatened. The DPS consists of four populations in one major population group. These populations spawn and rear in the rivers and tributaries draining the eastern slope of the Cascade Mountains upstream of Rock Island Dam.

The most recent 10-year average return of natural-origin Upper Columbia River steelhead was 2,669 adults (1998-2007). The most recent four-year average return was 2,628 adults (Figure 26). An analysis of adult returns from 1990-2007 indicates that the ESU-level trend in abundance was positive during this period.

The FCRPS BiOp considered population-level information based on adult returns from between 1985 or 1986 through 2004 or 2005, depending on the population. Hatchery returns have dominated natural spawning in all populations in this DPS. Historical broodstock protocols included the use of out-of-basin broodstock and extensive mixing of stocks from different populations within the DPS. This may be a major contributor to the poor productivity seen in these populations.

The BiOp concluded that short- and long-term abundance trends for all populations were positive. During the 20-year base period analyzed in the BiOp, these populations failed to replace themselves. The estimates represent average survivals during the periods in question and do not fully reflect survival improvements resulting from more recent hydrosystem improvements and other management changes.

Table 7 summarizes the tributary habitat metrics completed since 2005 with Action Agency support in areas used by Upper Columbia River steelhead.

Table 6. Upper Columbia River Spring Chinook Tributary Habitat Metrics, 2005-2009

Metric	2009	2005-2009
Acre-feet/year of water protected	4422	9293
Acres improved	36	37
Acres protected	42	233
Water flow protected (cfs)	35	69
Miles of enhanced or newly accessible habitat	3	4
Miles of improved stream complexity	2	1
Miles protected	1	3
Screens installed or addressed	1	1

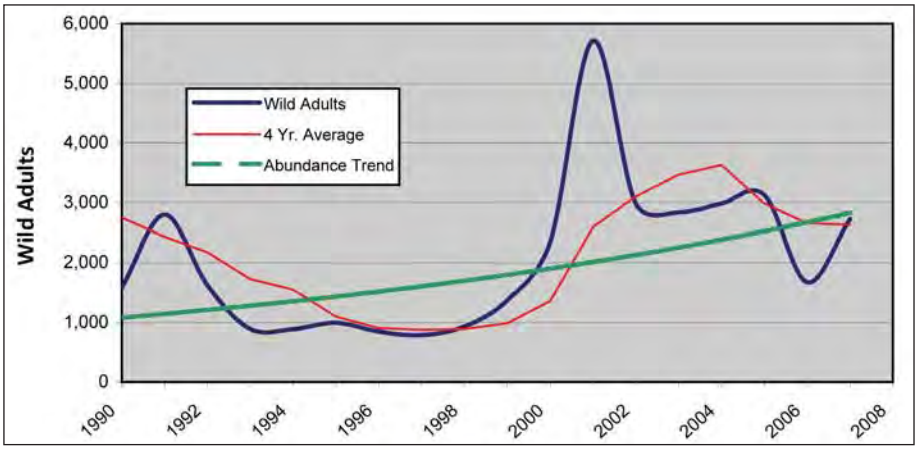


Figure 26. Returns of Naturally Produced Adult Upper Columbia River Steelhead at Rock Island Dam, 1990-2007.

Table 7. Upper Columbia River Steelhead Tributary Habitat Metrics, 2005-2009

Metric	2009	2005-2009
Acre-feet/year of water protected	5152	11416
Acres improved	49	72
Acres protected	46	337
Water flow protected (cfs)	65	150
Miles of enhanced or newly accessible habitat	17	18
Miles of improved stream complexity	2	2
Miles protected	1	4
Screens installed or addressed	1	1

Middle Columbia River Steelhead

The Middle Columbia River steelhead DPS was listed as threatened in 1999. The DPS is composed of 17 individual populations in four major population groups. These populations spawn in Oregon and Washington drainages

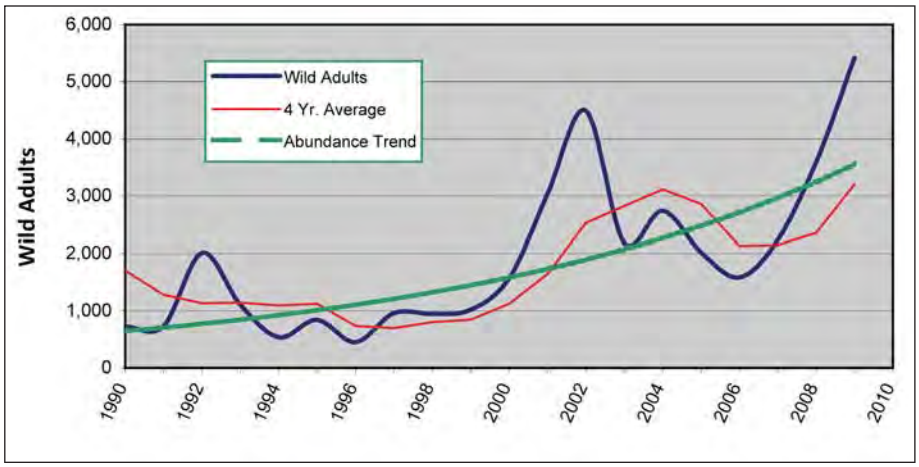


Figure 27. Returns of Naturally Produced Adult Middle Columbia River Steelhead (Yakima River Major Population Group) at Prosser Dam, 1990-2009.

Table 8. Middle Columbia River Steelhead Tributary Habitat Metrics, 2005-2009

Metric	2009	2005-2009
acre-feet/year of water protected	6622	24214
acres improved in various ways	1391	3613
acres protected	1071	12903
cubic-feet per second (cfs) of water flow protected	31	142
miles of habitat accessed	147	514
miles of stream with improved complexity	4	55
miles protected	116	581
Screens installed or addressed	24	136

upstream of the Hood River and Wind River systems up to and including the Yakima River Basin. Almost all populations within this DPS are summer-run steelhead; the exceptions are the winter-run populations returning to the Klickitat Creek and Fifteen Mile Creek watersheds.

The most recent 10-year average return of natural-origin Middle Columbia River steelhead was 17,201 adults (1996-2005). The most recent four-year average return was 21,985 adults (Figure 27). An analysis of adult returns from 1990-2005 indicates that the ESU-level trend in abundance was positive during this period. Due to the difficulty in obtaining timely estimates of DPS-level abundance for Middle Columbia River steelhead, the Adaptive Management Implementation Plan relies on abundance estimates based on dam counts for the Yakima River Major Population Group (MPG) of this DPS. Based on preliminary estimates, the most recent 10-year average return from this MPG was 2,888 natural-origin adults (2000-2009). The abundance trend for this MPG between 1990 and 2009 was positive.

The 2008 FCRPS BiOp considered population-level abundance estimates of natural-origin Middle Columbia River steelhead based on adult returns through 2004 or 2005. Eleven of the 13 populations for which adequate information is available had a positive trend in abundance since 1990. Over the most recent 10 years, the average abundance of three populations has been more than the minimum level needed for recovery, as identified by the Interior Columbia Technical Recovery Team. However, over the 20 years considered in the BiOp (concluding with the adult returns for 2004 or 2005), only eight of those 13 populations had positive recruit-per-spawner productivity.

Table 8 summarizes the tributary habitat metrics completed since 2005 with Action Agency support in areas used by Middle Columbia River steelhead.

Lower Columbia and Willamette River ESUs

These ESUs are currently threatened by a broad array of habitat and other environmental factors. Because they largely do not migrate through the federal dams on the Columbia and lower Snake rivers, the proposed operation of the Columbia/Snake projects of the FCRPS has a limited impact on these populations and there is limited potential to improve their status with improvements to these dams. The Action Agencies will provide an update on the status of these ESUs as part of the Comprehensive Evaluations called for in 2013 and 2016.

2009 Observations

The FCRPS BiOp is premised on adaptive management and accountability for results. The Action Agencies use the best available scientific information to achieve performance standards and make needed adjustments so that actions meet the BiOp goals.

The Obama Administration undertook an extensive effort to review the 2008 FCRPS BiOp. The process included listening to the views of the parties to the litigations, as well as those of agency and independent scientists. The Administration determined that the science underlying the BiOp is fundamentally sound, but there are uncertainties in some predictions regarding the future condition of the listed species. As a result of this review, the Administration developed the Adaptive Management Implementation Plan (AMIP) too include:

Accelerated and enhanced actions, include commitments to additional estuary actions under a new agreement with the state of Washington, efforts to control predators and invasive species, and biologically based changes to spring and summer spill;

Enhanced research and monitoring, improvements include expanding adult status and trend monitoring, expanding intensively monitored watershed (IMW's), a new life-cycle model to evaluate contingency actions, and enhanced research on predators, invasive species and potential reintroduction of fish into areas not currently occupied;

Biological triggers for contingencies, linked to declining abundance of listed fish at odds with BiOp expectations. The triggers, if tripped, would activate rapid or long-term responses to address significant declines in the abundance of naturally produced salmon and steelhead. A Significant Decline Trigger will result in implementation of Rapid Response contingency actions. An Early Warning Indicator will focus attention on possible problems to come and may result in implementation of Rapid Response contingency actions if deemed necessary;

Contingency actions, Rapid Response Actions, which are short term contingency actions to improve fish survival, include additional hydro operations, increased predator controls, certain harvest controls, and safety net hatcheries. Long-Term Contingency Actions are measures taken across "all Hs," including the study of Snake River dam breaching as a contingency of last resort; and

Continued collaboration and independent scientific review, continue the partnerships with states and tribes to provide for ongoing science input and to ensure transparent reporting on progress.

Based on 2009 research and implementation, the Action Agencies have developed questions and identified issues that affect BiOp implementation. This information will be used to inform future actions.

For hydropower actions, the Action Agencies have observed the following:

- Dam modifications and spill/surface passage improvements appear to be on track to achieve the hydrosystem performance standards of 96 and 93 percent average dam survival for spring and summer migrating fish, respectively.
    - In response to reduced juvenile fish survival due to avian predation at John Day Dam observed during the summer 2008, an expanded avian deterrent wire array was installed downstream of the dam and predator hazing efforts were increased. Future actions will include installing a new spillway deflector in spillbay 20, which will allow more flexibility in spill operations and may help further reduce avian predation by allowing smolts to exit the tailrace faster.
- Mean PIT tag in-river juvenile survival estimates for Upper Columbia River steelhead and Snake River steelhead were higher than mean COMPASS estimates. Snake River Chinook PIT tag mean estimate was the only estimate lower than mean COMPASS estimates, and was within the 95 percent confidence interval (i.e, the difference was not statistically significant). These results suggest that steelhead may be deriving more benefits from recently installed surface flow weirs compared to Chinook. Improvements planned to deter predation near dams (avian wires and egress improvements) are expected to result in additional benefits to all species.
- Survival rates of ESA-listed adult Chinook and steelhead through the FCRPS dipped below adult passage performance standards in 2009 for five of the six stocks. Three of the five stocks that fell short of the BiOp performance standard were within five percent. Two stocks, Snake River spring/summer Chinook salmon ESU and Snake River steelhead DPS, were significantly outside the adult performance standard. Adult system survival reductions may be related to modifications made at dams to improve juvenile outmigration, injuries and mortalities related to sea lion predation, unquantifiable levels of mortality related to fisheries, and unaccounted levels of straying.
- Adult return data continue to confirm that smolt transportation during May is correlated with higher adult steelhead returns than is in-river migration and somewhat higher returns for Chinook. Nevertheless, under adaptive management (as discussed with the Regional Implementation Oversight Group), the Action Agencies are continuing to spill during this time period (May 7-20) and monitoring the adult return data to see whether this relationship changes based on improved in-river conditions.
- Pursuant to court-ordered operations, spill continued through August 31, 2009. For comparison, under 2008

BiOp criteria, spill in August at Snake River dams may be curtailed on or after August 1 to coincide with juvenile fish migration. The range of spill curtailment dates for Lower Granite Dam observed in recent years using BiOp criteria has ranged from as early as August 1 to as late as August 31. According to August spill curtailment criteria, spill would have been curtailed on August 3 at Lower Granite Dam, August 12 at Little Goose Dam, August 15 at Lower Monumental Dam, and August 17 at Ice Harbor Dam.

For habitat actions, the Action Agencies have observed the following:

- The habitat program structure, which consists of biologically targeted projects, assessment of habitat quality improvements, use of expert panels, and independent scientific review, is under way and functioning well overall.
  - Hundreds of on-the-ground actions were completed throughout the Columbia Basin in 2009 to improve tributary spawning and rearing habitat for numerous populations of salmon and steelhead. Many new projects are being prepared for future implementation.
  - Several estuary projects were successfully completed in 2009. A few are behind schedule but are scheduled for completion in 2010. Many new estuary projects are under development for completion in 2011-2012.
- Tangible habitat benefits are being achieved by specific projects. For example:
  - Idaho Department of Water Resources developed agreements with local landowners to secure over 1,800 acre-feet of water annually to increase streamflows in the Lemhi River by 25-35 cfs during spring and summer migration periods.
  - The Sandy River Project is part of a larger 1,500-acre long-term restoration project. In 2009, 201 acres of riparian habitat along 1.2 stream miles were planted with native vegetation; 35 acres of riparian shrubs were planted; and 45 acres of native vegetation were maintained. Sandy River Delta historically was a wooded, riparian wetland with components of ponds, sloughs, bottomland woodland, oak woodland, prairie, and low- and high-elevation floodplain. Restoration of historical landscape components is a primary goal for this land, with current focus on restoration of riparian forest and wetlands.
  - In the estuary, long-term action effectiveness is ongoing for four habitat restoration projects, and the data/information being collected will be compared to reference sites. The data collected from the action effectiveness monitoring will aid in adaptively managing estuary restoration.

For predator management, the Action Agencies have observed the following:

- Predation continues to be a serious issue for the survival of both juvenile and adult salmon and steelhead. Future management actions must focus on controlling predation by native and non-native species.
- Predation by Caspian terns on juvenile fish continues to suggest that successfully relocating much of the tern nesting colony away from East Sand Island, where fish are most vulnerable to predation, will reduce mortality of juvenile salmonids. Diet studies have shown that steelhead smolts appear to be particularly vulnerable to predation, especially by Caspian terns.
- However, total avian predation on young fish has increased as a result of a nearly threefold expansion of a colony of double-crested cormorants on East Sand Island and predation by terns and cormorants from other colonies (Crescent Island, Rock Island, Foundation Island, Potholes Reservoir, etc.). Successful management of avian predation must be based on a broader framework, both in terms of the geographical area covered and the community of all potential avian predators present within that area. In recognition of the seriousness of this issue, the Action Agencies will be working with the RIOG to discuss and identify potential management actions.
- Predation by northern pikeminnow is being successfully controlled, with significant survival benefits. Examination of predation by non-native species, such as shad, walleye, and bass, is under way. Management of non-native species predation may conflict with state management of exotic warm-water game species (walleye, largemouth and smallmouth bass, Northern pike, catfish, etc.) for sport fisheries. Action agencies must proceed with sensitivity to other management jurisdictions through well designed basic research within this topic area.
- The amount of fish eaten by sea lions continued to increase in 2009, with an expanded catch estimate of 4,489 adult salmon and steelhead. Increases in Stellar sea lion abundance and salmon predation in 2009 may be countering some of the expected reductions from efforts by the states to remove sea lions.

For hatchery actions, the Action Agencies have observed the following:

- The Snake River sockeye captive broodstock and conservation/ supplementation program returned high numbers of adult fish in 2008 and 2009. This indicates that conditions have potentially moved from handfuls of adult fish on the brink of extinction to a more stable base for this program, which will be expanded in future years under the BiOp.
- The Hatchery Scientific Review Group process that concluded in 2009 developed useful guidelines for hatchery reforms, although each hatchery facility will need to be considered case by case.
- Reconditioning of wild-born female kelt steelhead may increase the abundance of repeat spawners, but there is not yet enough information from ongoing research

For harvest, the Action Agencies have observed the following:

- In the Colville selective fisheries study, the immediate release survival of summer/fall Chinook and steelhead was assessed for three gear types. Mortality was lowest for fish captured in the purse and beach seines (100 and 99 percent immediate release survival, respectively), compared to traditional hoop, dip, and tangle nets, which had only an 80 percent immediate release survival. Pursuit of purse-seining for longer-term post research is currently planned for the Confederated Colville Tribes. Test of the technology in the lower Columbia River below Bonneville Dam in the non-treaty commercial salmon fishery occurred in 2009.

Regarding fish status, the Action Agencies have observed the following:

- Adult fish returns in 2009 were good, with counts of adult and jack summer Chinook, fall Chinook, and sockeye passing Bonneville Dam all exceeding the 10-year average; spring Chinook, steelhead, and coho counts being below the 10-year average. The Snake River sockeye return was particularly strong with a record 1,219 adults counted at Lower Granite Dam. Snake River steelhead returns also broke records for both the overall return and the wild component of the run. This is likely a result of both the survival improvements made in recent years and excellent ocean conditions. It is not likely that current levels will be sustained, and future variability is expected. Action Agencies will be looking for overall trends that are stable and increasing at the species level.

Working with the Region

Regional efforts to protect and recover threatened and endangered fish in the Columbia River Basin reflect the complex life cycles of the fish themselves. Progress has been made each year by building on successful efforts in previous years. It will take many years to rebuild sustainable populations of some species.

The Action Agencies work with regional interests to improve regional coordination and collaboration, and to implement actions to strengthen Columbia River Basin salmon and steelhead stocks. Tribal, state, and federal agency representatives are jointly looking at options for a better way to stabilize salmon and steelhead populations in the Columbia River Basin and bring these fish back to sustainable levels. The Action Agencies work closely with the region through the federal-state-tribal Regional Implementation Oversight Group (RIOG), the Columbia Basin Fish Accords, and NPCC's Fish and Wildlife Program.

Regional Implementation Oversight Group

In 2008, the RIOG was established to provide high-level policy review for the Columbia River Basin—to discuss and coordinate implementation of the FCRPS and related BiOps. The RIOG is the successor to the Policy Working Group formed in 2005 to address court concerns and collaborate on development of the BiOp. The RIOG involves federal, state, and tribal agencies actively engaged in salmon recovery efforts. The group reviews the Action Agencies' progress reports under the BiOp, considers adaptive management decisions based on emerging scientific information, evaluates contingency plans, and helps to resolve policy and technical disputes. The group encourages collaboration, accountability, and transparency for BiOp implementation. The RIOG structure includes technical subgroups for each H (e.g., the Technical Management Team or TMT) to support regional review.

Columbia Basin Fish Accords

In 2008, the Action Agencies entered into the Columbia Basin Fish Accords with the Confederated Tribes of the Warm Springs Reservation of Oregon, the Confederated Tribes of the Umatilla Indian Reservation, the Confederated Tribes and Bands of the Yakama Nation, the CRITFC, the Confederated Tribes of the Colville Indian Reservation, the Shoshone-Bannock Tribes of Fort Hall, and the states of Idaho and Montana. In addition, in 2009, the Action Agencies entered into an Estuary Habitat Memorandum of Agreement with the state of Washington. These historical, long-term agreements are intended to support and strengthen RPA implementation, foster cooperation and partnership, and advance fish recovery for all. These partnerships help accomplish "on-the-ground" implementation of actions that are beneficial to listed fish.

In 2009, tribal, state, and federal partners implemented new projects and expanded existing projects under the Columbia Basin Fish Accords. Projects under way include improvements in passage and assurance of sufficient water for the Walla Walla River's salmon populations, recovery of sockeye runs in Redfish Lake, installation of lamprey passage systems at Bonneville Dam, and numerous other projects designed to restore critical habitat from the estuary to the tributaries.

Northwest Power and Conservation Council Fish and Wildlife Program

Under the Northwest Power Act, the NPCC works to protect, mitigate, and enhance Columbia River Basin fish and wildlife and their related spawning grounds and habitat that have been affected by hydropower development. The council's Columbia Basin Fish and Wildlife Program guides BPA's funding and must be taken into account by all federal agencies that manage, operate, or regulate hydropower dams in the basin. The Council's amended program (finalized in 2009) can be found at *http://www.nwcouncil.org/library/2009/2009-09/Default.asp*.

Conclusion

In 2009, as the result of a multi-year collaboration process, the Action Agencies continued the second year of implementing the 2008 FCRPS BiOps. This progress report summarizes the second year of implementation. Major dam improvements occurred, acres of habitat were improved, predators were controlled, and fish status overall was good. Working with our regional partners, the Action Agencies will build on these accomplishments in the years ahead.

For More Information on Regional Efforts:

- Pacific Coastal Salmon Recovery Fund: *http://www.nwr.noaa.gov/Salmon-Recovery-Planning/PCSRF/*
- Columbia River Inter-Tribal Fish Commission: *http://www.critfc.org*
- Upper Columbia United Tribes: *http://www.ucut.org*
- Columbia Basin Fish and Wildlife Authority: *http://www.cbfwa.org*
- Northwest Power and Conservation Council: *http://www.nwcouncil.org*
- Oregon Watershed Enhancement Board: *http://www.oregon.gov/OWEB/index.shtml*
- Washington Salmon Recovery Office: *http://www.rco.wa.gov/salmon_recovery/gsro.shtml*
- Idaho Office of Species Conservation: *http://www.species.idaho.gov*
- Federal Columbia River Power System 2008 Annual Report, website links, and more information on federal agency efforts for salmon and steelhead: *http://www.salmonrecovery.gov*

Endangered Species Act
Federal Columbia River Power System
2009 Annual ESA Progress Report: Section 2

Reasonable and Prudent Alternative (RPA) Summary Table: Actions and Accomplishments

Adaptive Management Actions

RPA No.	Action Description	2009 Actions and Accomplishments
The Action Agencies will continue collaborating with states and tribes in the implementation of RPA actions, progress reporting, and adaptive management using regional forums such as the Regional Implementation Oversight Group, as described in their Biological Assessment, Section 2.1.		
1	***Implementation Plans*** *The Corps, BPA, and Reclamation will collectively submit to NOAA Fisheries Action Implementation Plans by the end of December 2009, December 2013, and December 2016 that detail commitments to implement actions during subsequent years. Specifically, that Action Implementation Plans will describe the tributary and estuary habitat actions that will be funded during the 2010-2013, 2014-2016, and 2017-2018 periods. The Implementation Plans will take into account pertinent new information on climate change and effects of that information on limiting factors and project prioritization. The Action Implementation Plans will also detail any changes in hydro, predation management, hatchery, or RM&E RPA actions from the actions described in this RPA for each time period. This information will assist NOAA Fisheries in determining if the RPA is being implemented as identified in this Biological Opinion or, conversely, if re-initiation triggers defined in 50 CFR 402.16 have been exceeded.*	The Action Agencies took numerous steps aimed at developing the full set of actions for the 2010-2013 implementation plan, including establishing work groups to identify Research, Monitoring and Evaluation (RME) gaps. The agencies also reviewed and updated configuration and operation plans and convened expert panel workshops to identify and evaluate tributary and estuary habitat actions.
2	***Annual Progress Reports*** *The Corps, BPA, and Reclamation will submit to NOAA Fisheries Annual Progress Reports in September of all years except 2013 and 2016. The reports will cover operations for the previous calendar year. These Annual Progress Reports will describe the status of implementing all actions as of the end of the previous calendar year. For example, the 2009 RPA Progress report will describe the status of actions through December 2008. In addition to RPA action implementation status, the*	Completed and distributed 2008 Progress Report. That report was posted to http://www.salmonrecovery.gov on December 21, 2009.

Adaptive Management Actions

RPA No.	Action Description	2009 Actions and Accomplishments
	Annual Progress Reports will describe the status of physical or biological metrics monitoring (as described in the RM&E). Annual progress reports will include a summary of the annual forecast review and also summarize any new, pertinent climate change information or research. This information will assist NOAA Fisheries in determining if the RPA is being implemented as anticipated in this Biological Opinion or, conversely, if re-initiation triggers defined in 50 CFR 402.16 have been exceeded.	
3	***Comprehensive RPA Evaluations*** *The Corps, BPA, and Reclamation will submit to NOAA Fisheries Comprehensive RPA Evaluation of multi-year implementation activities by the end of June 2013 and June 2016. The Comprehensive Evaluations shall review all implementation activities through the end of the previous calendar year (as would be covered in the Annual Progress Report) and compares them to scheduled completion dates as identified in this RPA or modified in the Implementation Plans in 2009, 2013 and 2016. The Comprehensive Evaluations will also describe the status of the physical and biological factors identified in this RPA, and compare these with the expectations in the survival improvements identified in the Comprehensive Analysis or Supplemental Comprehensive Analysis. Physical and biological factors will include new information on climate change and its effects on listed salmon and steelhead. The Comprehensive Evaluation will include a discussion of the Action Agencies' plan to address any shortcomings of current estimated survival improvements as compared to the original survival estimates identified in the Comprehensive Analysis referenced in this Biological Opinion. This information will assist NOAA Fisheries in determining if the RPA is being implemented as anticipated in this Biological Opinion or, conversely, if re-initiation triggers defined in 50 CFR 402.16 have been exceeded.*	Agencies continued the preliminary planning begun in 2008.

Hydro Actions

RPA No.	Action Description	2009 Actions / Accomplishments
Hydropower Strategy 1—Operate the FCRPS to Provide Flows and Water Quality to Improve Juvenile and Adult Fish Survival		
The overall hydropower objective for all ESUs is to improve the survival of juvenile and adult fish as they pass through the hydrosystem. The Action Agencies will pursue four strategies to meet this overall objective: ▪ Hydropower Strategy 1—Operate the FCRPS to provide flows and water quality to improve juvenile and adult fish survival ▪ Hydropower Strategy 2—Modify Columbia and Snake River dams to maximize juvenile and adult fish survival ▪ Hydropower Strategy 3—Implement spill and juvenile transportation improvements at Columbia River and Snake River dams ▪ Hydropower Strategy 4—Operate and maintain facilities at Corps mainstem projects to maintain biological performance **Each strategy consists of one or more specific actions. These are summarized in the following sections.**		
4	***Storage Project Operations*** *The Action Agencies will operate the FCRPS storage projects (Libby, Hungry Horse, Albeni Falls, Grand Coulee and Dworshak projects) for flow management (see FCRPS Biological Assessment, Appendix B.2-1, for pertinent discussion and Table B.2.1-2 for a summary of seasonal flow objectives and planning dates for the mainstem Columbia and Snake rivers) to aid anadromous fish. Specific operations for each storage project are identified in Table 1 below. These storage project operations will be included in the Water Management Plan. These projects are operated for multiple purposes including fish and wildlife, flood control, irrigation, navigation, power, and recreation. Table 1 primarily identifies operations that are designed to benefit flow management specifically for listed species. For more detail on the operation of storage projects for other purposes see Appendix B.1.*	The Federal Columbia River Power System (FCRPS) storage projects were operated in accordance with the 2009 Water Management Plan (WMP), which was developed in the fall 2008 with full Regional Forum coordination. Under the 2009 WMP the operation of FCRPS projects was based on the 2008 National Oceanic and Atmospheric Administration (NOAA) Fisheries Biological Opinion (BiOp) and the 2000 and 2006 USFWS BiOps. As in 2008, 2009 operations continued under court order, and there were some differences between the 2009 operations and those called for by the noted BiOps. Details regarding the operation of storage projects are included in Section 3.

Hydro Actions

RPA No.	Action Description	2009 Actions / Accomplishments
Hydropower Strategy 1—Operate the FCRPS to Provide Flows and Water Quality to Improve Juvenile and Adult Fish Survival		
5	***Lower Columbia and Snake River Operations*** *The Action Agencies will operate the FCRPS run-of-river mainstem lower Columbia River and Snake River projects (Bonneville, The Dalles, John Day, McNary, Ice Harbor, Lower Monumental, Little Goose and Lower Granite projects) to minimize water travel time through the lower Columbia and Snake rivers to aid in juvenile fish passage as defined below. These projects are operated for multiple purposes including fish and wildlife, irrigation, navigation, power, recreation, and limited flood control. The following description primarily identifies operations that are designed to benefit listed anadromous species.*	These projects were operated consistent with the 2009 WMP, Fish Passage Plan (FPP), and Fish Operations Plan (FOP), all of which were developed collaboratively with the region. Specific operations to benefit listed anadromous species are described below.
	▪ *Lower Snake River projects (Ice Harbor, Lower Monumental, Little Goose and Lower Granite projects) will be operated at minimum operating pool (MOP) with a 1-foot operating range from April 3 until small numbers of juvenile migrants are present (approximately September 1) unless adjusted to meet authorized project purposes, primarily navigation. Lower Granite reservoir may be raised as needed after September 1, in order to operate the adult fish holding facilities to support brood stock collection.*	The lower Snake River projects were operated at minimum operating pool (MOP) from April 7 through September 3, 2009, except for a few instances of short duration related to navigation safety of fish barges. Timing of the MOP operations was fully coordinated through the Technical Management Team (TMT) process.
	▪ *Except for the John Day Project, the Lower Columbia River projects (Bonneville, The Dalles, and McNary) will be operated at normal operating range for each project. John Day Reservoir will be operated at the lowest elevation (elevation 262.5 to 264.0) (with a 1.5-foot operating range) that continues to allow irrigation withdrawals from April 10 through September 30. Slight deviations from these levels, based on navigation needs, load following, and operational sensitivity, may be required on occasion.*	John Day Dam was operated 262.5–264 ft from April 10 through September 30, 2009.
	▪ *These run-of-river operations will be included in the annual WMP.*	The operations were included in the annual WMP.

Hydro Actions

RPA No.	Action Description	2009 Actions / Accomplishments
Hydropower Strategy 1—Operate the FCRPS to Provide Flows and Water Quality to Improve Juvenile and Adult Fish Survival		
6	***In-Season Water Management*** *Prioritization of the use of flow augmentation water is done through in-season management by the Regional Forum (see FCRPS BA Appendix B.2.1). Each fall, the Action Agencies will prepare an annual Water Management Plan (WMP) and seasonal updates that describe planned hydrosystem fish operations for the upcoming fall and winter, and for the spring, and summer passage seasons. The annual WMP strives to achieve the best possible mainstem passage conditions, recognizing the priorities established in the FCRPS BA and the need to balance the limited water and storage resources available in the region. Fall/winter and spring/summer updates are prepared as more data is available on the water conditions for that year.*	In the fall 2008 the Action Agencies developed the WMP for 2009 operations. That report can be accessed at http://www.nwd-wc.usace.army.mil/tmt/documents/wmp/2009/. In the fall 2009 the Action Agencies developed the WMP for 2010 operations, as detailed below. That report can be accessed at http://www.nwd-wc.usace.army.mil/tmt/documents/wmp/2010.
	A draft update of the WMP will be prepared by October 1 each year, with a final plan completed by January 1.	A draft of the 2010 plan was released on October 1, 2009. The final 2010 plan was released on December 31, 2009.
	The fall/winter update to the WMP will be drafted by November 1 and finalized by January 1	A fall/winter update to the draft 2010 plan was released on November 1, 2009.
	A draft of the spring/summer update to the WMP will be prepared by March 1 and finalized by May 15.	A draft spring/summer update to the 2009 plan was released on March 1, 2009. The finalized update was released on May 15, 2009.
7	***Forecasting and Climate Change/Variability*** *The Action Agencies will hold annual forecast performance reviews looking at in-place tools for seasonal volume forecasts and to report on the effectiveness of experimental or developing/emerging technologies and procedures. As new procedures and techniques become available and are identified to have significant potential to reduce forecast error and improve the reliability of a forecast, the Action Agencies will discuss the implementation possibilities with regional interests. The purpose is to improve upon achieving upper rule curve elevations by reducing forecasts errors and thereby providing for improved spring flows.*	The Columbia River Forecast Group (CRFG) spent most of 2009 on developing a charter and organizational structure as well as organizing expectations and a strategy for the group. Two workshops were held to review the performance of the previous year's forecasts and to hear speakers on various topics related to water supply forecasting. The first workshop was in March 2009 (to review water year 2008), and a second was held in December 2009 (to review water year 2009). Toward the end of 2009, the group developed a workplan for 2010 to address specific issues surrounding water supply forecasting and implementation. In general the 2010 workplan includes: ▪ Working with the U.S. Army Corps of Engineers (Corps) on its efforts to improve the water supply forecast equations for Libby

Hydro Actions

RPA No.	Action Description	2009 Actions / Accomplishments
Hydropower Strategy 1—Operate the FCRPS to Provide Flows and Water Quality to Improve Juvenile and Adult Fish Survival		
		Dam through evaluation of various climate indices. ▪ Working with the Bonneville Power Administration (BPA) and the Columbia River Treaty Hydrometeorological Committee (CRTHC) to look at the benefits of additional snow pillows in the Columbia Basin in British Columbia. ▪ Working with the Corps and U.S. Bureau of Reclamation (Reclamation) to assess the benefits of mid-month water supply forecast updates. The effort entails looking a two test locations, Hungry Horse and Dworshak. ▪ Develop an Annual Report and report format for the CRFG that includes an appendix which will track water supply forecast performance each year.
	The Action Agencies will work collaboratively with other agencies and research institutions to investigate the impacts of possible climate change scenarios to the Pacific Northwest and listed salmon and steelhead. Focus areas will cover 1) modeling the hydrology and operations of the Columbia River system using possible future climate change scenarios, 2) investigating possible adaptation strategies for the system, 3) monitoring the hydrologic system for trends, cycles, and changes, and 4) staying abreast of research and studies that address climate cycles, trends, and modeling.	Acting in coordination under the Reservoir Management Joint Operating Committee (RMJOC), BPA, the Corps, and Reclamation are collaborating to adopt a climate change and hydrology dataset for longer-term planning activities in the Columbia-Snake River Basin (CSRB). In addition to these data, these agencies are working together to adopt a set of methods for incorporating these data into longer-term planning activities. The purpose of adopting such data and methods is to promote consistent incorporation of regional climate projection information in the agencies' planning efforts, and to promote efficient development of these data and methods by pooling agency resources. The study officially began in October 2009 and is scheduled to be complete by September 2010.
8	***Operational Emergencies*** *The Action Agencies will manage interruptions or adjustments in water management actions, which may occur due to unforeseen power system, flood control, navigation, dam safety, or other emergencies. Such emergency actions will be viewed by the Action Agencies as a last resort and will not be used in*	There were no operational emergencies in 2009.

Hydro Actions

RPA No.	Action Description	2009 Actions / Accomplishments
Hydropower Strategy 1—Operate the FCRPS to Provide Flows and Water Quality to Improve Juvenile and Adult Fish Survival		
	place of operations outlined in the annual WMP. Emergency operations will be managed in accordance with TMT Emergency Protocols, the Fish Passage Plan (FPP) and other appropriate Action Agencies emergency procedures. The Action Agencies will take all reasonable steps to limit the duration of any emergency impacting fish.	
9	***Fish Emergencies*** *The Action Agencies will manage operations for fish passage and protection at FCRPS facilities. They may be modified for brief periods of time due to unexpected equipment failures or other conditions. These events can result in short periods when projects are operating outside normal specifications due to unexpected or emergency events. Where there are significant biological effects of more than short duration resulting from emergencies impacting fish, the Action Agencies will develop (in coordination with the inseason management Regional Forum (see BA Appendix B.2.1) and implement appropriate adaptive management actions to address the situation. The Action Agencies will take all reasonable steps to limit the duration of any fish emergency.*	Two fish emergencies occurred during 2009, one at Lower Granite Dam and one at McNary Dam: Lower Granite Dam: Fish collection for routine transport temporarily stopped on May 22 due to excessive debris entering the collection system and clogging the incline dewatering screen, causing injury and mortality to fish present in the collection system. COE personnel calculate that over 500,000 juvenile salmonids passed Lower Granite on May 22 with 721 juvenile mortalities, plus an undetermined number of impacted fish that exited the bypass system. Fish collection for transport operations resumed on May 25 after debris levels subsided. McNary Juvenile Fish Facility: Water temperatures increased rapidly on July 16-18, 2009, stressing fish passing through the system and elevating mortality. The north powerhouse turbine unit operating priority began on July 17 for temperature abatement. The facility switched to primary bypass on July 22-23. On July 21, several regional fish managers submitted a System Operational Request (SOR) to the TMT requesting an increase in spill from 50 percent to 24-hour spill to the gas cap, in order to pass as many fish as possible via the spillway. Gas cap spill at began at 1300 hours on July 22, 2009. At 1300 hours on July 24, the COE achieved all the criteria outlined in the SOR and resumed 50 percent spill. Fish transport operations changed from alternate-day departures to daily departures on July 24, reducing fish holding times in the raceways. By July 24, fish mortalities returned to the normally observed low levels.

Hydro Actions

RPA No.	Action Description	2009 Actions / Accomplishments
Hydropower Strategy 1—Operate the FCRPS to Provide Flows and Water Quality to Improve Juvenile and Adult Fish Survival		
		In both instances, actions were coordinated with the Regional Forum through the TMT process.
10	***Columbia River Treaty Storage*** *BPA and the Corps will pursue negotiations with Canada of annual agreements to provide 1 MAF of storage in Treaty space by April 15 consistent with:* ▪ *Providing the greatest flexibility possible for releasing water to benefit U.S. fisheries May through July.* ▪ *Giving preference to meeting April 10 upper rule curve elevation or achieving refill at Grand Coulee Dam over flow augmentation storage in Canada in lower water supply conditions.* ▪ *Releasing flow augmentation storage to avoid causing damaging flow or excessive TDG in the United States or Canada.*	The Columbia River Treaty Operating Committee Agreement on Operation of Treaty Storage for Non-Power Uses for December 15, 2008, through July 31, 2009, (Non-Power Uses Agreement) was executed on December 20, 2008. Under this agreement, 1 million acre-feet (MAF) of flow augmentation water was stored in Mica Reservoir during January .2009. All flow augmentation storage was released by July 31, 2009, under the Non-Power Uses Agreement.
	▪ *BPA and the Corps will coordinate with Federal agencies, States and Tribes on Treaty operating plans*	Treaty operations were coordinated during fall 2009 stakeholder briefings.
11	***Non-Treaty Storage (NTS)*** *BPA, in concert with BC Hydro, will refill the remaining non-Treaty storage space by June 30, 2011, as required under the 1990 non-Treaty storage agreement. Refill will be accomplished with minimal adverse impact to fisheries operations.*	Progress was made in return of non-Treaty Storage (NTS), with BPA filling to nearly match the BC Hydro storage. At the end of 2009, the BC Hydro account remained at 88.4 percent of full and the U.S. parties' accounts stood at 88.3 percent full. BPA filled 223 ksfd between September 2008 and February 2009, with no activity in the accounts after February for the balance of the year. (A "ksfd" is a thousand-second-foot-day, a volume of water sufficient to provide a flow of 1,000 cubic feet per second for a 24-hour period, or approximately 1983 acre-feet.)

Hydro Actions

RPA No.	Action Description	2009 Actions/Accomplishments
Hydropower Strategy 1—Operate the FCRPS to Provide Flows and Water Quality to Improve Juvenile and Adult Fish Survival		
12	***Non-Treaty Long-Term Agreement*** *BPA will seek to negotiate a new long-term agreement on use of non-Treaty space in Canada so long as such an agreement provides both power and non-power benefits for BC Hydro, BPA, and Canadian and U.S. interests. As part of these negotiations, BPA will seek opportunities to provide benefits to ESA-listed fish, consistent with the Treaty.*	Before approaching BC Hydro to negotiate a new long-term NTS agreement, BPA has committed to the following: ▪ Substantially refilling the U.S. account ▪ The dry year strategy work group defining potential use of NTS in dry years ▪ Coordinating with federal agencies, states, and tribes under the BiOp ▪ Coordination with tribes under the Fish Accords ▪ Establishing the collective U.S. interests in terms of such a new NTS agreement In addition, BC Hydro has agreed to coordinate with Canadian stakeholders on reservoir impacts in Canada. Stakeholder coordination in Canada and the United States began in the fall of 2009.
	If a new long-term non-Treaty agreement is not in place, or does not address flows for fisheries purposes, BPA will approach BC Hydro about possibly negotiating an annual/seasonal agreement to provide U.S. fisheries benefits, consistent with the Treaty.	An annual NTS agreement was negotiated in 2009 between BPA and B.C. Hydro. During June 2009 a total of 56 ksfd was stored in order to reduce inflow to Grand Coulee during the peak of the freshet period. This storage was released from late July through early September.
13	*Non-Treaty Coordination with Federal Agencies, States, and Tribes* *Prior to negotiations of new long-term or annual non-Treaty storage agreements, BPA will coordinate with Federal agencies, States, and Tribes to obtain ideas and information on possible points of negotiation, and will report on major developments during negotiations.*	No long-term storage agreement was negotiated in 2009, however coordination continued with federal agencies, states and tribes to obtain information, ideas, and viewpoints for possible future negotiations.
14	***Dry Water Year Operations*** *Flow management during dry years is often critical to maintaining and improving habitat conditions for ESA-listed species. A dry water year is defined as the lowest 20th percentile years based on the Northwest River Forecast Center's (NWRFC) averages for their statistical period of record (currently 1971*	(See below)

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Hydropower Strategy 1—Operate the FCRPS to Provide Flows and Water Quality to Improve Juvenile and Adult Fish Survival		
	to 2000) using the May final water supply forecast for the April to August period as measured at The Dalles. The Action Agencies will complete the following activities to further the continuing efforts to address the dry flow years:	
	▪ *Within the defined "buckets" of available water (reservoir draft limits identified in RPA Action 4), flexibility will be exercised in a dry water year to distribute available water across the expected migration season to optimize biological benefits and anadromous fish survival. The Action Agencies will coordinate use of this flexibility in the Regional Forum TMT*	No action; water year 2009 did not meet the definition of a dry year.
	▪ *In dry water years, operating plans developed under the Treaty may result in Treaty reservoirs being operated below their normal refill levels in the late spring and summer, therefore, increasing flows during that period relative to a standard refill operation.*	No action; water year 2009 did not meet the definition of a dry year.
	▪ *Annual agreements between the U.S. and Canadian entities to provide flow augmentation storage in Canada for U.S. fisheries needs will include provisions that allow flexibility for the release of any stored water to provide U.S. fisheries benefits in dry water years, to the extent possible.*	No specific provisions for dry water year operations were needed or included in the agreement for 2009.
	▪ *BPA will explore opportunities in future long-term NTS storage agreements to develop mutually beneficial in-season agreements with BC Hydro to shape water releases using NTS space within the year and between years to improve flows in the lowest 20th percentile water years to the benefit of ESA-listed ESUs, considering their status.*	See RPA action 12 above. These commitments also apply to potential dry water year provisions in the potential new long-term NTS agreement.
	▪ *Upon issuance of the FCRPS Biological Opinion, the Action Agencies will convene a technical workgroup to scope and initiate investigations of alternative dry water year flow strategies to enhance flows in dry years for the benefit of ESA-listed ESUs.*	The dry year strategy work group met on November 19, 2009.
	▪ *In very dry years, the Action Agencies will maximize transport for Snake*	No action; water year 2009 did not meet the definition of a dry year.

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RPA No.	Action Description	2009 Actions/Accomplishments
Hydropower Strategy 1—Operate the FCRPS to Provide Flows and Water Quality to Improve Juvenile and Adult Fish Survival		
	River migrants in early spring, and will continue transport through May 31 (see RPA 30).	
	▪ *BPA will implement, as appropriate, its Guide to Tools and Principles for a Dry Year Strategy to reduce the effect energy requirements may pose to fish operations and other project purposes.*	No action; water year 2009 did not meet the definition of a dry year.
15	***Water Quality Plan for Total Dissolved Gas and Water Temperature in the Mainstem Columbia and Snake Rivers*** *The Action Agencies will continue to update the Water Quality Plan for Total Dissolved Gas and Water Temperature in the Mainstem Columbia and Snake Rivers (WQP) and implement water quality measures to enhance ESA-listed juvenile and adult fish survival and mainstem spawning and rearing habitat. The WQP is a comprehensive document which contains water quality measures needed to meet both ESA and Clean Water Act responsibilities. For purposes of this RPA, the WQP will include the following measures to address TDG and water temperature to meet ESA responsibilities:*	The Action Agencies released an update of the Water Quality Plan (WQP) in January 2009.
	▪ *Real-time monitoring and reporting of TDG and temperatures measured at fixed monitoring sites,*	The Corps monitored and reported total dissolved gas (TDG) and temperature per the Corps Plan of Action for Dissolved Gas Monitoring, updated in 2009.
	▪ *Continued development of fish passage strategies with less production of TDG (e.g., removable spillway weirs [RSWs]) and update the SYSTDG model to reflect modifications to spillways or spill operations,*	▪ Continued construction of The Dalles 8-9 spillwall. Construction completed March 2010. ▪ Continued construction of John Day Spill Bay 21 flow deflector. Construction completed at end of first quarter 2010. ▪ Completed construction of Little Goose spillway weir, and flow deflectors in spill bays 1 and 8. ▪ A post-construction spill test was conducted to evaluate TDG production with the completed flow deflectors at Chief Joseph Dam.

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RPA No.	Action Description	2009 Actions / Accomplishments
Hydropower Strategy 1—Operate the FCRPS to Provide Flows and Water Quality to Improve Juvenile and Adult Fish Survival		
	▪ *Continued development and use of SYSTDG model for estimating TDG production to assist in real-time decision making, including improved wind forecasting capabilities as appropriate,*	The Corps evaluated the statistical distribution of the System Total Dissolved Gas (SYSTDG) model predictive errors. Wind forecast improvements were not incorporated into the SYSTDG in 2009.
	▪ *Continued development of the CE-QUAL-W2 model for estimating river temperatures from Dworshak Dam on the Clearwater and Upper Snake River near confluence with the Grand Ronde River (USGS Anatone gage) through the lower Snake River (all four Corps lower Snake River projects) to assist in real-time decision making for Dworshak Dam operations, and*	Used the model for real-time decision making for Dworshak storage releases for temperature moderation. Changes to the model were limited to enhancements and streamlining of input data to improve model execution.
	▪ *Expand water temperature modeling capabilities to include the Columbia River from Grande Coulee to Bonneville dams to better assess the effect of operations or flow depletions on summer temperatures*	Funding requests to support this effort were submitted in 2009. Initial work efforts are expected to begin in 2010.
	▪ *Investigate alternatives to reduce total mass loading of TDG at Bonneville Dam while maintaining juvenile survival performance, and*	Completed development of alternative spill operations. Testing expected to be carried out in 2010.
	▪ *Continued operation of lower Snake River projects at MOP.*	Snake River Projects were operated at MOP. Detail presented under RPA action 5.

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RPA No.	Action Description	2009 Actions / Accomplishments
Hydropower Strategy 1—Operate the FCRPS to Provide Flows and Water Quality to Improve Juvenile and Adult Fish Survival		
16	***Tributary Projects*** *The tributary projects that have not yet completed ESA Section 7 consultation are located in the Yakima, Okanogan, and Tualatin river basins. Reclamation will, as appropriate, work with NOAA Fisheries in a timely manner to complete supplemental, project-specific consultations for these tributary projects. These supplemental consultations will address effects on tributary habitat and tributary water quality, as well as direct effects on salmon survival in the tributaries. The supplemental consultations will address effects on mainstem flows only to the extent to which they reveal additional effects on the in-stream flow regime not considered in the FCRPS and Upper Snake River BA/Comprehensive Analysis.*	▪ Reclamation completed work on a draft supplement to the 2000 Biological Assessment (BA) for the Yakima Project. NOAA Fisheries and U.S. Fish and Wildlife Service (USFWS) have suggested that Reclamation should consider delaying submission of the supplement until issues associated with the Yakima Basin Work Group/Basin Study are resolved so that potential actions coming from those efforts can be incorporated into the supplement. ▪ NOAA Fisheries requested a time extension to complete work on the Okanogan Project BiOp, to which the Action Agencies agreed. During this period, Reclamation and NOAA Fisheries have been investigating the potential for refining the proposed action. ▪ The Tualatin BA was submitted to NOAA Fisheries in 2009. Clarifying information has also been provided to NOAA Fisheries for use in developing a BiOp for the Tualatin Project, now scheduled for completion in 2012.
17	***Chum Spawning Flows*** *Provide adequate conditions for chum spawning in the mainstem Columbia River in the area of the Ives Island complex and/or access to the Hamilton and Hardy Creeks for this spawning population:*	Chum spawning operations were consistent with the 2009 WMP discussed above. More details are included in Section 3, including a discussion of chum operations in the fourth quarter of 2009 for the next brood year.
	▪ *Provide a tailwater elevation below Bonneville Dam of approximately 11.5 feet beginning the first week of November (or when chum arrive) and ending by December 31, if reservoir elevations and climate forecasts indicate this operation can be maintained through incubation and emergence.*	Spawning protection levels for the 2008-2009 operation were established in coordination with TMT in 2008. Minutes for 2008 TMT meetings can be referenced at http://www.nwd-wc.usace.army.mil/tmt/agendas/2008/. Details on the operation began in the November 5 meeting minutes.
	▪ *Through TMT, if water supply is deemed insufficient to provide adequate mainstem spawning or continuous tributary access, provide, as appropriate, mainstem flow intermittently to allow fish access to tributary spawning sites if adequate spawning habitat is available in the tributaries.*	Water supply was sufficient for this operation.

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RPA No.	Action Description	2009 Actions / Accomplishments
Hydropower Strategy 1—Operate the FCRPS to Provide Flows and Water Quality to Improve Juvenile and Adult Fish Survival		
	▪ *Make adjustments to the tailwater elevation through the TMT process consistent with the size of the spawning population and water supply forecasts.*	Adjustments were coordinated through the TMT process. Minutes for TMT meetings can be referenced under Meeting Calendar at http://www.nwd-wc.usace.army.mil/tmt/agendas/2008/. Details on the operation began in the November 5 meeting minutes.
	▪ *After the completion of spawning, use the TMT process to establish the tailwater elevation needed to provide protection for mainstem chum redds through incubation and the end of emergence*	Chum incubation and emergence protection levels were established in coordination with the TMT in December 2008. Minutes for December TMT meetings can be referenced under Meeting Calendar at http://www.nwd-wc.usace.army.mil/tmt/agendas/2008/.
	▪ *If the emergence period extends beyond April 10th and the decision is made to maintain the tailwater, TMT will discuss the impacts of TDG associated with spill for fish in the gravel. Bonneville Dam typically starts its spring spill around April 10, but a delay in the start of spill may be needed.*	The April 1, 2009, TMT meeting minutes reflect that chum emergence was completed by that date. Those meeting minutes are at: http://www.nwd-wc.usace.army.mil/tmt/agendas/2009/0401min.pdf.
	▪ *Revisit the chum protection level decision at least monthly through the TMT process to assure it is consistent with the need to provide spring flows for listed Columbia and Snake River stocks.*	The chum protection level was periodically reviewed during the chum operations (which ran from October 2008 through April 2009) in the TMT process. Minutes for TMT meetings can be referenced under Meeting Calendar at http://www.nwd-wc.usace.army.mil/tmt/.

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RPA No.	Action Description	2009 Actions / Accomplishments
Hydropower Strategy 2—Modify Columbia and Snake River Dams to Maximize Juvenile and Adult Fish Survival[1]		
Once the Action Agencies meet hydrosystem performance standards, they will ensure overall system performance through appropriate monitoring and maintenance activities. The Action Agencies will decide on the tools needed to maintain performance after coordinating with NOAA Fisheries and the regional forum.		
18	***Configuration and Operational Plan for Bonneville Project*** *The Corps will consider all relevant biological criteria and prepare, in cooperation with NOAA Fisheries and the co-managing agencies, a Configuration and Operational Plan for the Bonneville Project (2008). As part of the first phase of modifications, the Corps will investigate, and implement the following reasonable and effective measures to reduce passage delay and increase survival of fish passing through the forebay, dam, and tailrace as warranted. Initial modifications will likely include:*	The initial Configuration and Operational Plan (COP) had already been completed at the time of the BiOp and was updated in 2008. The key objective of the COP is achievement and maintenance of hydro performance standards.
	Bonneville Powerhouse I ▪ *Sluiceway modifications to optimize surface flow outlet to improve fish passage efficiency (FPE) and reduce forebay delay (2009).*	Completed installation of automated sluice gates in spring 2009. Started removal of sluiceway divider wall in late 2009. Removal completed spring 2010.
	▪ *Minimum-gap turbine runner installation to improve survival of fish passing through turbines (2009)*	Continued turbine rehab. Final two units completed in 2010.
	Bonneville Powerhouse II ▪ *Screened bypass system modification to improve fish guidance efficiency (FGE) and reduce gatewell residence time (2008)*	Continued gathering data on gatewell injuries. Alternatives study scheduled for 2010/2011.
	▪ *Shallow BGS installation to increase Corner Collector efficiency and reduce forebay delay (prototype 2008)*	Completed second year of Behavioral Guidance System (BGS) testing.
	Bonneville Dam Spillway *Spillway operation or structure (e.g., spillway deflectors) modification to reduce injury and improve survival of spillway passed fish; and to improve conditions for upstream migrants (2013).*	Study of potential improvements was completed in 2008. No action taken in 2009 pending performance testing.

[1] Dates shown are scheduled planning dates for completion.

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RPA No.	Action Description	2009 Actions / Accomplishments
Hydropower Strategy 1—Operate the FCRPS to Provide Flows and Water Quality to Improve Juvenile and Adult Fish Survival		
	The COP will be updated periodically and modifications may be made as new biological and engineering information is gathered. The COP and modifications will be coordinated through the Regional Forum. Comments developed by NOAA Fisheries on the draft COPs shall be reconciled by the Corps in writing to NOAA Fisheries' satisfaction before release of the final COP. If Phase I actions fail to meet the intended biological targets, the COP will be updated to identify additional Phase II actions for further implementation.	COP was updated in 2008. No action needed in 2009.
19	***Configuration and Operational Plan for The Dalles Project*** *The Corps will consider all relevant biological criteria and prepare, in cooperation with NOAA Fisheries and the co-managing agencies, a Configuration and Operational Plan for The Dalles Project (2008). As part of the first phase of modifications, the Corps will investigate, and implement the following reasonable and effective measures to reduce passage delay and increase survival of fish passing through the forebay, dam, and tailrace as warranted. Initial modifications will likely include:*	The initial COP had already been completed at the time of the BiOp. The key objective of the COP is achievement and maintenance of hydro performance standards.
	▪ *Turbine operation optimization to improve overall dam survival (2011)*	Completed purchase of model turbine runner to be used in physical model for development of best operating point hypothesis. Also see RPA actions 27 and 55.6.
	▪ *Extended tailrace spill wall to increase direct and indirect survival of spillway passed fish (2010)*	Continued construction of 700-foot long spill wall between Bays 8 and 9. (Completed March 2010)
	The COP will be updated periodically and modifications may be altered as new biological and engineering information is gathered. The COP and modifications will be coordinated through the Regional Forum. Comments developed by NOAA Fisheries on the draft COPs shall be reconciled by the Corps in writing to NOAA Fisheries' satisfaction before release of the final COP. If Phase I actions fail to meet the intended biological targets, Phase II actions, as described in the FCRPS BA – Appendix B.2.1 will be considered for further	Completed preparation of update to the existing COP.

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RPA No.	Action Description	2009 Actions/Accomplishments
Hydropower Strategy 1—Operate the FCRPS to Provide Flows and Water Quality to Improve Juvenile and Adult Fish Survival		
	implementation.	
20	***Configuration and Operational Plan for John Day Project*** *The Corps will consider all relevant biological criteria and prepare, in cooperation with NOAA Fisheries and the co-managing agencies, a Configuration and Operational Plan for the John Day Project (2008). As part of the first phase of modifications, the Corps will investigate, and implement the following reasonable and effective measures to reduce passage delay and increase survival of fish passing through the forebay, dam, and tailrace as warranted. Initial modifications will likely include:*	Continued preparation of the COP addendum started in 2008. Completion expected in 2011.
	▪ *Full-flow bypass and PIT-tag detection installation to reduce handing stress of bypassed fish (2007)*	Action completed. A full-flow bypass and Passive Integrated Transponder (PIT)-detector were installed in 2007.
	▪ *Turbine operation optimization to improve overall dam survival (2011)*	▪ Developed hypothesis for best turbine operating point and initiated field study planning. (Study now intended for 2011.) ▪ See entries for RPA actions 27 and .55.6.
	▪ *Surface flow outlet(s) construction to increase FPE, reduce forebay delay and improve direct and indirect survival (prototype 2008 with final installation by 2013), and improve tailrace egress conditions.*	▪ Conducted second year of testing spillway weirs installed in 2009. Details are discussed in Section 3. ▪ Continued model study of tailrace improvement alternatives, including a tailrace flow deflector for Bay 20. ▪ Designed expanded avian deterrent wire array. Array installed spring 2010.
	The COP will be updated periodically and modifications may be altered as new biological and engineering information is gathered. The COP and modifications will be coordinated through the Regional Forum. Comments developed by NOAA Fisheries on the draft COPs shall be reconciled by the Corps in writing to NOAA Fisheries' satisfaction before release of the final COP. If Phase I actions fail to meet the intended biological targets, Phase II actions, as described in the FCRPS BA – Appendix B.2.1, will be considered for further implementation.	Continued work on the draft addendum to the COP. Finalization expected in 2011.

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RPA No.	Action Description	2009 Actions / Accomplishments
Hydropower Strategy 1—Operate the FCRPS to Provide Flows and Water Quality to Improve Juvenile and Adult Fish Survival		
21	***Configuration and Operational Plan for McNary Project*** *The Corps will consider all relevant biological criteria and prepare, in cooperation with NOAA Fisheries and the co-managing agencies, a Configuration and Operational Plan for the McNary Project (2009). As part of the first phase of modifications, the Corps will investigate, and implement the following reasonable and effective measures to reduce passage delay and increase survival of fish passing through the forebay, dam, and tailrace as warranted. Initial modifications will likely include:*	COP alternatives identified, screened, and ranked through the Regional Forum. Completion now expected in 2011.
	▪ *Turbine operation optimization to improve survival of fish passing through turbines (2013)*	A Biological Index Test (BIT) was planned for 2009 to evaluate operating turbines at the higher end of the 1 percent efficiency range at McNary dam. The evaluation was limited to operations within 1 percent due to concerns of potential gatewell descaling raised in the Studies Review Work Group (SRWG) forum. A gatewell descaling evaluation is being conducted in 2010 at McNary Dam. See entries for RPA actions 27 and .55.6.
	▪ *Improve debris management to reduce injury of bypass and turbine passed fish (2011)*	Initiated analysis of screen debris cleaning and descaling issues. Further data collection and analysis will be conducted in 2010.
	▪ *Relocate juvenile bypass outfall to improve egress, direct, and indirect survival on bypassed fish (2011)*	Continued bypass outfall development. Conducted physical and visual tracking data modeling. Modeling efforts narrowed potential site locations to a zone well downstream of the existing outfall.
	▪ *Surface flow outlet installation to increase FPE, reduce forebay delay, and improve direct and indirect survival (temporary structure testing in 2007 and 2008 to develop a permanent system)*	Third year of testing for spillway weirs installed in 2007. New configuration in 2009, with weirs placed in spillbays 4 and 20. Results are discussed in Section 3 under RPA Action 21.

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RPA No.	Action Description	2009 Actions / Accomplishments
Hydropower Strategy 1—Operate the FCRPS to Provide Flows and Water Quality to Improve Juvenile and Adult Fish Survival		
	The COP will be updated periodically and modifications may be altered as new biological and engineering information is gathered. The COP and modifications will be coordinated through the Regional Forum. Comments developed by NOAA Fisheries on the draft COPs shall be reconciled by the Corps in writing to NOAA Fisheries' satisfaction before release of the final COP. If Phase I actions fail to meet the intended biological targets, Phase II actions, as described in the FCRPS BA – Appendix B.2.1, will be considered for further implementation.	Continued work on the draft addendum to the COP. Finalization and approval expected in 2011.
22	***Configuration and Operational Plan for Ice Harbor Project*** *The Corps will consider all relevant biological criteria and prepare, in cooperation with NOAA Fisheries and the co-managing agencies, a Configuration and Operational Plan for the Ice Harbor Project (2008). As part of the first phase of modifications, the Corps will investigate, and implement the following reasonable and effective measures to reduce passage delay and increase survival of fish passing through the forebay, dam, and tailrace as warranted. Initial modifications will likely include:*	Completed draft COP and released for Regional Forum review in December 2008. Regional Forum review continued in 2009. Completion is now scheduled for 2011.
	▪ *Guidance screen modification to improve FGE (2010)*	Indefinitely deferred. This action was not included in the draft COP due to a lack of regional support.
	▪ *Turbine operation optimization to improve survival of turbine passed fish (2011)*	See entries for RPA actions 27 and 55.6.
	▪ *Spillway chute and/or deflector modification to reduce injury and improve survival of spillway passed fish through the RSW (2009)*	Continued design and hydraulic tests. Expanded scope to include consideration of PIT-tag system. (Chute and deflector modification is now planned for the winter of 2011-2012.) In 2009, passage behavior, passage distribution, and survival were evaluated using radio telemetry at Ice Harbor Dam for yearling Chinook, juvenile steelhead, and subyearling Chinook.
	▪ *Turbine unit 2 replacement to improve the survival of fish passing through turbines and reduce oil spill potential (2012)*	▪ Completed turbine runner design work. ▪ Advertised contract spring 2009. Contract awarded in 2010.

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RPA No.	Action Description	2009 Actions / Accomplishments
Hydropower Strategy 1—Operate the FCRPS to Provide Flows and Water Quality to Improve Juvenile and Adult Fish Survival		
	The COP will be updated periodically and modifications may be altered as new biological and engineering information is gathered. The COP and modifications will be coordinated through the Regional Forum. Comments developed by NOAA Fisheries on the draft COPs shall be reconciled by the Corps in writing to NOAA Fisheries' satisfaction before release of the final COP. If Phase I actions fail to meet the intended biological targets, Phase II actions, as described in the FCRPS BA – Appendix B.2.1, will be considered for further implementation.	Completed draft COP and released for Regional Forum review in December 2008. Regional Forum review continued in 2009. Completion is now scheduled for 2011.
23	***Configuration and Operational Plan for Lower Monumental Project*** *The Corps will consider all relevant biological criteria and prepare, in cooperation with NOAA Fisheries and the co-managing agencies, a Configuration and Operational Plan for the Lower Monumental Project (2010). As part of the first phase of modifications, the Corps will investigate, and implement the following reasonable and effective measures to reduce passage delay and increase survival of fish passing through the forebay, dam, and tailrace as warranted. Initial modifications will likely include:*	The COP for Lower Monumental Dam was rescheduled for completion in 2011. A spillway weir was installed in 2008 and a second year of biological performance testing was performed in 2009.
	▪ *Primary bypass operations with PIT-tag detection installation to reduce handling stress of bypassed fish (2007)*	Completed in 2007.
	▪ *Juvenile bypass system outfall relocation to improve egress, direct and indirect survival on bypassed fish (2011)*	Continued outfall development. Conducted egress and velocity model tests.
	▪ *Turbine operation optimization to improve the survival of fish passing through turbines (2013)*	See entries for RPA actions 27 and .55.6.
	▪ *RSW installation to improve FPE, reduce forebay delay, and improve direct and indirect survival (2008)*	Conducted second year of post-construction testing of spillway weir installed in 2008. Biological performance evaluation results are discussed in Section 3.

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RPA No.	Action Description	2009 Actions / Accomplishments
Hydropower Strategy 1—Operate the FCRPS to Provide Flows and Water Quality to Improve Juvenile and Adult Fish Survival		
	The COP will be updated periodically and modifications may be altered as new biological and engineering information is gathered. The COP and modifications will be coordinated through the Regional Forum. Comments developed by NOAA Fisheries on the draft COPs shall be reconciled by the Corps in writing to NOAA Fisheries' satisfaction before release of the final COP. If Phase I actions fail to meet the intended biological targets, Phase II actions, as described in the FCRPS BA – Appendix B.2.1, will be considered for further implementation.	COP rescheduled for completion in 2011.
24	***Configuration and Operational Plan for Little Goose Project*** *The Corps will consider all relevant biological criteria and prepare, in cooperation with NOAA Fisheries and the co-managing agencies, a Configuration and Operational Plan for the Little Goose Project (2009). As part of the first phase of modifications, the Corps will investigate, and implement the following reasonable and effective measures to reduce passage delay and increase survival of fish passing through the forebay, dam, and tailrace as warranted. Initial modifications will likely include:*	The COP was initiated in 2010 and will be completed in 2011.
	▪ *Turbine operation optimization to improve the survival of fish passing through turbines (2014)*	See entries for RPA actions 27 and .55.6.
	▪ *Primary bypass operations with PIT-tag detection installation to reduce handling stress of bypassed fish (2008)*	Completed installation of PIT-tag detectors in primary bypass pipe, prior to start of 2010 juvenile fish migration.
	▪ *Primary bypass outfall relocation to improve egress, direct and indirect survival on bypassed fish (2009)*	Continued construction of relocated bypass outfall. Construction was initiated in 2008. Construction was completed in early 2010, prior to start of juvenile fish migration.
	▪ *Surface spillway weir and deflector installation to improve FPE, reduce forebay delay and improve direct and indirect survival (2009)*	Installed surface spillway weir in spillbay 1, along with flow deflectors in spillbays 1 and 8, prior to start of juvenile fish migration season. Passage, survival, and direct injury evaluations are discussed in Part 3.

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RPA No.	Action Description	2009 Actions / Accomplishments
Hydropower Strategy 1—Operate the FCRPS to Provide Flows and Water Quality to Improve Juvenile and Adult Fish Survival		
	The COP will be updated periodically and modifications may be altered as new biological and engineering information is gathered. The COP and modifications will be coordinated through the Regional Forum. Comments developed by NOAA Fisheries on the draft COPs shall be reconciled by the Corps in writing to NOAA Fisheries' satisfaction before release of the final COP. If Phase I actions fail to meet the intended biological targets, Phase II actions as described in the FCRPS BA – Appendix B.2.1 will be considered for further implementation.	The COP was initiated in 2010 and will be completed in 2011.
25	***Configuration and Operational Plan for Lower Granite Project*** *The Corps will consider all relevant biological criteria and prepare, in cooperation with NOAA Fisheries and the co-managing agencies, a Configuration and Operational Plan for Lower Granite Project (2009). As part of the first phase of modifications, the Corps will investigate, and implement the following reasonable and effective measures to reduce passage delay and increase survival of fish passing through the forebay, dam, and tailrace as warranted. Initial modifications will likely include:*	COP alternatives and biological evaluations were completed in 2009. Review continued in 2010. Completion is expected in 2011.
	▪ *New juvenile fish facility including orifice configuration changes, primary dewatering, holding for transport, and primary bypass to improve direct and indirect survival of all collected fish (2012)*	Continued engineering development. Completed Value Engineering document. Design document expected in 2010.
	▪ *Turbine operation optimization to improve survival of turbine passed fish (2014).*	See entries for RPA actions 27 and 55.6.
	The COP will be updated periodically and modifications may be altered as new biological and engineering information is gathered. The COP and modifications will be coordinated through the Regional Forum. Comments developed by NOAA Fisheries on the draft COPs shall be reconciled by the Corps in writing to NOAA Fisheries' satisfaction before release of the final COP. If Phase I actions fail to meet the intended biological targets, Phase II actions as described in the FCRPS BA – Appendix B.2.1 will be considered for further implementation.	Alternatives and the associated biological evaluations for the Lower Granite COP were completed in 2009. Completion of the COP is expected in 2011.

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RPA No.	Action Description	2009 Actions / Accomplishments
Hydropower Strategy 1—Operate the FCRPS to Provide Flows and Water Quality to Improve Juvenile and Adult Fish Survival		
26	***Chief Joseph Dam Flow Deflector*** *The Corps will complete the flow deflector construction at Chief Joseph Dam by 2009.* *Deflector construction was initiated in 2005 in response to RPA 136 in the 2000 Biological Opinion and previous discussions on the importance of these deflectors. Chief Joseph Dam does not have spill for fish passage, but water is spilled at this project and Grand Coulee in order to pass high flows. Investigations by the Corps concluded that installation of flow deflectors at Chief Joseph Dam, which is immediately downstream of Grand Coulee, and shifting spill and power generation between the projects is the most cost-effective alternative for gas abatement at these two dams.*	Construction of flow deflectors on all 19 spillway bays at Chief Joseph was completed in September 2008. A spill test was carried out during the spring 2009. The deflectors were found to be highly effective, and no further testing is planned.
27	***Turbine Unit Operations*** *The Action Agencies will operate turbine units to achieve best fish passage survival (currently within 1% of best efficiency at mainstem dams on the Lower Columbia and Lower Snake rivers from April 1 – October 31 (hard constraint) and from November 1 – March 31 (soft constraint) each year. Continue turbine operations evaluations and apply adaptive management to operate units in their optimum configuration for safe fish passage.*	▪ Operated turbine units on mainstem dams within 1 percent of best efficiency, with a few exceptions. ▪ Completed studies on effects of rapid decompression on tagged and untagged fish. ▪ Initiated new study to determine whether effects of rapid decompression on tagged fish will differ from the effects on untagged fish. ▪ Also see entry for RPA action 55.6.
28	***Columbia and Snake River Project Adult Passage Improvements*** *The Corps will implement the following structural improvements to adult passage at the mainstem Columbia and Snake river projects:*	(See below)
	Bonneville Dam ▪ *Improve the Bradford Island ladder system to reduce stress and improve reliability of upstream adult passage (2013).*	Planned for 2013.
	The Dalles Dam	Further efforts on the north ladder were deferred pending spillwall completion and testing, to allow for evaluation of the effects of the

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RPA No.	Action Description	2009 Actions/Accomplishments
Hydropower Strategy 1—Operate the FCRPS to Provide Flows and Water Quality to Improve Juvenile and Adult Fish Survival		
	▪ *East ladder emergency auxiliary water supply system and/or modifications that return adult salmon and steelhead use of the North ladder to pre-spillwall conditions to improve reliability of upstream adult passage (2013).*	new configuration on adult use of the north ladder. The Corps prepared a letter report that gives preliminary design and cost information for backup water supply alternative.
	John Day Dam ▪ *Adult ladder systems modifications to improve upstream adult passage conditions (2011).*	Initiated construction of new ladder exit section and count station. Construction completed in spring 2010, prior to migration season. Continued design of new ladder entrance section and auxiliary water system (AWS) system.
	Ice Harbor Dam ▪ *Repair or replace north shore fishway auxiliary water supply (AWS) equipment as needed so that any two of the three pumps can meet flow criteria.*	Completed warranty replacement of gear shaft on third north shore auxiliary water supply pump. First two were completed in 2008.
	Little Goose Dam ▪ *Investigate adult passage and determine whether structural, operational, or tailrace modifications can alleviate adult passage delays or blockages during spill operations for optimum juvenile passage (See RM&E Action 54).*	Monitored adult passage; no problems identified in 2009.
	Lower Granite Dam ▪ *Investigate and if necessary provide additional auxiliary water supply for the new adult trap at lower Granite so that it can operate at full capacity when the forebay is operated at MOP without affecting the fishway AWS (2012).*	Replaced water supply valve for the trap. At MOP elevation, all six adult fish holding tanks can now be operated without causing any flow reduction to the AWS.
	▪ *Adult fishway modification to improve upstream adult passage conditions impaired by temperature differentials (need will be determined by results of further research) (prototype 2011).*	Water temperature monitoring was continued, but no adult behavioral studies were conducted in 2009.

Hydro Actions

RPA No.	Action Description	2009 Actions / Accomplishments
Hydropower Strategy 3—Implement Spill and Juvenile Transportation Improvements at Columbia River and Snake River Dams		
29	***Spill Operations to Improve Juvenile Passage*** *The Corps and BPA will provide spill to improve juvenile fish passage while avoiding high TDG supersaturation levels or adult fallback problems. Specific spill levels will be provided for juvenile fish passage at each project, not to exceed established TDG levels (either 110 percent TDG standard, or as modified by State water quality waivers, currently up to 115 percent TDG in the dam forebay and up to 120 percent TDG in the project tailwater, or if spill to these levels would compromise the likelihood of meeting performance standards (see RPA Table, RM&E Strategy 2). The dates and levels for spill may be modified through the implementation planning process and adaptive management decisions. The initial levels and dates for spill operations are identified in Table 2 below. Future Water Management Plans will contain the annual work plans for these operations and spill programs, and will be coordinated through the TMT. The Corps and BPA will continue to evaluate and optimize spill passage survival to meet both the hydrosystem performance standards and the requirements of the Clean Water Act (CWA).*	Spill operations in 2009 were consistent with the 2009 Spring Fish Operations Plan and court order (April 10, 2009), and the 2009 Summer Fish Operations Plan and court order (June 10, 2009). Spill operations are discussed in detail in Section 3 and are fully reported in the *2009 Dissolved Gas and Water Temperature Monitoring Report*, available at http://www.nwd-wc.usace.army.mil/tmt/wqnew/tdg_and_temp/2009/.
30	***Juvenile Fish Transportation in the Columbia and Snake Rivers*** *The Corps and BPA will continue the juvenile fish transportation program toward meeting system survival performance metrics of Snake and Columbia River salmon and steelhead (see RPA, RM&E Strategy 2) with some adaptive management modifications based on results of RM&E. The Corps and BPA will continue to collect and transport juvenile fish at Lower Granite, Little Goose, Lower Monumental, and McNary dams, although under a modified operation as described in Table 3 and Table 4 below. While the dates mentioned in this section should be considered firm planning dates, if in-season information or results of ongoing RM&E indicates a need for adaptive management (for example, if modifying these dates are likely to increase in-river or system survival and would be likely to provide equivalent or increased SARs of the species transported), the Action Agencies will consider revising the dates and operations through the Regional Forum.*	Transport operations in 2009 were consistent with the 2009 Spring Fish Operations Plan and court order (April 10, 2009), and the 2009 Summer Fish Operations Plan and court order (June 10, 2009). The 2009 transportation program was accomplished in accordance with NOAA Fisheries ESA Permit Number 1237. Details are discussed in Section 3.
31	***Configuration and Operational Plan Transportation Strategy*** *The Corps, in coordination with the Regional Forum, will initiate a*	Preparation of a transportation COP is planned for 2010 and 2011. The goal of this plan is to use transportation in a way that optimizes

Hydro Actions

RPA No.	Action Description	2009 Actions / Accomplishments
Hydropower Strategy 3—Implement Spill and Juvenile Transportation Improvements at Columbia River and Snake River Dams		
	Configuration Operational Plan in 2009. The plan will be completed in 2010 and will present a strategy for prioritizing and carrying out further transportation actions at each dam. Comments developed by NOAA Fisheries on the draft COPs shall be reconciled by the Corps in writing to NOAA Fisheries' satisfaction before release of the final COP. Construction actions for transportation are primarily in the context of changes to juvenile bypass systems. Changes meant to increase adult salmon returns through the juvenile fish transportation process are being evaluated. Some changes include additional barges, a new juvenile fish facility at Lower Granite Dam and modifications to the juvenile fish facilities at Little Goose, Lower Monumental and McNary dams.	life cycle survival of ESA-listed fish, based on the latest empirical information. Details are discussed in Section 3.

Hydro Actions

RPA No.	Action Description	2009 Actions/Accomplishments
Hydropower Strategy 4—Operate and Maintain Facilities at Corps' Mainstem Projects to Maintain Biological Performance		
32	***Fish Passage Plan*** ***The Corps will annually prepare a FPP in coordination with NOAA Fisheries and the Regional Forum through the FPOM. The Corps will operate its projects (including juvenile and adult fish passage facilities) year-round in accordance with the criteria in the FPP. Comments developed by NOAA Fisheries on the draft FPP shall be reconciled by the Corps in writing to NOAA Fisheries' satisfaction before release of the final FPP. Key elements of the plan include:*** ▪ *Operate according to project-specific criteria and dates to operate and maintain fish facilities, turbine operating priorities, and spill patterns;* ▪ *Operate according to fish transportation criteria;* ▪ *Maintain turbine operations within the 1% of best efficiency range;* ▪ *Maintain spillway discharge levels and dates to provide project spill for fish passage;* ▪ *Implement TDG monitoring plan;* ▪ *Operate according to protocols for fish trapping and handling;* ▪ *Take advantage of low river conditions, low reservoir elevations or periods outside the juvenile migration season to accomplish repairs, maintenance, or inspections so there is little or no effect on juvenile fish;* ▪ *Coordinate routine and non-routine maintenance that affects fish operations or structures to eliminate and/or minimize fish operation impacts;* ▪ *Schedule routine maintenance during non-fish passage periods;* ▪ *Conduct non-routine maintenance activities as needed; and* ▪ *Coordinate criteria changes and emergency operations with FPOM.*	The FPP was completed and all modifications to the plan were carried out in full coordination with the Regional Forum. Corps fish passage facilities were operated in accordance with criteria in the FPP. Any deviations from the FPP were coordinated with the Regional Forum and were necessary to protect fish or make emergency repairs on vital equipment.
	Operations and Maintenance ▪ *Provide redundancy or contingency plans, developed in coordination with*	

Hydro Actions

RPA No.	Action Description	2009 Actions / Accomplishments
Hydropower Strategy 4—Operate and Maintain Facilities at Corps' Mainstem Projects to Maintain Biological Performance		
	NOAA Fisheries and the Regional Forum, which will assure that key adult fish passage facility equipment operates as necessary to minimize long-term adult passage delays. ▪ *Evaluate the condition of items necessary (e.g., spillway hoist systems, cranes, turbine units, AWS systems, etc.) to provide safe and effective fish passage and develop a prioritized list of these items that are likely to require maintenance now or within the term of this Opinion.*	

Hydro Actions

RPA No.	Action Description	2009 Actions / Accomplishments
Hydropower Strategy 5—Develop and Implement a Kelt Management Plan		
33	***Snake River Steelhead Kelt Management Plan*** *The BPA and Corps will prepare a Snake River Kelt Management Plan in coordination with NOAA Fisheries and the Regional Forum. The BPA and Corps will implement the plan to improve the productivity of interior basin B-run steelhead populations as identified in Sections 8.5. Key considerations in the development and implementation of the plan should include:* ▪ *Measures to increase the in-river survival of migrating kelts,* ▪ *Potential for the collection and transport (either with or without short-term reconditioning) of kelts to areas below Bonneville Dam,* ▪ *Potential for long-term reconditioning as a tool to increase the number of viable females on the spawning grounds,* ▪ *Research as necessary to accomplish the elements of this plan.*	Work continued on the Management Master Plan and was incorporated in the 2009 Kelt Management Plan prepared by the Corps and BPA.

Habitat Actions

RPA No.	Action Description	2009 Actions / Accomplishments
Habitat Strategy 1—Protect and Improve Tributary Habitat Based on Biological Needs and Prioritized Actions		
The overall habitat objective for all ESUs is to protect and improve tributary and estuary habitat to improve fish survival. The Action Agencies will pursue two broad strategies to meet this objective: ▪ Habitat Strategy 1—Protect and improve tributary habitat based on biological needs and prioritized actions ▪ Habitat Strategy 2—Improve juvenile and adult fish survival in estuary habitat Each strategy consists of one or more specific actions. These are summarized in the following sections.		
34	***Tributary Habitat Implementation 2007 to 2009 – Progress Toward 2018 Habitat Quality Improvement Targets.*** *The Action Agencies will provide funding and technical assistance necessary to implement the specific projects identified for implementation in 2007 to 2009 (FCRPS BA, Attachment B.2.2-2, Tables 1-5a) as part of a tributary habitat program to achieve the population-specific overall habitat quality improvement identified in Table 5.*	The expert panels finalized changes in estimated habitat limiting factors for planned, replacement, and additional actions completed in the 2007-2009 implementation cycle. Actions scheduled for completion in 2007-2009 that had implementation delays were carried forward to the 2010-2012 period; the associated benefits are included in the expert panel estimates for the 2010-2012 implementation cycle. Descriptions, limiting factors treated, populations affected, locations, and metrics for actions implemented in the 2007-2009 implementation cycle with funding and technical assistance from the Action Agencies are listed in Section 4, Attachments 1 through 4.
	If projects identified for implementation in 2007-2009 prove infeasible, in whole or in part, the Action Agencies will implement comparable replacement projects in 2010-2013 to maintain estimated habitat quality improvements to achieve equivalent survival commitments at the population level, or alternatively at the major population group (MPG) or ESU level. Habitat and population-specific survival benefits in each implementation plan cycle must also compensate for not meeting estimated benefits in the previous implementation plan cycle. Replacement project selection will follow Action 35 below.	For projects identified for implementation in 2007-2009 that proved infeasible, in whole or in part, the expert panels identified replacement projects that were either implemented in 2007-2009 or will be implemented in 2010-2013 to maintain estimated habitat quality improvements to achieve equivalent survival commitments at the population level. The Action Agencies are currently focusing on meeting commitments at the population level and have not discussed alternatives to meeting commitments at the major population group (MPG) or ESU level as of 2009. The action agencies are working to ensure that projects identified by the expert panels and implemented

Habitat Actions

RPA No.	Action Description	2009 Actions / Accomplishments
Habitat Strategy 1—Protect and Improve Tributary Habitat Based on Biological Needs and Prioritized Actions		
		with funding and technical assistance from the Action Agencies are expected to meet cumulative habitat and population-specific survival benefits. Replacement project selection follows RPA action 35 below.
35	***Tributary Habitat Implementation 2010-2018 – Achieving Habitat Quality and Survival Improvement Targets.*** *The Action Agencies will identify additional habitat projects for implementation based on the population specific overall habitat quality improvement still remaining in Table 5 below. Projects will identify location, treatment of limiting factor, targeted population or populations, appropriate reporting metrics, and estimated biological benefits based on achieving those metrics. Pertinent new information on climate change and potential effects of that information on limiting factors will be considered.*	The Action Agencies are providing funding and technical assistance to improve habitat for more than 90 interior Columbia Basin spring/summer Chinook and summer/winter steelhead populations, including most of the 18 priority and 38 non-priority populations listed in Table 5 of RPA action 35.
	a) *During 2010 to 2018, the Action Agencies will provide funding and/or technical assistance to implement specific habitat projects to achieve the specified habitat quality improvements listed in Table 5. Habitat quality improvements associated with projects will be estimated in advance of project selection by expert panels. The Action Agencies will convene expert panels to estimate changes in habitat limiting factors from the implementation of Action Agency habitat actions.*	Tributary habitat improvement actions to be implemented in 2010-2012 with Action Agency funding and technical assistance are listed in Appendix A of the 2010-2013 FCRPS BiOp Implementation Plan. Appendix A also contains links to relevant project information for more detailed implementation information and input from the expert panels, including: ▪ Target population(s) ▪ Location of action(s) ▪ Limiting factors treated ▪ Description of actions ▪ Reporting metrics ▪ Expected habitat quality improvement
	▪ *The Action Agencies shall convene an expert panel to evaluate the percent change in overall habitat quality at the population scale from projects implemented previously (if quantitative objectives not met) and projects proposed for the implementation until the next check-in.*	The Action Agencies convened expert panel meetings in La Grande and Joseph, Oregon; Lewiston, McCall, and Salmon, Idaho; and Pomeroy, Washington, for priority and other populations of Snake River spring/summer Chinook and steelhead, and in Wenatchee,

Habitat Actions

RPA No.	Action Description	2009 Actions / Accomplishments
Habitat Strategy 1—Protect and Improve Tributary Habitat Based on Biological Needs and Prioritized Actions		
		Washington, for priority populations of Upper Columbia River spring Chinook and steelhead. The purpose of the meetings was to review completion status of planned, replacement, and additional 2007-2009 actions and to identify actions planned for implementation in 2010-2012.
	▪ *The expert panel will use methods consistent with the NWR v. NMFS Remand Collaboration Habitat Workgroup process.*	Expert panels followed the Remand Collaboration Habitat Workgroup process to finalize changes in habitat limiting factors associated with the completed planned, replacement, and additional 2007-2009 habitat actions and to estimate changes in limiting factors for the planned 2010-2012 habitat actions.
	▪ *Project proposals will clearly describe the completed project in terms of quantitative habitat metrics which can be used to quantitatively evaluate progress and completion of individual projects.*	Expert panels provided project descriptions and associated metrics for individually-identified projects that addressed limiting factors in each assessment unit for each population. The Action Agencies recorded action descriptions and associated metrics provided by the expert panels for each population.
	▪ *The Action Agencies will use the expert panels to provide input on changes in habitat quality and function as a result of limiting factor improvements from project actions for the priority population areas and this information will be used to assess improvements to salmonid survival.*	The expert panels identified changes in limiting factor habitat function associated with projects for each priority population. The Action Agencies recorded this information pursuant to guidance provided by the Remand Collaboration Habitat Workgroup. This information will be used in the 2013 and 2016 Comprehensive Evaluations to assess improvements to salmonid survival.

Habitat Actions

RPA No.	Action Description	2009 Actions / Accomplishments
Habitat Strategy 1—Protect and Improve Tributary Habitat Based on Biological Needs and Prioritized Actions		
	▪ *If actions from the previous cycle prove infeasible, in whole or in part, the Action Agencies will ensure implementation of comparable replacement projects in the next implementation plan cycle to maintain estimated habitat quality improvements at the population level and achieve equivalent survival benefits. If infeasible at the population level, then alternatively replacement projects will be found to provide benefits at the MPG or ESU/DPS level. Selection of replacement projects to ensure comparable survival benefits will be made based on input from expert panels, regional recovery planning groups, the Northwest Power and Conservation Council, and NOAA Fisheries.*	Actions scheduled for completion in 2007-2009 that had implementation delays were carried forward to the 2010-2012 period; the associated benefits are included only in the expert panel estimates for the 2010-2012 implementation cycle.
	▪ *The Action Agencies will continue to work cooperatively with the Council to identify priorities and obtain ISRP review of projects proposed for BPA funding.*	The Action Agencies will continue to cooperate with the Council to identify priorities and obtain Independent Scientific Review Panel (ISRP) review of projects.
	▪ *RM&E will inform the relationship between actions, habitat quality and salmon productivity for use in a model developed through the FCRPS RM&E Strategy 3, Action 57 and new scientific information will be applied to estimate benefits for future implementation.*	See RPA action 57 action plan for 2009 progress on tributary habitat RME.

Habitat Actions

RPA No.	Action Description	2009 Actions / Accomplishments
Habitat Strategy 1—Protect and Improve Tributary Habitat Based on Biological Needs and Prioritized Actions		
	▪ *If new scientific or other information (except incomplete implementation or project modifications) suggests that habitat quality improvement estimates for projects from the previous cycle were significantly in error, the Action Agencies will examine the information and review the project or projects in question and their estimated benefits. This review will occur as part of the 2009 Annual Report and the Comprehensive RPA Evaluations in 2013 and 2016 and will be performed in conjunction with NOAA Fisheries. In the event such review finds that habitat quality improvement benefits were significantly overstated, the Action Agencies will implement replacement projects (selected as per Action 35 above) to provide benefits sufficient to achieve the habitat quality improvement and population-or MPG-specific survival benefit estimated for the original project or projects.*	New scientific information available to expert panel members did not suggest that habitat quality improvement estimates for 2007-2009 actions were significantly in error.
	b) During 2010-2018, for non-bolded populations in Table 5, the Action Agencies may provide funding and/or technical assistance for replacement projects should they become necessary for the Action Agencies to achieve equivalent MPG or ESU survival benefits.	The Action Agencies provided funding and technical assistance for projects directed to non-bolded populations in Table 5. These projects were not implemented as replacement projects, per se. However, benefits from these projects may be used should the 2013 comprehensive evaluation indicate they are necessary for the Action Agencies to achieve equivalent major population group (MPG) or evolutionarily significant unit (ESU) survival benefits.
	c) For those lower Columbia populations above Bonneville Dam that have been significantly impacted by the FCRPS (CR chum, LCR coho, LCR Chinook, and LCR steelhead) the Action Agencies may provide funding and/or technical assistance for habitat improvement projects consistent with basin wide criteria for prioritizing projects, including Recovery Plan priorities.	The Action Agencies provided funding to improve habitat for the lower Gorge population of Lower Columbia River coho, Hood River populations of Lower Columbia River Chinook and steelhead, and Wind River population of Lower Columbia River steelhead. The habitat improvements were consistent with Recovery Plan priorities.

Table 5. Estimated Habitat Quality Improvements

ESU	Major Population Group	Population	Estimated Percentage Habitat Quality Improvement of 2007-2009 Actions	Total Estimated Percentage Habitat Quality Improvement of 2007-2018 Actions
Snake River Spring/Summer Chinook	Grand Ronde/Imnaha	**Catherine Creek**	**4**	**23**
		Lostine/Wallowa River	2	2 *
		Grand Ronde River upper mainstem	**2**	**23**
		Imnaha River mainstem	1	1 *
	Middle Fork Salmon River	Big Creek	1	1 *
	South Fork Salmon River	Secesh River	1	1 *
		South Fork Salmon River Mainstem	<1	<1 *
	Lower Snake	**Tucannon River**	**7**	**17**
	Upper Salmon River	East Fork Salmon River	1	1 *
		Lemhi River	7	7 *
		Pahsimeroi River	41	41 *
		Salmon River lower mainstem below Redfish Lake	1	1 *
		Salmon River upper mainstem above Redfish Lake	14	14 *
		Valley Creek	1	1 *
		Yankee Fork	**10**	**30**

Table 5. Estimated Habitat Quality Improvements (continued)

ESU	Major Population Group	Population	Estimated Percentage Habitat Quality Improvement of 2007-2009 Actions	Total Estimated Percentage Habitat Quality Improvement of 2007-2018 Actions
Upper Columbia Spring Chinook	Upper Columbia – Below Chief Joseph	**Entiat River**	**10**	**22**
		Methow River	**2**	**6**
		Wenatchee River	**1**	**3**
Middle Columbia Steelhead	Cascades Eastern Slope Tributaries	Deschutes River – eastside	1	1 *
		Deschutes River – Westside	<1	<1 *
		Fifteen mile Creek (winter run)	<1	<1 *
		Klickitat River	4	4 *
	John Day River	John Day River lower mainstem tributaries	<1	<1 *
		John Day River upper mainstem	<1	<1 *
		Middle Fork John Day River	<1	<1 *
		North Fork John Day River	<1	<1 *
		South Fork John Day River	1	1 *
	Umatilla and Walla Walla River	Touchet River	4	4 *
		Umatilla River	4	4 *
		Walla Walla River	4	4 *
	Yakima River Group	Naches River	4	4 *

Table 5. Estimated Habitat Quality Improvements (continued)

ESU	Major Population Group	Population	Estimated Percentage Habitat Quality Improvement of 2007-2009 Actions	Total Estimated Percentage Habitat Quality Improvement of 2007-2018 Actions
		Satus Creek	4	4 *
		Toppenish	4	4 *
		Yakima River upper mainstem	4	4 *
Snake River Steelhead	Clearwater River	**Lochsa River**	**6**	**16**
		Lolo Creek	**8**	**12**
		Selway River	**<1**	**<1**
		South Fork Clearwater River	**5**	**14**
Snake River Steelhead	Grand Ronde River	Grand Ronde River lower mainstem tributaries	<1	<1 *
		Grand Ronde River upper mainstem	4	4 *
		Joseph Creek (OR)	<1	<1 *
		Joseph Creek (WA)	4	4 *
		Wallowa River	<1	<1 *
	Hells Canyon	Hells Canyon		
	Imnaha River	Imnaha River		*
	Lower Snake	Asotin Creek	4	4 *
		Tucannon River	5	5 *
	Salmon River	**Lower Middle Fork mainstem and tribs (Big, Camas, and Loon Creeks)**	**1**	**2**
		East Fork Salmon River	2	2 *
		Lemhi River	3	3 *

Table 5. Estimated Habitat Quality Improvements (continued)

ESU	Major Population Group	Population	Estimated Percentage Habitat Quality Improvement of 2007-2009 Actions	Total Estimated Percentage Habitat Quality Improvement of 2007-2018 Actions
		Pahsimeroi River	9	9 *
		Salmon River upper mainstem	6	6 *
		Secesh River	**1**	**6**
		South Fork Salmon River	**<1**	**1**
Upper Columbia Steelhead	Upper Columbia River – below Chief Joseph	**Entiat River**	**6**	**8**
		Methow River	**2**	**4**
		Okanogan River	**12**	**14**
		Wenatchee River	**1**	**4**

* The Action Agencies may provide funding and/or technical assistance for replacement projects should they become necessary for the Action Agencies to achieve equivalent MPG or ESU survival benefits.

Habitat Actions

RPA No.	Action Description	2009 Actions / Accomplishments
Habitat Strategy 2—Improve Juvenile and Adult Fish Survival in Estuary Habitat		
36	***Estuary Habitat Implementation 2007 to 2009*** *The Action Agencies will provide funding to implement specific actions identified for implementation in 2007-2009 (FCRPS BA, Attachment B.2.2) as part of a 10 year estuary habitat program to achieve the estimated ESU survival benefits of 9.0% and 6.0% for ocean type and stream-type ESUs respectively (CA Attachment D-1). Projects in an early state of development such that quantitative physical metrics have not been related to estimated survival benefits will be selected per Action 37. If projects identified for implementation in 2007-2009 prove infeasible, in whole or in part, the Action Agencies will implement comparable replacement projects in 2010-2013 to provide equivalent habitat benefits needed to achieve equivalent survival benefits. Replacement projects will be selected per Action 37.*	During 2009, the Action Agencies completed seven on-the-ground habitat projects with another nine estuary habitat projects in the planning, development and design phases. An additional action included one land acquisition, Elochoman, for which a feasibility study has been initiated through the Corps' 536 authority. Habitat activities included removing riparian/wetland invasive plant species and planting native species, improving and restoring streams/channels, improving fish passage structures, restoring riparian and wetland areas, and placing large wood material. 2009 also included execution of the Washington Memorandum of Agreement, identifying a mechanism for implementation of estuary projects and outlining 21 potential projects. Planning activities were initiated for 3 projects. The action agencies developed the framework to implement these MOA projects in future years. See Section 4, Attachment 5, for further detail on the estuary projects accomplished.
37	***Estuary Habitat Implementation 2010-2018—Achieving Habitat Quality and Survival Improvement Targets*** *The Action Agencies will provide funding to implement additional specific projects as needed to achieve the total estuary survival benefits identified in the FCRPS BA Attachment B.2.2). Projects will identify location, treatment of limiting factor, targeted ESU/DPS or ESUs/DPSs, appropriate reporting metrics, and estimated biological benefits based on the achieving of those metrics. Pertinent new information on climate change and potential effects of that information on limiting factors will be considered.*	In 2009 the Action Agencies continued to utilize the *Columbia River Estuary ESA Recovery Plan Module for Salmon and Steelhead* (by NOAA Fisheries) to guide restoration and protection efforts through a collaborative process. In 2009, the Action Agencies continued development of a strategic approach to identifying restoration and protection projects in the estuary using a new Ecosystem Classification System being developed by the University of Washington and the U.S. Geological Survey. The strategic approach will use guiding principles based on salmonid ecology to identify potential sites with the highest value to salmon and steelhead. This is a collaborative effort between the Action Agencies and other regional interests, including the Lower Columbia River Estuary Partnership (LCREP), the states of Oregon and Washington, the Cowlitz Tribe, and local restoration practitioners, including the Columbia River

Habitat Actions

RPA No.	Action Description	2009 Actions / Accomplishments
Habitat Strategy 2—Improve Juvenile and Adult Fish Survival in Estuary Habitat		
		Estuary Study Taskforce (CREST), the Columbia Land Trust, watershed councils, and conservation districts.
	▪ *Action Agencies will actively engage the LCREP Science workgroup to identify project benefits in coordination with other regional experts, using recovery planning products and the modified LCREP project selection criteria (FCRPS BA Attachment B.2.2-3) to identify projects that will benefit salmon considered in this RPA.*	In 2009, the Action Agencies continued to utilize LCREP's Science Work Group, using its ecosystem criteria, to help select restoration and protection projects in the lower Columbia River and Estuary.
	▪ *To support project selection the Action Agencies will convene an expert regional technical group. This group will use the habitat metrics to determine the estimated change in survival which would result from full implementation.*	The Estuary Regional Technical Group (ERTG) was convened in 2009 and began evaluating federal projects for their survival benefit potential.
	▪ *Project proposals will clearly describe the completed project in terms of quantitative habitat metrics which can be used to quantitatively evaluate progress and completion of individual projects.*	ERTG and the Action Agencies began development of a template for the data needed for submission of proposed project to ERTG. That template requires clearly described habitat metrics for the project.
	▪ *The expert regional technical group will use the approach originally applied in the FCRPS BA (Attachment B.2.2) (Estimated Benefits of Federal Agency Habitat Projects in the Lower Columbia River Estuary) and all subsequent information on the relationship between actions, habitat and salmon productivity models developed through the FCRPS RM&E to estimate the change in overall estuary habitat and resultant change in population survival.*	In 2009, the ERTG reviewed the habitat benefit estimation approach applied in the FCRPS BA. It then attempted to further systematize the FCRPS BA method, and explored several approaches aimed at increasing the degree of repeatability of estimates. The ERTG is developing its methodology for estimating survival benefits, with the goal of finalizing the method in 2010.

Habitat Actions

RPA No.	Action Description	2009 Actions / Accomplishments
Habitat Strategy 2—Improve Juvenile and Adult Fish Survival in Estuary Habitat		
	▪ *If actions from the previous cycle prove infeasible, in whole or in part, the Action Agencies will ensure implementation of comparable replacement estuary projects in the next implementation plan cycle to maintain estimated habitat quality improvements at the ESU/DPS level and achieve equivalent survival benefits. Selection of replacement projects, to ensure comparable survival benefits, will be made based on input from expert panels, regional recovery planning groups, the Northwest Power and Conservation Council, and NOAA Fisheries.*	Some projects scheduled for completion in 2007-2009 were delayed or proved infeasible. The Action Agencies are constructing projects in the 2010-2013 implementation period to replace the survival benefits those projects would have provided. The total amount of survival benefits still needed for the 2007-2009 implementation period is not yet known, since the ERTG is still finalizing its methodology for determining survival benefit estimates, leaving several of the projects completed in 2008 and 2009 still "unscored."
	▪ *FCRPS RM&E results will actively inform the relationship between actions, estuary habitat change and salmon productivity and new scientific information will be applied to estimate benefits for future implementation.*	As information from FCRPS estuary research and restoration project effectiveness monitoring becomes available, that information will be applied to the process of estimating benefits for projects implemented between 2010 and 2018.
	▪ *If new scientific or other information (except incomplete implementation of project modification) suggests that habitat quality improvement estimates for projects from the previous cycle were significantly in error, the Action Agencies will examine the information and review the project or projects in question and their estimated benefits. This review will occur as part of the 2009 Annual Report and the Comprehensive RPA Evaluations in 2013 and 2016 and will be performed in conjunction with NOAA Fisheries. In the event such review find that habitat based survival improvement were significantly overstated, the Action Agencies will implement replacement projects (selected as per new projects above) to provide benefits sufficient to achieve the ESU/DPS-specific survival benefit estimated for each affected project.*	In 2009 the Action Agencies actively engaged consultants, LCREP's Science Workgroup, the ERTG and other sources regarding new scientific information. A summary of recent publications is provided after the discussion of RPA Action 61, in Section 3. The Action Agencies have examined that and other information, and are not aware of any information that would indicate habitat quality improvement estimates for projects completed in the 2007-2009 implementation cycle were "significantly overstated." The Action Agencies will continue to coordinate with LCREP's Science Workgroup, and the ERTG regarding new scientific information.

Habitat Actions

RPA No.	Action Description	2009 Actions / Accomplishments
Habitat Strategy 2—Improve Juvenile and Adult Fish Survival in Estuary Habitat		
38	***Piling and Piling Dike Removal Program*** *To increase access to productive habitat and to reduce avian predation, the Action Agencies will develop and implement a piling and pile dike removal program.* ▪ *In 2008, the Action Agencies will work with Lower Columbia River Estuary Program to develop a plan for strategic removal of structures that have lower value to navigation channel maintenance, present low-risk to adjacent land use, support increased ecosystem function, and are cost-effective.*	A final draft pile structure program plan was presented to NOAA in November 2008, and was reviewed in early 2009. This plan will be modified as new information becomes available.
	▪ *Beginning in 2008 and 2009, the Action Agencies will begin implementation. Implementation will continue through 2018.*	In 2009, LCREP implemented a NOAA Fisheries-funded pile removal pilot project at Coal Creek Slough, near Longview. Pre- and post-project monitoring for that effort was provided by the Corps. In 2009, the Corps also initiated the contract process for a study to identify which pile dike structures were still needed to meet its navigation requirements. The Corps also determined that, because its pile structures were congressionally authorized, additional process may be required before removal can occur. As a result, emphasis for the early part of the program turned to removal of pile fields, and the Action Agencies, with LCREP and others, worked on planning for pile field removal pilot projects. Three pile fields were identified for possible removal as part of a pilot project.

Hatchery Actions

RPA No.	Action Description	2009 Actions / Accomplishments
Hatchery Strategy 1—Ensure that Hatchery Programs Funded by the FCRPS Action Agencies as Mitigation for the FCRPS are not Impeding Recovery of ESUs or steelhead DPSs		
The overall hatchery objective for all ESUs is to fund FCRPS mitigation hatchery programs in a way that contributes to reversing the decline of downward-trending ESUs. The Action Agencies will pursue two strategies to meet this overall objective: ▪ Hatchery Strategy 1—Ensure that hatchery programs funded by the FCRPS Action Agencies as mitigation for the FCRPS are not impeding recovery of ESUs or steelhead DPSs ▪ Hatchery Strategy 2—Preserve and rebuild the genetic resources through safety-net and conservation actions to reduce short-term extinction risk and promote recovery Each strategy consists of two specific actions. These are summarized in the following sections.		
39	***FCRPS Funding of Mitigation Hatcheries – Programmatic*** *The FCRPS Action Agencies will continue funding hatcheries in accordance with existing programs, and will adopt programmatic criteria for funding decisions on mitigation programs for the FCRPS that incorporate BMPs. The Hatchery Effects Report, the August 2006 NOAA Fisheries paper to the PWG and the NOAA Fisheries 2007 Guidance Paper should be considered in developing these criteria in addition to the BMPs in the Action Agency's BA. Site specific application of BMPs will be defined in ESA Section 7, Section 10, or Section 4(d) consultations with NOAA Fisheries to be initiated and conducted by hatchery operators with the Action Agencies as cooperating agencies.*	▪ Upper Columbia Programs: In 2009, hatchery program operators continued to develop Hatchery and Genetic Management Plans (HGMPs) for Action Agency-funded hatchery programs. Action Agencies reviewed and commented on draft HGMPs during development. The consultation-ready HGMP for Leavenworth National Fish Hatchery (NFH) was submitted to NOAA Fisheries in March 2009. HGMPs for Entiat and Winthrop hatcheries were submitted in July 2009. Updated and complete HGMPs will be submitted to NOAA Fisheries in 2010 and 2011 to initiate consultation on other programs. ▪ Middle Columbia: In March 2009, hatchery program operators began developing HGMPs for Action Agency-funded hatchery programs. Action Agencies reviewed and commented on draft HGMPs during development. Updated and complete HGMPs will be submitted to NOAA Fisheries in 2010 and 2011 to initiate consultation. ▪ Snake River Basin: In May 2009, hatchery program operators began developing HGMPs for Action Agency-funded hatchery programs. Action Agencies reviewed and commented on draft HGMPs during development. Updated and complete HGMPs will be submitted to NOAA Fisheries in 2010 and 2011 to initiate consultation.

Hatchery Actions

RPA No.	Action Description	2009 Actions / Accomplishments
Hatchery Strategy 1—Ensure that Hatchery Programs Funded by the FCRPS Action Agencies as Mitigation for the FCRPS are not Impeding Recovery of ESUs or steelhead DPSs		
		▪ In July 2009, the Action Agencies sent a letter to hatchery program operators that described a process for working collaboratively on development of HGMPs for consultation and transmitted the criteria for funding decisions on ongoing and new hatchery programs in the Columbia Basin.
40	***Reform FCRPS Hatchery Operations to Reduce Genetic and Ecological Effects on ESA-Listed Salmon and Steelhead*** *The Action Agencies will undertake/fund reforms to ensure that hatchery programs funded by the Action Agencies as mitigation for the FCRPS are not impeding recovery. The Action Agencies will work with FCRPS mitigation hatchery operators to cost effectively address needed reforms of current hatchery programs while continuing to meet mitigation responsibilities. Specific reforms to be implemented under this action (following any necessary regulatory approval) are listed in Table 6. Other reforms will be identified and implemented following the conclusion of the Columbia River Hatchery Scientific Review Group process.*	(See below)
	For Lower Columbia Chinook*: The COE will review the John Day Hatchery Mitigation Program.*	Negotiations continued with U.S. v. Oregon parties to resolve issues over the size of the mitigation program to be addressed in modifying the existing mitigation to meet an in-place, in-kind concept. It is anticipated that a way forward will be established in FY2010.
	For Snake River Steelhead: *Fund the Tucannon River steelhead supplementation program to transition to local broodstock using BMPs.*	This action will be funded by BPA and implemented by the Lower Snake Compensation Plan (LSRCP) program office and the Washington Department of Fish and Wildlife (WDFW), the hatchery program operator for the Tucannon River steelhead supplementation program. WDFW developed a revised HGMP to transition the Tucannon River steelhead program to local broodstock and submitted a summary of the proposed changes to the U.S. v. Oregon Production Advisory Committee for review. The proposal would increase the current Tucannon River endemic stock summer steelhead smolt production from 50,000 to 75,000 fish annually.

Hatchery Actions

RPA No.	Action Description	2009 Actions / Accomplishments
Hatchery Strategy 1—Ensure that Hatchery Programs Funded by the FCRPS Action Agencies as Mitigation for the FCRPS are not Impeding Recovery of ESUs or steelhead DPSs		
	*For **Middle Columbia Steelhead:** Fund the Touchet River steelhead supplementation program to transition to local broodstock using BMPs.*	This action will be funded and implemented by the LSRCP program office and WDFW. WDFW submitted an HGMP to NOAA Fisheries in June 2009. The new HGMP is consistent with the current management plan and the U.S. v. Oregon agreement. WDFW is conducting a statewide review of steelhead hatchery programs and expects that a review of the Touchet program will be completed in 2010.
	*For **Upper Columbia Steelhead:** For the Winthrop NFH steelhead program, implement measures to transition to local broodstock and to manage the number of Winthrop NFH-produced steelhead on the spawning grounds. Such broodstock and adult escapement reform measures, including capital construction, would be identified through development of an updated HGMP and ESA consultation. Implementation of reform measures is contingent on a finding, in consultation with NOAA, that the measures are biologically and economically feasible and effective. Implementation of reforms will be prioritized and sequenced.*	HGMPs for Winthrop NFH programs were submitted to NOAA Fisheries in July 2009 and may be updated in 2011. Winthrop NFH continued a pilot program to evaluate longer term rearing of juvenile steelhead as part of the transition to local broodstock.

Table 6. Specific Projects to Implement Hatchery RPA Actions

Hatchery Strategy 1, Action 40 Reform FCRPS Hatchery Operations to Reduce Genetic and Ecological Effects on ESA-Listed Salmon and Steelhead	
	For **Lower Columbia Chinook:** The COE will review the John Day Hatchery Mitigation Program.
	For **Snake River Steelhead:** Fund the Tucannon River steelhead supplementation program to transition to local broodstock using BMPs.[2]
	For **Middle Columbia Steelhead:** Fund the Touchet River steelhead supplementation program to transition to local broodstock using BMPs. [3]
	For **Upper Columbia Steelhead:** For the Winthrop NFH steelhead program, implement measures to transition to local broodstock and to manage the number of Winthrop NFH-produced steelhead on the spawning grounds. Such broodstock and adult escapement reform measures, including capital construction, would be identified through development of an updated HGMP and ESA consultation. Implementation of reform measures is contingent on a finding, in consultation with NOAA, that the measures are biologically and economically feasible and effective. Implementation of reforms will be prioritized and sequenced.

Hatchery Actions

RPA No.	Action Description	2009 Actions / Accomplishments
Hatchery Strategy 2—Preserve and Rebuild Genetic Resources Through Safety-net and Conservation Actions to Reduce Short-term Extinction Risk and Promote Recovery		
41	***Implement Safety Net Programs to Preserve Genetic Resources and Reduce Short-term Extinction Risk*** *The Action Agencies will continue to fund the operation of on-going "safety net" programs that are providing benefits to ESA-listed stocks at high risk of extinction by increasing genetic resources and will identify and plan for additional safety-net programs, as needed. Specific safety-net programs to be implemented under this action are listed in Table 6.*	

[2] Current operation of these programs is undergoing site-specific ESA consultation; a Section 7 determination has not yet been made.
[3] Current operation of these programs is undergoing site-specific ESA consultation; a Section 7 determination has not yet been made.

Hatchery Actions

RPA No.	Action Description	2009 Actions / Accomplishments
Hatchery Strategy 2—Preserve and Rebuild Genetic Resources Through Safety-net and Conservation Actions to Reduce Short-term Extinction Risk and Promote Recovery		
	*For **Snake River sockeye:*** *Continue to fund the safety net program to achieve the interim goal of annual releases of 150,000 smolts while also continuing to implement other release strategies in nursery lakes such as fry and parr releases, eyed-egg incubation boxes, and adult releases for volitional spawning (see Action 42 for expansion of the program for building genetic resources and assisting in promoting recovery).*	BPA continued to fund the Snake River Sockeye Salmon Captive Broodstock Program project.
	*For **Snake River Spring/Summer Chinook:*** *For the Tucannon River spring/summer Chinook safety-net supplementation program fund capital construction, operation and monitoring and evaluation costs to implement a program that builds genetic diversity using local broodstock and a sliding scale for managing the composition of natural spawners comprised of hatchery-origin fish.*	BPA continued to fund this safety-net program through the Tucannon River Spring Chinook Captive Broodstock Program, a BPA project.
	*For **Snake River Spring/Summer Chinook:*** *For the Upper Grande Ronde and Catherine Creek safety net supplementation programs fund capital construction, operation and monitoring and evaluation costs to implement a program that builds genetic diversity using local broodstock, and a sliding scale for managing the composition of natural spawners comprised of hatchery origin fish.*	BPA continued to fund this safety-net program through the Oregon Spring Chinook Captive Propagation Program, a BPA project.
	For **Snake River Spring/Summer Chinook:** *Fund the Johnson Creek / South Fork Salmon River safety net supplementation program, as described in the existing Section 10 permit.*	BPA continued to fund this safety-net program through the Johnson Creek Artificial Propagation Enhancement Project, a BPA project.
	For Snake River Spring/Summer Chinook: *Fund the experimental captive rearing program for East Fork and West Fork Yankee Fork Salmon River (until phased out by IDFG).*	BPA continued to fund an experimental captive rearing program through the Idaho Snake River Spring Chinook Captive Propagation Project, a BPA project.
	*For **Snake River Steelhead**, as a project to benefit primarily B-run steelhead, the Action Agencies will work with NOAA Fisheries to develop a trigger for future artificial propagation safety-net planning or to identify populations for immediate safety-net planning.*	It is not feasible to implement this action at this time due to a lack of adequate B-run steelhead population viability data. Once sufficient data are available through enhanced Snake River steelhead monitoring, we will begin to work with NOAA Fisheries to develop the type of "trigger" described above.

Table 7. Specific Projects to Implement Hatchery RPA Actions

Hatchery Strategy 2, Action 41 Implement Safety-Net Programs to Preserve Genetic Resources and Reduce Short-term Extinction Risk	
	For **Snake River sockeye:** Continue to fund the safety net program to achieve the interim goal of annual releases of 150,000 smolts while also continuing to implement other release strategies in nursery lakes such as fry and parr releases, eyed-egg incubation boxes, and adult releases for volitional spawning (see Action 42 for expansion of the program for building genetic resources and assisting in promoting recovery).
	For **Snake River Spring/Summer Chinook:** For the Tucannon River spring/summer Chinook safety-net supplementation program fund capital construction, operation and monitoring and evaluation costs to implement a program that builds genetic diversity using local broodstock and a sliding scale for managing the composition of natural spawners comprised of hatchery-origin fish.
	For **Snake River Spring/Summer Chinook:** For the upper Grande Ronde and Catherine Creek safety net supplementation programs fund capital construction, operation and monitoring and evaluation costs to implement a program that builds genetic diversity using local broodstock, and a sliding scale for managing the composition of natural spawners comprised of hatchery origin fish.
	For Snake River Spring/Summer Chinook: Fund the Johnson Creek / South Fork Salmon River safety net supplementation program, as described in the existing Section 10 permit.
	For Snake River Spring/Summer Chinook: Fund the experimental captive rearing program for East Fork and West Fork Yankee Fork Salmon River (until phased out by IDFG).
	For **Snake River Steelhead**, as a project to benefit primarily B-run steelhead, the Action Agencies will work with NOAA Fisheries to develop a trigger for future artificial propagation safety-net planning or to identify populations for immediate safety-net planning.

Hatchery Actions

RPA No.	Action Description	2009 Actions / Accomplishments
Hatchery Strategy 2—Preserve and Rebuild Genetic Resources Through Safety-net and Conservation Actions to Reduce Short-term Extinction Risk and Promote Recovery		
42	***Implement Conservation Programs to Build Genetic Resources and Assist in Promoting Recovery*** *The Action Agencies will implement conservation programs for ESA-listed stocks where the programs assist in recovery. Specific conservation programs to be implemented under this action are listed in Table 6.*	
	*For **Upper Columbia Spring Chinook:** Fund reintroduction of spring Chinook salmon into the Okanogan Basin consistent with the Upper Columbia Salmon Recovery Plan including capital construction, operation and monitoring and evaluation costs to implement a transition to local broodstock and a sliding scale for managing the composition of natural spawners comprised of hatchery origin fish. Reintroduction will be coordinated with the restoration and improvement of spring Chinook habitat in the Okanogan Basin and will be contingent on the availability of within ESU broodstock from the Methow Basin.*	The Confederated Colville Tribes' proposal for the Chief Joseph Hatchery was approved by the NPCC to move into Step 3 (final design) of the NPPC's Three-Step Review process for major artificial production projects. Final NPPC approval is expected in 2010, and construction is anticipated to begin in late 2010 or 2011.
	*For **Upper Columbia Steelhead:** Fund a program to recondition natural origin kelts for the Entiat, Methow and Okanogan basin including capital construction, operation and monitoring and evaluation costs.*	In 2009, BPA began funding the Yakama Tribes to implement an Upper Columbia River steelhead kelt reconditioning project that will implement this RPA action as well as a similar Columbia River Fish Accords action.
	*For **Upper Columbia Steelhead:** Fund a program that builds genetic diversity using local broodstock and accelerates steelhead recovery in the Okanogan Basin as steelhead habitat is restored and improved, including capital construction, operation, and monitoring and evaluation costs.*	This action is being implemented by the Confederated Colville Tribes through a Fish and Wildlife Program/Columbia River Fish Accords project: Local Okanogan steelhead Broodstock.
	*For **Middle Columbia Steelhead:** Fund a program to recondition natural origin kelts in the Yakima River basin including capital construction, implementation and monitoring and evaluation costs.*	BPA continued to fund this action through the BPA project, Kelt Reconditioning/Reproductive Success.
	*For **Snake River Steelhead:** For the East Fork Salmon River, fund a small-scale program (no more than 50,000 smolts) including trapping locally returning steelhead in the East Fork Salmon River for broodstock, and follow BMPs for rearing, release, and adult management strategies. Fund capital construction, operation and monitoring and evaluation costs to implement a program that builds genetic diversity using local broodstock and a sliding scale*	BPA continued to fund operation and maintenance for this action through the LSRCP Direct Funding Agreement.

Hatchery Actions

RPA No.	Action Description	2009 Actions / Accomplishments
Hatchery Strategy 2—Preserve and Rebuild Genetic Resources Through Safety-net and Conservation Actions to Reduce Short-term Extinction Risk and Promote Recovery		
	for managing the composition of natural spawners comprised of hatchery origin fish.	
	*For **Snake River Spring/Summer Chinook Salmon:** For the Lostine and Imnaha rivers, contingent on a NOAA approved HGMP, fund these hatchery programs including capital construction, operation and monitoring and evaluation costs to implement supplementation programs using local broodstock and following a sliding scale for managing the composition of natural spawners comprised of hatchery origin fish.*	As of December 2009, a proposed action and HGMP had not bee completed for this program. Because funding of the action is contingent on a NOAA Fisheries-approved HGMP, BPA did not fund construction of the Northeast Oregon Hatchery Lostine and Imnaha spring/summer Chinook propagation facilities in 2009.
	*For **Snake River Sockeye:** Fund further expansion of the sockeye program to increase total smolt releases to between 500,000 and 1 million fish.*	Throughout 2009, BPA worked with Idaho Department of Fish and Game (IDFG) and the State of Idaho to identify and begin the acquisition process for property meeting the criteria for a hatchery facility that will assure propagation of up to 1 million sockeye smolts.
	*For **Snake River Sockeye**: The Action Agencies will work with appropriate parties to investigate feasibility and potentially develop a plan for ground transport of adult sockeye from LGR Dam to Sawtooth Valley lakes or artificial propagation facilities.*	In 2009, the Action Agencies, together with state and federal fishery agencies, started development of study plan to investigate the feasibility of transporting adult sockeye (A pilot project to evaluate feasibility of ground transport was implemented in 2010).
	*For **Columbia River Chum:** Fund a hatchery program to re-introduce chum salmon in Duncan Creek including capital construction, implementation and monitoring and evaluation costs as long as NOAA Fisheries considers it beneficial to recovery and necessary to reduce extinction risk of the target population.*	BPA continued to fund this action through the BPA project, Reintroduction of Chum Salmon into Duncan Creek.
	*For **Columbia River Chum**: Fund assessment of habitat potential, development of reintroduction strategies, and implementation of pilot supplementation projects in selected Lower Columbia River tributaries below Bonneville Dam.*	In 2009, BPA began funding a new project, Development of an Integrated Strategy for Chum Salmon Restoration in the Tributaries Below Bonneville Dam, to implement this action.

Table 8. Specific Projects to Implement Hatchery RPA Actions

Hatchery Strategy 2, Action 42 Implement Conservation Programs to Build Genetic Resources & Assist in Promoting Recovery	
	For **Upper Columbia Spring Chinook**: Fund reintroduction of spring Chinook salmon into the Okanogan Basin consistent with the Upper Columbia Salmon Recovery Plan including capital construction, operation and monitoring and evaluation costs to implement a transition to local broodstock and a sliding scale for managing the composition of natural spawners comprised of hatchery origin fish. Reintroduction will be coordinated with the restoration and improvement of spring Chinook habitat in the Okanogan Basin and will be contingent on the availability of within ESU broodstock from the Methow Basin.
	For **Upper Columbia Steelhead**: Fund a program to recondition natural origin kelts for the Entiat, Methow and Okanogan basins including capital construction, operation and monitoring and evaluation costs.
	For **Upper Columbia Steelhead**: Fund a program that builds genetic diversity using local broodstock and accelerates steelhead recovery in the Okanogan Basin as steelhead habitat is restored and improved, including capital construction, operation, and monitoring and evaluation costs.
	For **Middle Columbia Steelhead:** Fund a program to recondition natural origin kelts in the Yakima River Basin including capital construction, implementation and monitoring and evaluation costs
	For **Snake River Steelhead:** For the East Fork Salmon River**,** fund a small-scale program (no more than 50,000 smolts) including trapping locally returning steelhead in the East Fork Salmon River for broodstock, and follow BMPs for rearing, release, and adult management strategies. Fund capital construction, operation and monitoring and evaluation costs to implement a program that builds genetic diversity using local broodstock and a sliding scale for managing the composition of natural spawners comprised of hatchery origin fish.
	For **Snake River Spring/Summer Chinook Salmon**: For the Lostine and Imnaha rivers, contingent on a NOAA approved HGMP, fund these hatchery programs including capital construction, operation and monitoring and evaluation costs to implement supplementation programs using local broodstock and following a sliding scale for managing the composition of natural spawners comprised of hatchery origin fish.
	For **Snake River Sockeye:** Fund further expansion of the sockeye program to increase total smolt releases to between 500,000 and 1 million fish.
	For **Snake River Sockeye:** The Action Agencies will work with appropriate parties to investigate feasibility and potentially develop a plan for ground transport of adult sockeye from LGR Dam to Sawtooth Valley lakes or artificial propagation facilities.
	For **Columbia River Chum:** Fund a hatchery program to re-introduce chum salmon in Duncan Creek including capital construction, implementation and monitoring and evaluation costs as long as NOAA Fisheries considers it beneficial to recovery and necessary to reduce extinction risk of the target population.
	For **Columbia River Chum:** Fund assessment of habitat potential, development of reintroduction strategies, and implementation of pilot supplementation projects in selected lower Columbia River tributaries below Bonneville Dam.

Predation and Invasive Species Management Actions

RPA No.	Action Description	2009 Actions / Accomplishments
Predation and Invasive Species Management Strategy 1—Implement Piscivorous Predation Control Measures to Increase Survival of Juvenile Salmonids in the Lower Snake and Columbia Rivers		
The overall predation management objective for all ESUs is to improve the survival of juvenile and adult fish as they pass through the hydrosystem. The Action Agencies will pursue three strategies to meet this overall objective: ▪ Predation and Invasive Species Management Strategy 1—Implement piscivorous predation control measures to increase survival of juvenile salmonids in the lower Snake and Columbia rivers ▪ Predation and Invasive Species Management Strategy 2—Implement avian predation control measures to increase survival of juvenile salmonids in the lower Snake and Columbia rivers ▪ Predation and Invasive Species Management Strategy 3—Implement marine mammal control measures to increase survival of adult salmonids at Bonneville Dam Each strategy consists of two specific actions. These are summarized in the following sections.		
43	***Northern Pikeminnow Management Program (NPMP)*** *Action Agencies will continue to annually implement the base program and continue the general increase in the reward structure in the northern pikeminnow sport-reward fishery consistent with the increase starting in 2004. To better evaluate the effects of the NPMP, BPA will increase the number of tagged fish.* *The Action Agencies will evaluate the effectiveness of focused removals of pikeminnow at The Dalles and John Day Dams and implement as warranted. Additional scoping of other mainstem dams will be based upon evaluations and adaptive management principles with input from NOAA Fisheries, and other regional fisheries managers.*	▪ The Northern Pikeminnow Management Program (NPMP) was again implemented in 2009. In 2009, the exploitation rate on northern pikeminnow was 12.8 percent, based on a numerical catch of 141,645 from a sport reward fishery and dam angling fishery. ▪ In 2004, BPA increased the reward for the catch of this predator and increased the number removed by 25 percent over prior years. The increased reward was made permanent in 2005 to sustain the higher catches. ▪ In 2009, researchers were able to build upon the increase in cumulative tagging efforts achieved in 2008, which resulted in increases in year-over-year application of tags by 80 percent.
44	***Develop strategies to reduce non-indigenous fish*** *The Action Agencies will work with NOAA Fisheries, states and tribes to coordinate to review, evaluate, and develop strategies to reduce non-indigenous piscivorous predation. The formation of a workshop will be an initial step in the process.*	▪ In May 2009, BPA reconvened a mini-workshop to narrow the research objectives to a few high–priority topic areas and critical uncertainties from the many ideas presented at the 2008 non-indigenous predation workshop. ▪ In November 2009, Action Agencies, through project sponsors, submitted a research proposal to the NPCC – ISRP. The proposal's objective is to address the influence of juvenile American shad on the health and well being of piscivores and

		their predation rates on juvenile salmonids, the predatory impact of channel catfish on juvenile salmonids, and the potential efficacy of localized removals of smallmouth bass for predation control.

Predation and Invasive Species Management Actions

RPA No.	Action Description	2009 Actions / Accomplishments
Predation and Invasive Species Management Strategy 2—Implement Avian Predation Control Measure to Increase Survival of Juvenile Salmonids in the Lower Snake and Columbia Rivers		
45	***Reduce Caspian Terns on East Sand Island in the Columbia River Estuary*** *The FCRPS Action Agencies will implement the Caspian Tern Management Plan. East Sand Island tern habitat will be reduced from 6.5 to 1.5 to 2 acres. It is predicted that the target acreage on East Sand Island will be achieved in approximately 2010.*	▪ Prior to 2009 tern nesting season, constructed a one-half acre island in Summer Lake. This allowed the Corps to reduce habitat at East Sand Island to 3.5 acres in March 2009. ▪ After the 2009 nesting season, constructed an additional one-half acre island at Summer Lake and a total of 3.8 acres in the Klamath Basin; including a two acre island at Tule Lake sump 1b, a one-acre rock island in the Orems Unit, and a 0.8 acre floating island on Sheepy Lake in the Lower Klamath Refuge. Only the floating island will be available for the 2010 nesting season due to vegetation management of the managed wetlands at Tule and Orems locations. ▪ Development of islands at Don Edwards and Brooks does not appear feasible due to outside restrictions and therefore will not meet listed timeframe. Corps is coordinating the deviation.

Site	*Acres*	*Proposed Year of Creation*	*Proposed Year in which Target Acreage Is Achieved*
Fern Ridge Lake	*1*	*2007/2008*	*2007/2008*
Summer Lake	*1.5*	*2008*	*2008*
Crump Lake	*1*	*2009*	*2009*
Brooks Island (San Francisco Bay)	*2*	*2008/2009*	*2008/2009*
Hayward Regional Shoreline (San Francisco Bay)	*0.5*	*2008/2009*	*2008/2009*
Don Edwards NWR (San Francisco Bay)	*0.5-1*	*2009*	*2009*

Predation and Invasive Species Management Actions

RPA No.	Action Description	2009 Actions / Accomplishments
Predation and Invasive Species Management Strategy 2—Implement Avian Predation Control Measure to Increase Survival of Juvenile Salmonids in the Lower Snake and Columbia Rivers		
46	***Double-Crested Cormorant*** *The FCRPS Action Agencies will develop a cormorant management plan encompassing additional research, development of a conceptual management plan, and implementation of warranted actions in the estuary.*	▪ Continued testing feasibility of potential management techniques for reducing losses of juvenile salmonids due to cormorant predation: habitat enhancement at other locations and social attractions at Fern Ridge Reservoir. No observed success. ▪ Tested three techniques to discourage nesting on East Sand Island: human disturbance, hazing with a laser, and placement of pond liner on known nesting area. Only the pond liner was successful.
47	***Inland Avian Predation*** *The FCRPS Action Agencies will develop an avian management plan (for Double-Crested Cormorants, Caspian Terns, and other avian species as determined by RM&E) for Corps-owned lands and associated shallow-water habitat.*	▪ Inland Avian Management Plan outline scoped and completed under regional review. Three workshops held on dam and habitat-related predator effects and potential management actions. Programmatic framework for plan completed. ▪ Completion of full draft of management plan for agency/regional review is planned for Q1 FY2011, with additional action implementation beginning Q2 FY2011. ▪ Enhanced data collection on avian species use of dam operation zones, with increased tailwater hazing implemented.
48	***Other Avian Deterrent Actions*** *The Corps will continue to implement and improve avian deterrent programs at all lower Snake and Columbia River dams. This program will be coordinated through the Fish Passage Operations and Maintenance Team and included in the FPP.*	▪ Avian deterrent actions, such as hazing and wire arrays, were carried out in accordance with the FPP. ▪ Started construction of new avian wire array at John Day Dam. Construction finished early 2010.

Predation and Invasive Species Management Actions

RPA No.	Action Description	2009 Actions/Accomplishments
Predation and Invasive Species Management Strategy 3—Implement Marine Mammal Control Measures to Increase Survival of Adult Salmonids at Bonneville Dam		
49	***Marine Mammal Control Measures*** *The Corps will install and improve as needed sea lion excluder gates at all main adult fish ladder entrances at Bonneville dam annually. In addition, the Corps will continue to support land and water based harassment efforts by NOAA Fisheries, Oregon Department of Wildlife (ODFW), Washington Department of Fish and Wildlife (WDFW), and the Tribes to keep sea lions away from the area immediately downstream of Bonneville Dam.*	The Corps installed sea lion exclusion devices (SLEDs) at Bonneville Dam's 12 primary fishway entrances. In addition, the Corps and BPA supported land- and water-based harassment efforts by states and tribes.

Research, Monitoring, and Evaluation Actions

Research, Monitoring and Evaluation Actions

The overall RME objective is to provide information needed to support planning and adaptive management and demonstrate accountability related to the implementation of FCRPS ESA hydropower and offsite actions for all ESUs. The Action Agencies will undertake RME through project implementation and compliance monitoring, status monitoring, action effectiveness research, and critical uncertainties research in the following nine areas:

- *RME Strategy 1—Monitor Status of Selected Fish Populations Related to FCRPS Actions*
- *RME Strategy 2—Hydropower RME*
- *RME Strategy 3—Tributary Habitat RME*
- *RME Strategy 4—Estuary and Ocean RME*
- *RME Strategy 5—Harvest RME*
- *RME Strategy 6—Hatchery RME*
- *RME Strategy 7—Predation and Invasive Species Management RME*
- *RME Strategy 8—Coordination and Data Management*
- *RME Strategy 9—Project Implementation and Compliance Monitoring*

Each of the nine areas is identified as a strategy in the following discussion. Each strategy consists of one or more specific actions. These are summarized in the following sections.

The following identified measures will be monitored to assess progress toward achievement of performance standards (benchmarks) and performance targets (longer-term goals) to inform adaptive management actions. Two aspects of performance will be monitored:

- ***Programmatic performance. This will be tracked through project implementation and compliance monitoring.***

Biological and environmental performance. This will be tracked and evaluated through status monitoring, action effectiveness research, and critical uncertainty research in combination with existing and developing quantitative models. Performance standards will be monitored to ensure accountability and adherence to proposed actions. Biological performance targets will be evaluated over longer time periods as new information and learning are applied through analytical models. Targets allow us to check for progress toward expected life stage survival improvements and trends in evolutionary significant unit (ESU) or population performance. Performance targets inform longer-term adaptive management decisions and prioritization of options across populations with different relative needs.

Research, Monitoring, and Evaluation Actions

RPA No.	Action Description	2009 Actions / Accomplishments
RME Strategy 1—Monitor the Status of Selected Fish Populations Related to FCRPS Actions		
The Action Agencies' strategy is to support performance monitoring and adaptive management related to the status of fish populations.		
50	***Fish Population Status Monitoring*** *The Action Agencies will enhance existing fish population status monitoring performed by fish management agencies through the specific actions listed below. In addition, ancillary population status and trend information is being obtained through several ongoing habitat and hatchery improvement projects (see project tables in Attachment B.2.6-1).*	
	▪ *Implement and maintain the Columbia River Basin passive integrated transponder (PIT)-Tag Information System. (Annually)*	Six BPA projects were implemented in 2009 to support this RPA action. The BPA-funded Columbia Basin PIT-Tag Information project (PTAGIS) was implemented to perform research at mainstem juvenile or adult fish facilities. PTAGIS provides coordination, setup, operations, and maintenance for about a dozen NPCC Fish and Wildlife Program (FWP) or Anadromous Fish Evaluation Program (AFEP) projects throughout the fish migration season.
	▪ *Monitor adult returns at mainstem hydroelectric dams using both visual counts and the PIT-tag detection system (see Hydrosystem section). (Annually)*	In 2009 the Corps again implemented its adult fish count program as laid out in the FPP. Results are available in the 2009 Annual Fish Passage Report: Columbia and Snake Rivers, available at http://www.nwp.usace.army.mil/environment/FishData/docs/2009afpr.pdf. BPA continued implementation of three projects in 2009 for additional support of this RPA subaction. For example, the Lower Granite Dam Adult Trap Operations, BPA project number 2001-003-00, continued in 2009 for daily operation of the Lower Granite Dam adult trap to sample steelhead, spring/summer Chinook, and PIT-tagged fall Chinook (scales and length measurement) for run-reconstruction and transportation and life history studies. Fish with coded-wire-tags or PIT-tags (if targeted) were diverted into the adult trap holding area for collection of timed samples (a percentage of all passing adults) for run reconstructions. Operation information was included in the adult trap annual report provided to BPA. This RPA

Research, Monitoring, and Evaluation Actions

RPA No.	Action Description	2009 Actions / Accomplishments
RME Strategy 1—Monitor the Status of Selected Fish Populations Related to FCRPS Actions		
		action is well covered through the Corps adult fish count program and the BPA projects. Additional work is being implemented in 2010 for Upper Columbia spring Chinook and steelhead.
	▪ *Monitor juvenile fish migrations at mainstem hydroelectric dams using smolt monitoring and the PIT-tag detection system (see Hydrosystem section). (Annually)*	BPA implemented seven projects to monitor smolts. For example, the Smolt Monitoring by Non-Federal Entities project, BPA project number 1987-127-00, collected species, condition, and external mark detail from all sampled fish, along with condition and length data from a subsample of the smolts and all incidental species caught in the samples.
	▪ *Fund status and trend monitoring as a component of the pilot studies in the Wenatchee, Methow, and Entiat river basins in the Upper Columbia River, the Lemhi and South Fork Salmon river basins, and the John Day River Basin to further advance the methods and information needed for assessing the status of fish populations. (Initiate in FY 2007-2009 Project Funding, review and modify annually to ensure that these projects continue to provide a means of evaluating the effectiveness of tributary mitigation actions).*	Nine BPA projects continued to be implemented and one new BPA project was implemented to support ongoing pilot studies. For example, the BPA-funded Integrated Status and Effectiveness Program projects conducted monitoring to evaluate food web and life history responses to habitat change. The program also continued juvenile snorkel surveys in winter (30) and summer (42), sampling sites to evaluate population dynamics at restoration sites compared to unrestored sites.
	▪ *Provide additional status monitoring to ensure a majority of Snake River B-Run steelhead populations are being monitored for population productivity and abundance. (Initiate by FY 2009, then annually)*	Ten projects were implemented to supplement B-run steelhead monitoring needs. For example, BPA continued to fund Idaho Monitoring and Evaluation Studies project PIT-tagged juveniles in streams of the Middle Fork Salmon River, South Fork Salmon River, and Little Salmon River to estimate juvenile steelhead production and timing. The Action Agencies are implementing additional BiOp monitoring projects in 2010 and 2011 identified in a regional collaboration effort with state and tribal entities that support this RPA action.

Research, Monitoring, and Evaluation Actions

RPA No.	Action Description	2009 Actions / Accomplishments
RME Strategy 1—Monitor the Status of Selected Fish Populations Related to FCRPS Actions		
	▪ *Review and modify existing Action Agencies' fish population status monitoring projects to improve their compliance with regional standards and protocols, and ensure they are prioritized and effectively focused on critical performance measures and populations. (Initiate in FY 2008, develop proposed modification in FY 2009, implement modifications in FY 2010)*	Forty-four BPA projects were continued that supported fish population status monitoring based on strategies developed through the Anadromous Salmonid Monitoring Strategy (ASMS) in 2009. Regional fish population status monitoring standards and protocol documentation tools were advanced through Pacific Northwest Aquatic Monitoring Partnership (PNAMP) in 2008 under BPA project number 2004-002-00 through management of the Protocol Library tool which was integrated into the BPA RME categorical review scheduled for 2010.
	▪ *Fund marking of hatchery releases from Action Agencies funded facilities to enable monitoring of hatchery-origin fish in natural spawning areas and the assessment of status of wild populations. (Annually)*	Twenty-four BPA projects were continued that supported monitoring and research on hatchery marking. For example, BPA project number 2008-740-00 was initiated to support additional marking under BPA-funded hatchery programs.
	▪ *Report available information on population viability metrics in annual and comprehensive evaluation reports. (Initiate in FY 2008)*	The RPA RME Work Group recommended finalizing the NOAA Fisheries viable salmonid population (VSP) data dictionary in coordination with PNAMP and integrate those results into Action Agency project requirements to support this RPA action.

Research, Monitoring, and Evaluation Actions

RPA No.	Action Description	2009 Actions / Accomplishments
RME Strategy 1—Monitor the Status of Selected Fish Populations Related to FCRPS Actions *The Action Agencies' strategy is to support performance monitoring and adaptive management related to the status of fish populations.*		
51	***Collaboration Regarding Fish Population Status Monitoring*** *The Action Agencies will enhance existing fish populations status monitoring performed by fish management agencies through the following collaboration commitments:*	
	▪ *Support the coordination, data management, and annual synthesis of fish population metrics through Regional Data Repositories and reports. (Annually)*	Ten BPA projects were implemented to support annual synthesis of fish population data for reports. Action Agency staff participated in RME Hydro and Hatchery RME work groups through which this was pursued.
	▪ *Facilitate and participate in ongoing regional RM&E collaboration process to develop a regional strategy for status and trend monitoring for key ESA fish populations. (Initiate in FY 2008)*	Two BPA projects were continued to support ongoing collaboration to develop regional strategies. In collaboration with NOAA Fisheries, the Action Agencies and the NPCC FCRPS BiOp RME work groups completed a draft recommendation report.
	▪ *Provide cost-shared funding support and staff participation in regional coordination forums such as the Pacific Northwest Aquatic Monitoring Partnership (PNAMP) fish population monitoring workgroup and the Northwest Environmental Data Network to advance regional standards and coordination for more efficient and robust monitoring and information management. (Annually)*	Five BPA projects were continued in 2009 to fully provide cost sharing for staff support in regional monitoring and evaluation coordination. The PNAMP Support Project, BPA project number 2004-002-00, facilitated coordination work at the program, subbasin, and regional level by providing personnel to serve as the lead staff, liaison, and point of contact for PNAMP.

Research, Monitoring, and Evaluation Actions

RME Strategy 2—Hydrosystem Research, Monitoring, and Evaluation

NOAA Fisheries concurs with the Action Agencies' strategy to support performance monitoring and adaptive management related to hydropower actions. Performance standards have been identified for average juvenile dam survival for run-of-river spring and summer migrants and adult hydro system survival. Hydrosystem Action programmatic standards have also been identified and will be annually monitored with project implementation monitoring. The expected increase in total juvenile system survival associated with the Hydrosystem Action has been identified as a long-term performance target. This performance target will be assessed in the future using the same modeling approach used to assess the benefit of actions within the Biological Opinion, but using actual operations and configurations in place in 2012 and 2015, at the time of the comprehensive evaluation. These estimates will be based on the Comprehensive Fish Passage Model (COMPASS), calibrated and validated by the most recent years' empirical survival data.

Juvenile Dam Passage Performance Standards

The Action Agencies' juvenile performance standards are an average across Snake River and lower Columbia River dams of 96 percent average dam passage survival for spring Chinook and steelhead and 93 percent average across all dams for Snake River subyearling Chinook. Dam passage survival is defined as survival from the upstream face of the dam to a standardized reference point in the tailrace. (See RME Hydro Performance Monitoring, Appendix B.2.6-2). NOAA Fisheries considers the "effect zone" of the dams to extend into the forebays. However, the available information does not support the establishment of a dam survival or delay performance standard that includes the forebay. NOAA Fisheries expects that surface passage improvements proposed in the RPA will decrease delay and increase survival through the forebays of dams that will be configured with new surface passage routes.

Juvenile In-River Survival Performance Metric

The FCRPS Action Agencies will annually measure the survival of in-river migrating fish and compare these numbers with COMPASS model estimates based on the conditions experienced and the expected benefits of completed hydro actions (SCA, In-River Juvenile Survival Appendix).

Juvenile System Survival Performance Targets

The Action Agencies' juvenile system survival performance targets estimate the expected increase in juvenile fish survival through the hydrosystem (system survival to below Bonneville Dam) that are associated with the proposed hydrosystem actions, relative to the 2004 base level (See Appendix B to the Action Agencies' Comprehensive Analysis). These relative survival improvements will be used as the biological performance target as the basis for performance tracking.

Adult Performance Standards

The Action Agencies' adult performance standards will track and confirm that the relatively high levels of adult survival currently observed are maintained or increased (see Table 7).

Research, Monitoring, and Evaluation Actions

RME Strategy 2—Hydrosystem Research, Monitoring, and Evaluation

Table 7. Adult Performance Standard by ESU.*

ESU	Adult Standard	Reach	Rationale
SR Fall Chinook	81.2%	BON to LGR	
SR Spring -Summer Chinook	91.0%	BON to LGR	
SR Sockeye	Surrogate, develop in future if data is sufficient.	BON to LGR	Standards will be developed when sufficient numbers of PIT-tagged SR sockeye return to Bonneville Dam to allow survival estimates to be made. Until then, assume that survival is adequate if SR spring/summer Chinook salmon and steelhead BON to LGR standards are met. (See below)
SR steelhead	90.1%	BON to LGR	Due to some data limitations/uncertainties, the performance standards will be reviewed as new information becomes available, and standards updated as appropriate.
UCR spring Chinook	90.1%	BON to MCN	
UCR steelhead	84.5%	BON to MCN	Due to data limitations/uncertainties, the performance standards will be reviewed as new information becomes available, and standards updated as appropriate.
MCR steelhead	Surrogate	Variable	Assume that survival is adequate if SR steelhead BON to LGR standard is met. Due to some data limitations/uncertainties, the performance standards will be reviewed as new information becomes available, and standards updated as appropriate. (See below)
CR chum	None	None	Cannot be directly measured at present. Assume that survival is adequate if SR fall Chinook BON to LGR standard is met.
LCR Chinook	None	None	Cannot be directly measured at present. Assume that survival for spring and fall populations is adequate if SR spring/summer Chinook and SR fall Chinook standards are met.

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RME Strategy 2—Hydrosystem Research, Monitoring, and Evaluation

LCR coho	None	None	Cannot be directly measured at present. Assume that survival is adequate if SR fall Chinook BON to LGR standard is met.
LCR steelhead	None	None	Cannot be directly measured at present. Assume that survival is adequate if SR steelhead BON to MCN standard is met.
UWR Chinook	None	None	Not expected to migrate upstream of Bonneville Dam
UWR steelhead	None	None	Not expected to migrate upstream of Bonneville Dam

*NMFS developed these survival standards (wild- and hatchery-origin fish combined) based on detections of PIT-tagged that were known to migrate in-river as juveniles; detections were at Bonneville Dam and later at the uppermost federal dam for the species detected from 2002 to 2006. These estimates have been adjusted to account for estimated harvest and straying rates of adults within the FCRPS migration corridor, but otherwise capture all other sources of mortality manifested within the identified reaches, including those resulting from the existence and operation of the FCRPS, unquantifiable levels of mortality from other potential sources (e.g., unreported or delayed mortality caused by fisheries, marine mammal predator attacks, etc.), and unquantifiable levels of "natural" mortality (i.e., levels of mortality in the migratory corridor that would have occurred "naturally" without human influence). Estimates are generally based on 2002 to 2007 data (see SCA - Adult Survival Rate Appendix).

Research, Monitoring, and Evaluation Actions

RPA No.	Action Description	2009 Actions / Accomplishments
RME Strategy 2—Hydrosystem Research, Monitoring, and Evaluation		
52	***Monitor and Evaluate Fish Performance within the FCRPS*** *The Action Agencies will monitor the following biological responses and/or environmental attributes involved in passage through the hydrosystem, and report these estimates on an annual basis:*	
	▪ *Monitor and evaluate salmonid dam survival rates for a subset of FCRPS projects.*	The Action Agencies addressed this subaction through implementation of three BPA projects that have successfully demonstrated that acquiring survival estimates is feasible using strategically located releases of smolts tagged with active tags (Juvenile Salmonid Acoustic Tags [JSATs] in these applications).
	▪ *Monitor and evaluate juvenile salmonid in-river and system survival through the FCRPS, including estimates of differential post-Bonneville survival of transported fish relative to in-river fish (D-value) as needed.*	Eight BPA projects were continued that addressed this subaction. Tagged smolts entering and migrating through the FCRPS (Lower Granite through Bonneville dams) were used in 2009 to estimate survival and have been produced annually since 1994.
	▪ *Monitor and evaluate adult salmonid system survival upstream through the FCRPS.*	Three BPA projects were continued to fulfill this subaction. For example, the PTAGIS system, BPA project number 1990-080-00, provides data on returning adults of known origin. In addition, NOAA Fisheries biologists conducted analyses and reported upstream passage survival for 2009.
	▪ *Provide additional PIT-tag marking of Upper Columbia River populations to provide ESU specific estimates of juvenile and adult survival through the Federal mainstem dams.*	Two projects were continued to fully address this effort in 2009: BPA project numbers 2008-724-00 and 1987-127-00. Planning is ongoing for the extent of tagging and stock coverage required and will be specified in the tagging plan being developed under RPA Action 52.6.
	▪ *Assess the feasibility of PIT-tag marking of juvenile Snake River Sockeye Salmon for specific survival tracking of this ESU from the Stanley Basin to Lower Granite Dam and through the mainstem FCRPS projects.*	Two projects, BPA project number 2008-724-00 and 1987-127-00, were continued to address this subaction. This work was initiated as a pilot study in 2009 to assess long-term needs with respect to precision levels and sample sizes for future work.
	▪ *Develop an action plan for conducting hydrosystem status monitoring (analytical approaches, tagging needs, methods, and protocols) in ongoing collaboration with the State and Federal fishery agencies and Tribes. This will be done in coordination with status monitoring needs and strategies*	One BPA project was continued to support the baseline monitoring needs of this RPA action. This RPA action will be addressed in 2010 through development of a regional PIT-tagging plan, including input from the Action Agencies, NOAA Fisheries, other federal agencies,

Research, Monitoring, and Evaluation Actions

RPA No.	Action Description	2009 Actions / Accomplishments
RME Strategy 2—Hydrosystem Research, Monitoring, and Evaluation		
	being developed for estuary/ocean, habitat, hatcheries, and harvest. (Initiate in FY2009)	and state and tribal agencies.
	▪ *Cooperate with NOAA Fisheries, US v Oregon parties, Confederated Tribes of the Colville Reservation, and other co-managers to 1) review relevant information and identify factors (migration timing, spatial distribution, etc.) that might explain the differential conversion rates (BON to MCN) observed for UCR steelhead and spring Chinook salmon compared to SR steelhead and spring/summer Chinook salmon (see RPA Table 7 and SCA - Adult Survival Estimates Appendix); 2) develop a monitoring plan to determine the most likely cause of these differential losses (considering the potential use of flat plate PIT tag detectors in tributaries or fishery areas, additional adult detectors at The Dalles and John Day fishways, etc. to provide improved estimates of harvest or stray rates for improved conversion rate estimates in the future); and 3) implement the monitoring plan.*	Three BPA projects were continued to support this RPA. The feasibility of using a tributary PIT antenna to detect adult salmon in the John Day River (see RPA Action 52) was evaluated. The PIT antenna withstood spring freshet flows and has been detecting PIT-tagged adult fish.
	Monitoring adult passage counts is a cornerstone monitoring activity that must be performed on an annual basis. Adult fish counting is typically performed 16 hours per day, during daylight hours, by either video or visual counting methods, at all of the Corps projects that pass fish. Adult fish counting will continue at a minimum on the schedule presented in Table 8.	Adult fish counts were conducted as called for in Table 8 with the following exceptions: At The Dalles, John Day, McNary and Ice Harbor dams, adult fish were counted from April 1 through October 31, rather than the dates shown in Table 8. At Lower Granite, 24-hour counts were conducted from June 15 through September 30, rather than through August 31. All changes were fully coordinated during development of the Fish Passage Plan and through the FPOM work group process.

Table 8. Minimum Adult Fish Counting Schedule

Dam	Duration of Operation	Duration of Counting	Hours of Count
Bonneville	January 1 - December 31	January 1 - December 31	04:00 - 20:00
The Dalles	February 20 – December 7	February 20 – December 7	04:00 - 20:00
John Day	February 20 – December 7	February 20 – October 31	04:00 - 20:00
McNary	March 1 – December 31	March 1 – October 31	04:00 - 20:00
Ice Harbor	March 1 – December 31	March 1 - October 31	04:00 - 20:00
Lower Monumental	March 1 – December 31	April 1 - October 31	04:00 - 20:00
Little Goose	March 1 – December 31	April 1 - October 31	04:00 - 20:00
Lower Granite	March 1 – December 31	March 1 – March 31	06:00 - 16:00
		April 1 - June 14	04:00 - 20:00
		June 15 - August 31	24 hours
		August 31 - October 31	04:00 - 20:00
		November 1 - December 31	06:00 - 16:00

Research, Monitoring, and Evaluation Actions

RPA No.	Action Description	2009 Actions / Accomplishments
RME Strategy 2—Hydrosystem Research, Monitoring, and Evaluation		
53	***Monitor and Evaluate Migration Characteristics and River Condition*** *The Action Agencies will monitor and evaluate the following biological and physical attributes of anadromous fish species migrating through the FCRPS on an annual basis:*	
	▪ *Monitor and estimate the abundance of smolts passing index dams.*	Three BPA projects were continued to address this subaction. For example, in 2009, the Fish Passage Center project, BPA project number 1994-030-00, calculated passage indices at all collector dams, as well as population estimates at Lower Granite Dam.
	▪ *Monitor and describe the migration timing of smolts at index dams, identify potential problems, and evaluate implemented solutions.*	Eleven BPA projects were continued to fully address this subaction. For example, in 2009, this was addressed by the Smolt Monitoring Program, BPA project number 1987-127-00. Data provided by this program were analyzed by the Fish Passage Center, BPA project number 1994-030-00, and NOAA Fisheries, as well as a host of other regional fish management agencies.
	▪ *Monitor and document the condition (e.g., descaling and injury) of smolts at all dams with JBS systems, identify potential problems, and evaluate implemented solutions.*	Eight BPA projects were continued to fully address this subaction. Again, as in RPA action 53.2, the Smolt Monitoring Program (SMP) monitored and documented fish condition in 2009. The Fish Passage Center and other management agencies provided analysis and implementation recommendations.
	▪ *Monitor and enumerate adult salmonids passing through fishways in the FCRPS, identify potential problems, and evaluate implemented solutions.*	The Corps again implemented its adult fish count program. Fishways were monitored on a regular basis, as per FPP requirements. Results are discussed in annual Fishway Inspection Report prepared for each project.
	▪ *In addition to current operations (generally April 10 – August 31), evaluate operation of the Bonneville PH2 corner collector from March 1 through start of spill as a potential means to provide a safer downstream passage route for steelhead kelts, and implement if warranted.*[4]	The Bonneville Corner Collector was operated beginning on April 3, 2009. This was seven days earlier than the start of operations called for in the 2008 BiOp. The April 3 start date was coordinated through the TMT and FPOM processes.

[4] Planning dates and voluntary operation of the Bonneville Dam corner collector may be adjusted (increased or decreased) through the adaptive management process or for research purposes.

Research, Monitoring, and Evaluation Actions

RPA No.	Action Description	2009 Actions / Accomplishments
RME Strategy 2—Hydrosystem Research, Monitoring, and Evaluation		
54	***Monitor and Evaluate Effects of Configuration and Operation Actions*** *The following will be conducted at specific projects for specific years as operations or configurations change, or new problems are identified.*	
	▪ *Monitor and evaluate the effects of existing spillways, modifications, and operations on smolt survival.*	▪ Evaluated effectiveness of spillway weirs at John Day Dam. The summer test of fall Chinook passage and survival was cut short due to breakage of avian array wires, allowing high levels of predation. Summer was 30 percent vs. 40 percent test (north bulk [FPP]) spill pattern). ▪ Ice Harbor – two spill treatments – looked at 30 percent reduced spill vs. BiOp spill (45 day vs. TDG cap night). ▪ McNary – evaluated survival spring and summer ▪ Lower Monumental – Spillway weir evaluation of passage distribution, forebay behavior and survival under two different spill patterns (uniform vs. bulk). Little Goose spillway weir evaluation of passage distribution, forebay behavior, and survival.
	▪ *Monitor and evaluate the effectiveness of traditional juvenile bypass systems and modifications to such, on smolt survival and condition.*	▪ Second year of study of gatewell turbulence and injuries at Bonneville Powerhouse 2 juvenile bypass system. ▪ AFEP regularly evaluates bypass performance as new systems are built, or upgrades occur to existing systems. The passage and survival studies above also estimated the proportions collected by the bypass system and the resulting survival rates.
	▪ *Monitor and evaluate the effectiveness of surface bypass structures and modifications on smolt survival and condition.*	▪ John Day • Conducted second year of testing spillway weirs installed in 2009. Details are discussed in Section 3, under RPA action 20. • Continued model study of tailrace improvement alternatives, including a tailrace flow deflector for Bay 20. ▪ Second year of evaluation of guidance efficiency of Behavioral Guidance System at Bonneville Powerhouse 2.

Research, Monitoring, and Evaluation Actions

RPA No.	Action Description	2009 Actions / Accomplishments
RME Strategy 2—Hydrosystem Research, Monitoring, and Evaluation		
		▪ Estimated route-specific passage and survival rates at Little Goose, Lower Monumental, Ice Harbor, and McNary dams.
	▪ *Monitor and evaluate the effectiveness of turbine operations and modifications on smolt survival and condition.*	▪ Estimated route-specific passage and survival rates at Little Goose, Lower Monumental, Ice Harbor, McNary, and John Day dams. ▪ At Bonneville Second Powerhouse, an assessment of turbine operations on fish injury and survival in the Juvenile Bypass System gatewells was conducted. ▪ Biological Index Test to evaluate operating turbines at the higher end of the 1 percent band at McNary dam was canceled due to concerns of potential gatewell descaling raised in the SRWG forum. As a result, a gatewell descaling evaluation is planned for 2010.
	▪ *Monitor and evaluate overall dam passage with respect to modifications at projects (including forebay delay and survival).*	Five Corps AFEP projects (at Little Goose, Lower Monumental, Ice Harbor, McNary and John Day dams) were continued to fully address this subaction through passage and survival studies, which estimated forebay and tailrace passage times and survival rates in the forebay.
	▪ *Monitor and evaluate the effectiveness of the juvenile fish transportation program and modifications to operations.*	Six BPA projects were continued to fully address this subaction. In 2009, the Action Agencies continued to make progress on monitoring and evaluating the effectiveness of the juvenile fish transportation program. Information resulting from the 2009 RME will enable further progress in identifying the benefits of transportation and supporting adaptive management actions.
	▪ *Monitor and evaluate the effects of environmental conditions affecting juvenile fish survival.*	Seven projects were continued to fully address this subaction. Total dissolved gas, temperature, turbidity, and flow are considered key factors, and they are regularly monitored throughout the FCRPS. Many PIT-tagged fish migrating through the system from assorted projects provide response units for analyzing effects on smolt survival or migration characteristics.

Research, Monitoring, and Evaluation Actions

RPA No.	Action Description	2009 Actions / Accomplishments
RME Strategy 2—Hydrosystem Research, Monitoring, and Evaluation		
	▪ *Monitor and evaluate the effectiveness of reducing predation toward improving juvenile fish survival.*	Seven projects were continued to fully address this subaction. In 2009, ongoing research under Columbia River Fish Mitigation (CRFM) and BPA FWP funding continued monitoring of avian predators and their colonies (O&M), dam angling, and estimates of annual exploitation of pikeminnow (modeling), in conjunction with juvenile dam survival studies.
	▪ *Investigate, evaluate and deploy alternative technologies and methodologies for fish passage and the RM&E Action.*	▪ Carried out second year of evaluation of spillway weirs at John Day. ▪ Carried out second year of evaluation of spillway weir at Lower Monumental Dam. ▪ Carried out first year of evaluation of spillway weirs at Little Goose Dam.
	▪ *Determine if actions directed at benefiting juveniles have an unintended effect on migrating adults (e.g., certain spill operations).*	Four projects were continued to fully address this subaction. This issue is addressed at each project as need arises. The AFEP forum addresses this matter.
	▪ *Install and maintain adult PIT-tag detectors in fish ladders at key dams in the FCRPS and evaluate adult survival (conversion rates).*	No new installations in 2009. PIT-tag detectors are now installed in all key FCRPS ladders. However, currently there are no detectors at The Dalles and John Day dams. Tributary turn-off and straying between Bonneville and McNary dams is of concern when calculating conversion rates or upstream passage survival.
	▪ *Monitor and evaluate the effects of fish ladder operations and configurations on adult passage rates.*	A new entrance was evaluated at the Bonneville Cascade Island ladder for spring Chinook (first year of evaluation). In addition, five projects were continued to fully address this subaction. This issue is addressed at each project as needed through the AFEP process.
	▪ *In addition to the current sluiceway operation (generally April 1 – November 30), evaluate operation of The Dalles Dam sluiceway from March 1 – March 31 and from December 1 – December 15 as a potential*	Second year of evaluation initiated in December 2009 (and continued in March 2010). Results will be used to develop a long-term operation plan.

Research, Monitoring, and Evaluation Actions

RPA No.	Action Description	2009 Actions / Accomplishments
RME Strategy 2—Hydrosystem Research, Monitoring, and Evaluation		
	means to provide a safer fallback passage rout for overwintering steelhead and kelts, implement if warranted.[5]	
	▪ *Investigate surface-flow outlets during wintertime to provide safer fallback opportunity for over wintering steelhead (need will be determined by results of further research).*	▪ See work at The Dalles Dam, immediately above ▪ Also see bullet five under RPA 53, above
55	***Investigate Hydro Critical Uncertainties and Investigate New Technologies*** *The Action Agencies will fund selected research directed at resolving critical uncertainties that are pivotal in lifecycle model analyses. These specific actions include:*	
	▪ *Investigate and quantify delayed differential effects (D-value) associated with the transportation of smolts in the FCRPS as needed. (Initiate in FY 2007-2009 Projects)*	▪ Continued post-Bonneville JSAT survival study, with increased focus on lower end of estuary (approximately lower 35 km). ▪ Projects were continued (including nine BPA projects) to fully address this subaction. Species coverage was expanded in 2009 to include sockeye. Other species will continue at some level, but the frequency of and sample size for acquiring estimates needs clarification for future years.
	▪ *Investigate the post-Bonneville mortality effect of changes in fish arrival timing and transportation to below Bonneville. (Initiate in FY 2007-2009)*	▪ Projects (including 10 BPA projects) were continued to fully address this subaction through review in AFEP, with focus on smolt-to-adult returns. ▪ Species coverage expanded in 2009 to include sockeye.

[5] Planning dates and voluntary operation of The Dalles Dam sluiceway may be adjusted (increased or decreased) through the adaptive management process or for research purposes.

Research, Monitoring, and Evaluation Actions

RPA No.	Action Description	2009 Actions / Accomplishments
RME Strategy 2—Hydrosystem Research, Monitoring, and Evaluation		
	▪ *Conduct a workshop every other year with members of the Independent Scientific Advisory Board (ISAB) to review current research and monitoring approaches on post Bonneville mortality for transported and non-transported fish. (Initiate in FY 2009)*	▪ BPA and Corps initiated a research project in 2008 and continued in 2009 to fully support this subaction. The workshop is in the early planning stages and will be held in the fall 2010. The workshop will synthesize research results and analyses, identify further needs, and plan the direction of future research. ▪ In 2009 the Independent Scientific Advisory Board (ISAB) began review of the proposed 2010 studies for lower river survival and the estuary program.
	▪ *Investigate, describe and quantify key characteristics of the early life history of Snake River Fall Chinook Salmon in the mainstem Snake, Columbia, and Clearwater rivers. (Initiate in FY 2007-2009 Project)*	Four BPA projects were continued to fully address this subaction. Studies have been funded by BPA for more than a decade, and complementary projects (such as radio tag investigations in Snake reservoirs) have been funded by the Corps under AFEP.
	▪ *Complete analysis and reporting of a multi-year (2000-2007) investigation on the effects of adult passage experience in the FCRPS on pre-spawning mortality (2008). Following reporting, SRWG will review the results and provide a recommendation on the need and nature of future research. Future research will be coordinated through the Regional Forum.*	Research was completed and a draft report presented in 2008. The report was finalized and posted to the Web in 2009.

Research, Monitoring, and Evaluation Actions

RPA No.	Action Description	2009 Actions / Accomplishments
RME Strategy 2—Hydrosystem Research, Monitoring, and Evaluation		
	▪ *Continue development of state-of-the-art turbine units to obtain improved fish passage survival through turbines with the goal of using these new units in all future turbine rehabilitation or replacement programs.*	▪ Submitted a draft final report of rapid decompression effects on tagged and untagged fish and initiated a new study to determine whether effects of rapid decompression on tagged fish will differ from the effects on untagged fish. ▪ Conducted physical studies at the Engineering Research and Development Center observational turbine model to determine alternatives for runner, stay vane, wicket gate and draft tube designs for new turbine unit at Ice Harbor. ▪ Advertised contract for new turbine unit at Ice Harbor, including design, manufacture and delivery of a fixed blade runner for Unit 2, with an option for manufacture of an adjustable blade runner for unit 3. ▪ Completed alternatives study of methods of capturing fish that have passed through turbines. That study recommended direct capture device. ▪ Started development of plans and specs for direct capture device. (That device is now expected to be deployed at Ice Harbor as part of effectiveness testing of new turbine runner design.)
	▪ *Investigate feasibility of developing PIT-tag detectors for spillways and turbines.*	▪ Two projects continued to fully address this subaction. Work in 2009 involved determining the feasibility of installing a PIT detector in the spillway at Bonneville and Ice Harbor dams, as well as the feasibility of installing detectors in the various surface spill weirs that are currently installed throughout the system.
	▪ *Evaluate new tagging technologies for use in improving the accuracy and assessing delayed or indirect hydro effects on juvenile or adult fish.*	▪ Through the Corps' Survival Methodologies Program, research was conducted on the effects of tagging juvenile Chinook salmon in an effort to improve surgical implantation techniques used for implanting acoustic transmitters. Utilizing this research as well as input from regional experts, substantial progress was made on the standardization of surgical tagging protocols. A final protocol document is pending finalization in 2010. In addition to tagging protocols, standardization of methods for estimating dam

Research, Monitoring, and Evaluation Actions

RPA No.	Action Description	2009 Actions / Accomplishments
RME Strategy 2—Hydrosystem Research, Monitoring, and Evaluation		
		passage survival were completed in 2009. This effort included extensive review by the region and the ISRP. ▪ Three (two BPA projects) projects were continued to fully address this subaction. JSATS (AFEP program) and the Pacific Ocean Survival Tracking Project both continued the development of tags and methods in 2009 to determine delayed or indirect effects of hydro passage by looking in the estuary below Bonneville Dam and the ocean environment off the Pacific coast. Data from these efforts are presented in a variety of government reports and peer-reviewed journal articles.
	▪ *Assess the feasibility of developing PIT-tag detectors for use in natal streams and tributaries, or other locations, as appropriate to support more comprehensive and integrated All-H monitoring designs and assessments of stray rates.*	▪ Evaluated the feasibility of using a tributary PIT antenna to detect adult salmon in the John Day River (see also RPA Action 52.7). The PIT antenna withstood spring freshet flows and has been detecting PIT-tagged adult fish (Effectiveness monitoring was initiated in 2009 and will be continued in 2010 to determine the detection efficiency of the system).

Research, Monitoring, and Evaluation Actions

RPA No.	Action Description	2009 Actions / Accomplishments
RME Strategy 3—Tributary Habitat Research, Monitoring, and Evaluation		
The Action Agencies' strategy is to support performance monitoring and adaptive management related to tributary habitat actions.		
56	***Monitor and Evaluate Tributary Habitat Conditions and Limiting Factors*** *The Action Agencies will:*	
	▪ *Implement research in select areas of the pilot study basins (Wenatchee, Methow and Entiat river basins in the Upper Columbia River, the Lemhi and South Fork Salmon river basins, and the John Day River Basin) to quantify the relationships between habitat conditions and fish productivity (limiting factors) to improve the development and parameterization of models used in the planning and implementation of habitat projects. These studies will be coordinated with the influence of hatchery programs in these habitat areas. Review and modify annually to ensure that these projects continue to provide a means of evaluating the effectiveness of tributary mitigation actions).*	Thirty BPA projects were continued and one was initiated by BPA; and three projects by Reclamation were continued that have elements that support research in select areas of the pilot study basins (Wenatchee, Methow, and Entiat River basins in the upper Columbia River; the Lemhi and South Fork Salmon River basins; and the John Day River Basin) to quantify the relationships between habitat conditions and fish productivity (limiting factors) and improve the development and parameterization of models used in the planning and implementation of habitat projects.
	▪ *Implement habitat status and trend monitoring as a component of the pilot studies in the Wenatchee, Methow and Entiat river basins in the Upper Columbia River, the Lemhi and South Fork Salmon river basins, and the John Day River Basin. (Initiate in FY 2007-2009 Projects, annually review and modify annually to ensure that these project continue to provide a means of evaluating the effectiveness of tributary mitigation actions.*	Seven projects were continued that have elements that support the implementation of habitat status and trend monitoring as a component of the pilot basin studies. To further support this RPA, the ASMS strategy identified opportunities to expand habitat status and trend monitoring for one population per major population group.
	▪ *Facilitate and participate in an ongoing collaboration process to develop a regional strategy for limited habitat status and trend monitoring for key ESA fish populations. This monitoring strategy will be coordinated with the status monitoring needs and strategies being developed for hydropower, habitat, hatchery, harvest, and estuary/ocean. (Initiate in FY 2008)*	Seven projects continued to be implemented in 2009 to support this RPA action. Collaboration work groups for fish population and tributary habitat monitoring were formed in late 2008 and continued to make progress in 2009 on the ASMS that includes fish population and habitat monitoring for at least one population per major population group. Additional projects are being implemented in 2010 and 2011 to support this strategy and help meet this RPA action.

Research, Monitoring, and Evaluation Actions

RPA No.	Action Description	2009 Actions / Accomplishments
RME Strategy 3—Tributary Habitat Research, Monitoring, and Evaluation		
57	***Evaluate the Effectiveness of Tributary Habitat Actions*** *The Action Agencies will evaluate the effectiveness of habitat actions through RM&E projects that support the testing and further development of relationships and models used for estimating habitat benefits. These evaluations will be coordinated with hatchery effectiveness studies.*	
	▪ *Action effectiveness pilot studies in the Entiat River Basin to study treatments to improve channel complexity and fish productivity. (Initiate in FY 2007-2009 Projects, review and modify annually to ensure that these projects continue to provide a means of evaluating the effectiveness of tributary mitigation actions).*	Two BPA projects were continued to support action effectiveness pilot studies in the Entiat River Basin to study treatments to improve channel complexity and fish productivity. Results of this project were shared in development of the ASMS strategy and upper Columbia recovery strategy to support further implementation of habitat treatment actions.
	▪ *Pilot study in the Lemhi River Basin to study treatments to reduce entrainment and provide better fish passage flow conditions. (Initiate in FY 2007-2009 Projects, review and modify annually to ensure that these projects continue to provide a means of evaluating the effectiveness of tributary mitigation actions).*	Two BPA projects were continued to fully address the pilot study in the Lemhi River Basin to study treatments to reduce entrainment and provide better fish passage flow conditions. The Integrated Status and Trend Monitoring Program (ISEMP) successfully installed large Biomark PIT-tag arrays in the Lemhi River and collected PIT-tag information for 2009.
	▪ *Action effectiveness pilot studies in Bridge Creek of the John Day River Basin to study treatments of channel incision and its effects on passage, channel complexity, and consequentially fish productivity. (Initiate in FY 2007-2009 Projects, review and modify annually to ensure that these projects continue to provide a means of evaluating the effectiveness of tributary mitigation actions).*	Two BPA projects were continued to fully support action effectiveness pilot studies in Bridge Creek of the John Day River Basin to study treatments of channel incision and its effects on passage, channel complexity, and consequentially, fish productivity. The ISEMP project findings supported effectiveness of reintroduction of beavers on improving fish habitat condition as a treatment to channel incision.
	▪ *Project and watershed level assessments of habitat, habitat restoration and fish productivity in the Wenatchee, Methow and John Day basins. (Initiate in FY 2007-2009 Projects, review and modify annually to ensure that these projects continue to provide a means of evaluating the effectiveness of tributary mitigation actions).*	Seven BPA projects were continued and one was initiated to support project- and watershed-level assessments of habitat, habitat restoration, and fish productivity in the Wenatchee, Methow, and John Day river basins. ISEMP completed assessment to develop common protocols for monitoring salmonid habitat conditions and fish juvenile density to support watershed assessments of habitat

Research, Monitoring, and Evaluation Actions

RPA No.	Action Description	2009 Actions / Accomplishments
RME Strategy 3—Tributary Habitat Research, Monitoring, and Evaluation		
		condition. Reclamation continued its work through an interagency agreement with USGS to evaluate listed steelhead population changes in response to barrier removals in Beaver, Libby, and Gold creeks. Reclamation led coordinated monitoring planning in the Methow Basin, including the development of a water quality monitoring program and an inventory of basin-wide passage projects that will lead to an assessment in 2010.
	▪ *Action Agencies will convene a regional technical group to develop an initial set of relationships in FY 2008, then annually convene the group to expand and refine models relating habitat actions to ecosystem function and salmon survival by incorporating research and monitoring results and other relevant information. (Initiate in FY 2008)*	The Tributary Habitat and Fish Population Work Group continued to meet in 2009 to evaluate survival models. However, the technical group did not include other technical staff from the co-managers (federal and state agencies and the tribes).

Research, Monitoring, and Evaluation Actions

RPA No.	Action Description	2009 Actions / Accomplishments
RME Strategy 4—Estuary Habitat and Ocean Research, Monitoring, and Evaluation		
The Action Agencies' strategy is to support performance monitoring and adaptive management related to estuary habitat actions.		
58	***Monitor and Evaluate Fish Performance in the Estuary and Plume*** *The Action Agencies will monitor biological responses and/or environmental attributes, and report in the following areas:*	
	▪ *Monitor and evaluate smolt survival and/or fitness in select reaches from Bonneville Dam through the estuary. (Initiate in FY 2007-2009 Projects, annually review and modify until complete)*	More than 15,000 juvenile salmonids were tagged with acoustic transmitters, released at several sites upstream of Bonneville Dam, and detected at seven acoustic telemetry arrays deployed across the lower Columbia River and estuary. Data from the studies were used to estimate survival rates of yearling and subyearling Chinook salmon and steelhead in various reaches of the lower river and estuary. The Estuary/Ocean RME Subgroup recommended fish fitness be addressed in future research.
	▪ *Develop an index and monitor and evaluate life history diversity of salmonid populations at representative locations in the estuary. (Initiate in FY 2007-2009 Projects)*	During 2009, an AFEP project developed a suite of life history diversity indices. Data collected as part of other AFEP and BPA projects are pertinent to this subaction.
	▪ *Monitor and evaluate juvenile salmonid growth rates and prey resources at representative locations in the estuary and plume. (Initiate in FY 2007-2009 Projects, annually review and modify until complete)*	Four BPA projects were continued to fully address this RPA subaction. In BPA projects number 1998-014-00, Ocean Survival of Salmonids, and number 2003-010-00, Historic Habitat Opportunities and Food-Web Linkages, data were collected on juvenile salmon growth and prey resources during cruises along transects in the nearshore ocean and plume, and research was conducted in estuarine wetlands. Data from these studies and others were used to assess how environmental effects in the estuary and ocean affect juvenile salmon survival and adult return rates.
	▪ *Monitor and evaluate temporal and spatial species composition, abundance, and foraging rates of juvenile salmonid predators at representative locations in the estuary and plume. (Initiate in FY 2007-2009 Projects, annually review and modify until complete)*	Two BPA projects were continued to fully support this subaction. BPA project number 1998-014-00, Ocean Survival of Salmonids, focused on the plume component of this RPA subaction. Also, several projects focused on avian and piscivorous predators in the estuary. Additional relevant information is presented below as part of the predation RPA

Research, Monitoring, and Evaluation Actions

RPA No.	Action Description	2009 Actions / Accomplishments
RME Strategy 4—Estuary Habitat and Ocean Research, Monitoring, and Evaluation		
		actions 68-70. Surveys of predation on juvenile salmon are conducted annually. The survey results reveal the most common predators and, in some cases, lead to estimates of predation rates.
59	***Monitor and Evaluate Migration Characteristics and Estuary/Ocean Conditions*** *The Action Agencies will monitor and evaluate selected ecological attributes of the estuary, which include the following or equivalent:*	
	▪ *Map bathymetry and topography of the estuary as needed for RM&E. (Initiate in FY 2007-2009 Projects)*	Three BPA projects were continued to fully address this subaction for mapping the channel. However, a gap exists until the bathymetry and topographic mapping can be completed for the floodplain. BPA project number 2003-007-00, Lower Columbia River/Estuary Ecosystem Monitoring, was pivotal to work throughout the estuary during 2009 to address this RPA subaction. Hydrographic surveys were conducted during 2008 and 2009 for BPA project number 2003-007-00, based on bathymetric data gaps identified and prioritized at a workshop in October 2007. Numerous other projects collected site-scale elevation data using real-time kinematic GPS. In addition, Light Detection and Ranging (LIDAR) data for topography were processed for selected sites under AFEP Project EST-02-P-04, Cumulative Effects of Habitat Restoration.
	▪ *Establish a hierarchical habitat classification system based on hydro-geomorphology, ground-truth it with vegetation cover monitoring data, and map existing habitats. (Initiate in FY 2007-2009 Projects)*	This RPA subaction was addressed as a primary objective of the BPA-funded Lower Columbia River/Estuary Ecosystem Monitoring project. Development of the classification system continued during 2009.
	▪ *Develop an index of habitat connectivity and apply it to each of the eight reaches of the study area. (Initiate in FY 2007-2009 Projects)*	During 2009, an AFEP project developed several habitat connectivity diversity indices or concepts for said indices. Data collected as part of other AFEP and BPA projects are pertinent to this subaction.
	▪ *Evaluate migration through and use of a subset of various shallow-water habitats from Bonneville Dam to the mouth toward understanding specific habitat use and relative importance to juvenile salmonids. (Initiate in FY 2007-2009 Projects, then annually)*	This RPA subaction was covered by four Action Agency projects that involved study of juvenile salmon in various shallow-water habitats from Bonneville Dam to Astoria.

Research, Monitoring, and Evaluation Actions

RPA No.	Action Description	2009 Actions / Accomplishments
RME Strategy 4—Estuary Habitat and Ocean Research, Monitoring, and Evaluation		
	▪ *Monitor habitat conditions periodically, including water surface elevation, vegetation cover, plan community structure, primary and secondary productivity, substrate characteristics, dissolved oxygen, temperature, and conductivity, at representative locations in the estuary as established through RM&E. (FY 2007-2009 Projects, then annually)*	The Action Agencies funded nine projects that address this subaction. One in particular—the Lower Columbia River/Estuary Ecosystem Monitoring project, BPA project number 2003-007-00—monitored habitat conditions at four sites in the reach between Bonneville Dam and Woodland, Washington. The data characterized the relationships between plant communities, elevation, and hydrology. Other BPA-funded projects involved study of juvenile salmon in various shallow-water habitats from Bonneville Dam to Astoria. The data increased understanding of specific habitat use and the relative importance of different habitats to juvenile salmonids.
60	***Monitor and Evaluate Habitat Actions in the Estuary*** *The Action Agencies will monitor and evaluate the effects of a representative set of habitat projects in the estuary, as follows:*	
	▪ *Develop a limited number of reference sites for typical habitats (e.g., tidal swamp, marsh, island, and tributary delta to use in action effectiveness evaluations). (Initiate in FY 2007-2009)*	BPA funded four projects. For example, the Lower Columbia River/Estuary Habitat Restoration project includes a component to evaluate reference sites as part of action effectiveness monitoring in the lower Columbia River and estuary. Data were collected from four sites during 2009 to assess the structure, function, and condition of a suite of tidal freshwater wetland habitats for comparison between restoration and reference sites to determine the effectiveness of habitat restoration.
	▪ *Evaluate the effects of selected individual habitat restoration actions at project sites relative to reference sites and evaluate post-restoration trajectories based on project-specific goals and objectives. (Initiate in FY 2007-2009 Projects, annually review and modify as appropriate or until complete)*	Ten projects, where site-scale restoration effectiveness monitoring took place, were continued to fully address this RPA subaction. Under BPA project number 2003-011-00, Lower Columbia River/Estuary Habitat Restoration, researchers intensively monitored water surface elevation, bathymetry and topography, substrate, vegetation composition and percent cover, and juvenile salmon density at three sites where tidal reconnections were restored: Mirror Lake, Scappoose Bottomlands, and Fort Clatsop. This and other projects showed that juvenile salmon typically access the newly restored areas once the opportunity is provided. Site-scale action effectiveness was also conducted under AFEP EST-02-P-04.

Research, Monitoring, and Evaluation Actions

RPA No.	Action Description	2009 Actions / Accomplishments
RME Strategy 4—Estuary Habitat and Ocean Research, Monitoring, and Evaluation		
	▪ *Develop and implement a methodology to estimate the cumulative effects of habitat conservation and restoration projects in terms of cause-and-effect relationships between ecosystem and controlling factors, structures, and processes affecting salmon habitats and performance. (Initiate in FY 2007-2009 Projects, annually review and modify as appropriate or until complete)*	Six projects were continued to support this subaction. One project, the Corps-funded multi-year project (2004-2011), has developed and is applying a methodology to evaluate the cumulative effects of multiple habitat restoration projects in the lower Columbia River and estuary.
61	***Investigate Estuary/Ocean Critical Uncertainties*** *The Action Agencies will fund selected research direct at resolving critical uncertainties that are pivotal in understanding estuary and ocean effects, which could include the following:*	
	▪ *Continue work to define the ecological importance of the tidal freshwater, estuary, plume, and nearshore ocean environments to the viability and recovery of listed salmonid populations in the Columbia River Basin.*	Seven multi-year projects are collectively investigating the relationships between juvenile salmonid condition, growth, and survival indicators.
	▪ *Continue work to define the causal mechanisms and migration/behavior characteristics affecting survival of juvenile salmon during their first weeks in the ocean.*	Two projects addressed this subaction. As an example, juvenile salmon were sampled with trawls as the fish transitioned between riverine and marine waters. Data such as species, age class, abundance, stock origin, size, and diet were collected to determine how juvenile salmon change as they move between environments.
	▪ *Investigate the importance of early life history of salmon populations in tidal fresh water of the lower Columbia River.*	Four projects conducted research to address this subaction. See RPA Action 61 in Section 3 or Table 1 of Section 4 for more information.
	▪ *Continue development of a hydrodynamic numerical model for the estuary and plume to support critical uncertainties investigations.*	Two projects conducted research to address this subaction. Modelers worked to develop an advanced observatory for the Pacific Northwest coastal margin, including the Columbia River Estuary and plume.

Research, Monitoring, and Evaluation Actions

RPA No.	Action Description	2009 Actions/Accomplishments
RME Strategy 5—Harvest Research, Monitoring, and Evaluation		
The Action Agencies' strategy is to support performance monitoring and adaptive management related to harvest actions.		
62	***Fund Selected Harvest Investigations*** *The Action Agencies will fund selected harvest investigations linked to FCRPS interests:*	
	▪ *Evaluate the feasibility of obtaining PIT-tag recoveries between Bonneville and McNary dams (Zone 6) to determine whether recoveries can help refine estimates of in-river harvest rates and stray rates used to assess adult survival rates. For FY 2009, focus on a pilot to test the feasibility of PIT-tag recoveries of harvested fish in this reach (spring, summer, and fall Chinook salmon and summer steelhead). (Initiate in FY 2007-2009 Projects)*	Nine BPA projects were continued and two were initiated to fully address this RPA subaction. For example, BPA project number 2008-508-00 evaluated run timing and upstream migration mortality of adult Chinook and sockeye salmon and steelhead through PIT-tagging at Bonneville Dam.
	▪ *Evaluate methods to develop or expand use of selective fishing methods and gear. (Initiate in FY 2007-2009 Projects)*	Four projects were continued to fully address this RPA subaction. The Action Agencies support investigations of alternative gear and modifications to existing gear strategies for fisheries in the Columbia Basin. They support development of selective gear methods to reduce hatchery surpluses consistent with Hatchery Scientific Review Group (HSRG) recommendations. In addition to gear testing, selective fishing can involve modifications to time and area management. BPA project number 1993-060-00, Select Area Fisheries Enhancement, has investigated the use of off-channel terminal fishing locations in concert with hatchery rearing and acclimation protocols to offer commercial and sport fishers harvest opportunities even when conventional mainstem fisheries are severely constrained or eliminated because of ESA limitations.
	▪ *Evaluate post-release mortality rates for selected fisheries. (Initiate in FY 2007-2009 Projects)*	One project was continued and two new projects were initiated to support this RPA subaction. BPA project number 2007-249-00, Evaluate Live-Capture Fishing Gear for Salmon project, incorporated monitoring protocols to assess fish condition after capture, holding, and release.
	▪ *Support coded-wire tagging and coded-wire tag recovery operations that inform survival, straying, and harvest rates of hatchery fish by stock,*	Fourteen BPA projects were continued to address this RPA subaction. The RME Work Group encouraged additional sampling effort on the

Research, Monitoring, and Evaluation Actions

RPA No.	Action Description	2009 Actions / Accomplishments
RME Strategy 5—Harvest Research, Monitoring, and Evaluation		
	rearing facility, release treatment, and location. (Initiate in FY 2007-2009 Projects)	spawning grounds. This may require shifting some effort from the ocean fisheries to in-river monitoring. The RME Work Group also recommends that contracts include language to improve quality assurance/quality control (QA/QC), analysis, and data management.
	▪ *Investigate the feasibility of genetic stock identification monitoring techniques. (Initiate in FY 2007-2009 Projects)*	Twenty-five projects were continued and two were initiated to fully address this RPA subaction. For example, for BPA Project number 2008-907-00, the Genetic Assessment of Columbia River Stocks., work began in 2008 to address single nucleotide polymorphism (SNP) discovery, genetic baseline expansion, genetic stock identification (GSI) to evaluate catch, and GSI of salmon and steelhead passing Bonneville Dam.

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RPA No.	Action Description	2009 Actions / Accomplishments
RME Strategy 6—Hatchery Research, Monitoring, and Evaluation		
The Action Agencies' strategy is to support performance monitoring and adaptive management related to hatchery actions.		
63	*Monitor Hatchery Effectiveness* *The Action Agencies will continue to fund selected monitoring and evaluation of the effectiveness of Hatchery Actions. The evaluation of hatchery projects will be coordinated with the Tributary Habitat monitoring and evaluation program. These actions include:*	
	▪ *Determine the effect that safety-net and conservation hatchery programs have on the viability and recovery of the targeted populations of salmon and steelhead. (Initiate in FY 2007-2009 Projects)*	Sixteen BPA projects were continued to address this RPA subaction. All ongoing BPA-funded safety-net and conservation program projects to implement RPA actions 41 and 42 have monitoring and evaluation elements to evaluate effectiveness. In some cases, there is a separate project to monitor effects on the viability and recovery of targeted populations.
	▪ *Determine the effect that implemented hatchery reform actions have on the recovery of targeted salmon and steelhead populations. (Initiate in FY 2007-2009 Projects)*	Two BPA projects were continued to address this RPA subaction. In 2009, there were no projects that addressed this RPA for the Tucannon, Touchet, and Winthrop NFH steelhead programs. However, the USFWS is currently evaluating a means of implementing the reform recommendations at Winthrop NFH. Reclamation provided PIT tags to Winthrop NFH and through actions associated with RPA actions 56 and 57 will evaluate in-river survival of the 2010 releases. WDFW will develop proposals in 2010 for evaluating implementation of the reform actions for the Tucannon and Touchet steelhead programs, with the RME funding to be provided through the LSRCP.
64	*Investigate Hatchery Critical Uncertainties* *The Action Agencies will continue to fund selected research directed at resolving artificial propagation critical uncertainties:*	
	▪ *Continue to estimate the relative reproductive success (RSS) of hatchery – origin salmon and steelhead compared to reproductive success of their natural-origin counterparts for ESA-listed spring/summer Chinook population in the Upper Grande Ronde, Lostine River, and Catherine*	Fourteen BPA projects were continued to fully address this RPA subaction. In 2009, BPA continued to fund relative reproductive success (RRS) studies for listed spring/summer Chinook salmon in the upper Grande Ronde River, Lostine River, and Catherine Creek;

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RPA No.	Action Description	2009 Actions/Accomplishments
RME Strategy 6—Hatchery Research, Monitoring, and Evaluation		
	Creek; listed spring Chinook in the Wenatchee River; and listed steelhead in the Hood River. Continue to fund the ongoing RRS feasibility study for Snake River fall Chinook to completion in 2009. (Initiate in FY 2007-2009 Projects)	for listed spring Chinook in the Wenatchee River; for listed steelhead in the Hood River; and for listed fall Chinook in the Snake River.
	▪ *Determine if properly designed intervention programs using artificial production make a net positive contribution to recovery of listed populations. (Initiate in FY 2007-2009)*	Thirty-nine projects were continued and one was initiated to fully address this RPA subaction. Wild-origin adults from spawning grounds and other previous samples were sorted into single brood year samples (based on scale ages) and compared to same brood year wild juvenile samples and other brood year-specific project samples. The relative reproductive success of Snake River hatchery and wild fall Chinook was evaluated against the proportions of hatchery and wild fall Chinook estimated to be on upper Snake River spawning grounds. The estimates for origins and relative abundance of potential natural spawners were made from data collected annually at the Lower Granite Dam adult trap.
	▪ *In collaboration with the other entities responsible for steelhead mitigation in the Methow River, BPA will fund a new RSS study for ESA-listed steelhead in the Methow River. BPA will also fund a new RSS study for listed fall Chinook in the Snake River. NOAA Fisheries will provide technical assistance to the Action Agencies in development of conceptual study designs suitable for use by the Action Agencies in obtaining a contractor to implement the new studies. (Initiate in FY 2007-2009 Projects)*	Three BPA projects were continued to fully support Subaction 3 of RPA action 64. For example, BPA project number 1989-098-00, the Salmon Studies in Idaho Rivers project, estimated overall survival to Lower Granite Dam using the Survival Using Proportional Hazards (SURPH) model by life stage for juvenile Chinook salmon from Idaho Supplementation Studies (ISS) treatment and control streams based on PIT-tag detections at Lower Granite, Little Goose, and Lower Monumental dams on the Snake River and McNary Dam on the Columbia River.
65	*Investigate Hatchery Critical Uncertainties* *The Action Agencies will fund research directed at resolving critical uncertainties:*	
	▪ *In the mainstem Snake River above the Lower Granite Dam, estimate the effectiveness/fitness in nature of hatchery-origin fall Chinook salmon from federally funded Snake River hatchery programs relative to natural origin Snake River fall Chinook.*	Five BPA projects were continued to support this RPA subaction. BPA plans to issue a targeted solicitation in 2010 for a new study to compare reproductive success/fitness of hatchery origin Snake River fall Chinook to reproductive success/fitness of natural-origin fall

Research, Monitoring, and Evaluation Actions

RPA No.	Action Description	2009 Actions / Accomplishments
RME Strategy 6—Hatchery Research, Monitoring, and Evaluation		
		Chinook.
	▪ *Estimate fall Chinook hatchery program effects on the productivity of the fall Chinook salmon ESU.*	One BPA project was continued and one was initiated to address this RPA subaction. In addition, the BPA projects associated with Subaction 1 of RPA action 65 were implemented to support Subaction 2 by evaluating fall Chinook salmon productivity. The Hatchery/Harvest RME Work Group recommended additional research on Snake River fall Chinook RRS and effects of hatchery programs on productivity of the ESU, and BPA plans to issue a targeted solicitation for the studies in 2010.
	▪ *NOAA Fisheries will provide technical assistance to the Action Agencies in development of conceptual study designs suitable for use by the Action Agencies in obtaining a contractor to implement new studies.*	NOAA Fisheries is expected to provide technical assistance to BPA in 2010 to support development of a targeted solicitation for a new Snake River fall Chinook RRS study to estimate the effects of the fall Chinook hatchery programs on productivity of the ESU.

Research, Monitoring, and Evaluation Actions

RPA No.	Action Description	2009 Actions/Accomplishments
RME Strategy 7—Predation and Invasive Species Management Research, Monitoring, and Evaluation		
The Action Agencies' strategy is to support performance monitoring and adaptive management related to predation management actions.		
66	***Monitor and Evaluate the Caspian Tern Population in the Columbia River Estuary*** *The Action Agencies will monitor the tern population in the estuary and its impacts on outmigrating juvenile salmonids, as well as the effectiveness of the Caspian tern management plan.*	▪ Continued Caspian tern monitoring, focusing on colony size, reproduction rates, diet composition, and predation rates. ▪ Colony monitoring conducted on newly created islands in central and southeastern Oregon. ▪ Fern Ridge remains the only non-used island of those available for nesting in 2009.
67	***Monitor and Evaluate the Double-Crested Cormorant Population in the Columbia River Estuary*** *The Action Agencies will monitor the cormorant population in the estuary and its impacts on outmigrating juvenile salmonids and develop and implement a management plan to decrease predation rates, if warranted.*	Double-crested cormorant monitoring continued, focusing on colony size, reproduction rates, diet composition, and predation rates. An approximate 10 percent increase in colony size observed in 2009, eating an estimated 11.1 million juvenile salmonids.
68	***Monitor and Evaluate Inland Avian Predators*** *The Action Agencies will monitor avian predator populations in the Mid-Columbia River and evaluate their impacts on outmigrating juvenile salmonids and develop and implement a management plan to decrease predations rates, if warranted.*	Inland avian monitoring was conducted at primary nesting sites and for overwintering double-crested cormorants throughout 2009. Colony size, reproduction rates, diet composition, and predation rates were monitored to determine the annual trend effect of the colonies on juvenile salmonids. Reclamation funded tagging fish at Rock Island and recovery of tags on Goose Island in Potholes Reservoir. Three workshops on dam vs. habitat-related RME and potential implementable management actions were completed in 2009 between the Action Agencies and the Regional Forum to coordinate development of the Inland Avian Management Plan for Corps-owned lands. The development and implementation of the Inland Avian Management Plan continued through regional collaboration throughout 2009.

Research, Monitoring, and Evaluation Actions

RPA No.	Action Description	2009 Actions / Accomplishments
RME Strategy 7—Predation and Invasive Species Management Research, Monitoring, and Evaluation		
69	***Monitoring Related to Marine Mammal Predation*** *The Action Agencies will:*	
	Estimate overall sea lion abundance immediately below Bonneville Dam. (Initiate in FY 2007-2009 Projects)	Sea lion abundance below Bonneville Dam was estimated in 2009. See the discussion in Section 3 for details.
	▪ *Monitor the spatial and temporal distribution of sea lion predation attempts and estimate predation rates. (Initiate in FY 2007-2009 Projects)*	Spatial and temporal distribution of predation attempts and predation rates were monitored in 2009 through BPA- and Corps-funded efforts.
	▪ *Monitor the effectiveness of deterrent actions (e.g., exclusion gates, acoustics, harassment and other measures) and their timing of application on spring runs of anadromous fish passing Bonneville Dam. (Initiate in FY 2007-2009 Projects)*	The effectiveness of deterrent actions and the timing of application on spring runs was determined in 2009 through BPA- and Corps-funded efforts.
70	***Monitoring Related to Piscivorous (Fish) Predation*** *The Action Agencies will:*	
	▪ *Continue to update and estimate the cumulative benefits of sustained removals of northern pikeminnow since 1990. (Initiate in FY 2007-2009 Projects)*	The BPA-funded NPMP has an extensive biological evaluation component that annually collects and validates biological field data and updates the benefit model with the latest year's data. The 2009 estimated reduction in potential predation was 38 percent, based on the 2009 exploitation rate of 12.8 percent for pikeminnow 250 millimeters in fork length or larger and the cumulative effect of previous years removals.
	▪ *Continue to evaluate if inter and intra compensation is occurring. (Initiate in FY 2007-2009 Projects)*	The evaluation of the NPMP annually assesses whether compensation is occurring as a result of cumulative removals to date. Program evaluation gives no indication that compensation by smallmouth bass, walleye, or channel catfish is occurring.
	▪ *Evaluate the benefit of additional removals and resultant increase in exploitation rate's affect on reduction in predator mortality since the 2004 program incentive increase. (Initiate in FY 2007-2009 Projects)*	System-wide exploitation in 2009 of northern pikeminnow was 12.8 percent based on a numerical catch of 141,645 from a sport reward fishery and dam angling fishery.

Research, Monitoring, and Evaluation Actions

RPA No.	Action Description	2009 Actions / Accomplishments
RME Strategy 7—Predation and Invasive Species Management Research, Monitoring, and Evaluation		
	▪ *Develop a study plan to review, evaluate, and develop strategies to reduce non-indigenous piscivorous predation. (Initiate in FY 2007-2009 Projects)*	In December, 2009 the project sponsors submitted for review of the Independent Scientific Review Panel for the Northwest Power and Conservation Council the proposal titled "*Understanding the influence of predation by introduced fishes on juvenile salmonids in the Columbia River Basin: closing some knowledge gaps.*" Implementation of research activities can occur once this review is completed.

Research, Monitoring, and Evaluation Actions

RPA No.	Action Description	2009 Actions / Accomplishments
RME Strategy 8—Coordination and Data Management Research, Monitoring, and Evaluation		
The Action Agencies are committed to making coordination and data management more effective, since FCRPS RME is part of the overall RME for recovery of salmon in the Columbia River Basin.		
71	***Coordination*** *The Action Agencies will coordinate RM&E activities with other Federal, State and Tribal agencies on an ongoing annual basis, including:*	
	▪ *Organizing and supporting the Corps AFEP.*	The Corps implemented its AFEP. The selection and development of experimental design and methodology of research projects to be carried out in 2010 was extensively coordinated with other federal agencies, states, and tribal interests through their involvement in the SRWG, which met several times through the year. The AFEP program also includes the Fish Facility Design and Review Work Group (FFDRWG) and the Fish Passage Operations and Maintenance (FPOM) work group. Federal, state, and tribal fishery agencies are invited to participate in FFDRWG and FPOM meetings, both of which generally occur monthly.
	▪ *Supporting and participating in the Council's Columbia River Basin Fish and Wildlife Program project planning and review efforts.*	BPA continued to work with NPCC staff in coordinating its Fish and Wildlife Program's project planning and review efforts. In 2009 BPA and the NPCC initiated the process to conduct the RME and Artificial Production Categorical Review to support a comprehensive evaluation of the Fish and Wildlife Program's research and monitoring projects.
	▪ *Supporting the standardization and coordination of tagging and monitoring efforts through participation and leadership in regional coordination forums such as PNAMP.*	Four BPA projects and one Reclamation project were continued to fully support this subaction. The PNAMP project supported the Tagging and Telemetry Monitoring project to evaluate tagging and telemetry work and make recommendations on field protocols and methods for fish tagging and telemetry field data collection techniques. The Fish Passage Center continued to support the evaluation and synthesis of fish passage of tagged fish through the hydropower system.

Research, Monitoring, and Evaluation Actions

RPA No.	Action Description	2009 Actions / Accomplishments
RME Strategy 8—Coordination and Data Management Research, Monitoring, and Evaluation		
	▪ *Working with regional monitoring agencies to develop, cooperatively fund, and implement standard metrics, business practices, and information collection and reporting tools needed to cooperatively track and report on the status of regional fish improvement and fish monitoring projects.*	Ten BPA projects were continued and two were initiated to address this subaction. The PNAMP integrated a Status and Trend Monitoring demonstration project to support management of a regional master sample based on a Generated Random Tessellated Sample (GRTS) design to support efficient and statistically based monitoring designs for fish and habitat programs across the Northwest.
	▪ *Coordinating the further development and implementation of Hydrosystem, Tributary Habitat, Estuary/Ocean, Harvest, Hatchery, and Predation RM&E through leadership and participation in ongoing collaboration and review processes and workgroups.*	Four BPA projects were continued to fully support this RPA subaction. The ISEMP project, BPA project number 200301700, continued facilitation and coordination of the RME Tributary Habitat RME workgroup and provided staff time, developed monitoring inventories for the RME gap assessment, and completed the RPA workgroup draft RPA Recommendation Report.
	▪ *Coordinating implementation with other appropriate regional collaboration processes. This includes coordination related to statutory provisions for the Federal government (BPA/Council), voluntary coordination among Federal agencies (Federal Caucus), and coordination with regional processes for Federal/non-Federal engagement (Technical Management Team (TMT), System Configuration Team (SCT), PNAMP, Northwest Environmental Data-Network (NED)), and others.*	Two BPA projects were continued and two were initiated to fully support this subaction. The BPA funded the Columbia Basin Fish and Wildlife Authority (CBFWA) to support the regional workshops to support development of the Columbia Basin ASMS through collaboration of state, tribal, and federal entities. The workshops supported evaluation of the RME workgroup RME RPA Gap Assessment and Recommendation Report and helped fill gaps in tributary and VSP monitoring.

Research, Monitoring, and Evaluation Actions

RPA No.	Action Description	2009 Actions / Accomplishments
RME Strategy 8—Coordination and Data Management Research, Monitoring, and Evaluation		
72	***Data Management*** *The Action Agencies will ensure that the information obtained under the auspices of the FCRPS RM&E Program is archived in appropriate data management systems. Actions include:*	
	▪ *Continue to work with regional, Federal, State and Tribal agencies to establish a coordinated and standardized information system network to support the RM&E program and related performance assessments. The coordination of this development will occur primarily through leadership, participation, and joint funding support in regional coordination forums such as the NED workgroup, and PNAMP and the ongoing RM&E pilot studies in the Wenatchee River, John Day River, Upper Salmon River, and Columbia River Estuary. (Initiate in FY 2007-2009 Projects)*	One Reclamation and eight BPA projects were continued to fully support this subaction. BPA project number 2008-727-00 was implemented to support development of a coordinated and standardized information management network through use of a PNAMP data steward to help coordinate data management efforts in the region.
	▪ *Contribute funding for data system components that support the information management needs of individual Hydrosystem, Tributary Habitat, Estuary/Ocean, Harvest, Hatchery, and Predation RM&E. (Initiate in FY 2007-2009 Projects)*	Three BPA projects were continued to address this subaction. Additional recommendations for data stewards and technical support were identified by the RME Work Group.
	▪ *Participate in Northwest regional coordination and collaboration efforts such as the current PNAMP and NED efforts to develop and implement a regional management strategy for water, fish and habitat data. (Initiate in FY 2007-2009 Projects)*	Five BPA projects were continued and three were initiated to fully support this subaction. The PNAMP funding for BPA project number 2004-002-00 supported staff for coordination or work sessions and regional collaboration discussion by the PNAMP Data Management Work Group to continue implementation of Northwest Environmental Data-network (NED) recommendations.

Research, Monitoring, and Evaluation Actions

RPA No.	Action Description	2009 Actions/Accomplishments
RME Strategy 9—Project Implementation and Compliance Monitoring Research, Monitoring, and Evaluation		
The Action Agencies have identified specific commitments or actions for each of the hydrosystem, estuary/ocean, tributary habitat, hatchery, and predator control strategies, providing clear programmatic-level measures for evaluating progress, subject to adaptive management. Implementation details will be updated in 3-year cycles. Projects will be monitored for implementation of planned deliverables and compliance to performance expectations.		
73	***Implementation and Compliance Monitoring*** *The Action Agencies will:*	
	▪ *Annually monitor the successful implementation of projects through standard procedures and requirements of contract oversight and management, and review of project deliverables and final reports.*	BPA updated the Pisces program to track project implementation to support project effectiveness evaluations.
	▪ *Maintain project and action level details for planning and reporting purposes. This approach will provide the most up-to-date information about the status of actions and projects being implemented.*	BPA implemented the Pisces program to track project implementation for all projects and started development of the BPA Dashboard and Taurus program to track action implementation for the FCRPS RPA actions.
	▪ *Maintain a comprehensive habitat project tracking system where relevant project information is contained in an accessible comprehensive data system. The data system will contain project level information that is needed for both implementation and effectiveness monitoring. The system will include the set of minimum metrics and meta data for RM&E data design listed in Data Management Needs for Regional Project Tracking to Support Implementation and Effectiveness Monitoring (Katz et al. 2006). (Initiate in FY 2008)*	BPA updated the Pisces system to support Katz et al. (2006) metrics to help support action effectiveness evaluations across the Columbia Basin.

Endangered Species Act
Federal Columbia River Power System
2009 Annual ESA Progress Report: Section 3

Detailed Description of Reasonable and Prudent Alternative (RPA) Action Implementation

Under Reasonable and Prudent Alternative (RPA) action 2, the Action Agencies submit an annual progress report that describes the status of implementation for the previous calendar year. Section 3 describes this progress for each RPA action. Section 4 includes a list of all projects implemented in 2009 along with their associated RPA subactions.

Contents

Tables

Figures

Hydropower Implementation Reports, RPA Actions 4–33

This document reports on actions taken during calendar year 2009. The Hydropower RPA actions are intended to be implemented over the term of the Biological Opinion (BiOp). Although many of these actions were under way or being implemented during 2008, some will be implemented later in the BiOp period. For hydro operations, actions are reported by water year (October thru September) rather than calendar year because this is more meaningful.

Table 1. Hydropower Strategy Reporting

RPA Action No.	Action	Annual Progress Report
Hydropower Strategy 1		
4	Storage Project Operations	Prepare an annual year-end review.
5	Lower Columbia and Snake River Operations	Prepare an annual year-end review.
6	In-Season Water Management	Annual progress reports will describe Federal Columbia River Power System (FCRPS) operations for the fish passage season. There is no other physical or biological monitoring or reporting.
7	Forecasting and Climate Change/Variability	Annual progress reports will include a summary of the annual forecast review and any new, pertinent climate change information or research.
8	Operational Emergencies	Annual progress reports will describe any emergency situations and actions taken per the emergency protocols. There is no other physical or biological monitoring or reporting.
9	Fish Emergencies	Annual progress reports will describe any fish emergency situations and actions taken. There is no other physical or biological monitoring or reporting.
10	Columbia River Treaty Storage	Annual progress reports will describe actions taken to provide 1 million acre-feet (maf) of storage in treaty space. There is no other physical or biological monitoring or reporting.
11	Non-Treaty Storage (NTS)	Annual progress reports will describe actions taken to refill non-treaty storage space. There is no other physical or biological monitoring or reporting.
12	Non-Treaty Long-Term Agreement	Annual progress reports will describe actions taken to develop long-term and/or annual agreements that affect lower Columbia River flows during the April through August period. There is no other physical or biological monitoring or reporting.
13	Non-Treaty Coordination with Federal Agencies, States, and Tribes	Annual progress reports will describe actions to coordinate non-treaty storage agreements. There is no other physical or biological monitoring or reporting.

Table 1. Hydropower Strategy Reporting

RPA Action No.	Action	Annual Progress Report
14	Dry Water Year Operations	Annual progress reports will describe actions taken during dry water years. There is no other physical or biological monitoring or reporting.
15	Water Quality Plan for Total Dissolved Gas and Water Temperature in the Mainstem Columbia and Snake Rivers	Annual progress reports will describe actions taken to implement Endangered Species Act (ESA) commitments. There is no other physical or biological monitoring or reporting.
16	Tributary Projects	Status of the consultations for Reclamation's tributary projects will be provided in the annual progress reports.
17	Chum Spawning Flows	Annual progress reports will describe in-season water management actions taken during the water year, which includes part of the previous calendar year.
18	Configuration and Operational Plan for Bonneville Project	Annual progress reports will describe status of the actions taken in the Configuration and Operational Plan (COP) and the results of the associated research, monitoring, and evaluation (RME).
19	Configuration and Operational Plan for The Dalles Project	Annual progress reports will describe the status of the actions taken in the COP and the results of the associated RME.
20	Configuration and Operational Plan for John Day Project	Annual progress reports will describe the status of the actions taken in the COP and the results of the associated RME.
21	Configuration and Operational Plan for McNary Project	Annual progress reports will describe the status of the actions taken in the COP and the results of the associated RME.
22	Configuration and Operational Plan for Ice Harbor Project	Annual progress reports will describe the status of the actions taken in the COP and the results of the associated RME.
23	Configuration and Operational Plan for Lower Monumental Project	Annual progress reports will describe status of the actions taken in the COP and the results of the associated RME
24	Configuration and Operational Plan for Little Goose Project	Annual progress reports will describe the status of the actions taken in the COP and the results of the associated RME.
25	Configuration and Operational Plan for Lower Granite Project	Annual progress reports will describe the status of the actions taken in the COP and the results of the associated RME.
26	Chief Joseph Dam Flow Deflector	Annual progress reports will describe the status of the flow deflector construction. Note: This construction project was completed in spring 2009.

Table 1. Hydropower Strategy Reporting

RPA Action No.	Action	Annual Progress Report
27	Turbine Unit Operations	Annual progress reports are developed by Bonneville Power Administration (BPA).
Hydropower Strategy 2		
28	Columbia and Snake River Project Adult Passage Improvements	Annual progress reports will describe the status of the actions taken.
Hydropower Strategy 3		
29	Spill Operations to Improve Juvenile Passage	Spill operations are reported annually.
30	Juvenile Fish Transportation in the Columbia and Snake Rivers	Annual progress reports will provide the number of fish collected and transported in an annual report each February.
31	Configuration and Operational Plan Transportation Strategy	Annual progress reports will describe the status of the construction and operational actions and associated RME to support the transportation strategy.
Hydropower Strategy 4		
32	Fish Passage Plan	Not applicable.
Hydropower Strategy 5		
33	Snake River Steelhead Kelt Management Plan	Status of project implementation (including project milestones) through December of the previous year for all actions identified in implementation plans.

Hydropower Strategy 1 (RPA Actions 4–27)

RPA Action 4 – Storage Project Operations: *The Action Agencies will operate the FCRPS storage projects (Libby, Hungry Horse, Albeni Falls, Grand Coulee, and Dworshak projects) for flow management to aid anadromous fish. These storage project operations will be included in the Water Management Plan. These projects are operated for multiple purposes including fish and wildlife, flood control, irrigation, navigation, power, and recreation.*

The Federal Columbia River Power System (FCRPS) storage projects were operated in accordance with the 2009 Water Management Plan (WMP), at *http://www.nwd-wc.usace.army.mil/tmt/documents/wmp/2009/final/wmp_final_20081231.pdf*), which was developed in the fall 2008 with full regional coordination.[1] The 2009 operations were under court order, as in

[1] *The Regional Forum process was developed in 1995 and has been employed ever since by NOAA Fisheries and other regional entities to implement ESA provisions for protection and recovery of listed salmon species. Members of the Regional Forum include: State and Tribal sovereigns with management authority over fish and wildlife resources and water quality in the Columbia River basin; and Federal agencies with regulatory or action authority in the Columbia River, including NOAA Fisheries, USFWS, BPA, Corps, EPA, and Reclamation. Other agencies and regional interests, such as the Northwest Power and Conservation Council, the Idaho Power Company and the Mid-Columbia Public Utility Districts, may also attend. The Regional Forum consists of several technical workgroups*

2008. In accordance with the adaptive management provisions of the 2008 BiOp, the WMP was developed to meet RPA hydro actions identified in the 2008 FCRPS BiOp and the 2000 and 2006 U.S. Fish and Wildlife Service (USFWS) BiOps (USFWS 2000, 2006). The WMP incorporates operations consistent with the 2009 Spring and Summer Fish Operations Plans (FOPs) and the respective court orders. Details of the operations of the projects are shown in Figures 1 through 4 and described below. Further discussion of these operations is included in the minutes of the Technical Management Team (TMT) meeting "Annual Review of Lessons Learned 2009" at *http://www.nwd-wc.usace.army.mil/tmt/agendas/2009/1211min.pdf*

Dworshak Dam

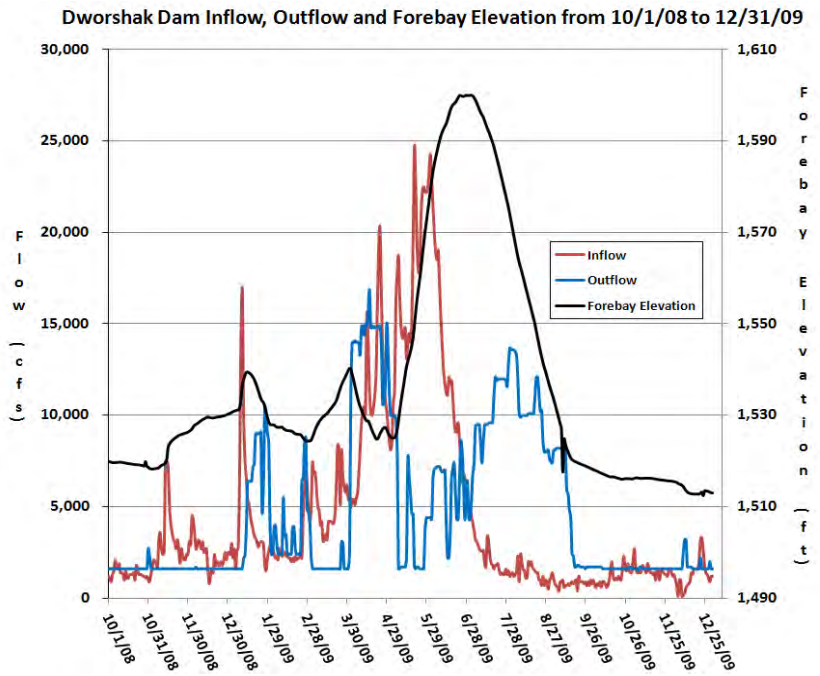

Figure 1. Dworshak Dam Inflow, Outflow, and Forebay Elevation from October 1, 2008, through December 31, 2009.

From October 2008 through early January 2009, Dworshak Dam released the minimum flow requirements of approximately 1,500 cubic feet per second (cfs), except for some minor unit testing. Dworshak Dam began January 2009 at elevation 1530.5 feet, well under flood control elevations. The project drafted to meet system and local flood control elevation targets for the end of January and February (Figure 1). The outflow was shaped daily and weekly to most efficiently meet system power requirements.

During March and through mid-April the project was operated near minimum outflow to shift system flood control to Grand Coulee Dam and to meet local flood control targets. The April 1 forecast was 2.683 thousand acre-feet (kaf), or 98 percent of average, but significant rains and rises in inflow required that the project increase to powerhouse plus spill to attempt to meet mid and end of April elevation targets. The project averaged 14,127 cfs outflow during April and was at elevation 1526.2

such as the Technical Management Team (TMT), the System Configuration Team (SCT), the Studies Review Work Group (SRWG), and the Fish Passage Operations and Maintenance (FPOM) workgroup. As used in this document, "the region" or "regional coordination" generally refers to the Regional Forum technical subgroup appropriate for the issue at hand.

feet on April 30. Dworshak Dam was operated to standard flood control criteria during the winter and spring flood control season.

The start of refill began on May 6, when Dworshak Dam began operating according to Flood Control/Refill Curve procedures. Releases from Dworshak Dam in May averaged 4,529 cfs. During portions of May project outflow was increased and adjusted at the request of the salmon managers to maintain flow objectives in the lower Snake River for salmon. The May forecast for the May to July inflow volume was 2,631 kaf, which was 98 percent of average. During April and May, the inflows averaged 10,530 cfs and 16,874 cfs, respectively. Dworshak Dam reached full levels (maximum elevation of 1,600.0 feet) on July 1.

The reservoir began drafting on July 5 to provide temperature and flow augmentation for the lower Snake River. Summer temperature management was successful, maintaining Lower Granite Dam tailwater temperatures below 68 degrees Fahrenheit for all but portions of two days, July 29 and August 1. The maximum Lower Granite Dam tailwater temperature recorded in 2009 was 68.4 degrees Fahrenheit. By August 31, the reservoir was drafted to elevation 1,535.0 feet. September operations followed the Nez Perce 200 kaf operational plan for 2009, with orderly prescribed stepdowns to a flow of about 2000 cfs on September 17, where the reservoir reached 1,520 feet.

From October to December, Dworshak Dam released minimum flows of 1,500 cfs, except during brief periods of turbine testing following normal maintenance activities. Dworshak ended December at elevation 1,513.1 feet, with flood control elevation being 1,558.2 feet.

Libby Dam

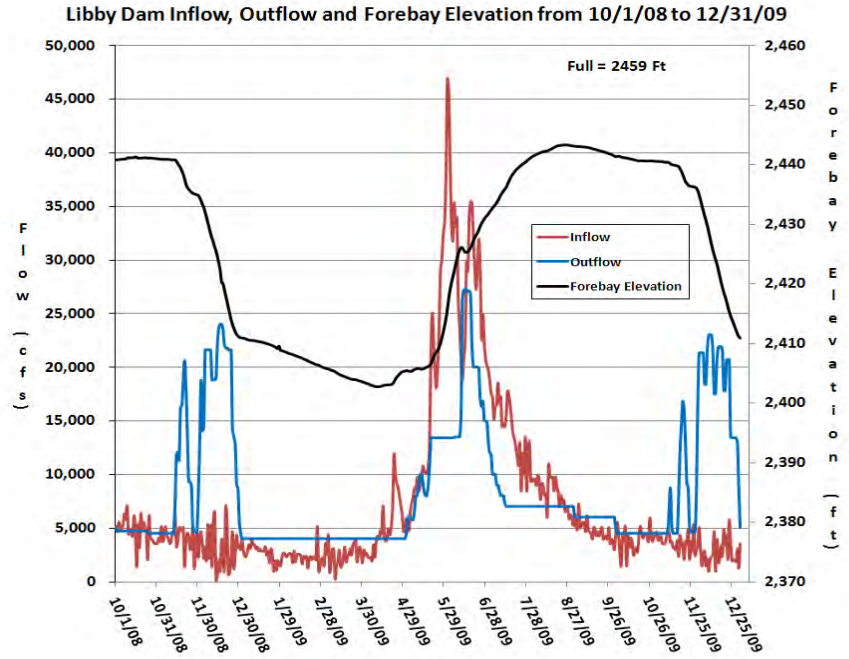

Figure 2. Libby Dam Inflow, Outflow, and Forebay Elevation from October 1, 2008, through December 31, 2009.

After meeting an end of December 2008 flood control elevation target of 2411.0 feet, from January through April 2009, Libby Dam released the minimum flow of 4,000 cfs (Figure 2).

Libby Dam operated consistent with the variable outflow flood control procedures (VARQ) that were incorporated into RPA action 4 of the 2008 BiOp. The start of refill was declared on April 27, with outflows averaging 10,100 cfs for all of May. The project was then operated to provide tiered augmentation volumes for listed Kootenai River white sturgeon to achieve habitat attributes for

sturgeon spawning/recruitment shaped through coordination with the regional Technical Management Team (TMT) and consistent with the 2008 BiOp RPA action regarding May, June, and July operations. The May forecast for the April through August inflow volume was 5,209 kaf, which set the sturgeon volume at 0.8 million acre-feet (maf) and established the tiered bull trout minimum flows from the end of the sturgeon pulse through August 31 at 7,000 cfs. The sturgeon pulse started June 10. The sturgeon volume was exhausted on July 12. The pulse included seven days at Libby Dam's full powerhouse and an additional five days above 20,000 cfs on the descending limb. Libby Dam reached a maximum elevation of 2,444.3 feet on August 24 and did not refill. The actual April through August water supply volume was 4400 kaf, much drier than forecasted.

After the sturgeon pulse Libby Dam ramped down to a minimum bull trout flow of 7,000 cfs for July and August. In September, Libby Dam operated to the minimum bull trout flow of 6,000 cfs.

From October to December 2009, Libby Dam was regulated to meet the projected end-of-December target elevation, to optimize for power any draft to meet the December flood control target, and to limit any fluctuations by operating to the ramping rates in the 2006 USFWS BiOp. The project followed the end-of-December variable flood control draft based on the December early season forecast. This forecast was 6,544 kaf for the April through August inflow volume forecast. This forecast set the end-of-December flood control target at 2,411 feet. Actual elevation on December 31 was 2,410.9 feet. Throughout 2009, Libby Dam avoided spill and did not exceed the Montana state total dissolved gas standard of 110 percent. In accordance with the 2008 BiOp, Libby Dam was also regulated consistently with the Columbia River Treaty, the International Joint Commission, and the 1938 Order on Kootenay Lake.

Grand Coulee Dam

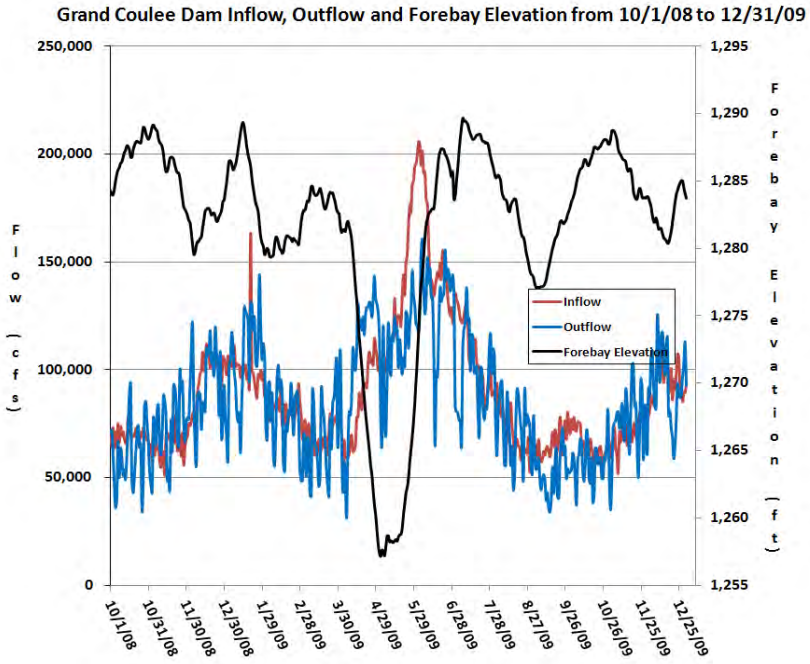

Figure 3. Grand Coulee Dam Inflow, Outflow, and Forebay Elevation from October 1, 2008, through December 31, 2009.

Grand Coulee Dam was operated during November and December 2008 to help support chum spawning below Bonneville Dam and maintain the chum redd protection tailwater below Bonneville Dam of 11.5 feet through the winter 2009 (Figure 3). Also during this period, Grand Coulee Dam was operated to help support the Vernita Bar protection flows of 60 thousand cubic feet per second (kcfs). The project was operated using standard flood criteria, which included accepting a 134 kaf shift of flood control space from Dworshak Dam on March 31. Water supply forecasts for the basin above

Grand Coulee Dam during the April to September period were at 93 percent of average in January, 88 percent of average in March, 92 percent of average in April, and 87 percent of average in June. Grand Coulee Dam reached the March 31 flood control elevation of 1281.6 feet. However, in early April, it became apparent that it would be difficult to maintain the Vernita Bar protection flows of 60 kcfs and also reach the April 10 elevation objective of 1281.9 feet. The issue was discussed at TMT, and it was decided to maintain the Vernita Bar protection flows. It was estimated that maintaining the Vernita Bar flows may draft Grand Coulee Dam about 1-2 feet below the 1281.9 feet April 10 objective. An additional complicating factor was the large increase in the Northwest River Forecast Center's (NWRFC) Water Supply Forecast (WSF) from March to April at The Dalles Dam. The April final forecast increased about 8 maf (9 percent) from the March final forecast resulting in Grand Coulee Dam's April 30 flood control elevation dropping 24 feet to elevation 1257.7 feet (from March's forecast of 1281.7 feet). The April 15 flood control elevation decreased 9 feet from 1282 feet to 1273 feet. To achieve the new April 15 and April 30 flood control elevations, Grand Coulee Dam began drafting to the new flood control elevations starting on April 9. Grand Coulee Dam's maximum elevation on April 10 was 1280.4 feet.

Because of the relatively high flood control elevations at Grand Coulee Dam, drum gate maintenance was not performed and was deferred during 2009.

During the refill, there were periods of high flows and elevated TDG throughout the system because of forced spill. To minimize downstream spill and TDG production in the Columbia River, operations were coordinated through the TMT and in accordance with the 2009 Total Dissolved Gas Management Plan (*http://www.nwd-wc.usace.army.mil/tmt/documents/wmp/2009/final/app4.pdf*). Grand Coulee Dam began refill in mid-May and achieved elevation 1290 feet on July 6, as coordinated through the TMT, and then began drafting for summer flow augmentation. The August 31 elevation target for Grand Coulee Dam was elevation 1277.8 feet, which included 0.2 feet that was released under the Lake Roosevelt Incremental Storage Release Project. Grand Coulee Dam drafted to elevation 1277.5 feet on August 31. Pumping was reduced to Banks Lake during August, and Banks Lake reached an elevation of 1564.68 feet on August 31.

Hungry Horse Dam

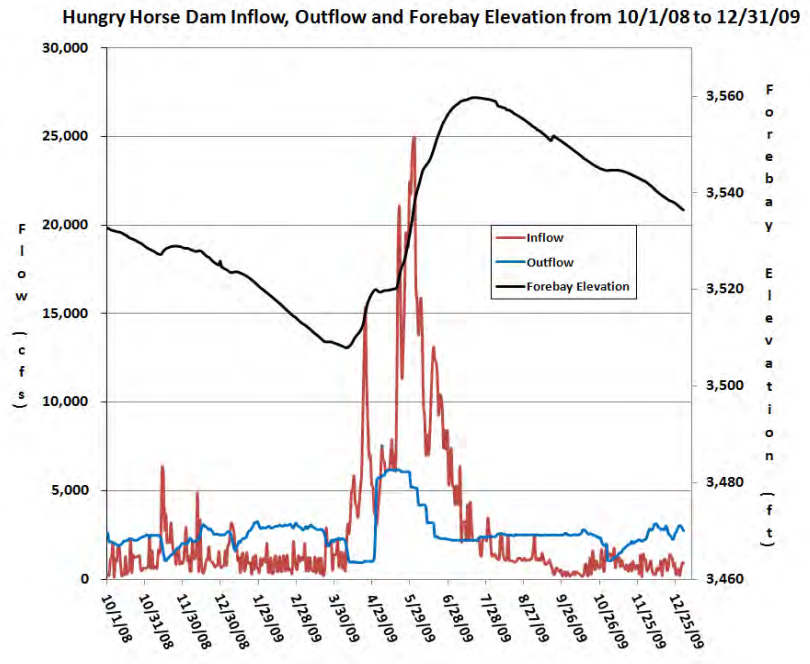

Figure 4. Hungry Horse Dam Inflow, Outflow and Forebay Elevation from October 1, 2008, through December 31, 2009.

Hungry Horse Dam was operated through fall 2008 and throughout 2009 to maintain the minimum flow requirements of 3,500 cfs at Columbia Falls and 900 cfs in the South Fork Flathead River (Figure 4). Minimum flows were for Endangered Species Act (ESA)-listed bull trout and were calculated from a sliding scale based on the Hungry Horse Dam inflow volume forecast. Hungry Horse Dam operations in 2009 followed VARQ flood control procedures. The water supply forecast for Hungry Horse Dam inflow from May to September was at 99 percent of average in January and 99 percent of average by May. Hungry Horse Dam was drafted to elevation 3508.75 feet by April 10 for minimum flow requirements at Columbia Falls. The April 10 elevation objective was 3538.4 feet. Flows were increased to approximately 6 kcfs by May 1 to target refill and to shape the discharges into the spring migration period. Discharges were gradually stepped down during late May and June to fill the reservoir as much as possible and to transition to the forecasted summer flow. During refill and throughout the 2009 water year, Hungry Horse Dam was operated to avoid spill and to limit TDG production in the South Fork of the Flathead River to below Montana's standard of 110 percent. Hungry Horse Dam was operated using the ramping rates as prescribed in the 2000 BiOp (FWS 2000). Hungry Horse Dam refilled to elevation 3559.15 feet on July 19 and then began drafting for summer flow augmentation.

Hungry Horse Dam was operated to provide a stable flow operation during the summer flow augmentation period while targeting a September 30 elevation of 3550 feet. The average flow from July through September was 2.4 kcfs, and Hungry Horse Dam reached elevation 3549.7 feet on September 30.

Albeni Falls Dam

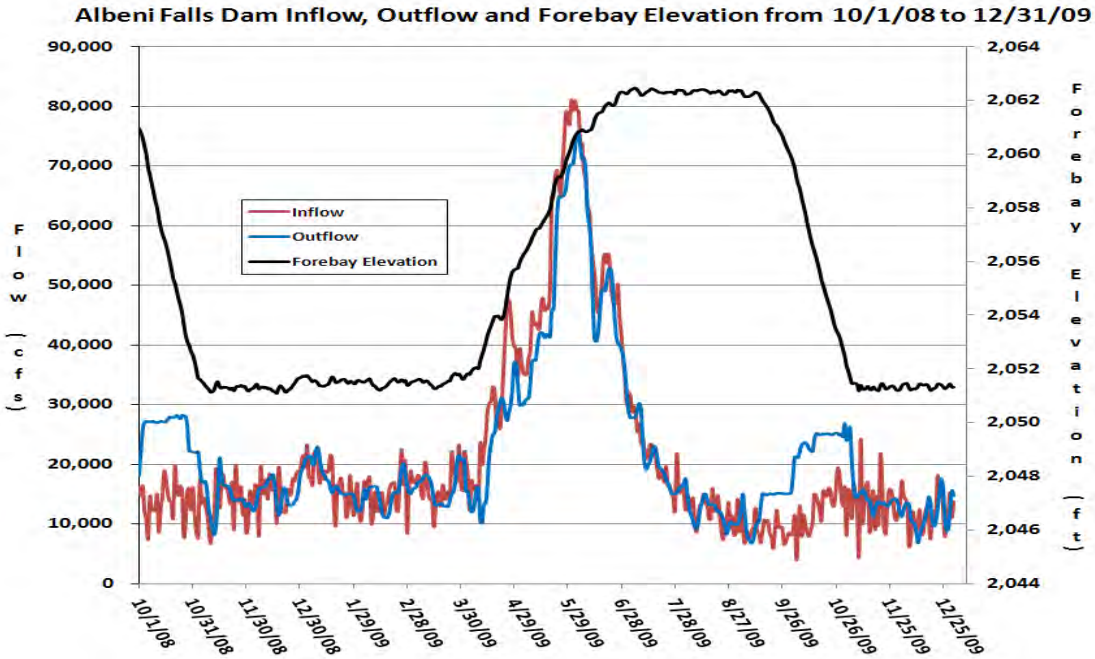

Figure 5. Albeni Falls Dam Inflow, Outflow and Forebay Elevation from October 1, 2008, through December 31, 2009.

The project was operated to standard flood control criteria (Figure 5). Lake Pend Oreille was drawn down to a minimum control elevation (MCE) of 2,051 feet for kokanee spawning in November 2008 after interagency coordination consistent with the USFWS' 2000 FCRPS BiOp (FWS 2000). The lake was operated between elevations 2051 and 2052 feet for kokanee incubation from January through early April in 2009. Refill of Lake Pend Oreille started April 7, and the lake reached its target elevation 2062.25 feet by June 27. For the remainder of the summer and until mid-September, the lake elevation was maintained at between 2,062 and 2,062.5 feet. The lake was drawn down mid-

September through early November to reach an MCE of 2,051 feet, as determined through interagency coordination for kokanee spawning. The lake elevation was then held through December at between 2,051 and 2,051.5 feet until the Idaho Department of Fish and Game (IDFG) declared the end of kokanee spawning at the end of December. After the end of spawning was declared, the lake was managed to between 2,051 and 2,052 feet.

RPA Action 5 – Lower Columbia and Snake River Operations: *The Action Agencies will operate the FCRPS run-of-river mainstem lower Columbia River and Snake River projects (Bonneville, The Dalles, John Day, McNary, Ice Harbor, Lower Monumental, Little Goose and Lower Granite projects) to minimize water travel time through the lower Columbia and Snake rivers to aid in juvenile fish passage. These run-of-river operations will be included in the annual WMP (see RPA Action 6).*

The 2009 WMP included operations for these run-of-river projects. The projects were operated consistent with the WMP and the FOPs to minimize water travel time through the lower Columbia and Snake rivers to aid in juvenile fish passage and water temperature management. River operators do as much as possible to manage flows to help fish while also managing for flood risk and safe navigation. Specific operating rules, including earmarking amounts of water for fish flows, are used at individual reservoirs to provide salmon flows, protect resident fish, control floods, and operate for navigation and other authorized purposes. Further discussions of these operations are included in the minutes of the TMT meeting "Annual Review of Lessons Learned 2009" at *http://www.nwd-wc.usace.army.mil/tmt/agendas/2009/1211min.pdf*

Lower Monumental, Ice Harbor, Little Goose, and Lower Granite projects operated at minimum operating pool (MOP) from April 7 through September 3, in full coordination with regional forums. In a few instances, pool levels went outside of MOP criteria for a short time due to navigation safety issues, primarily for passage of fish barges.

The storage projects in the Columbia and Snake river systems, which are described under RPA action 4 above, have limited ability to shape natural runoff. This limited storage capability can be managed to make modest adjustments in river flows for fish but cannot convert a dry water year into a much better one or save water from a wet year for future dry years. As a result, flow objectives for juvenile fish are goals that cannot be physically achieved under many conditions. The flow objectives were used for pre-season planning and in-season water management to guide decision making. Figures 6, 7, and 8 show the observed outflow at McNary, Lower Granite, and Priest Rapids dams relative to the flow objectives.

In 2009, the Columbia River had a below average water year, with the January through September volume as measured at The Dalles Dam at 84 percent of average. Spring precipitation in the Snake River Basin brought up Snake River flows to 96 percent of average for the same period. On the Columbia River mainstem, during the spring flows preliminarily spiked at The Dalles in mid-April and then dropped again until early May with steadily increasing flows for the rest of May. Flows peaked the second week of June and then steadily receded. John Day Dam was operated at 262.5 to 264 feet from April 10 through September 30, 2009.

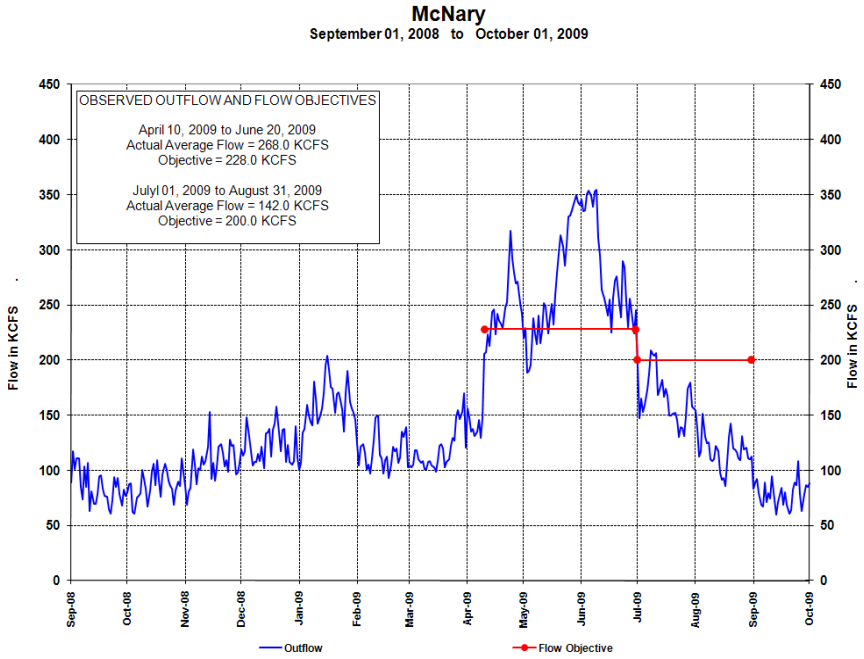

Figure 6. McNary Dam, Observed Outflow and Flow Objectives. The flow objectives are not achievable in all water conditions; rather they are used for pre-season planning and in-season water management to guide decision making.

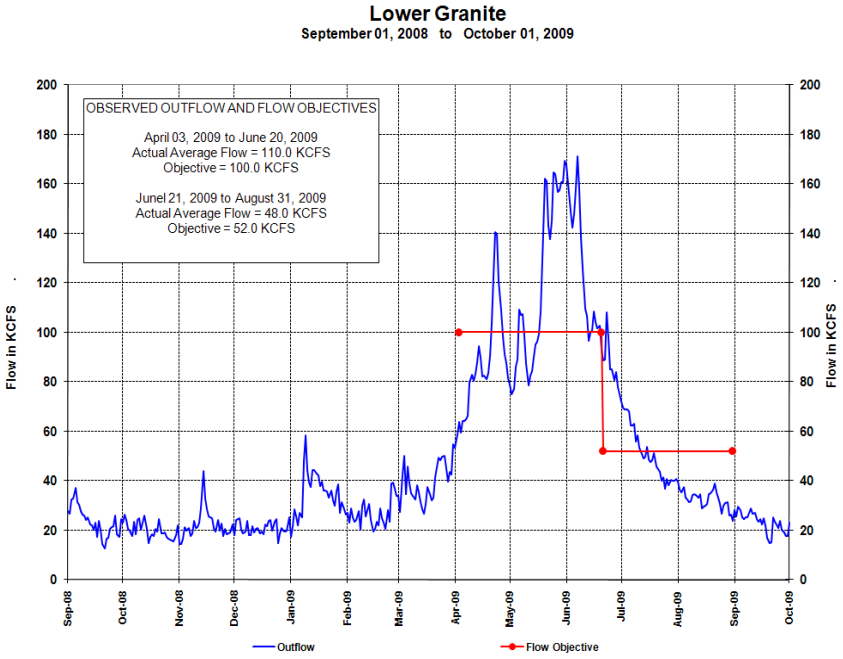

Figure 7. Lower Granite Dam, Observed Outflow and Flow Objectives. The flow objectives are achievable in all water conditions; rather they are used for pre-season planning and in-season water management to guide decision making.

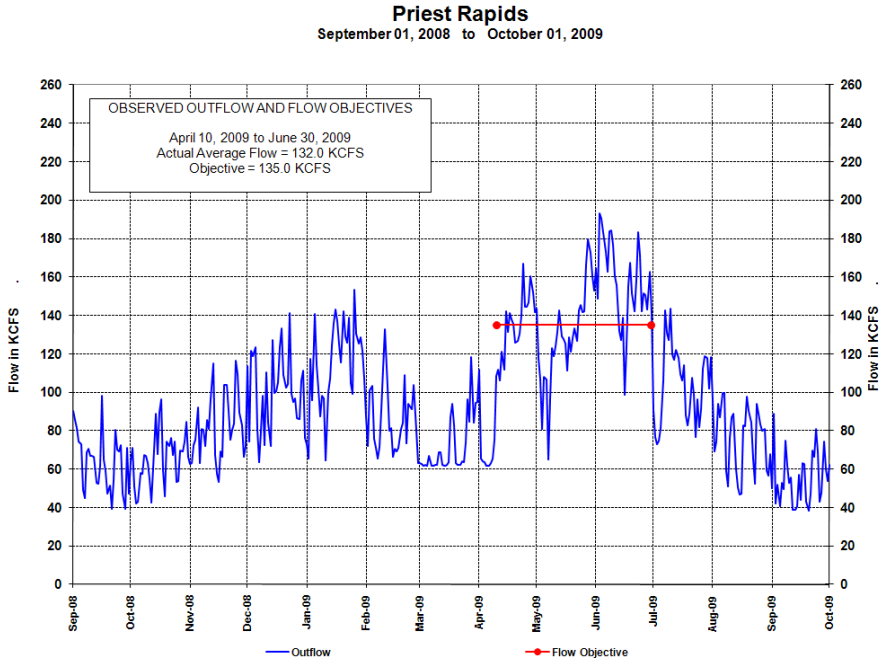

Figure 8. Priest Rapids Dam, Observed Outflow and Flow Objectives. The flow objectives are not achievable in all water conditions; rather they are used for pre-season planning and in-season water management to guide decision making.

RPA Action 6 – In-Season Water Management: *Prioritization of the use of flow augmentation water is done through in-season management by the Regional Forum. Each fall, the Action Agencies will prepare an annual Water Management Plan (WMP) and seasonal updates that describe planned hydrosystem fish operations for the upcoming fall and winter, and for the spring, and summer passage seasons. The annual WMP strives to achieve the best possible mainstem passage conditions, recognizing the priorities established in the FCRPS BA and the need to balance the limited water and storage resources available in the region. Fall/winter and spring/summer updates are prepared as more data is available on the water conditions for that year. A draft update of the WMP will be prepared by October 1 each year, with a final plan completed by January 1. The fall/winter update to the WMP will be drafted by November 1 and finalized by January 1. A draft of the spring/summer update to the WMP will be prepared by March 1 and finalized by May 15.*

The annual WMP for the 2009 operating season (October 1, 2008, through September 30, 2009) and the 2010 operating season (October 1, 2009, through September 30, 2010) were developed collaboratively with the region in accordance with the 2008 BiOp.

In fall 2008, the Action Agencies developed the WMP for the 2009 operating season. A draft of the 2009 spring/summer update to the 2009 WMP was released on March 1, 2009, and the final spring/summer update was released on May 15, 2009.

A draft of the WMP for the 2010 operating season was released on October 1, 2009, and the fall/winter update was released on November 1, 2009. The final WMP was released on December 31, 2009, and the final fall/winter update was released on December 31, 2009.

RPA Action 7 – Forecasting and Climate Change / Variability: *The Action Agencies will hold annual forecast performance reviews looking at in-place tools for seasonal volume forecasts and to report on the effectiveness of experimental or developing/emerging technologies and procedures. As new procedures and techniques become available and are identified to have significant potential to reduce forecast error and improve the reliability of a forecast, the Action Agencies will discuss the implementation possibilities with regional interests. The purpose is to improve upon achieving upper rule curve elevations by reducing forecasts errors and thereby providing for improved spring flows. The Action Agencies will work collaboratively with other agencies and research institutions to investigate the impacts of possible climate change scenarios to the Pacific Northwest and listed salmon and steelhead. Focus areas will cover 1) modeling the hydrology and operations of the Columbia River system using possible future climate change scenarios, 2) investigating possible adaptation strategies for the*

system, 3) monitoring the hydrologic system for trends, cycles, and changes, and 4) staying abreast of research and studies that address climate cycles, trends, and modeling.

Columbia River Forecast Group

The Action Agencies and Fish Accord partners formed the Columbia River Forecast Group (CRFG) to collaboratively implement this RPA action. The CRFG spent most of 2009 developing a charter and organizational structure as well as organizing expectations and a strategy for the group. Under the terms of the charter, the CRFG is also open for participation from any representative of a governmental organization, academic institution, or invited guests of the CRFG who are willing to contribute to the effectiveness and success of the group. Even as the start-up process was proceeding, two workshops were held to review the performance of the previous year's forecasts and to hear speakers on various topics related to water supply forecasting. The first workshop was in March 2009 (to review water year 2008), and a second was held in December 2009 (to review water year 2009).

The March 12, 2009, workshop was attended by numerous agencies including the Natural Resources Conservation Service, NWRFC, U.S. Geological Survey (USGS), Washington Department of Ecology (WDOE), NOAA Fisheries, Columbia River Inter-Tribal Fish Commission (CRITFC), Bonneville Power Administration (BPA), U.S. Army Corps of Engineers (Corps), Bureau of Reclamation (Reclamation), Northwest Power and Conservation Council (NPCC), and BC Hydro and Power Authority. The morning session included brief overviews of the water supply forecast procedures used in 2008 as well as an assessment of the performance of the procedures during the past water year. Also included in the workshop were sessions ranging from new applications developed to utilize Ensemble Streamflow Predictions (ESP) to ongoing work evaluating glacial changes on future water supply. With climate change being part of the group's focus, the workshop included several talks addressing current work on developing climate change streamflow scenarios for the Columbia River Basin and a project to evaluate the impacts of climate change on water supply forecast procedures over time.

The December workshop recapped the 2009 water year forecast performance and included speakers addressing topics such as extended range weather forecasting, use of various teleconnection parameters for use in extended range forecasting, Geographical Information System (GIS) and other modeling tools, and an update regarding the Corps' flood risk management modeling work for the Columbia River Treaty 2014/2024 Review. A portion of the workshop was also set aside for discussion regarding the feasibility of using mid-month updating for water supply forecasting and, therefore, more frequent updates of end-of-month flood control target elevations. This discussion provided information and guidance for the development of test cases for looking at the value of mid-month updates, which was to be incorporated in the group's workplan for 2010.

Toward the end of 2009, the group developed a workplan for 2010 to address specific issues surrounding water supply forecasting and implementation. In general the 2010 workplan includes:

- Working with the Corps on its efforts to improve the water supply forecast equations for Libby Dam through evaluation of various climate indices.
- Working with BPA and the Columbia River Treaty Hydrometeorological Committee to look at the benefits of additional snow pillows in the Columbia Basin in British Columbia.
- Working with the Corps and Reclamation to assess the benefits of mid-month water supply forecast updates. The effort entails looking at two test locations: Hungry Horse and Dworshak dams.
- Develop an Annual Report and report format for the group that includes an appendix that will track water supply forecast performance each year.

Climate Change Study

The Action Agencies have been collaborating on the development of a climate change and hydrology dataset to be used in their longer-term planning models in the Columbia-Snake River Basin and to

adopt a set of methods for incorporating these data into these longer-term planning models. The purpose of adopting such data and methods is to promote consistent incorporation of regional climate projection information in the agencies' planning efforts, and to promote efficient development of these data and methods by pooling agency resources.

The Action Agencies met with outside agencies including National Oceanic and Atmospheric Administration (NOAA) Fisheries, NPCC, and CRITFC to coordinate a work plan ("Climate and Hydrology Dataset for Use in the RMJOC Agencies Longer Term Planning Studies") for the development of these climate change datasets and to filter through existing global circulation models. The group agreed on a subset of scenarios for further work. Runoff scenarios were generated by the University of Washington's Climate Impacts Group (CIG) and reviewed by the Action Agencies. CIG used temperature and precipitation data input from global circulation models with a variety of emissions scenarios to create data sets of unregulated flows at 297 locations in the Columbia River Basin.

The Action Agencies selected a subset of the CIG data resulting in 18 data sets of monthly future regulated flows at all key points in the FCRPS using system reservoir models. The 18 data sets included twelve "hybrid-delta" data sets of future runoff of the Columbia River that reflected 30-year periods centered around 2020 (six scenarios) and 2040 conditions (six additional scenarios). In addition, six "transient" data sets, which are time-evolving temperature and precipitation data sets beginning in 1950 evolving through 2099, were also selected. Future work in 2010 is expected to be the development of 1) additional inflow data by Reclamation for its projects in tributaries to the mainstem Columbia River 2) water supply forecasts reflecting the respective climate change conditions for each scenario for key points across the entire Columbia-Snake River Basin, 3) flood control regulation modeling by the Corps, and 4) reservoir regulation modeling of the FCRPS by BPA to assess the climate change impacts to reservoirs, generation, inflows and major ESA fish flow objectives for the Columbia River Basin. The climate change study officially began in October 2009 and is scheduled for completion in spring 2011.

RPA Action 8 – Operational Emergencies: *The Action Agencies will manage interruptions or adjustments in water management actions, which may occur due to unforeseen power system, flood control, navigation, dam safety, or other emergencies. Such emergency actions will be viewed by the Action Agencies as a last resort and will not be used in place of operations outlined in the annual WMP. Emergency operations will be managed in accordance with TMT Emergency Protocols, the Fish Passage Plan (FPP) and other appropriate Action Agencies emergency procedures. The Action Agencies will take all reasonable steps to limit the duration of any emergency impacting fish.*

No operational emergencies occurred in 2009.

RPA Action 9 – Fish Emergencies: *The Action Agencies will manage operations for fish passage and protection at FCRPS facilities. They may be modified for brief periods of time due to unexpected equipment failures or other conditions. These events can result in short periods when projects are operating outside normal specifications due to unexpected or emergency events. Where there are significant biological effects of more than short duration resulting from emergencies impacting fish, the Action Agencies will develop (in coordination with the in-season management Regional Forum and implement appropriate adaptive management actions to address the situation. The Action Agencies will take all reasonable steps to limit the duration of any fish to limit emergency.*

Two "fish emergency" situations occurred during 2009, one at Lower Granite Dam and one at McNary Dam:

Lower Granite Dam: Fish collection for routine transport at Lower Granite Dam continued until the operation was temporarily stopped on May 22 due to excessive debris entering the collection system and clogging the incline dewatering screen. These conditions caused injury and mortality to fish present in the collection system (screens, raceways, and sampling tanks). NOAA Fisheries and TMT representatives were notified of the change in operations on May 22. Corps personnel calculate that a total of over 500,000 juvenile salmonids passed Lower Granite Dam on May 22, with a total of 721 juvenile fish mortalities associated with the debris conditions. These mortalities included 347 clipped yearling Chinook, 104 unclipped yearling Chinook, 60 clipped subyearling Chinook, 54 unclipped

subyearling Chinook, 37 clipped steelhead, 9 unclipped steelhead, 23 clipped sockeye, 6 unclipped sockeye, and 81 coho. In addition, project personnel noted that an undetermined number of impacted fish exited the bypass system, increasing the overall total number of mortalities. The 721 known mortalities represent approximately 0.14 percent of the total number of juvenile fish estimated to have passed Lower Granite Dam on May 22. Fish collection for transport operations at Lower Granite Dam resumed on May 25 after debris levels subsided, with notification to TMT representatives on May 26.

McNary Dam: Water temperatures at the McNary Juvenile Fish Facility increased rapidly on July 16-18, resulting in temperatures ranging from 64 degrees Fahrenheit in the gatewells to 71 degrees Fahrenheit in the bypass system. It is believed this relatively large temperature change, which continued until July 24, stressed fish passing through the system and contributed to elevated juvenile mortality. The average daily facility mortality rate between July 16 and July 22 was 8.8 percent, peaking at 17.1 percent on July 18 (11,101 fish mortalities occurred, of which an estimated 405 were listed Chinook). The north powerhouse turbine unit operating priority began on July 17 for temperature abatement as described in the Fish Passage Plan (FPP). The Juvenile Fish Facility switched to primary bypass on July 22 until July 23. In addition, on July 21, several regional fish managers submitted a System Operational Request (SOR) to the TMT requesting an increase in spill from 50 percent of project outflow to 24-hour spill to the gas cap to pass as many fish as possible via the spillway. As requested in the SOR and supported by TMT members, the Corps began gas cap spill at McNary Dam at 1300 hours on July 22, 2009. At 1300 hours on July 24, the Corps achieved all the criteria outlined in the SOR and resumed 50 percent spill. Fish transport operations changed from alternate-day departures to daily departures on July 24 and continued through August 16. This reduced fish holding times in the raceways. By July 24, fish mortalities returned to the normally observed low levels as a result of reduced temperature gradients and reduced fish holding times.

In both instances, these actions were coordinated with the region through the TMT process.

RPA Action 10 – Describe actions taken to provide 1 MAF of treaty storage: *BPA and the Corps will pursue negotiations with Canada of annual agreements to provide 1 MAF of storage in Treaty space by April 15 consistent with:*

- *Providing the greatest flexibility possible for releasing water to benefit U.S. fisheries May through July.*
- *Giving preference to meeting April 10 upper rule curve elevation or achieving refill at Grand Coulee Dam over flow augmentation storage in Canada in lower water supply conditions.*
- *Releasing flow augmentation storage to avoid causing damaging flow or excessive TDG in the United States or Canada.*
- *BPA and the Corps will coordinate with Federal agencies, States and Tribes on Treaty operating plans.*

The Columbia River Treaty Operating Committee Agreement on Operation of Treaty Storage for Non-Power Uses for December 15, 2008, through July 31, 2009, (Non-Power Uses Agreement) was executed on December 20, 2008. Under this agreement, 1 maf of flow augmentation water was stored in Mica Reservoir during January 2009. All flow augmentation storage was released by July 31, 2009, under the Non-Power Uses Agreement. Treaty operations were coordinated during fall 2009 stakeholder briefings.

RPA Action 11 – Non-Treaty Storage: *BPA, in concert with BC Hydro, will refill the remaining non-Treaty storage space by June 30, 2011, as required under the 1990 non-Treaty storage agreement. Refill will be accomplished with minimal adverse impact to fisheries operations.*

Some progress was made in return of non-Treaty Storage, with BPA filling to nearly match the BC Hydro storage. At the end of 2009 the BC Hydro account remained at 88.4 percent of full and the U.S. Parties accounts stood at 88.3 percent full. BPA filled 223 ksfd (A “ksfd” is a thousand-second-foot-day, a volume of water sufficient to provide a flow of 1,000 cubic feet per second for a 24-hour period, or approximately 1983 acre-feet) between September 2008 and February 2009, with no activity in the accounts after February for the balance of the year.

RPA Action 12 – Non-Treaty Long-Term Agreement: *BPA will seek to negotiate a new long-term agreement on use of non-Treaty space in Canada so long as such an agreement provides both power and non-power benefits for BC Hydro, BPA, and Canadian and U.S. interests. As part of these negotiations, BPA will seek opportunities to provide benefits to ESA-listed fish, consistent with the Treaty. If a new long-term, non-Treaty agreement is not in place, or does not address flows for fisheries purposes, BPA will approach BC Hydro about possibly negotiating an annual/seasonal agreement to provide U.S. fisheries benefits, consistent with the Treaty.*

Before approaching BC Hydro to negotiate a new long-term, non-treaty storage (NTS) agreement, BPA has committed to the following:

- Substantial refilling of the U.S. NTS account
- The Dry Year Strategy Work Group defining potential use of NTS in dry years
- Coordinating with federal agencies, states, and tribes under the BiOp
- Coordinating with tribes under the Fish Accords
- Establishing the collective U.S. interests in terms of such a new NTS agreement

In addition, BC Hydro has agreed to coordinate with Canadian stakeholders regarding reservoir impacts in Canada. Stakeholder coordination in Canada and the United States began in fall 2009.

An annual NTS agreement was negotiated in 2009 between BPA and BC Hydro. During June 2009 a total of 56 ksfd was stored to reduce inflow to Grand Coulee Dam during the peak of freshet period. This storage was released from late July through early September.

RPA Action 13 – Non-Treaty Coordination with Federal Agencies, States, and Tribes: *Prior to negotiations of new long-term or annual non-Treaty storage agreements, BPA will coordinate with Federal agencies, States, and Tribes to obtain ideas and information on possible points of negotiation, and will report on major developments during negotiations.*

No long-term storage agreement was negotiated in 2009, but coordination continued with federal agencies, states, and tribes to obtain information, ideas, and viewpoints for possible future negotiations.

RPA Action 14 – Dry Water Year Operations: *Flow management during dry years is often critical to maintaining and improving habitat conditions for ESA-listed species. A dry water year is defined as the lowest 20th percentile years based on the Northwest River Forecast Center's (NWRFC) averages for their statistical period of record (currently 1971 to 2000) using the May final water supply forecast for the April to August period as measured at The Dalles. The Action Agencies will complete the following activities to further the continuing efforts to address the dry flow years:*

- *Within the defined "buckets" of available water (reservoir draft limits identified in RPA Action 4), flexibility will be exercised in a dry water year to distribute available water across the expected migration season to optimize biological benefits and anadromous fish survival. The Action Agencies will coordinate use of this flexibility in the Regional Forum TMT.*
- *In dry water years, operating plans developed under the Treaty may result in Treaty reservoirs being operated below their normal refill levels in the late spring and summer, therefore, increasing flows during that period relative to a standard refill operation.*
- *Annual agreements between the U.S. and Canadian entities to provide flow augmentation storage in Canada for U.S. fisheries needs will include provisions that allow flexibility for the release of any stored water to provide U.S. fisheries benefits in dry water years, to the extent possible.*
- *BPA will explore opportunities in future long-term NTS storage agreements to develop mutually beneficial in-season agreements with BC Hydro to shape water releases using NTS space within the year and between years to improve flows in the lowest 20th percentile water years to the benefit of ESA-listed ESUs, considering their status.*
- *Upon issuance of the FCRPS Biological Opinion, the Action Agencies will convene a technical workgroup to scope and initiate investigations of alternative dry water year flow strategies to enhance flows in dry years for the benefit of ESA–listed ESUs.*
- *In very dry years, the Action Agencies will maximize transport for Snake River migrants in early spring, and will continue transport through May 31.*
- *BPA will implement, as appropriate, its Guide to Tools and Principles for a Dry Year Strategy to reduce the effect energy requirements may pose to fish.*

Because the 2009 water year did not meet the definition for a dry year, the dry year strategy was not implemented.

The dry year strategy technical work group held a meeting on November 19, 2009. Participants included Action Agencies, NOAA Fisheries, and representatives from the Colville tribe, CRITFC, and NPCC. Discussion covered a wide range of topics such as what to include in the BaseCase hydro modeling, proposed operating alternatives (what actions to consider), when to initiate dry year operations, and how to perform the biological analysis. This group agreed on the overall study objectives, agreed on the general study steps, and defined the first alternative for modeling.

The biological sub-group and COMPASS modeling group met several times in 2009 and made some progress in the development/expansion of the Comprehensive Fish Passage Model (COMPASS) to include the mid-Columbia and identified numerous challenges for assessing operational effects on fall Chinook or chum.

RPA Action 15 – Water Quality Plan for Total Dissolved Gas and Water Temperature in the Mainstem Columbia and Snake Rivers: *The Action Agencies will continue to update the Water Quality Plan for Total Dissolved Gas and Water Temperature in the Mainstem Columbia and Snake Rivers (WQP) and implement water quality measures to enhance ESA-listed juvenile and adult fish survival and mainstem spawning and rearing habitat.*

The Water Quality Plan for Total Dissolved Gas and Water Temperature in the Mainstem Columbia and Snake Rivers (ACOE 2009) was updated in January 2009. The 2009 plan was coordinated among the Corps and regional federal, state, local, and tribal stakeholders and was tied to other past and current water quality efforts in the region. This document sets forth the Corps' plan concerning water quality in the mainstem Columbia and Snake rivers, including actions called for in the 2008 BiOp that pertain to improving water quality for ESA-listed salmon and steelhead and applicable TMDLs. (Currently there are three TMDLs for TDG in the lower Columbia River, lower Snake River, and middle Columbia River, which are in effect until 2020.)

Real-time monitoring and reporting of TDG and temperatures measured at fixed monitoring sites:

The Dissolved Gas Monitoring Plan of Action was updated for 2009 and is included as Appendix B of the 2009 Annual TDG and Temperature Report. Access to the data is available at *http://www.nwd-wc.usace.army.mil/tmt/wqnew/tdg_and_temp/2009/*.

Continued development of fish passage strategies with less production of TDG:

Four efforts were implemented to further develop fish passage strategies and reduce TDG through structural and operational alternatives in 2009:

- Chief Joseph Dam: A post-construction spill test was conducted in 2009 to evaluate TDG production with the completed flow deflectors. The final report is expected to be released in 2010.
- Little Goose Dam: Installed surface spillway weir in spillbay 1, along with flow deflectors in spillbays 1 and 8, prior to start of juvenile fish migration season.
- John Day Dam: Construction continued on the John Day Spill Bay 21 flow deflector (Construction was completed in first quarter of 2010).
- The Dalles Dam: Construction continued on the spillwall between spillbays 8 and 9 at The Dalles Dam (Construction was completed in March 2010). This project is expected to improve juvenile egress conditions without the need to increase spill, which would increase TDG.

Update the SYSTDG model to reflect modifications to spillways or spill operations:

The System Total Dissolved Gas (SYSTDG) model was used as a real-time decision support tool to manage spill at lower Columbia and Snake river projects. The model was updated to incorporate the spillway flow deflectors at Chief Joseph Dam and spill pattern changes that were implemented in 2009.

Continued development and use of SYSTDG model for estimating TDG production to assist in real-time decision making, including improved wind forecasting capabilities as appropriate:

After completion of the fish migration season, the Corps performed a statistical evaluation of the predictive errors based on observed TDG levels during the 2009 fish passage season to quantify the uncertainty of SYSTDG estimates and improve modeling accuracy and reliability. The results of this analysis are included as Appendix G of the *2009 Dissolved Gas and Water Temperature Monitoring Report* at *http://www.nwd-wc.usace.army.mil/tmt/wqnew/tdg_and_temp/2009/*. Wind forecast improvements were not incorporated into SYSTDG in 2009.

Continued development of the CEQUAL-W2 model for estimating river temperatures from Dworshak Dam on the Clearwater and Upper Snake River near the confluence with the Grand Ronde River (USGS Anatone gauge) through the lower Snake River (all four Corps lower Snake River projects) to assist in real-time decision making for Dworshak Dam operations:

The CE-QUAL-W2 model was used from late June through mid-August 2009 to support decisions regarding operation of Dworshak Dam for flow augmentation and temperature management on the lower Snake River. The results were presented and discussed routinely with TMT members and Action Agencies to develop best management strategies.

The Corps' Walla Walla District made improvements in pre-processing data that resulted in more efficient model execution.

Expand water temperature modeling capabilities to include Columbia River from Grande Coulee to Bonneville dams to better assess the effect of operations or flow depletions on summer temperatures:

In 2009, the Corps submitted funding requests to initiate the effort to expand temperature modeling capabilities to include the middle and lower Columbia River. Initial work efforts are expected to begin in 2010.

Investigate alternatives to reduce total mass loading of TDG at Bonneville Dam while maintaining juvenile survival performance:

The Action Agencies performed base-case and alternative spill model simulations to evaluate alternative summer spill operations at Bonneville Dam. Testing of final alternatives is expected to occur in 2010.

Continued operation of the Lower Snake River projects at MOP:

All lower Snake River projects were operated at MOP for the 2009 fish passage season. This operation is recommended because reducing the cross section of the reservoirs may assist in moderating river temperatures. See additional information under RPA action 5.

RPA Action 16 – Tributary Projects: *The tributary projects that have not yet completed ESA Section 7 consultation are located in the Yakima, Okanogan, and Tualatin river basins. Reclamation will, as appropriate, work with NOAA Fisheries in a timely manner to complete supplemental, project-specific consultations for these tributary projects. These supplemental consultations will address effects on tributary habitat and tributary water quality, as well as direct effects on salmon survival in the tributaries. The supplemental consultations will address effects on mainstem flows only to the extent to which they reveal additional effects on the in-stream flow regime not considered in the FCRPS and Upper Snake River BA/Comprehensive Analysis.*

Reclamation is working on ESA Section 7 consultations for the Yakima, Okanagan, and Tualatin Project operations. Biological Assessments (BA) have been submitted to NOAA Fisheries for all these projects.

Reclamation completed work on a draft supplement to the 2000 BA for the Yakima Project. NOAA Fisheries and USFWS have suggested that Reclamation should consider delaying submission of the supplement until issues associated with the Yakima Basin Work Group/Basin Study are resolved so that potential actions coming from those efforts can be incorporated into the supplement.

NOAA Fisheries requested a time extension to complete work on the Okanogan Project BiOp, which was granted. During this period, Reclamation and NOAA Fisheries have been investigating the potential for refining the proposed action.

Clarifying information has been provided to NOAA Fisheries for use in developing a BiOp for the Tualatin Project, now scheduled for completion in 2012.

RPA Action 17 – Chum Spawning Flows: *Provide adequate conditions for chum spawning in the mainstem Columbia River in the area of the Ives Island complex and/or access to the Hamilton and Hardy Creeks for this spawning population.*

2008-2009 Operation

For chum tailwater readings, the official gauge is 0.9 mile downstream from Bonneville Dam's first powerhouse, 50 feet upstream from Tanner Creek, and at River Mile (RM) 144.5

Chum operations were coordinated regularly through the TMT prior to the initiation of chum spawning and through the end of chum emergence. Chum operations were complicated by forebay constraints in place to facilitate the construction of the spillwall at The Dalles Dam. In response, the Action Agencies drafted a plan for operations during chum spawning season. Some of the conditions addressed in the plan included: 1) use of a new gauge installed near The Dalles' spillbay 23, to help with real-time surface elevation monitoring throughout the season; 2) modification of operating restrictions for spillwall construction to support more flexibility of the chum operations; and 3) specific guidance from the salmon managers on real-time management (timing, patterns) of excess water that might enter the system. Excess water was generally discharged at night, when chum tend not to spawn. In addition, the TMT developed contingency plans for managing chum operations that established a priority for actions to be taken to manage excess water if it could not be managed at night.

Beginning November 7, 2008, Bonneville Dam was operated at a tailwater elevation between 11.3 and 11.7 feet. High inflows at times during November and December necessitated deviations to move excess water at night (from 1500 to 0600 hours). The salmon managers recommended the Action Agencies utilize nighttime hours, expand the operating range, and use late afternoon pulses to move excess water. If those steps were insufficient, the Action Agencies were to target a Bonneville Dam tailwater elevation of 12 feet, with an operating range of 11.5-12.5 feet, if necessary, to manage the excess water.

Chum spawning operations ended on December 31, 2008, and the post-spawning and incubation operation began on January 1, 2009.

On January 1, 2009, when operations shifted from a spawning to an incubation operation, a 24-hour minimum tailwater elevation of 11.5 feet took effect to protect chum redds through incubation and the end of emergence. On April 1, 2009, chum emergence was completed.

2009-2010 Operation

The 2009-2010 chum operation began on November 6, 2009. The Action Agencies issued the following guidance to Bonneville Dam to protect spawning chum: 1) maintain a project tailwater elevation of no lower than 11.3 feet during all hours; 2) maintain an 11.3 to 11.7 foot project tailwater elevation between 0600 and 1700 hours daily, with the target elevation of 11.5 feet; and 3) as conditions allow, maintain an 11.3 to 11.7 foot tailwater elevation between 1700 to 0600 hours, with a target elevation of 11.5 feet. The Corps noted spikes on November 8 and 9 were due to higher flows being passed at night (ideally around midnight), pursuant to the protocols in the current teletype for chum spawning operations. During 2009, the abundance of spawning chum salmon was a bit higher compared to 2008; however abundance was still lower than the 10-year average.

On December 30, the TMT agreed with regional salmon managers that chum spawning operations did not need to continue beyond December 30. Based on this information the Action Agencies ended the chum spawning operation at 1600 hours on December 30, 2009.

RPA Action 18 – Configuration and Operation Plan (COP) for Bonneville Project: *The Corps will consider all relevant biological criteria and prepare, in cooperation with NOAA Fisheries and the co-managing agencies, a Configuration and Operational Plan for the Bonneville Project (2008). As part of the first phase of modifications, the Corps will investigate, and implement the following reasonable and effective measures to reduce passage delay and increase survival of fish passing through the forebay, dam, and tailrace as warranted. Initial modifications will likely include:*

Bonneville Powerhouse I

- *Sluiceway modifications to optimize surface flow outlet to improve fish passage efficiency (FPE) and reduce forebay delay (2009).*
- *Minimum-gap turbine runner installation to improve survival of fish passing through turbines (2009)*

Bonneville Powerhouse II

- *Screened bypass system modification to improve fish guidance efficiency (FGE) and reduce gatewell residence time (2008)*
- *Shallow BGS installation to increase Corner Collector efficiency and reduce forebay delay (prototype 2008)*

Bonneville Dam Spillway

- *Spillway operation or structure (e.g., spillway deflectors) modification to reduce injury and improve survival of spillway passed fish; and to improve conditions for upstream migrants (2013).*

The COP will be updated periodically and modifications may be made as new biological and engineering information is gathered. The COP and modifications will be coordinated through the Regional Forum. Comments developed by NOAA Fisheries on the draft COPs shall be reconciled by the Corps in writing to NOAA Fisheries' satisfaction before release of the final COP. If Phase I actions fail to meet the intended biological targets, the COP will be updated to identify additional Phase II actions for further implementation.

- **Powerhouse I Sluiceway Modifications** – Planned sluiceway modifications, including increasing the width of the collection channel, shaping the sluiceway floor, removing the decommissioned juvenile bypass outfall and other components, and automating the sluiceway gates were completed during the 2009-10 winter work period.
- **Powerhouse I Minimum-Gap Turbine Runner Installation** – Installation of minimum-gap runners continued in 2009 (The final minimum-gap runner was installed in 2010).
- **Powerhouse II Screened Bypass System Modifications to Improve Fish Guidance Efficiency** – Improvements to the juvenile bypass system were completed in 2008. The intended purpose of those modifications was to increase the fish guidance efficiency of the juvenile bypass system. Since completion of those modifications, a fish injury problem has been identified. Research to better understand the nature and source of these injuries was conducted during the 2008 and 2009 juvenile fish passage seasons. An alternatives report to evaluate potential solutions to the gatewell injury problem was initiated in 2009 and will be completed in 2011.
- **Powerhouse II Shallow Behavioral Guidance System (BGS) Installation** – A prototype shallow draft BGS was installed in 2008 and evaluated in 2008 and 2009. During the spring 2008, Unit 11, the turbine at the Corner Collector (south) end of Powerhouse II, was taken offline due to mechanical failure. The unit remained offline through the 2009 for evaluation. Pre- and post-BGS results are presented in the Table 2 below.

Table 2. Percent of yearling Chinook, yearling steelhead, and subyearling Chinook passing from the Bonneville Dam Second Powerhouse forebay into the Corner Collector in 2004 and 2005 without the BGS compared to 2008-09 with the BGS. Results from 2004-05 are based on radio telemetry studies (Reagan et. al 2005; Adams et al. 2006); 2008-09 results are based on acoustic telemetry studies (Faber et al. 2009; Faber et al. 2010).

Age / Species	Percent of Second Powerhouse Salmonids that Passed through the Corner Collector		
	2004-05 (No BGS)	2008 (With BGS)	2009 (With BGS)
Yearling Chinook	40%	49%	40%
Yearling steelhead	70%	75%	59%
Subyearling Chinook	40%	40%	52%

- **Spillway Operation or Structure Modification to Reduce Injury and Improve Survival** – An alternatives report that evaluated the cost, feasibility, and potential biological benefits of structural modification to the spillway was completed in 2009.

  Analysis and reporting of biological results from the 2008 spillway survival study were completed in 2009. No other actions were taken in 2009 pending performance testing. Results from 2008 and 2007 studies indicated that subyearling Chinook spillway survival can be increased substantially by changing summer spill operations from 75 kcfs daytime spill to 85 kcfs daytime spill (see Table 3 below).

Table 3. Subyearling Chinook spillway Survival Rates from radio and acoustic telemetry studies at Bonneville Dam, 2004 – 2008. From Counihan et al. 2005a; Counihan et al. 2005b; Ploskey et al. 2007; Ploskey et al. 2008; Ploskey et al. 2009.

Year	Operation	Subyearling Chinook Spillway Passage Survival Rate
2004	48 Day / TDG Cap Night	88%
2005	75 Day / TDG Cap Night	91%
2006	75 Day / TDG Cap Night	86%
2007	85 Kcfs Daytime Only	93% (daytime survival estimate)
2008	85 Day / TDG Cap Night	97%

RPA Action 19 – Configuration and Operation Plan for The Dalles Project: *The Corps will consider all relevant biological criteria and prepare, in cooperation with NOAA Fisheries and the co-managing agencies, a Configuration and Operational Plan for The Dalles Project (2008). As part of the first phase of modifications, the Corps will investigate, and implement the following reasonable and effective measures to reduce passage delay and increase survival of fish passing through the forebay, dam, and tailrace as warranted. Initial modifications will likely include:*

- *Turbine operation optimization to improve overall dam survival (2011)*
- *Extended tailrace spill wall to increase direct and indirect survival of spillway passed fish (2010)*

The COP will be updated periodically and modifications may be altered as new biological and engineering information is gathered. The COP and modifications will be coordinated through the Regional Forum. Comments developed by NOAA Fisheries on the draft COPs shall be reconciled by the Corps in writing to NOAA Fisheries' satisfaction before release of the final COP. If Phase I actions fail to meet the intended biological targets, Phase II actions, as described in the FCRPS BA – Appendix B.2.1 will be considered for further implementation.

The initial COP had already been completed at the time of the BiOp. The key objective of the COP is achievement and maintenance of hydro performance standards. Significant accomplishments at The Dalles Dam in 2009 included the following:

- **Turbine operation optimization to improve overall dam survival** – Completed purchase of a model turbine runner. This will be used in construction of a physical model so that flow patterns can be observed. That data will be used to develop a best operating point hypothesis. Also see RPAs 27 and 55.6.
- **Extended Tailrace Spill Wall to Increase Direct and Indirect Survival of Spillway Passed Fish** – Construction of an extended length spillwall was completed during the 2009-10 winter work period. The 700-foot long spillwall is expected to increase survival to meet juvenile passage dam survival performance standards. Performance testing was carried out during the March 2010 juvenile fish migration season.
- **COP Update** – An update to the COP was completed in 2009. The current version is available at *http://www.nwp.usace.army.mil/pm/e/reports/afep/config/TDA-COP_December2009.pdf*.

RPA Action 20 – Configuration and Operation Plan for John Day Project: *The Corps will consider all relevant biological criteria and prepare, in cooperation with NOAA Fisheries and the co-managing agencies, a Configuration and Operational Plan for the John Day Project (2008). As part of the first phase of modifications, the Corps will investigate, and implement the following reasonable and effective measures to reduce passage delay and increase survival of fish passing through the forebay, dam, and tailrace as warranted. Initial modifications will likely include:*

- *Full-flow bypass and PIT-tag detection installation to reduce handing stress of bypassed fish (2007)*
- *Turbine operation optimization to improve overall dam survival (2011)*
- *Surface flow outlet(s) construction to increase FPE, reduce forebay delay and improve direct and indirect survival (prototype 2008 with final installation by 2013), and improve tailrace egress conditions.*

The COP will be updated periodically and modifications may be altered as new biological and engineering information is gathered. The COP and modifications will be coordinated through the Regional Forum. Comments developed by NOAA Fisheries on the draft COPs shall be reconciled by the Corps in writing to NOAA Fisheries' satisfaction before release of the final COP. If Phase I actions fail to meet the intended biological targets, Phase II actions, as described in the FCRPS BA – Appendix B.2.1, will be considered for further implementation.

Preparation of the COP addendum was continued in 2009, and is expected to be completed in 2011. Significant accomplishments at John Day Dam in 2009 included the following:

- **Full-flow Bypass and PIT-tag Detection Installation** – This action was completed in 2007.
- **Turbine Operation Optimization to Improve Overall Dam Survival –** Work continued in 2009 to develop a best turbine operating point hypothesis to test in 2011. Lab studies to develop an understanding of the effect of the turbine pressure environment on juvenile Chinook were completed in 2009 and a new study to assess the effects of rapid decompression on tagged versus untagged fish was started. Lab data from rapid decompression studies and computational fluid dynamic model data were synthesized to analyze and estimate pressure-related mortalities for turbine-passed fish. The Turbine Survival Program (TSP) team hypothesized that the best operating point for juvenile fish survival at John Day Dam is approximately half way between peak efficiency and the upper one percent of the peak efficiency range. Coordination with John Day Dam operators and BPA on conducting a best turbine operation field test was initiated in 2009. Coordination will continue in 2010 to determine if a field test is feasible, and to develop a test plan. Also see RPAs 27 and 55.6.

- **Surface Flow Outlet(s) Construction** – Two prototype spillway weirs were tested a second year to determine if surface spill near the powerhouse reduces turbine entrainment. Two spill treatments, 30 percent and 40 percent spill, were tested to help design the final configuration, including tailrace improvements. Compared to previous years, the spillway weirs reduced the proportion of juvenile salmonids that pass through turbines (see Table 4 below). An expanded avian wire array was installed in the tailrace to better protect fish from heavy predation by birds observed in 2008. Due to a design flaw, many of the new wires broke during the juvenile migration season, and bird predation was substantial in the summer. After coordination with resource agencies and tribes, the Corps shut down the spillway weirs in the summer and reverted back to the FPP spill pattern. The 40 percent versus 30 percent spill test continued throughout the summer, but without the spillway weirs.

Table 4. Yearling Chinook, steelhead, and subyearling Chinook percent passage through John Day Dam turbines during pre-Top Spill Weir (TSW) years with 24-hour spill (Baseline) and TSW tests in 2008 and 2009. (Beeman et al. 2006; Beeman et al. 2003; Hansel et al. 2003; Weiland et al. 2010; Weiland et al. 2009).

Species/Age	Percent of Fish Passing Through Turbines		
	Baseline (No TSWs)	2008 (w/TSWs)	2009 (w/TSWs)
Yearling Chinook	10-17%	7%	8%
Yearling steelhead	7-15%	3%	3%
Subyearling Chinook	25-30%	17%	NA

Evaluations of alternatives for tailrace modifications continued in 2009 with a focus on an extended length deflector in spill bay 20. The extended deflector was designed, new spill patterns developed with Top Spill Weirs (TSWs) moved to bays 18 and 19, and a new avian wire array designed for the tailrace. Installation of these features was planned for the 2009-10 winter work period.

RPA Action 21 – Configuration and Operational Plan for the McNary Project: *The Corps will consider all relevant biological criteria and prepare, in cooperation with NOAA Fisheries and the co-managing agencies, a Configuration and Operational Plan for the McNary Project (2009). As part of the first phase of modifications, the Corps will investigate, and implement the following reasonable and effective measures to reduce passage delay and increase survival of fish passing through the forebay, dam, and tailrace as warranted. Initial modifications will likely include:*

- *Turbine operation optimization to improve survival of fish passing through turbines (2013)*
- *Improve debris management to reduce injury of bypass and turbine passed fish (2011)*
- *Relocate juvenile bypass outfall to improve egress, direct, and indirect survival on bypassed fish (2011)*
- *Surface flow outlet installation to increase FPE, reduce forebay delay, and improve direct and indirect survival (temporary structure testing in 2007 and 2008 to develop a permanent system)*

The COP will be updated periodically and modifications may be altered as new biological and engineering information is gathered. The COP and modifications will be coordinated through the Regional Forum. Comments developed by NOAA Fisheries on the draft COPs shall be reconciled by the Corps in writing to NOAA Fisheries' satisfaction before release of the final COP. If Phase I actions fail to meet the intended biological targets, Phase II actions, as described in the FCRPS BA – Appendix B.2.1, will be considered for further implementation.

Progress continued in 2009 on surface passage alternative feasibility studies and biological testing of prototype spillway weirs at McNary Dam. Information and data resulting from these actions were incorporated in the selection of alternatives and their associated biological evaluations for the McNary COP. The McNary COP was initiated in 2009, with alternatives identified, screened, and ranked

through the Regional Forum. Completion of the COP is expected in 2011. Significant accomplishments at McNary Dam in 2009 included the following:

- **Turbine operation optimization to improve survival of turbine passed fish** – A Biological Index Test (BIT) was planned for 2009 to evaluate operating turbines above the upper end of the 1 percent efficiency range at McNary Dam. The evaluation was limited to operations within 1 percent due to concerns of potential gatewell descaling raised in the Studies Review Work Group (SRWG) forum. A gatewell descaling evaluation is being conducted in 2010 at McNary Dam.
- **Debris management** – An evaluation of the existing screen cleaning data and consultation with project staff was conducted to initiate the process for improving debris management at McNary Dam. Preliminary analysis of available screen cleaning data showed little correlation between descaling detected at the McNary Dam fish facility and screen cleaning events. Further data collection and analysis will be conducted in 2010.
- **Juvenile Bypass Outfall Relocation Site Selection** – The McNary Dam outfall relocation project entered the design and site selection phase. Progress in 2009 included modeling visits to the Corps' Engineer Research and Development Center (ERDC), visual tracking data modeling, estimates of potential survival improvements and a literature review of related predator information. Modeling efforts narrowed the potential site locations to a zone well downstream of the existing outfall.
- **Surface Flow Outlet Installation - Prototype Spillway Weir Evaluation** – In 2009, the third year of biological testing was conducted to assess relative juvenile survival, passage efficiencies, and forebay behavior while operating two prototype spillway weirs. In 2007, the weirs were installed in spillbays 20 and 22. During 2008, the weir in spillbay 22 was moved to spillbay 19 to investigate whether this configuration would improve biological performance. In 2009, the weir in spillbay 19 was moved to spillbay 4 for the spring outmigration. Spill operations maintained for this test and biological performance are discussed below.
- Evaluation of Survival and Passage Rates with Respect to Spill Operations – During the spring fish passage season a single treatment test of 40 percent spill was undertaken. After May 20, there was also an involuntary spill that took the overall spill level above 40 percent for 80 percent of the remaining days during the spring spill period. This was not a distinct break in flow volume as in 2008, and the subsequent survival and passage analysis was provided as a single estimate for the entire spring migration period. It was found that a shift occurred in spillway weir passage, for both steelhead and yearling Chinook, when spillway weir 1 was shifted from the south end of the spillway (spillbay 19 in 2007 and spillbay 22 in 2008) to the north in 2009 (spillbay 4). Steelhead passage over the spillway weirs dropped from 67.4 percent in 2007 to 41.6 percent in 2008 and 34.9 percent in 2009. Yearling Chinook passage over spillway weirs was also lower during 2009 than 2007-2008. The total discharge was similar for the three years, but the late season involuntary spill was present during 2008-2009, and surface flow outlets are generally less effective at passing fish at higher flow levels. The relative concrete survival estimates exceeded the performance standard for steelhead (99.2 percent) and yearling Chinook (97.2 percent) during 2009.
- The summer passage season test was a single treatment of 50 percent spill, and subyearling Chinook were tagged for a telemetry evaluation. This was the first year for estimating survival at 50 percent, and average flow was lower than 2006-2008 when we tested the 40 percent vs. 60 percent spill treatments. With 50 percent spill during 2009, subyearling Chinook passage through the spillway weirs was notably higher than had been estimated during 2008. The primary passage difference was in the number passing spillway weir 1. The average summer flow volume was lower in 2009 than in 2008, which appears to make smolts more readily utilize a surface passage route. The relative concrete survival estimate with 50 percent spill for

subyearling Chinook was 89.2 percent, which did not meet the performance standard. This was influenced heavily by mortality attributable to thermal shock which occurred beginning around July 18. It is believed that passing smolts were being rapidly transitioned through water where the temperature differential was roughly 6 degrees Fahrenheit, inducing thermal shock and subsequent mortality. This water temperature issue emerged around July 17, after which time the measured survival for passing subyearlings declined precipitously from earlier estimates. Powerhouse units were being run at a slightly higher level on the north end of the powerhouse, and this is thought to have contributed to the thermal shock thought to have been inducing mortality.

RPA Action 22 – Configuration and Operation Plan for the Ice Harbor Project: *The Corps will consider all relevant biological criteria and prepare, in cooperation with NOAA Fisheries and the co-managing agencies, a Configuration and Operational Plan for the Ice Harbor Project (2008). As part of the first phase of modifications, the Corps will investigate, and implement the following reasonable and effective measures to reduce passage delay and increase survival of fish passing through the forebay, dam, and tailrace as warranted. Initial modifications will likely include:*

- *Guidance screen modification to improve FGE (2010)*
- *Turbine operation optimization to improve survival of turbine passed fish (2011)*
- *Spillway chute and/or deflector modification to reduce injury and improve survival of spillway passed fish through the RSW (2009)*
- *Turbine unit 2 replacement to improve the survival of fish passing through turbines and reduce oil spill potential (2012)*

The COP will be updated periodically and modifications may be altered as new biological and engineering information is gathered. The COP and modifications will be coordinated through the Regional Forum. Comments developed by NOAA Fisheries on the draft COPs shall be reconciled by the Corps in writing to NOAA Fisheries' satisfaction before release of the final COP. If Phase I actions fail to meet the intended biological targets, Phase II actions, as described in the FCRPS BA – Appendix B.2.1, will be considered for further implementation.

The Ice Harbor COP, initiated in 2007, was further developed in 2008 with alternatives refined and screened. A draft was released for regional review in December 2008. Review continued through 2009. Completion of the COP is now scheduled for 2011. Significant accomplishments at Ice Harbor Dam in 2009 included the following:

- **Guidance Screen Modification to improve fish guidance efficiency (FGE)** – Due to a lack of regional support, this action has been deferred indefinitely, and it was not included in the draft COP.
- **Turbine operation optimization to improve survival of turbine passed fish** – See RPA actions 27 and 55.6.
- **Design Documentation Report Phase I Ice Harbor Unit 2 Test Turbine** – The TSP team prepared a plan (FY2008 & FY2009) for the development of a test turbine as a replacement for the failing Ice Harbor Unit 2 runner. BPA and Corps' Walla Walla District have agreed to support the design and installation of a test turbine optimized for to improve survival and reduce juvenile fish passage injury at Ice Harbor Dam. The design of this test turbine was developed using a process recommended by the TSP team and was incorporated into the procurement documents. The contract was advertised in spring 2009 and awarded in 2010.
- **Development of Direct Capture of Turbine-Passed Fish Test Methods** – The preliminary Ice Harbor test turbine design project included the design and implementation of a selected direct capture method for the purpose of sampling run-of-the-river fish for verification of pressure related and other injuries after passing through a turbine unit and potentially as a turbine fish survival and injury evaluation tool (FY2010 activity will be development of a biological study plan and design documents).
- **Evaluation of Survival and Passage Rates with Respect to Spill Operations** – In 2009, passage behavior, passage distribution, and survival were evaluated using radio-telemetry at

Ice Harbor Dam for yearling Chinook, juvenile steelhead, and subyearling Chinook. Two treatments were planned (30 percent spill and 45 kcfs daytime spill/gas cap nighttime spill) and a third (50 percent spill) was evaluated due to involuntary spill during the latter part of the spring study. No reference fish (controls) were released below Ice Harbor Dam for these evaluations, hence all survival estimates are single release. Single release survival estimates ranged between 91-94 percent for yearling Chinook, 90-95 percent for juvenile steelhead, and 89-91 percent for subyearling Chinook salmon. The 30 percent spill operation produced the highest survival estimates for both stocks of Chinook salmon while juvenile steelhead had slightly higher survival during the 50 percent spill operations. The results of these evaluations were not intended to evaluate concrete survival, but they may be used to inform operations in future years.

- **Removable Spillway Weir (RSW) modifications** – Design and hydraulic tests continued in 2009 on potential RSW spillway chute modifications and inclusion of Passive Integrated Transponder (PIT) tag system integration. Implementation of modifications is planned for winter 2011-2012.

RPA Action 23 – Configuration and Operation Plan for the Lower Monumental Project: *The Corps will consider all relevant biological criteria and prepare, in cooperation with NOAA Fisheries and the co-managing agencies, a Configuration and Operational Plan for the Lower Monumental Project (2010). As part of the first phase of modifications, the Corps will investigate, and implement the following reasonable and effective measures to reduce passage delay and increase survival of fish passing through the forebay, dam, and tailrace as warranted. Initial modifications will likely include:*

- *Primary bypass operations with PIT-tag detection installation to reduce handling stress of bypassed fish (2007)*
- *Juvenile bypass system outfall relocation to improve egress, direct and indirect survival on bypassed fish (2011)*
- *Turbine operation optimization to improve the survival of fish passing through turbines (2013)*
- *RSW installation to improve FPE, reduce forebay delay, and improve direct and indirect survival (2008)*

The COP will be updated periodically and modifications may be altered as new biological and engineering information is gathered. The COP and modifications will be coordinated through the Regional Forum. Comments developed by NOAA Fisheries on the draft COPs shall be reconciled by the Corps in writing to NOAA Fisheries' satisfaction before release of the final COP. If Phase I actions fail to meet the intended biological targets, Phase II actions, as described in the FCRPS BA – Appendix B.2.1, will be considered for further implementation.

The COP for Lower Monumental Dam was rescheduled for completion in 2011. A spillway weir was installed in 2008 and a second year of biological performance testing was performed in 2009. Significant accomplishments at Lower Monumental Dam in 2009 included the following:

- **Evaluation of Survival and Passage Rates for Spill Operations** – In 2009, a two treatment spring test was conducted based on bulk spill and uniform spill patterns for yearling Chinook salmon and steelhead from April 28 to May 24, and bulk spill only for sub-yearlings in summer from June 8 to July 3.
- Yearling Chinook salmon relative concrete survival estimate exceeded the BiOp performance standard for both the bulk and uniform spill patterns (97.5 percent and 97.3 percent, respectively) in 2009. Steelhead relative concrete survival estimates exceeded the BiOp performance standard for both the bulk (97.6 percent) and flat (96.7 percent) spill patterns in 2009. The subyearling Chinook relative concrete survival estimate was slightly under the BiOp standard at 92.9 percent during the bulk spill pattern operation.
- **Evaluation of the Approach Depth of Fish Entering the Spillway Weir** – In 2009, a study to determine the approaching depth of fish entering the Lower Monumental Dam spillway weir was conducted. A direct injury study in 2008 indicated there was a higher level of injury among fish released deep (1.5 feet above the ogee; 12.8 percent injury rate) as opposed to fish released shallow (6.5 feet above the ogee; 2.2 percent). During the 2009

vertical distribution study, we determined that only 3 percent of fish were detected moving at depths greater than the deep release pipe. This suggests that only a very small proportion of the run-of-river fish would be expected to be exposed to conditions similar to those experienced by fish released from the deep release pipe during the 2008 direct injury study.

- **Continued progress on the Juvenile Outfall Relocation Project** – During August 2009 both velocity and egress model tests of potential outfall relocation sites were conducted at the US Army ERDC. Site selection and design will continue in 2010.

RPA Action 24 – Configuration and Operation Plan for the Little Goose Project: *The Corps will consider all relevant biological criteria and prepare, in cooperation with NOAA Fisheries and the co-managing agencies, a Configuration and Operational Plan for the Little Goose Project (2009). As part of the first phase of modifications, the Corps will investigate, and implement the following reasonable and effective measures to reduce passage delay and increase survival of fish passing through the forebay, dam, and tailrace as warranted. Initial modifications will likely include:*

- *Turbine operation optimization to improve the survival of fish passing through turbines (2014)*
- *Primary bypass operations with PIT-tag detection installation to reduce handling stress of bypassed fish (2008)*
- *Primary bypass outfall relocation to improve egress, direct and indirect survival on bypassed fish (2009)*
- *Surface spillway weir and deflector installation to improve FPE, reduce forebay delay and improve direct and indirect survival (2009).*

The COP will be updated periodically and modifications may be altered as new biological and engineering information is gathered. The COP and modifications will be coordinated through the Regional Forum. Comments developed by NOAA Fisheries on the draft COPs shall be reconciled by the Corps in writing to NOAA Fisheries' satisfaction before release of the final COP. If Phase I actions fail to meet the intended biological targets, Phase II actions as described in the FCRPS BA – Appendix B.2.1 will be considered for further implementation.

Significant progress to resolve juvenile passage issues has been accomplished at Little Goose Dam. However, adult passage concerns associated with current spill operations have prompted debate over the current configuration. The Little Goose COP was initiated in 2010 and will be completed in 2011. Significant accomplishments at Little Goose Dam in 2009 included the following:

- **Surface spillway weir and deflector installation** – A spillway weir was installed in spillbay 1 and flow deflectors were installed in spillbays 1 and 8, prior to the start of the juvenile fish migration season.
- **Passage and survival evaluation** – The purpose of the 2009 passage and survival study was to document fish passage and survival when the dam was operated with a new spillway weir that was installed in March of 2009. The USGS used radio telemetry to examine behavior, passage, and survival of spring and summer juvenile salmonid migrants passing Little Goose Dam. Tagged fish were released near Central Ferry State Park, 21 km upstream from the dam, and in the tailrace, approximately 0.5 km downstream from the dam. Relative concrete survival estimates were 99.4 percent for yearling Chinook, 99.8 percent for steelhead, and 95.2 percent for sub-yearling Chinook.
- **Direct Injury Evaluation of the Spillway Weir and a Spillbay with a New Spill Deflector** – Post-construction evaluation included estimating the direct injury of salmonids prior to the juvenile outmigration. The study design included estimating the survival (direct effects) and injury of yearling Chinook salmon during passage through a newly installed spillway weir in spillbay 1 with a low and high crest. The investigation also evaluated survival and condition of fish passing over new flow deflectors (30-foot turning radius) installed in both spillbay 1 (spillway weir) and spillbay 8 (unmodified spillway gate). The direct survival/condition of the fish was determined by the HI-Z Turb 'N Tag recapture technique.
- **Juvenile Bypass System Full Flow PIT-Tag Monitoring** – The installation of a juvenile PIT-tag monitoring system in the full-flow section of the primary bypass pipe occurred during

the 2008-2009 winter maintenance period. The system provides PIT-tag detections without subjecting fish to potential stressors in the facility.

- **Juvenile Bypass Outfall Relocation** – Construction was initiated on the relocation of the bypass outfall in late 2008. The relocation was completed during the 2009–2010 juvenile bypass system winter maintenance period. The relocated outfall will release fish in an area with higher river velocities and consistent downstream flow during all operations. This relocation is expected to decrease predation on the bypassed fish.

RPA Action 25 – Configuration and Operation Plan for the Lower Granite Project: *The Corps will consider all relevant biological criteria and prepare, in cooperation with NOAA Fisheries and the co-managing agencies, a Configuration and Operational Plan for Lower Granite Project (2009). As part of the first phase of modifications, the Corps will investigate, and implement the following reasonable and effective measures to reduce passage delay and increase survival of fish passing through the forebay, dam, and tailrace as warranted. Initial modifications will likely include:*

- *New juvenile fish facility including orifice configuration changes, primary dewatering, holding for transport, and primary bypass to improve direct and indirect survival for all collected fish (2012)*
- *Turbine operation optimization to improve survival of turbine passed fish (2014)*

The COP will be updated periodically and modifications may be altered as new biological and engineering information is gathered. The COP and modifications will be coordinated through the Regional Forum. Comments developed by NOAA Fisheries on the draft COPs shall be reconciled by the Corps in writing to NOAA Fisheries' satisfaction before release of the final COP. If Phase I actions fail to meet the intended biological targets, Phase II actions as described in the FCRPS BA – Appendix B.2.1 will be considered for further implementation.

Alternatives and the associated biological evaluations for the Lower Granite COP were completed in 2009. Completion of the COP is expected in 2011. Significant accomplishments at Lower Granite Dam in 2009 included the following:

- **Juvenile Fish Facility (JFF) Upgrade** – Development of the Engineering Design Report on modifications to upgrade the JFF at Lower Granite Dam continued, and the report is expected to be completed in 2010. The facility design will include kelt management facilities, benefits to transported fish, and improvement to collected lamprey.

RPA Action 26 – Chief Joseph Dam Flow Deflectors: *The Corps will complete the flow deflector construction at Chief Joseph Dam by 2009.*

Deflector construction was initiated in 2005 in response to RPA action 136 in the 2000 BiOp and previous discussions on the importance of these deflectors. Chief Joseph Dam does not have spill for fish passage, but water is spilled at this project and Grand Coulee Dam to pass high flows. Investigations by the Corps concluded that installing flow deflectors at Chief Joseph Dam, which is immediately downstream of Grand Coulee Dam, and shifting spill and power generation between the projects is the most cost-effective alternative for gas abatement at these two dams.

Construction of flow deflectors on all 19 spillway bays at Chief Joseph Dam was completed in September 2008. This completed the structural component of the two-part alternative to reduce TDG downstream of Chief Joseph and Grand Coulee dams. A successful spill test was carried out in spring 2009. No further testing is planned.

RPA Action 27 – Turbine Unit Operations: *The Action Agencies will operate turbine units to achieve best fish passage survival (currently within 1 percent of best efficiency at mainstem dams on the Lower Columbia and Lower Snake rivers from April 1–October 31 (hard constraint) and from November 1–March 31 (soft constraint) each year. Continue turbine operations evaluations and apply adaptive management to operate units in their optimum configuration for safe fish passage.*

In 2009, turbine units on mainstem dams on the lower Columbia and lower Snake rivers were operated within 1 percent of best efficiency from April 1-October 31 (hard constraint) and from November 1-March 31 (soft constraint).

Work continued to determine the safest operating point for fish passing through existing FCRPS turbines. Physical model studies and numerical model studies were conducted to further this understanding. The Corps completed a final draft report of rapid decompression effects on tagged and untagged fish, and it initiated a new study to determine whether effects of rapid decompression on tagged fish differ from the effects on untagged fish.

An alternatives study was continued in 2009 to assess the feasibility of directly capturing juvenile fish that have passed through a mainstem dam turbine. This method provides a means of directly assessing turbine mortality, including capturing the effects of rapid decompression.

Hydropower Strategy 2 (RPA Action 28)

RPA Action 28 – Columbia and Snake River Project Adult Passage Improvements: *The Corps will implement the following structural improvements to adult passage at the mainstem Columbia and Snake river projects:*

- *Bonneville Dam*
  - *Improve the Bradford Island ladder system to reduce stress and improve reliability of upstream adult passage (2013).*
- *The Dalles Dam*
  - *East ladder emergency auxiliary water supply system and/or modifications that return adult salmon and steelhead use of the North ladder to pre-spillwall conditions to improve reliability of upstream adult passage (2013).*
- *John Day Dam*
  - *Adult ladder systems modifications to improve upstream adult passage conditions (2011).*
- *Ice Harbor Dam*
  - *Repair or replace north shore fishway auxiliary water supply (AWS) equipment as needed so that any two of the three pumps can meet flow criteria.*
- *Little Goose Dam*
  - *Investigate adult passage and determine whether structural, operational, or tailrace modifications can alleviate adult passage delays or blockages during spill operations for optimum juvenile passage (See RME Action 54).*
- *Lower Granite Dam*
  - *Investigate and if necessary provide additional auxiliary water supply for the new adult trap at lower Granite so that it can operate at full capacity when the forebay is operated at MOP without affecting the fishway AWS (2012).*
  - *Adult fishway modification to improve upstream adult passage conditions impaired by temperature differentials (need will be determined by results of further research) (prototype 2011).*

- **Bonneville Dam** – No action taken in 2009.
- **The Dalles Dam** – The Corps prepared a letter report that gives preliminary design and cost information for a backup water supply alternative. Further efforts on the north ladder were deferred pending spillwall completion and testing. This will allow for evaluation of the effects of the new configuration on adult use of the north ladder.
- **John Day Dam** – Completed plans and specifications for the north ladder exit section and count station improvements. Continued progress on a design document report for ladder entrance and Auxiliary Water System (AWS) improvements in the lower north fish ladder.
- **Ice Harbor Dam North Shore Adult Fish Ladder AWS** – Warranty replacement of two of three gear shafts on the north shore AWS pumps was completed in fall 2008. The third gear shaft was replaced in early 2009. These actions will allow the system to meet the hydraulic criteria outlined in the fish passage plan.

- **Little Goose Dam Adult Passage Delays** – Adult passage was monitored at Little Goose Dam in 2009, but it did not reveal any passage delays.
- **Lower Granite Dam Water supply for adult trap** – The water supply valve for the trap was replaced during the 2009-2010 winter maintenance period. At MOP, all six adult fish holding tanks can now be operated without causing any flow reduction to the AWS.
- **Lower Granite Dam Ladder Temperature Monitoring** – Water temperature monitoring is ongoing in the Lower Granite Ladder, but no adult behavioral studies were conducted in 2009.

Hydropower Strategy 3 (RPA Actions 29–31)

RPA Action 29 – Spill Operations to Improve Juvenile Passage: *The Corps and BPA will provide spill to improve juvenile fish passage while avoiding high TDG supersaturation levels or adult fallback problems. Specific spill levels will be provided for juvenile fish passage at each project, not to exceed established TDG levels (either 110 percent TDG standard, or as modified by State water quality waivers, currently up to 115 percent TDG in the dam forebay and up to 120 percent TDG in the project tailwater, or if spill to these levels would compromise the likelihood of meeting performance standards (see RPA action table, RME Strategy 2). The dates and levels for spill may be modified through the implementation planning process and adaptive management decisions. The initial levels and dates for spill operations are identified in Table 2 of the RPA action table. Future Water Management Plans will contain the annual work plans for these operations and spill programs, and will be coordinated through the TMT. The Corps and BPA will continue to evaluate and optimize spill passage survival to meet both the hydrosystem performance standards and the requirements of the Clean Water Act (CWA).*

Spill Operations

Spill operations for 2009 are reported in the 2009 Dissolved Gas and Water Temperature Monitoring Report (*http://www.nwd-wc.usace.army.mil/tmt/wqnew/tdg_and_temp/2009/*). This report describes the Corps' water quality monitoring program for 2009. The report provides information consistent with the TDG waiver issued by Oregon and the criteria adjustment by Washington. The report also includes the following additional technical information:

- Flow and runoff conditions for the spill season
- Duration and volume of spill for fish passage versus spill for other reasons for each project
- Data from the physical and biological monitoring programs, including incidences of gas bubble trauma (GBT)
- Progress on implementing measures contained in the lower Columbia and lower Snake River total dissolved gas TMDL documents.

The report focuses on the water quality monitoring of TDG and temperature at the 12 Corps dams in the Columbia River Basin.

Spring Spill

During 2009, spring spill at the lower Columbia and Snake River projects were consistent with the 2009 Spring FOP (*http://www.nwd-wc.usace.army.mil/tmt/documents/fpp/2009/final/App_E.pdf*). Spring spill began April 3 and continued through June 20 at the lower Snake River projects. Spring spill began April 10 and continued through June 19 at McNary Dam, through June 30 at John Day and The Dalles dams; and through June 20 at Bonneville Dam.

The 2009 Spring FOP called for the following spill operations during the spring:

- Lower Granite Dam: 20 kcfs, 24 hours per day
- Little Goose Dam: 30 percent of total project outflow, 24 hours per day
- Lower Monumental Dam: to the spill cap, 24 hours per day

- Ice Harbor Dam: spill alternating between 30 percent of total project outflow 24 hours per day, or 45 kcfs during the day and up to the spill cap at night
- McNary Dam: 40 percent of total project outflow
- John Day Dam: 30 percent of total project outflow from April 10 through April 27 and from June 4 through June 30, and alternating between 30 percent and 40 percent of total project outflow from April 27 through June 4
- The Dalles Dam: 40 percent of total project outflow
- Bonneville Dam: 100 kcfs

Total river flows as measured at Bonneville Dam remained elevated on the Columbia River from the third week of May to the second week of June, when the freshet occurred. Total river flows on the Columbia River during this period ranged from a daily average flow of 93 kcfs to 360 kcfs, with an overall daily average flow of 218 kcfs. These flows were lower than in 2008, when the daily average flow was between 276 and 418 kcfs. Flow began to taper off in late June and early July. Total river flows as measured at Ice Harbor Dam remained elevated on the Snake River from May to early June, when the freshet occurred there. Total river flows on the lower Snake River from May to early June ranged from a daily average flow of 137 kcfs to 169 kcfs.

Summer Spill

During 2009, consistent with the Summer FOP, summer spill began June 21 and continued through August 31 at the lower Snake River projects. Summer spill on the lower Columbia River began June 20 at McNary Dam, July 1 at John Day and The Dalles dams, and June 21 at Bonneville Dam. Spill continued through August 31.

The 2009 FOP called for the following spill operations during the summer:

- Lower Granite Dam: 18 kcfs, 24 hours per day
- Little Goose Dam: 30 percent of total project outflow, 24 hours per day
- Lower Monumental Dam: 17 kcfs, 24 hours per day
- Ice Harbor Dam: From June 21 through July 11, spill alternating between 30 percent of the river flow 24 hours per day, or 45 kcfs during the day and up to the spill cap at night. From July 12 through August 31, 45 kcfs during the day and up to the spill cap at night.
- McNary Dam: spill 50 percent of total project outflow
- John Day Dam: spill 30 percent of total project outflow, 24 hours per day
- The Dalles Dam: 40 percent of total project outflow
- Bonneville Dam: spill 85 kcfs during the day and to the spill cap at night from June 21 through July 20. Spill 75 kcfs during the day and to the spill cap at night from July 21 through August 31.

Total river flows continued to recede on the Columbia River during July and tapered off in August. Total river flows on the Columbia River during July were a daily average of 165 kcfs. Total river flows on the Columbia River during August averaged 118 kcfs.

On the Snake River total river flow also began to decrease in July and tapered off in August. On the Snake River the daily average total river flow was 51 kcfs, which is among the highest of the last five years. Daily average total river flows during August was 32 kcfs, which is also among the highest of the last five years.

Total Dissolved Gas Instances

The intent of the spill operations is to help meet juvenile fish survival performance standards identified in the 2008 FCRPS BiOp. These fish passage spills may result in the generation of TDG supersaturation in the Columbia and lower Snake rivers at levels above current state and federal water quality standards. The states of Washington and Oregon have exceptions to these standards as long as the elevated TDG levels provide for improved fish passage through the spillway without causing more harm to fish populations than through other passage routes.

There are instances when TDG levels exceed state standards resulting from either voluntary spill for fish passage or involuntary spill. These instances can result from:

- Flows exceeding powerhouse capacity
- Operation or mechanical failure of non-generating equipment (e.g. spill gates, fixed monitoring stations, communication errors, etc)
- Professional judgment and uncertainty in modeling results

During the 2009 fish passage spill season, there were a total of 308 TDG instances: 116 instances from voluntary spill and 192 instances from involuntary spill. These instances are measured in gauge-days[2] where TDG levels exceed either the Washington or Oregon TDG criteria.

Instances from voluntary spill:

- 1 - related to non-generating equipment (operation or mechanical failure)
- 17 - malfunctioning fixed-monitoring station gauges
- 98 - uncertainties associated with using best professional judgment, SYSTDG model, and forecasts

Instances from involuntary spill:

- 191 - high runoff flows and flood control efforts, BPA load requirements lower than actual powerhouse capacity, and involuntary spill
- 1 - outage of hydro power equipment

During the 2009 migration season, there were 52 instances in which TDG levels were higher than either the Oregon one-hour standard or Washington two-hour standards of 125 percent TDG, all but one due to involuntary spill associated with high runoff. The other instance resulted from special spill operations to pass debris. Debris spill operations can elevate TDG levels for a short period of time (usually from one to four hours) but are necessary to allow for safe access to juvenile fish passage systems.

Examination of data obtained from the Fish Passage Center (under "Smolt Data" at *www.fpc.org*) showed that 11,148 juvenile fish were examined for gas bubble trauma at Corps dams in 2009. Of those, only 25 were found to have moderate symptoms and none had severe symptoms.

RPA Action 30 – Juvenile Fish Transportation in the Columbia and Snake Rivers: *The Corps and BPA will continue the juvenile fish transportation program toward meeting system survival performance metrics of Snake and Columbia River salmon and steelhead with some adaptive management modifications based on results of RME. The Corps and BPA will continue to collect and transport juvenile fish at Lower Granite, Little Goose, Lower Monumental, and McNary dams, although under a modified operation as described in Table 3 and Table 4 of the RPA action table. While the dates mentioned in this section should be considered firm planning dates, if in-season information or results of ongoing RME indicates a need for adaptive management (for example, if modifying these dates are likely to increase in-*

[2] [number of TDG gauges] x [number of days in spill season, April 3 through August 31]

river or system survival and would be likely to provide equivalent or increased SARs of the species transported), the Action Agencies will consider revising the dates and operations through the Regional Forum.

The 2009 transportation program was conducted in accordance with NOAA Fisheries ESA Permit Number 1237 and the Juvenile Fish Transportation Program criteria in the Corps' 2009 FPP. The start dates for initiating transport operations were staggered at Snake River operating projects. Collection of juvenile fish for barge transport began May 1 at Lower Granite Dam, May 5 at Little Goose Dam, and May 8 at Lower Monumental Dam. Before transport began, sampling operations took place at the Lower Granite, Little Goose, and Lower Monumental facilities in support of research activities, BPA-sponsored smolt monitoring activities, and assessment of bypass system conditions. Smolt Monitoring Program activities took place daily at Lower Granite Dam throughout the entire season. Transport operations at the Snake River facilities continued through October 1 at Lower Monumental Dam and through October 31 at Little Goose and Lower Granite dams.

Fish at McNary Dam were bypassed from March 31 through July 15 and transported from July 16 to October 1. Before transport began, sampling operations took place on an every-other-day basis beginning April 8 to support research and BPA-sponsored smolt monitoring activities, as well as to assess bypass system conditions.

Juvenile fish barged during 2009 were released at varying locations below Bonneville Dam as required in the permit. The ending date for the barging season in 2009 was August 14 for Snake River facilities and August 15 for McNary Dam. Trucks carried juvenile fish from August 16 through the end of the transport season. Trucked fish were released into the Bonneville Juvenile Monitoring Facility outfall flume. No early season (April) trucking took place in 2009.

Estimates of the number of fish collected, bypassed, and transported as part of the juvenile fish transportation program are based on sampling portions of the fish collected. Sampled numbers were expanded according to the percentage of the time sampled. At Snake River operating projects, the sampled fish were hand-counted and differentiated by species and whether or not adipose fins were clipped. A total of 6,593,661 juvenile fish were collected at Lower Granite Dam, with 2,465,023 of these fish bypassed to the river and 4,119,643 transported. At Little Goose Dam, 5,182,190 juvenile salmon and steelhead were collected in 2009. Of these, 2,228,651 were bypassed back to the river, and 2,944,890 were transported. At Lower Monumental Dam, 1,182,585 juvenile salmon and steelhead were collected in 2009. Of these, 13,891 fish were bypassed, and 1,167,425 were transported. At McNary Dam, 3,784,658 juvenile salmon and steelhead were collected in 2009. Approximately 3,298,319 of the fish collected were bypassed back to the river to meet fishery agency requirements, and 448,833 juvenile fish were transported.

A total of 16,743,094 juvenile salmon and steelhead were collected at all transport program locations in 2009, with 8,680,791 fish transported (52 percent) and 8,005,884 bypassed (48 percent). Of the fish transported, 8,637,279 were transported by barge (99 percent) and 43,512 were trucked (1 percent).

Table 5. Estimated Proportion of Non-Tagged Spring/Summer Chinook and Steelhead Smolts Transported in the Columbia and Snake Rivers in 2009.

Species	Percent Transported in 2009
Snake River Spring Chinook—Wild	40%
Snake River Spring Chinook—Hatchery	38%
Snake River Spring Steelhead—Wild	46%
Snake River Spring Steelhead—Hatchery	43%

RPA Action 31 – Configuration and Operational Plan Transportation Strategy:

The Corps, in coordination with the Regional Forum, will initiate a Configuration Operational Plan in 2009. The plan will be completed in 2010 and will present a strategy for prioritizing and carrying out further transportation actions at each dam. Comments developed by NOAA Fisheries on the draft COPs shall be reconciled by the Corps in writing to NOAA Fisheries' satisfaction before release of the final COP. Construction actions for transportation are primarily in the context of changes to juvenile bypass systems. Changes meant to increase adult salmon returns through the juvenile fish transportation process are being evaluated. Some changes include additional barges, a new juvenile fish facility at Lower Granite Dam and modifications to the juvenile fish facilities at Little Goose, Lower Monumental and McNary dams.

Various studies continued in 2009 to inform the Transportation Strategy COP, slated for completion in 2011. The data will be used to evaluate operational and construction alternatives to improve the transportation program. Significant among these were the following studies:

- **Transportation of Hatchery Spring Chinook of 2002-2004 and Hatchery Steelhead of 2003-2005 from McNary Dam** – The draft report of research for McNary Dam transport was received and reviewed during October 2009. Based on overall study results, Columbia River hatchery Chinook salmon that passed McNary Dam via the spillway/turbine route had higher smolt-to-adult return (SARs) than fish collected and transported (geometric mean of 0.83 with 95 percent CI, 0.72-0.93). However, if a hatchery Chinook was guided into the juvenile collection system, transport provided a benefit over returning the fish to the river via the full-flow bypass pipe (geomean of 1.39 with 95 percent CI, 1.04-2.14).
- In contrast to results for spring Chinook salmon, overall results from studies of Columbia River hatchery steelhead transported from McNary Dam showed that transportation provided a benefit over fish that passed the dam through the spillway/turbine route (geomean of 1.10 with 95 percent CI, 1.02-1.18). Also, if a fish was guided into the juvenile collection system, transport provided a benefit over returning to the river via either the full-flow bypass pipe (geometric mean of 1.20 with 95 percent CI, 1.10-1.31) or the facility bypass pipes (geomean of 1.39 with 95 percent CI, 1.15-1.72).
- **Evaluation of Effects of Extended Transport on Survival of Salmonid Smolts: Impacts of Fish Predation in the Lower Columbia River** – The draft report "Evaluation of Effects of Extended Transport on Survival" was received and reviewed in 2009. In 2006-2007, tagged experimental groups of smolts were released on an outgoing tide, during nighttime hours to determine if survival to adult return for these fish noticeably improved over the standard release site. The result of the analysis of predation effects shows that extended transportation provides a substantial benefit to survival of transported fish through the lower Columbia River. The ratio of extended transport survival over status quo transport was 1.1 to 1.4 depending on the type of smolt (subyearling Chinook were predicted to have the greatest benefit). The effect on in-river migrant smolts originating from upstream of Bonneville Dam or from sources downstream of Bonneville Dam was negligible (survival ratio of 0.98 to 1.00). Because the

results only examined the effects of predation to the point of ocean entry, it is not possible to conclusively state that benefits to survival will carry over to higher adult returns.

- **Transportation of Juvenile Salmonids on the Snake River, 2007: Final Report for the 2003 Fall Chinook Salmon Juvenile Migration** – From 2001 through 2003, hatchery subyearling fall Chinook salmon were PIT-tagged at Lyons Ferry Hatchery and released in the Snake River 81 km above Lower Granite Dam at river kilometer 254. Fall Chinook salmon were also collected, tagged, and transported from Lower Granite Dam during September and October 2003 to develop an index of adult returns from fish transported in the fall.
- The study was designed to compare the SAR of fish transported as juveniles from Lower Granite Dam with that of fish released to migrate inriver and not detected at any collector dam. However, recent data have shown that the method used to estimate numbers of non-detected yearling Chinook migrants cannot produce unbiased estimates of non-detected Snake River fall Chinook salmon. This method assumes equal probabilities of downstream detection among fish from each cohort after release. However, it is now known that a considerable proportion of fall Chinook overwinter within the migration corridor.
- The combined SAR (jacks through age-4 ocean fish) for Lyons Ferry Hatchery study groups was 0.09 percent (95 percent CI, 0.05-0.14 percent) for transported, 0.13 percent (0.02-0.24 percent) for bypassed, and 3.64 percent (0.00-8.68 percent) for holdover groups. The SAR for fall transport index fish was 3.84 percent (3.08-4.60 percent). Transportation appeared to neither greatly harm nor help Snake River fall Chinook salmon. For the 2003 releases overall, the transported group had slightly lower SARs than the bypassed group, but the highest SARs were seen in holdover fish, or those that delayed migration. Fall transport index fish also had relatively high SARs.

Hydropower Strategy 4 (RPA Action 32)

RPA Action 32 – Fish Passage Plan:

The Corps will annually prepare a FPP in coordination with NOAA Fisheries and the Regional Forum through the FPOM. The Corps will operate its projects (including juvenile and adult fish passage facilities) year-round in accordance with the criteria in the FPP. Comments developed by NOAA Fisheries on the draft FPP shall be reconciled by the Corps in writing to NOAA Fisheries' satisfaction before release of the final FPP.

The draft 2009 FPP was released in October 2008. The final *FPP, Corps of Engineers Projects, CENWD-PDW-R* (*http://www.nwd-wc.usace.army.mil/tmt/documents/fpp/2009/*) was released in March 2009. The FPP was completed in full coordination with the region. Corps fish passage facilities were operated in accordance with criteria in the FPP. Any deviations from the FPP were coordinated with the region and were necessary to protect fish or make emergency repairs on vital equipment.

Hydropower Strategy 5 (RPA Action 33)

RPA Action 33 – Snake River Steelhead Kelt Management Plan: *The BPA and Corps will prepare a Snake River Kelt Management Plan in coordination with NOAA Fisheries and the Regional Forum. The BPA and Corps will implement the plan to improve the productivity of interior basin B-run steelhead populations.*

BPA and Corps completed the 2009 Kelt Management Plan and released it for comment in December. The 2009 version of the Kelt Management Plan was a synthesis of previous research on kelt migration studies through the hydrosystem as well as kelt reconditioning efforts. The 2009 Kelt Management Plan also discussed research efforts that would continue in 2010 as well as kelt-specific operations at Bonneville and The Dalles dams. To facilitate increased efforts in the kelt research program, the Corps

initiated construction of kelt holding facilities at Lower Granite Dam. In addition, the Corps worked with BPA, CRITFC, and the University of Idaho to provide space and water for kelt holding tanks associated with reconditioning efforts at the Dworshak Fish Hatchery.

BPA funded CRITFC to prepare a Master Plan for kelt.BPA project number 2007-401-00, which will provide the detail on the reconditioning topic in the broader Kelt Management Plan. The Master Plan will focus on kelt collection and reconditioning at various locations. CRITFC has subcontracted portions of this project to the University of Idaho. Preparing a Kelt Master Plan is one deliverable that CRITFC will provide as part of its contract with BPA. The Kelt Master Plan, which will apply to reconditioning Snake River kelts, is part of a three-step technical review process required by the NPCC for artificial propagation projects, particularly those that affect natural populations and involve construction of capital facilities.

Habitat Implementation Reports, RPAs 34–38

Table 6. Habitat Strategy Reporting, RPA Actions 34–38

RPA Action No.	Action	Annual Progress Report
Habitat Strategy 1		
34	Tributary Habitat Implementation 2007 to 2009 – Progress Toward 2018 Habitat Quality Improvement Targets	• Status of project implementation (including project milestones) through December of previous year for all 2007-2009 actions. • Report physical metrics for implementation achieved (e.g., miles of access, cfs of streamflow acquired, numbers of screens, miles or acres of habitat protected or enhanced, and miles of complexity enhanced) relative to the project objectives.
35	Tributary Habitat Implementation 2010-2018 – Achieving Habitat Quality and Survival Improvement Targets	• Status of project implementation (including project milestones) through December of previous year for all actions identified in implementation plans. • Report physical metrics for implementation achieved (e.g., miles of access, cfs of streamflow acquired, numbers of screens installed, miles of acres of habitat protected or enhanced, and miles of complexity enhanced by benefited population(s)) relative to the total needed to complete the project and achieve the estimated survival benefits, by project.
Habitat Strategy 2		
36	Estuary Habitat Implementation 2007 to 2009	• Status of project implementation (including project milestones) through December of previous year for all 2007-2009 actions. • Report physical metrics for implementation achieved (e.g., number of acres protected/restored/enhanced; riparian miles protected) relative to the total needed to complete project and achieve the estimated survival benefits.

Table 6. Habitat Strategy Reporting, RPA Actions 34–38

RPA Action No.	Action	Annual Progress Report
37	Estuary Habitat Implementation 2010-2018 – Achieving Habitat Quality and Survival Improvement Targets	• Status of project implementation (including project milestones) through December of previous year for all actions identified in implementation plans. • Report physical metrics for implementation achieved (e.g., number of acres protected, restored, enhanced; riparian miles protected) relative to the total needed to complete the project and achieve the estimated survival benefits, by project. • By ESU, report progress toward Evolutionary Significant Unit/Distinct Population Segment (ESU/DPS)-specific survival benefit. • Where ESU/DPS-specific survival benefits are not achieving the progress guidelines above, identify processes or projects in place to ensure achievements by the next comprehensive report.
38	Piling and Piling Dike Removal Program	• Status of project implementation (including project milestones) through December of previous year for all actions identified in implementation plans. • Report physical metrics for implementation achieved (e.g., number of pilings/pile dikes removed, habitat area restored) by project.

Habitat Strategy 1 (RPA Actions 34–35)

RPA Action 34 – Tributary Habitat Implementation 2007 to 2009 - Progress Toward 2018 Habitat Quality Improvement Targets:

The Action Agencies will provide funding and technical assistance necessary to implement the specific projects identified for implementation in 2007 to 2009 as part of a tributary habitat program to achieve the population-specific overall habitat quality improvement identified in Table 5 of the RPA action table.

If projects identified for implementation in 2007-2009 prove infeasible, in whole or in part, the Action Agencies will implement comparable replacement projects in 2010-2013 to maintain estimated habitat quality improvements to achieve equivalent survival commitments at the population level, or alternatively at the major population group (MPG) or ESU level. Habitat and population-specific survival benefits in each implementation plan cycle must also compensate for not meeting estimated benefits in the previous implementation plan cycle. Replacement project selection will follow Action 35 below.

RPA action 34 includes specifications for the three-year cycle from 2007 to 2009. Summary information for water quantity and quality, in-stream habitat complexity, riparian improvement and protection, and access actions completed through 2009 is presented in Section 1 of this report. Detailed information on the 2007 to 2009 progress of individual projects and actions is presented in Section 4, Attachment 3, Tables 1 through 6. The projects and actions listed in Tables 1 through 6 were identified as implementation commitments in the 2007 FCRPS BiOp. NOAA Fisheries used these actions in its jeopardy analysis and to finalize RPA actions 34 and 35 in the BiOp. The tables are organized by Evolutionarily Significant Unit (ESU) and Distinct Population Segment (DPS) and include project descriptions and habitat metrics that were completed from 2007 to 2009. Projects may be reported multiple times if they benefit more than one species or more than one population.

It should be noted that the metrics included in these tables are not yet consistent with the Katz et al. (2006) metrics described in RPA action 73. The actual metrics reported will evolve as the Action Agencies, working with regional forums, develop a comprehensive system to collect, store, and report tributary habitat action implementation information consistent with the guidance provided in Katz et al. (2006). The Action Agencies will eventually track and report habitat metrics appropriate for their respective habitat programs that are consistent with the Katz et al. (2006) metrics.

The Population Summary in Section 4, Attachment 2, summarizes metrics completed in 2009 that are related to the populations listed in the 2008 BiOp RPA 35, Table 5. Attachment 2 is included to provide an overview of implementation progress relative to the population-specific biological needs presented by state and tribal partners.

RPA Action 35 – Tributary Habitat Implementation 2010–2018 - Achieving Habitat Quality and Survival Improvement Targets:

The Action Agencies will identify additional habitat projects for implementation based on the population specific overall habitat quality improvement still remaining in Table 5 of the RPA action table. Projects will identify location, treatment of limiting factor, targeted population or populations, appropriate reporting metrics, and estimated biological benefits based on achieving those metrics. Pertinent new information on climate change and potential effects of that information on limiting factors will be considered.

Annual progress for projects implemented under RPA action 35, which includes specifications for three-year cycles between 2010 and 2018, will be reported in future progress reports.

However, one of the 2008 BiOp's key improvements over previous BiOps is the expanded use of population-specific biological information to target actions in combination with the use of on-the-ground experts to identify and prioritize tributary habitat projects and assess their biological benefits. In 2009, the "expert panel" process was conducted by the Action Agencies to address collaboration with states and tribes as recommended by the Oregon District Court, and it support the process called for in RPA action 35.

Beginning in March 2009, the Action Agencies conducted and facilitated expert panel workshops in LaGrande and Joseph, Oregon, Wenatchee and Pomeroy, Washington, and Lewiston, McCall ,and Salmon, Idaho. The local experts focused on those areas where fish populations have the greatest biological need (as listed in the BiOp RPA table, action 35, Table 5): the Clearwater, lower Snake, Grande Ronde/Imnaha, upper Salmon, and upper Columbia (Wenatchee, Entiat, Methow, and Okanogan) geographic areas. The process was used to inform the 2010–2012 Implementation Plan released in June 2010 and provided input for the Action Agencies to assess habitat quality improvements for salmon and steelhead. Expert panel members reviewed the benefits associated with habitat actions completed between 2007 and 2009, revised those benefits where necessary, identified potential habitat improvement actions for the 2010–2012 implementation cycle, and associated biological benefits with the 2010–2012 actions (2008 FCRPS BiOp, RPA 35; 2007 FCRPS CA, Appendix C, Annex 1). Presentation of this information in upcoming Implementation Plans will illustrate the progress on commitments contained in RPA 35, Table 5 of the 2008 FCRPS BiOp.

Attendees at the workshops included representatives from NOAA Fisheries, tribal and state fish and wildlife agencies, the U.S. Forest Service, USFWS, local watershed groups, conservation districts, and recovery boards. All had extensive knowledge of and experience with local habitat conditions, and many hold undergraduate and advanced degrees in natural resource-related fields.

Additional Reports

Reclamation has produced a number of additional reports that document tributary habitat accomplishments. These reports are listed in Section 4, Attachment 4; the reports can be accessed at *http://www.usbr.gov/pn/programs/fcrps/thp/index.html*.

Habitat Strategy 2 (RPA Actions 36–38)

RPA Action 36 – Estuary Habitat Implementation 2007 to 2009:

The Action Agencies will provide funding to implement specific actions identified for implementation in 2007–2009 as part of a 10-year estuary habitat program to achieve the estimated ESU survival benefits of 9.0 percent and 6.0 percent for ocean type and stream-type ESUs, respectively. Projects in an early state of development such that quantitative physical metrics have not been related to estimated survival benefits will be selected per Action 37. If projects identified for implementation in 2007–2009 prove infeasible, in whole or in part, the Action Agencies will implement comparable replacement projects in 2010–2013 to provide equivalent habitat benefits needed to achieve equivalent survival benefits.

During 2009, the Action Agencies completed seven on-the-ground habitat projects with another nine estuary habitat projects in the planning, development and design phases. An additional action included one land acquisition, Elochoman, for which a feasibility study has been initiated through the Corps' 536 authority. Habitat activities included removing riparian/wetland invasive plant species and planting native species, improving and restoring streams/channels, improving fish passage structures, restoring riparian and wetland areas, and placing large wood material.

2009 accomplishments also included finalizing the Washington Memorandum of Agreement, outlining 21 potential projects and kicking off the initial planning activities of 3 projects. The action agencies developed the framework to implement these MOA projects in future years.

See Section 4, Attachment 5, for further detail on the estuary projects accomplished.

RPA Action 37 – Estuary Habitat Implementation 2010–2018 – Achieving Habitat Quality and Survival Improvement Targets:

The Action Agencies will provide funding to implement additional specific projects as needed to achieve the total estuary survival benefits identified in the FCRPS BA. Projects will identify location, treatment of limiting factor, targeted ESU/DPS or ESUs/DPSs, appropriate reporting metrics, and estimated biological benefits based on the achieving of those metrics. Pertinent new information on climate change and potential effects of that information on limiting factors will be considered.

The Action Agencies continue to utilize the *Columbia River Estuary ESA Recovery Plan Module for Salmon and Steelhead* to guide restoration and protection efforts through a collaborative process. In 2009, the Action Agencies continued development of a strategic approach to identifying restoration and protection projects in the estuary using a new Ecosystem Classification System being developed by the University of Washington and the U.S. Geological Survey. The strategic approach will use guiding principles based on salmonid ecology to identify potential sites with the highest value to salmon and steelhead. This is a collaborative effort between the Action Agencies and other regional interests, including the Lower Columbia River Estuary Partnership (LCREP), the states of Oregon and Washington, the Cowlitz Tribe, and local restoration practitioners, including the Columbia River Estuary Study Taskforce (CREST), the Columbia Land Trust, watershed councils, and conservation districts.

- *Action Agencies will actively engage the LCREP Science workgroup to identify project benefits in coordination with other regional experts, using recovery planning products and the modified LCREP project selection criteria (FCRPS BA Attachment B.2.2-3) to identify projects that will benefit salmon considered in this RPA.*

  In 2009, the Action Agencies continued to utilize LCREP's Science Work Group, using its ecosystem criteria to help select restoration and protection projects in the Lower Columbia River and Estuary.

- *To support project selection the Action Agencies will convene an expert regional technical group. This group will use the habitat metrics to determine the estimated change in survival which would result from full implementation.*

  The Expert Regional Technical Group (ERTG) was convened in 2009 and began evaluating federal projects for their survival benefit potential. The ERTG has five members, representing: the Oregon Department of Fish and Wildlife; the Washington Department of Fish and Wildlife; NOAA Fisheries' Northwest Fisheries Science Center; the Department of Energy's Pacific Northwest National Laboratory, and the Skagit River System Cooperative.

- *Project proposals will clearly describe the completed project in terms of quantitative habitat metrics which can be used to quantitatively evaluate progress and completion of individual projects.*

  In 2009, the ERTG and the Action Agencies began development of a template for the data needed for submission of proposed projects to ERTG. That template requires clearly described habitat metrics for each aspect of the project. This approach is expected to provide project sponsors with clear guidelines regarding the information they need to provide, and reduce the amount of time needed for ERTG to provide habitat benefit estimates.

- *The expert regional technical group will use the approach originally applied in the FCRPS BA (Attachment B.2.2) (Estimated Benefits of Federal Agency Habitat Projects in the Lower Columbia River Estuary) and all subsequent information on the relationship between actions, habitat and salmon productivity models developed through the FCRPS RM&E to estimate the change in overall estuary habitat and resultant change in population survival.*

  In 2009, the ERTG reviewed the habitat benefit estimation approach applied in the FCRPS BA. It then attempted to further systematize the FCRPS BA method, and explored several approaches aimed at increasing the degree of repeatability of estimates. The ERTG is developing its methodology for estimating survival benefits, with the goal of finalizing the method in 2010.

- *If actions from the previous cycle prove infeasible, in whole or in part, the Action Agencies will ensure implementation of comparable replacement estuary projects in the next implementation plan cycle to maintain estimated habitat quality improvements at the ESU/DPS level and achieve equivalent survival benefits. Selection of replacement projects, to ensure comparable survival benefits, will be made based on input from expert panels, regional recovery planning groups, the Northwest Power and Conservation Council, and NOAA Fisheries.*

  Some projects scheduled for completion in 2007-2009 were delayed or proved infeasible. The Action Agencies will construct projects in the 2010-2013 implementation period to replace the survival benefits those projects would have provided. The total amount of survival benefits still needed for the 2007-2009 implementation period is not yet known, since the ERTG is still finalizing its methodology for determining survival benefit estimates, leaving several of the projects completed in 2008 and 2009 still "unscored."

  Replacement project selection will be based on input from expert panels, regional recovery planning groups, the Northwest Power and Conservation Council, and NOAA Fisheries.

- *FCRPS RM&E results will actively inform the relationship between actions, estuary habitat change and salmon productivity and new scientific information will be applied to estimate benefits for future implementation.*

  As information from FCRPS estuary research and restoration project effectiveness monitoring becomes available, it will be applied to the process of estimating benefits for projects implemented between 2010 and 2018.

- *If new scientific or other information (except incomplete implementation of project modification) suggests that habitat quality improvement estimates for projects from the previous cycle were significantly in error, the Action Agencies will examine the information and review the project or projects in question and their estimated benefits. This review will occur as part of the 2009 Annual Report and the Comprehensive RPA Evaluations in 2013 and 2016 and will be performed in conjunction with NOAA Fisheries. In the event such review find that habitat based survival improvement were significantly overstated, the Action Agencies will implement replacement projects (selected as per new projects above) to provide benefits sufficient to achieve the ESU/DPS-specific survival benefit estimated for each affected project.*

  In 2009 the Action Agencies actively engaged consultants, LCREP's Science Workgroup, the ERTG and other sources regarding new scientific information. A summary of recent publications is provided after the discussion of RPA Action 61, below. The Action Agencies have examined that and other information, and are not aware of any information that would indicate habitat quality improvement estimates for projects completed in the 2007-2009 implementation cycle were "significantly overstated". The Action Agencies will continue to coordinate with LCREP's Science Workgroup, and the ERTG regarding new scientific information.

When available, new scientific information resulting from FCRPS research, monitoring, and evaluation (RME) will be applied to estimate benefits for projects implemented between 2010 and 2018.

RPA Action 38 – Piling and Piling Dike Removal Program:

To increase access to productive habitat and to reduce avian predation, the Action Agencies will develop and implement a piling and pile dike removal program.

- *In 2008, the Action Agencies will work with [the]Lower Columbia River Estuary Program develop a plan for strategic removal of structures that have lower value to navigation channel maintenance, present low-risk to adjacent land use, support increased ecosystem function, and are cost-effective.*

  A final draft pile structure program plan was presented to NOAA in November 2008, and was reviewed in early 2009. This plan will be modified as new information becomes available.

- *Beginning in 2008 and 2009, the Action Agencies will begin implementation. Implementation will continue through 2018.*

  In 2009, LCREP implemented a NOAA Fisheries-funded pile removal pilot project at Coal Creek Slough, near Longview. Pre- and post-project monitoring for that effort was provided by the Corps. One outcome of that effort was a report on the feasibility of assessing the effects of pile structure removal projects (Vavrinec et al., 2009) In 2009, the Corps also initiated the contract process for a study to identify which pile dike structures are still needed to meet its navigation requirements. The Corps also determined that, because its pile structures were congressionally authorized, additional process may be required before removal can occur. As a result, emphasis for the early part of the program turned to removal of pile fields, and the Action Agencies, with LCREP and others, worked on planning for pile field removal pilot projects. Three pile fields were identified for possible removal as part of a pilot project.

Hatchery Implementation Reports, RPA Actions 39–42

Table 7. Hatchery Strategy RPA Action Reporting

RPA Action No.	Action	Annual Progress Report
Hatchery Strategy 1		
39	FCRPS Funding of Mitigation Hatcheries – Programmatic	• Status of submittal/approval of Hatchery and Genetic Management Plans (HGMPs), including site-specific application of Best Management Practices.
40	Reform FCRPS Hatchery Operations to Reduce Genetic and Ecological Effects on ESA-Listed Salmon and Steelhead	• Status of implementation through December of the previous year for all reforms identified in the BiOp RPA table, action 40, Table 6. • Status of implementation of future reforms identified by the Action Agencies following the Hatchery Scientific Review Group (HSRG) process.
Hatchery Strategy 2		
41	Implement Safety Net Programs to Preserve Genetic Resources and Reduce Short-term Extinction Risk	• Status of implementation through December of the previous year for all safety net programs identified in the BiOp RPA table, action 41, Table 7.

Table 7. Hatchery Strategy RPA Action Reporting

RPA Action No.	Action	Annual Progress Report
42	Implement Conservation Programs to Build Genetic Resources and Assist in Promoting Recovery	• Status of implementation through December of the previous year for all conservation programs identified in the BiOp RPA table, action 42, Table 8.

Hatchery Strategy 1 (RPA Actions 39–40)

RPA Action 39 – FCRPS Funding of Mitigation Hatcheries – Programmatic:

The FCRPS Action Agencies will continue funding hatcheries in accordance with existing programs, and will adopt programmatic criteria for funding decisions on mitigation programs for the FCRPS that incorporate BMPs. The Hatchery Effects Report, the August 2006 NOAA Fisheries paper to the PWG and the NOAA Fisheries 2007 Guidance Paper should be considered in developing these criteria in addition to the BMPs in the Action Agencies' BA. Site specific application of BMPs will be defined in ESA Section 7, Section 10, or Section 4(d) consultations with NOAA Fisheries to be initiated and conducted by hatchery operators with the Action Agencies as cooperating agencies.

In 2009, the Action Agencies continued to fund mitigation hatcheries in accordance with existing programs and, as appropriate, used the programmatic funding criteria developed in 2008 for funding decisions on mitigation programs for the FCRPS.

To implement RPA action 39, NOAA Fisheries announced initiation of its ESA consultation process in a series of letters to Columbia Basin hatchery operators and other interested parties. The process was initiated in September 2008 for upper Columbia hatchery programs, in March 2009 for programs in the Mid-Columbia Steelhead DPS, and in May 2009 for Snake River Basin programs. Following each NOAA Fisheries announcement, the Action Agency-funded hatchery operators in these regions began updating the Hatchery and Genetic Management Plans (HGMPs) for their respective hatchery programs. Information from the reports of the recently completed USFWS Hatchery Review Team process and the Hatchery Scientific Review Group (HSRG) will guide and inform the development of program-specific HGMPs.

Throughout 2009, hatchery program operators in the Upper Columbia region continued to develop Hatchery and Genetic Management Plans (HGMPs) for Action Agency-funded hatchery programs. Action Agencies reviewed and commented on draft HGMPs during development. As of December 2009, updated HGMPs for all FCRPS hatchery programs in the three regions requiring consultation were either underway or completed and sent to NOAA Fisheries (Tables 8, 9, and 10). In March 2009, the USFWS submitted a letter requesting Section 7 consultation and a consultation-ready HGMP for the spring Chinook program at Leavenworth National Fish Hatchery (NFH) to NOAA Fisheries. HGMPs for Entiat and Winthrop hatcheries were submitted in July 2009. Updated and completed HGMPs will be submitted to NOAA Fisheries in 2010 and 2011 to initiate consultation on other programs.

In March 2009, hatchery program operators in the Mid-Columbia region began developing HGMPs for Action Agency-funded hatchery programs. Action Agencies reviewed and commented on draft HGMPs during development. Updated and complete HGMPs will be submitted to NOAA Fisheries in 2010 and 2011 to initiate consultation.

In May 2009, hatchery program operators in the Snake River Basin began developing HGMPs for Action Agency-funded hatchery programs. Action Agencies reviewed and commented on draft HGMPs during development. Updated and complete HGMPs will be submitted to NOAA Fisheries in 2010 to initiate consultation.

In July 2009, the Action Agencies sent a letter to hatchery program operators that described a process for working collaboratively on development of HGMPs for consultation and transmitted the criteria for funding decisions on ongoing and new hatchery programs in the Columbia Basin.

Table 8. FCRPS-Funded Hatchery Programs in the Upper Columbia Region.

Program	Operator	Lead Action Agency	Basin
Leavenworth National Fish Hatchery (NFH) spring Chinook	USFWS	Reclamation	Wenatchee
Entiat NFH summer Chinook program	USFWS	Reclamation	Entiat
Upper Columbia steelhead kelt reconditioning	Confederated Tribes of the Colville Reservation (CTCR)[1] and Yakima Nation (YN)[2]	BPA	Okanogan, Entiat, Wenatchee
Winthrop NFH Methow Composite spring Chinook	USFWS	Reclamation	Methow
Winthrop NFH steelhead	USFWS	Reclamation	Methow
Methow coho	YN	BPA	Methow
Wenatchee coho	YN	BPA	Wenatchee

1/ Confederated Tribes of the Colville Reservation program is conducted in the Okanogan Subbasin

2/ The Yakama Nation upper Columbia kelt reconditioning program will probably be located in the Wenatchee Subbasin near Dryden, Washington, and not at Entiat NFH as originally proposed. The Yakama Nation will be the operator, with funding from BPA, for this FCRPS BiOp/Columbia Basin Fish Accords project.

Table 9. FCRPS-Funded Hatchery Programs in the Mid-Columbia Region

Program	Operator	Lead Action Agency	Basin
Yakima Spring Chinook	YN	BPA	Yakima
Yakima Summer-Fall Chinook [1]	YN	BPA	Yakima
Yakima Coho	YN	BPA	Yakima
Yakima Steelhead Kelt Reconditioning	YN	BPA	Yakima
Touchet Endemic Steelhead	Washington Department of Fish and Wildlife (WDFW)	BPA (LSRCP)	Walla Walla

Program	Operator	Lead Action Agency	Basin
Umatilla Spring Chinook	Oregon Department of Fish and Wildlife (ODFW) & Confederated Tribes of the Umatilla Indian Reservation (CTUIR)	BPA	Umatilla
Umatilla Fall Chinook [2]	ODFW & CTUIR	BPA and Corps	Umatilla
Umatilla Coho Chinook [3]	ODFW & CTUIR	BPA	Umatilla
Umatilla Summer Steelhead	ODFW & CTUIR	BPA	Umatilla

1/ COE funds release of John Day mitigation fish (fall Chinook salmon) in the Yakima Subbasin.

2/ Sub-yearling program funded by BPA, and Yearling program funded by COE

3/ BPA funds the operation of the CTUIR acclimation releases in the Umatilla Subbasin; and Mitchell Act Funding covers the Bonneville and Cascade Hatcheries operations of the program.

Table 10. FCRPS-Funded Hatchery Programs in the Snake River Region

Program	Operator	Lead Action Agency	Basin
Lyons Ferry Summer Steelhead	WDFW	BPA (LSRCP)	Lower Snake
Snake River Stock Fall Chinook (Lyons Ferry Hatchery) [1]	WDFW	BPA (LSRCP)	Lower Snake
Tucannon Summer Steelhead Endemic	WDFW	BPA (LSRCP)	Tucannon
Tucannon Summer Steelhead (Lyons Ferry)	WDFW	BPA (LSRCP)	Tucannon
NF Clearwater Summer Steelhead (B-Run-Clearwater Hatchery)	IDFG	BPA (LSRCP)	Clearwater
NF Clearwater Summer Steelhead (B-Run-Dworshak NFH)	USFWS	BPA (LSRCP)	Clearwater
Clearwater River Basin Spring Chinook (Clearwater Hatchery)	IDFG	BPA (LSRCP)	Clearwater
S.F. Clearwater B-Run Steelhead (Clearwater Hatchery)	IDFG	BPA (LSRCP)	Clearwater
Clearwater Spring Chinook (NPTH-Hatchery)	Nez Perce Tribe (NPT)	BPA	Clearwater

Program	Operator	Lead Action Agency	Basin
Clearwater Fall Chinook (NPTH-Hatchery)	NPT	BPA	Clearwater
Cottonwood Creek Summer Steelhead (Wallowa Stock)	WDFW	BPA (LSRCP)	Grande Ronde
Grande Ronde Basin Summer Steelhead (Wallowa Hatchery)	ODFW	BPA (LSRCP)	Grande Ronde
Grande Ronde Endemic Spring Chinook Salmon Supplementation (Upper Grande Ronde River Spring/Summer Chinook Salmon Stock)	ODFW & CTUIR	BPA (LSRCP)	Grande Ronde
Grande Ronde Basin Catherine Creek Spring/Summer Chinook	ODFW & CTUIR	BPA (LSRCP)	Grande Ronde
Lostine Spring Chinook	ODFW, NPT & CTUIR	BPA (LSRCP)	Grande Ronde
Lookingglass Creek Spring Chinook	ODFW	BPA (LSRCP)	Grande Ronde
Little Sheep Creek Summer Steelhead	ODFW	BPA (LSRCP)	Imnaha
Imnaha Spring/Summer Chinook	ODFW	BPA (LSRCP)	Imnaha
Upper Salmon River B-Run Steelhead (Sawtooth- Magic Valley)	IDFG	BPA (LSRCP)	Salmon
Upper Salmon Spring Chinook (Sawtooth Hatchery)	IDFG	BPA (LSRCP)	Salmon
South Salmon Summer Chinook (McCall Fish Hatchery)	IDFG	BPA (LSRCP)	Salmon
Johnson Creek Summer Chinook (South Fork Salmon)	IDFG & NPT	BPA (LSRCP)	Salmon
Yankee Fork Summer Steelhead Streamside Incubation Supplementation	IDFG & Shoshone-Bannock Tribes SBT	BPA	Salmon
Yankee Fork Summer Steelhead Supplementation	IDFG & SBT	BPA	Salmon
Yankee Fork Chinook Supplementation	IDFG & SBT	BPA	Salmon
SF Salmon-Dollar Creek Summer Chinook (McCall FH-Eggbox)	IDFG & SBT	BPA	Salmon

Program	Operator	Lead Action Agency	Basin
E. Fork Salmon River Natural integrated Steelhead (Sawtooth)	IDFG	BPA (LSRCP)	Salmon
Little Salmon River A&B Run Steelhead (Niagara/Magic Valley)	IDFG	BPA (LSRCP)	Salmon
Pahsimeroi A-Run Steelhead (Niagara Springs)	IDFG	BPA (LSRCP)	Salmon
Upper Salmon River A-Run Steelhead (Sawtooth/ Magic Valley/Hagerman National)	IDFG	BPA (LSRCP)	Salmon
Rapid River Fish Hatchery Chinook (Rapid River and Little Salmon)	IDFG	BPA (LSRCP)	Salmon
Snake River Sockeye (Eagle Fish Hatchery)	IDFG	BPA (LSRCP)	Salmon

RPA Action 40 – Reform FCRPS Hatchery Operations to Reduce Genetic and Ecological Effects on ESA-listed Salmon and Steelhead:

The Action Agencies will undertake/fund reforms to ensure that hatchery programs funded by the Action Agencies as mitigation for the FCRPS are not impeding recovery. The Action Agencies will work with FCRPS mitigation hatchery operators to cost effectively address needed reforms of current hatchery programs while continuing to meet mitigation responsibilities. Specific reforms to be implemented under this action (following any necessary regulatory approval) are listed in Table 6 of the RPA action table. Other reforms will be identified and implemented following the conclusion of the Columbia River Hatchery Scientific Review Group process.

- *For Lower Columbia Chinook: The COE will review the John Day Hatchery Mitigation Program.*

  The reprogramming of the John Day mitigation program has been the topic of ongoing coordination and negotiation for a number of years. The current effort, initiated in 2006, is to coordinate a regionally acceptable detailed plan to accomplish the construction and operational modifications to the program to address a long-held objective to better provide for an in-place, in-kind mitigation concept.

  In 2009, the Corps continued ongoing negotiations with U.S. v. Oregon parties to resolve key issues necessary to proceed with the evaluations and planning for the specific actions to achieve this objective and address the ESA issues associated with the current and potential future mitigation program. It is anticipated that a way forward will be established in 2010.

- *For Snake River Steelhead: Fund the Tucannon River steelhead supplementation program to transition to local broodstock using BMPs.*

  This action will be funded by BPA and implemented by the Lower Snake River Compensation Plan (LSRCP) program office and the Washington Department of Fish and Wildlife (WDFW), the LSRCP hatchery program operator for the Tucannon River steelhead supplementation program. For Tucannon steelhead, WDFW developed a revised HGMP to transition to local broodstock and submitted a summary of the proposed changes to the U.S. v. Oregon Production Advisory Committee for review. The proposal would increase the current Tucannon River endemic stock summer steelhead smolt production from 50,000 to 75,000 fish annually.

  As the program expands toward a production goal of 150,000 in the future, (following needed facility modifications at the Lyons Ferry and Tucannon fish hatcheries), up to two-thirds of the

annual production would be marked for harvest mitigation as part of the LSRCP mitigation program. The remaining one-third of the program would be used for supplementation in the Tucannon River. Production facilities, brood source, size and life history at release, and time of release would all remain the same as the current program.

- *For Middle Columbia Steelhead: Fund the Touchet River steelhead supplementation program to transition to local broodstock using BMPs.*

  This action will be funded and implemented by the LSRCP program office and WDFW. For Touchet steelhead, WDFW submitted a HGMP to NOAA Fisheries in June 2009 to comply with NOAA Fisheries' request to consult on mid-Columbia stocks. The new HGMP is consistent with the current management plan and the U.S. v. OR agreement. WDFW is in the process of conducting statewide review of steelhead hatchery programs and expects that a review of the Touchet program will be completed by the end of 2010.

- *For Upper Columbia Steelhead: For the Winthrop NFH steelhead program, implement measures to transition to local broodstock and to manage the number of Winthrop NFH-produced steelhead on the spawning grounds. Such broodstock and adult escapement reform measures, including capital construction, would be identified through development of an updated HGMP and ESA consultation. Implementation of reform measures is contingent on a finding, in consultation with NOAA, that the measures are biologically and economically feasible and effective. Implementation of reforms will be prioritized and sequenced.*

  The Winthrop NFH continued the pilot program to evaluate longer-term (two-year) rearing of juvenile steelhead as part of a program to transition to a locally adapted steelhead broodstock in the Methow River. The program will continue for several more years and was expanded from 25,000 juvenile steelhead in 2008 to 40,000 in 2009, while still meeting the goal of releasing 100,000 fish during the transition to locally adapted stock. Discussions about where on the Methow River and how to manage returning adult steelhead on the spawning grounds led to testing the fish ladder at Foghorn Dam as a place to intercept adult steelhead. The fish ladder was tested in 2009 and found not to be a very effective method of capturing returning adults. Most adult steelhead were caught by hook and line, with only two collected from the fish ladder. Since Foghorn Dam is not a complete barrier to fish passage, and it is relatively easy for adult fish to pass, a weir or some other type of structure is being considered as a means to guide upstream migrating fish for collection.

  An additional recommendation was for Winthrop NFH to reduce spring Chinook salmon production, thereby increasing steelhead capability. The hatchery investigated a partnership with the Colville Tribe, which indicated an interest in assuming Chinook salmon production. Sufficient progress was made to anticipate the tribe will be able to handle production of 100,000 spring Chinook salmon in coming years.

  In 2009, with BPA funding, the Hatchery Scientific Review Group (HSRG) completed its comprehensive review and analysis of all Columbia River Basin hatchery programs and its final reports with recommendations for hatchery reform.

Hatchery Strategy 2 (RPA Actions 41–42)

RPA Action 41 – Implement Safety Net Programs to Preserve Genetic Resources and Reduce Short-term Extinction Risk: *The Action Agencies will continue to fund the operation of on-going "safety net" programs that are providing benefits to ESA-listed stocks at high risk of extinction by increasing genetic resources and will identify and plan for additional safety-net programs, as needed.*

1. *For Snake River sockeye: Continue to fund the safety net program to achieve the interim goal of annual releases of 150,000 smolts while also continuing to implement other release strategies in nursery lakes such as fry and parr releases, eyed-egg incubation boxes, and adult releases for volitional spawning (see Action 42 for expansion of the program for building genetic resources and assisting in promoting recovery).*

BPA continued to fund the Snake River Sockeye Salmon Captive Broodstock Program, BPA project number 2007-402-00, to preserve this species. The program has produced hundreds of thousands of progeny from remnants of the wild stock. The progeny are raised in carefully managed hatcheries and released into their natural habitats using multiple release strategies, including smolt, fry, and parr releases; eyed-egg incubation boxes; and adult releases for volitional spawning. The Stanley Basin Technical Oversight Committee continues to provide guidance on the program. Since 1999, 1,838 adults from the program have returned to Redfish Lake. In 2009, 833 adult sockeye salmon returned to the Stanley Basin. This is the largest recorded annual return since 1956.

2. *For Snake River Spring/Summer Chinook: For the Tucannon River spring/summer Chinook safety-net supplementation program fund capital construction, operation and monitoring and evaluation costs to implement a program that builds genetic diversity using local broodstock and a sliding scale for managing the composition of natural spawners comprised of hatchery-origin fish.*

   In 2009, BPA funded the final analysis and reporting tasks of BPA project 2000-019-00, Tucannon River Spring Chinook Captive Brood, as this safety-net program neared completion.

3. *For Snake River Spring/Summer Chinook: For the Upper Grande Ronde and Catherine Creek safety net supplementation programs fund capital construction, operation and monitoring and evaluation costs to implement a program that builds genetic diversity using local broodstock, and a sliding scale for managing the composition of natural spawners comprised of hatchery origin fish.*

   BPA continued to fund this safety-net program through BPA project number 2007-404-00, Spring Chinook Captive Propagation - Oregon.

4. *For Snake River Spring/Summer Chinook: Fund the Johnson Creek / South Fork Salmon River safety net supplementation program, as described in the existing Section 10 permit.*

   BPA continued to fund this safety-net program through BPA project number 1996-043-00, the Johnson Creek Artificial Propagation Enhancement project.

5. *For Snake River Spring/Summer Chinook: Fund the experimental captive rearing program for East Fork and West Fork Yankee Fork Salmon River (until phased out by IDFG).*

   BPA continued to fund this experimental captive rearing program through BPA project number 2007-403-00, Idaho Snake River Spring Chinook Captive Propagation.

6. *For Snake River Steelhead, as a project to benefit primarily B-run steelhead, the Action Agencies will work with NOAA Fisheries to develop a trigger for future artificial propagation safety-net planning or to identify populations for immediate safety-net planning.*

   It is not feasible to implement this action at this time because of a lack of adequate B-run steelhead population viability data. Once sufficient data are available (as determined by NOAA Fisheries) through the enhanced Snake River B-run steelhead population productivity and abundance monitoring called for in RPA action 50.5, we will begin to work with NOAA Fisheries to develop the type of "trigger" described above. We estimate it may be several years before adequate data are available from the enhanced monitoring effort

RPA Action 42 – Implement Conservation Programs to Build Genetic Resources and Assist in Promoting Recovery:

The Action Agencies will implement conservation programs for ESA–listed stocks where the programs assist in recovery.

1. *For Upper Columbia Spring Chinook: Fund reintroduction of spring Chinook salmon into the Okanogan Basin consistent with the Upper Columbia Salmon Recovery Plan including capital construction, operation and monitoring and evaluation costs to implement a transition to local broodstock and a sliding scale for managing the composition of natural spawners composed of hatchery origin fish. Re-introduction will be coordinated with the restoration and improvement of spring Chinook habitat in the Okanogan Basin and will be contingent on the availability of within ESU broodstock from the Methow Basin.*

When constructed and fully operational, BPA-funded Chief Joseph Hatchery is expected to serve as the artificial production facility needed for this reintroduction program. This production will initially be contingent on the availability of within-ESU spring Chinook broodstock from the Methow Basin. Chief Joseph Hatchery was approved by the Northwest Power and Conservation Council (Council) in 2009 to move into Step 3 (final design) of the Council's three-step review process for major artificial production projects. Final approval is expected in 2010, and construction is anticipated to begin in late 2010 or 2011.

2. *For Upper Columbia Steelhead: Fund a program to recondition natural origin kelts for the Entiat, Methow and Okanogan basin, including capital construction, operation and monitoring and evaluation costs.*

   In 2009, BPA began funding the Yakama Tribes to implement an Upper Columbia Kelt Reconditioning project that will develop a site plan and construct a steelhead kelt reconditioning facility.

3. *For Upper Columbia Steelhead: Fund a program that builds genetic diversity using local broodstock and accelerates steelhead recovery in the Okanogan Basin as steelhead habitat is restored and improved, including capital construction, operation, and monitoring and evaluation costs.*

   This action is being implemented by the Confederated Colville Tribes through a Fish and Wildlife Program/Columbia River Fish Accords project: Local Okanogan Steelhead Broodstock.

4. *For Middle Columbia Steelhead: Fund a program to recondition natural origin kelts in the Yakima River basin including capital construction, implementation and monitoring and evaluation costs.*

   BPA continued to fund this action through a BPA project, Kelt Reconditioning/Reproductive Success.

5. *For Snake River Steelhead: For the East Fork Salmon River, fund a small-scale program (no more than 50,000 smolts) including trapping locally returning steelhead in the East Fork Salmon River for broodstock, and follow BMPs for rearing, release, and adult management strategies. Fund capital construction, operation, and monitoring and evaluation costs to implement a program that builds genetic diversity using local broodstock and a sliding scale for managing the composition of natural spawners comprised of hatchery origin fish.*

   BPA continued to fund operation and maintenance for this action through the LSRCP Direct Funding Agreement.

6. *For Snake River Spring/Summer Chinook Salmon: For the Lostine and Imnaha rivers, contingent on a NOAA approved HGMP, fund these hatchery programs including capital construction, operation and monitoring and evaluation costs to implement supplementation programs using local broodstock and following a sliding scale for managing the composition of natural spawners composed of hatchery origin fish.*

   As of December 2009, a proposed action and HGMP had not been completed for this program. Because funding of the action is contingent on a NOAA Fisheries-approved HGMP, BPA did not fund construction of the Northeast Oregon Hatchery Lostine and Imnaha spring/summer Chinook propagation facilities in 2009. It is possible that NOAA Fisheries may approve an HGMP for this program during the RPA action 39 ESA consultation process for the Snake River Basin in 2010.

7. *For Snake River Sockeye: Fund further expansion of the sockeye program to increase total smolt releases to between 500,000 and 1 million fish.*

   On September 2, 2008, BPA signed a Fish Accord with Idaho that will provide funding certainty over a 10-year period. The accord included the commitment to provide funding for a new sockeye salmon fish hatchery (property acquisition and construction). Throughout 2009, BPA worked with IDFG and the state of Idaho to identify and begin the acquisition process for property meeting the criteria for a facility that will allow propagation of up to 1 million sockeye salmon smolts. Funding will be provided through ongoing BPA projects.

8. *For Snake River Sockeye: The Action Agencies will work with appropriate parties to investigate feasibility and potentially develop a plan for ground transport of adult sockeye from LGR Dam to Sawtooth Valley lakes or artificial propagation facilities.*

   In 2009, the Action Agencies, together with state and federal fishery agencies, started development of study plan to investigate the feasibility of transporting adult sockeye. (A pilot project to evaluate feasibility of ground transport was implemented in 2010.)

9. *For Columbia River Chum: Fund a hatchery program to re-introduce chum salmon in Duncan Creek including capital construction, implementation and monitoring and evaluation costs as long as NOAA Fisheries considers it beneficial to recovery and necessary to reduce extinction risk of the target population.*

   BPA continued to fund this action through the BPA project, Reintroduction of Chum Salmon into Duncan Creek.

10. *For Columbia River Chum: Fund assessment of habitat potential, development of reintroduction strategies, and implementation of pilot supplementation projects in selected Lower Columbia River tributaries below Bonneville Dam.*

    In 2009, BPA began funding a new project, Development of an Integrated Strategy for Chum Salmon Restoration in the Tributaries Below Bonneville Dam, to implement this action.

Predation Management Implementation Reports, RPA Action 43–49

Table 11. Predation Management RPA Action Reporting

RPA Action No.	Action	Annual Progress Report
Predation Management Strategy 1		
43	Northern Pikeminnow Management Program (NPMP)	Annual progress reports will describe actions taken, including: - Number of pikeminnow removals - Estimated reduction of juvenile salmon consumed - Average exploitation rate - Results of periodic program evaluations (including updates on age restructuring and compensatory responses)
44	Develop strategies to reduce non-indigenous fish	Beginning in 2010, annual progress reports will describe actions taken as a result of the workshop.
Predation Management Strategy 2		
45	Caspian Tern	Annual progress reports will describe actions taken toward the implementation of the Caspian Tern Management Plan.
46	Double-Crested Cormorant	Annual progress reports will describe actions taken if warranted.
47	Inland Avian Predation	Annual progress reports will describe actions taken if warranted.
48	Other Avian Deterrent Actions	Annual deterrent actions will not be reported.

Predation Management Strategy 3		
49	Marine Mammal Control Measures	Not applicable.

Predation Management Strategy 1 (RPA Actions 43–44)

RPA Action 43 – Northern Pikeminnow Management Program:

Action Agencies will continue to annually implement the base program and continue the general increase in the reward structure in the northern pikeminnow sport-reward fishery consistent with the increase starting in 2004. To better evaluate the effects of the NPMP, BPA will increase the number of tagged fish. The Action Agencies will evaluate the effectiveness of focused removals of pikeminnow at The Dalles and John Day dams and implement as warranted. Additional scoping of other mainstem dams will be based upon evaluations and adaptive management principles with input from NOAA Fisheries, and other regional fisheries managers.

Since 1990, BPA has funded the Northern Pikeminnow Management Program (NPMP) to reduce the numbers of larger pikeminnow and improve survival of juvenile salmon. In 2004, after BPA increased the reward for the catch of this predator, the number of pikeminnow removed increased by 25 percent compared to prior years. The increased reward was made permanent in 2005 to sustain the higher catches. This resulted in the highest harvest rate of pikeminnow observed since the program began. The pikeminnow program has removed more than 3.3 million northern pikeminnow from the Columbia River since 1990. Evaluation indicates that as a result of the program, pikeminnow predation on juvenile salmon has declined 38 percent, saving 3-5 million juvenile salmon annually that would otherwise have been eaten by this predator.

The 2008 BiOp calls for BPA to increase tagging efforts to boost the number of tagged northern pikeminnow to better inform and increase the statistical significance of the biological evaluation of pikeminnow removals. The evaluation component of the NPMP uses tag recoveries in sponsored fisheries to quantitatively measure the benefit of removals within the year and cumulatively. In 2009, researchers were able to build upon the increase in cumulative tagging efforts achieved in 2008, which resulted in increases in year-over-year application of tags by 80 percent. This increase in tagging and resultant improvement in estimation is consistent with the 2008 BiOp and Independent Scientific Advisory Board (ISAB) recommendations (The Northern Pikeminnow Management Program Justification, Performance, and Cost Effectiveness, Hankin, 2000 *http://www.nwcouncil.org/library/2000/2000-16.pdf*).

Also in 2009, the exploitation rate on northern pikeminnow was 12.8 percent, within the program objective based on the hypothesis that a 10 to 20 percent exploitation rate (on northern pikeminnow 9 inches or longer) could achieve up to a 50 percent reduction in predation mortality (Rieman and Beamesderfer 1990). The exploitation rate was based on a numerical catch of 141,645 from a sport reward fishery and dam angling fishery. As part of the ongoing annual evaluation of the NPMP, managers determined that continued implementation of the dam angling program component is warranted based on the 2009 catch of 5,369 from the forebays and tailraces of The Dalles and John Day dams.

RPA Action 44 – Develop strategies to reduce non-indigenous fish: *The Action Agencies will work with NOAA Fisheries, states and tribes to coordinate to review, evaluate, and develop strategies to reduce non-indigenous piscivorous predation. The formation of a workshop will be an initial step in the process.*

In May 2009, BPA reconvened a smaller group of participants from the 2008 Predation Workshop to narrow and prioritize approximately one dozen grouped recommendations stemming from the workshop held in fall 2008. As a result of this half-day collaborative meeting with the regional agencies and tribes, the Action Agencies were able to narrow the research objectives to a few high–priority topic areas and critical uncertainties. Specifically the Action Agency's will address the influence

of juvenile American shad on the health and well being of piscivores and their predation rates on juvenile salmonids, the predatory impact of channel catfish on juvenile salmonids, and the potential efficacy of localized removals of smallmouth bass for predation control. In December 2009, the project sponsors submitted for review of the Independent Scientific Review Panel for the NPCC the proposal titled "*Understanding the influence of predation by introduced fishes on juvenile salmonids in the Columbia River Basin: closing some knowledge gaps."*

Predation Management Strategy 2 (RPA Action 45–48)

RPA Action 45 – Reduce Caspian Terns on East Sand Island in the Columbia River Estuary:

The FCRPS Action Agencies will implement the Caspian Tern Management Plan. East Sand Island tern habitat will be reduced from 6.5 to 1.5 to 2 acres. It is predicted that the target acreage on East Sand Island will be achieved in approximately 2010.

In November 2006, the USFWS and Corps signed separate Records of Decision (RODs) adopting the Caspian Tern Management Plan. NMFS completed the biological opinion for the proposed action on February 16, 2006.

In 2008, the Corps began the implementation of the Caspian Tern Management Plan with the construction of a one-acre island in Fern Ridge Reservoir (Oregon). Also completed that year was a one-acre island at Crump Lake (Oregon), and a one-half acre island at Summer Lake. In February 2009, an additional one-half acre island was completed at Summer Lake. The construction of these new islands allowed the Corps to reduce habitat at East Sand Island to 3.5 acres in March 2009.

Reducing habitat at East Sand Island in 2009 forced Caspian terns to nest at a higher density than previously recorded. In addition, Caspian terns that were not able to nest on the main colony formed a satellite colony near the beach on the eastern edge of East Sand Island. The Caspian tern colony consisted of about 9,854 breeding pairs in 2009, not significantly different from 2008.

Monitoring at Rice Island in May 2009 found Caspian terns attempting to nest on the western portion of Rice Island. The Corps immediately contracted services to place dissuasion materials on these locations, filled in nest scraps, and collected two Caspian tern eggs (under Federal Depredation Permit). The dissuasion was successful at keeping Caspian terns from nesting on Rice Island the remainder of the 2009 nesting season.

Construction of new islands continued during the summer 2009 with the creation of an additional one-half acre island at Summer Lake, as well as three new islands in the Klamath Basin at Tule Lake and Lower Klamath National Wildlife Refuges. A total of 3.8 acres were built in the Klamath Basin which included a two-acre island at Tule Lake sump 1b, a one-acre rock island in the Orems Unit, and a 0.8-acre floating island on Sheepy Lake in the Lower Klamath Refuge. Only the floating island will be available for the 2010 nesting season due to vegetation management of the managed wetlands at the other two locations.

The Corps does not expect to reach the initial implementation goal of 1.5 to 2 acres by the 2011 nesting season due to difficulties with developing the sites identified in the Caspian Tern Management Plan. Efforts are ongoing to develop nesting habitat in San Francisco Bay and in Malheur Wildlife Refuge. The ROD provides for the Corps to continue building islands at a two for one ratio to reduce East Sand Island to one acre. Evaluating the impacts from Caspian terns on the survival of juvenile salmonids will continue yearly to determine if more acres of alternative habitat are needed to further reduce habitat to reach the ultimate goal of 1.0 acres at East Sand Island.

The Corps is coordinating the deviations from the Management Plan with the appropriate agencies. This coordination effort is expected to be complete by the end of 2010.

RPA Action 46 – Double-Crested Cormorants: *The FCRPS Action Agencies will develop a cormorant management plan encompassing additional research, development of a conceptual management plan, and implementation of warranted actions in the estuary.*

In 2009, the Action Agencies continued a study to test the feasibility of potential management techniques for reducing losses of juvenile salmonids due to cormorant predation in the Columbia River Estuary. They continued employment of habitat enhancement (placement of old tires filled with nesting material) and social attraction techniques (decoys and audio playback systems) on a floating platform in Fern Ridge Reservoir, near Eugene, Oregon. The Fern Ridge site was selected because it supported significant numbers of cormorants during the non-breeding season.

Cormorants did not attempt to nest on the floating platform, nor were they ever observed perched on the floating platform during the nesting season in 2008 or 2009. Developing methodologies to enhance the size of existing double-crested cormorant colonies, along with establishing new colonies using habitat enhancement and social attraction techniques, may be necessary to shift cormorants from the colony on East Sand Island to alternative colony sites where ESA-listed salmonids are not as vulnerable to cormorant predation.

In 2009, three techniques were tested to discourage nesting by double-crested cormorants on East Sand Island. The first technique, human disturbance, was used on a discrete portion of the breeding colony area. The second technique, hazing with a green laser, was used on cormorants that were roosting on beaches adjacent to the colony. The third technique was the placement of pond liner on a portion of the known nesting area.

The human disturbance technique was tested as a potential method to discourage double-crested cormorant nesting on East Sand Island. Prior to the initiation of any breeding, a visual barrier (a fence of black plastic fabric, approximately 1.5 meters tall) was erected to isolate a small section of the easternmost end of the double-crested cormorant colony. Disturbances ceased as soon as evidence of egg laying was observed.

A green laser (LEM50 laser torch) was used during early morning and late evening periods to test its efficacy for dispersing targeted double-crested cormorants from roosting on East Sand Island. The laser was used during April before double-crested cormorants had initiated egg laying. Results were marginally successful in flushing response, but the birds quickly became accustomed to the laser, at which point the laser was no longer effective. It was determined that this method does not have validity as a long term management tool.

The pond liner was placed on sand and rip-rap areas and was 100 percent successful and dissuaded cormorants from nesting. This could be a possible long-term method for dissuasion, but it is fairly costly and would require maintenance.

RPA Action 47 – Inland Avian Predation:

The FCRPS Action Agencies will develop an avian management plan (for Double-Crested Cormorants, Caspian Terns, and other avian species as determined by RME) for Corps-owned lands and associated shallow water habitat.

In 2009, the Action Agencies and the USFWS met to begin development of an avian management plan for Corps-owned lands and associated shallow water habitat. Three workshops on potential research and management actions were also held in 2009. Development of the plan continued through regional collaboration, and a programmatic framework for the plan was completed. A full draft for regional review is now planned for completion in Q1 2011.

RPA Action 48 – Other Avian Deterrent Actions: *The Corps will continue to implement and improve avian deterrent programs at all lower Snake and Columbia River dams. This program will be coordinated through the Fish Passage Operations and Maintenance Team and included in the FPP.*

Other avian deterrent actions, such as hazing and wire arrays, were carried out in accordance with the FPP (*http://www.nwd-wc.usace.army.mil/tmt/documents/fpp/2009*) as called for in RPA action 48.

An extensive new array of gull deterrent wires was added to John Day Dam tailrace. Evaluations of the effectiveness of the new wire arrays in conjunction with the ongoing harassment program led to plans for modifications to the array in 2010, with construction finished early 2010.

Predation Management Strategy 3 (RPA Action 49)

RPA Action 49 – Marine Mammal Control Measures: *The Corps will install and improve as needed sea lion excluder gates at all main adult fish ladder entrances at Bonneville Dam annually. In addition, the Corps will continue to support land and water based harassment efforts by NOAA Fisheries, Oregon Department of Wildlife (ODFW), Washington Department of Fish and Wildlife (WDFW), and the Tribes to keep sea lions away from the area immediately downstream of Bonneville Dam.*

In 2009, the Corps implemented and evaluated a variety of sea lion deterrents, from physical barriers to non-lethal harassment (Stansell et al. 2009). Sea lion exclusion devices (SLEDs) were installed at Bonneville Dam's 12 primary fishway entrances to prevent sea lions from entering the fishways. SLEDs were installed on January 15, two weeks early, in response to a sea lion being observed in the Powerhouse 2 fishway entrance. The SLEDs were removed in June 2009. The SLEDs feature 15.38-inch (39.05-centimeter) gaps that are designed to allow fish passage. Floating orifice gates (FOGs) were equipped with SLED-like FOG barriers. Acoustic deterrent devices, which emit a 205-decibel sound in the 15 kHz range, were installed at fishway entrances in January 2009 and removed in May 2009.

Since 2006, the Corps has contracted with the U.S. Department of Agriculture (USDA) Wildlife Services to harass sea lions away from fishways and other dam structures. Dam-based harassment by USDA agents began in March 2009 and was conducted daily through the end of May 2009. Harassment involved a combination of acoustic, visual, and tactile non-lethal deterrents, including above-water pyrotechnics (cracker shells, screamer shells, or rockets), rubber bullets, rubber buckshot, and beanbags.

In part supported by BPA, CRITFC conducted boat-based harassment along with Oregon Department of Fish and Wildlife (ODFW) and WDFW from December 2008 through May 2009. Boats operated from the Bonneville Dam tailrace (RM 146) downstream to navigation marker 85 (RM 139). The Corps granted boats access to the Boat Restricted Zone (BRZ), but given concerns about human and fish safety, harassment was not allowed within 30 meters of dam structures or within 50 meters of fishway entrances. The use of "seal bomb" deterrents was prohibited within 100 meters of fishways, collection channels, or fish outfalls for the second powerhouse (PH2) corner collector and smolt monitoring facility. Boat crews ceased using seal bombs after adult salmon passage exceeded 1,000 fish per day. Corps biologists coordinated with USDA agents and boat-based crews from ODFW, WDFW, and CRITFC on all sea lion harassment activities at Bonneville Dam to ensure safety and increase the effectiveness of harassment efforts.

With funding from BPA, ODFW, and WDFW, four floating sea lion traps were deployed along the Powerhouse II corner collector to capture California sea lions. The sea lions were then weighed, branded, and released or transferred to aquariums. Of the 20 California sea lions trapped in 2009, four were sent to aquariums, 10 were euthanized, five were processed (measured, weighed, marked with a three-digit brand, and given acoustic tags), and released. One was already branded (but given an acoustic tag).

RME Implementation Reports, RPA Actions 50–73

The following section provides information on the RME actions implemented by the Action Agencies in 2009. In many cases, Action Agency projects identify actions that were funded and initiated prior to the completion of the 2008 BiOp, or were initiated as part of a previous BiOp. This section of the report will highlight examples of how projects contracted in 2009 fulfilled the RPAs, while Section 4 provides the full list of projects.

Table 12. RME Strategy Reporting

RPA Action No.	Action	Annual Progress Report
RME Strategy 1		
50	Fish Population Status Monitoring	Status of project implementation (including project milestones) through December of the previous year for all actions identified in Attachment B.2.6-1 or subsequent implementation plans.
51	Collaboration Regarding Fish Population Status Monitoring	Status of project implementation (including project milestones) through December of the previous year for all actions identified in implementation plans.
RME Strategy 2		
52	Monitor and Evaluate Fish Performance within the FCRPS	Status of project implementation (including project milestones) through December of the previous year for all actions identified in implementation plans.
53	Monitor and Evaluate Migration Characteristics and River Condition	Status of project implementation (including project milestones) through December of the previous year for all actions identified in implementation plans.
54	Monitor and Evaluate Effects of Configuration and Operation Actions	Status of project implementation (including project milestones) through December of the previous year for all actions identified in implementation plans.
55	Investigate Hydro Critical Uncertainties and Investigate New Technologies	Status of project implementation (including project milestones) through December of the previous year for all actions identified in implementation plans.
RME Strategy 3		
56	Monitor and Evaluate Tributary Habitat Conditions and Limiting Factors	Status of project implementation (including project milestones) through December of the previous year for all actions identified in implementation plans.
57	Evaluate the Effectiveness of Tributary Habitat Actions	Status of project implementation (including project milestones) through December of the previous year for all actions identified in implementation plans.
RME Strategy 4		
58	Monitor and Evaluate Fish Performance in the Estuary and Plume	Status of project implementation (including project milestones) through December of the previous year for all actions identified in implementation plans.

Table 12. RME Strategy Reporting

RPA Action No.	Action	Annual Progress Report
59	Monitor and Evaluate Migration Characteristics and Estuary/Ocean Conditions	• Status of project implementation (including project milestones) through December of the previous year for all actions identified in implementation plans. • Tabulate the amount of absolute acreage by habitat type that is restored or protected every year. (Initiate in FY 2007-2009 Projects.) • Report annually on indices of productivity for the estuary and ocean (i.e., Pacific Decadal Oscillation, primary productivity indices).
60	Monitor and Evaluate Habitat Actions in the Estuary	Status of project implementation (including project milestones) through December of the previous year for all actions identified in implementation plans.
61	Investigate Estuary/Ocean Critical Uncertainties	Status of project implementation (including project milestones) through December of the previous year for all actions identified in implementation plans.
RME Strategy 5		
62	Fund Selected Harvest Investigations	Status of project implementation (including project milestones) through December of the previous year for all actions identified in implementation plans.
RME Strategy 6		
63	Monitor Hatchery Effectiveness	Status of project implementation (including project milestones) through December of the previous year for all actions identified in implementation plans.
64	Investigate Hatchery Critical Uncertainties	Status of project implementation (including project milestones) through December of previous year for all actions identified in implementation plans.
65	Investigate Hatchery Critical Uncertainties	Status of project implementation (including project milestones) and analysis of new information through December of the previous year.
RME Strategy 7		
66	Monitor and Evaluate the Caspian Tern Population in the Columbia River Estuary	Status of project implementation (including project milestones) through December of the previous year for all actions (habitat actions are population response) identified in implementation plans.
67	Monitor and Evaluate the Double-Crested Cormorant Population in the Columbia River Estuary	Status of project implementation (including project milestones) through December of the previous year for all actions (habitat actions are population response) identified in implementation plans.
68	Monitor and Evaluate Inland Avian Predators	Status of project implementation (including project milestones) through December of the previous year for all actions (habitat actions are population response) identified in implementation plans.

Table 12. RME Strategy Reporting

RPA Action No.	Action	Annual Progress Report
69	Monitoring Related to Marine Mammal Predation	Status of project implementation (including project milestones) through December of the previous year for all actions (habitat actions are population response) identified in implementation plans.
70	Monitoring Related to Piscivorous (Fish) Predation	Status of project implementation (including project milestones) through December of the previous year for all actions identified in implementation plans.
RME Strategy 8		
71	Coordination	Status of coordination of RME projects through December of the previous year will be provided.
72	Data Management	Status of data management projects through December of the previous year will be provided.
RME Strategy 9		
73	Implementation and Compliance Monitoring	The Action Agencies will use the project-level detail contained in the Action Agencies' BA databases to track results and assess our progress in meeting programmatic-level performance targets. This performance tracking will be reported through annual progress reports and the 2013 and 2016 comprehensive reports.

RME Strategy 1 (RPA Actions 50–51)

A comprehensive list of all actions implemented by the Action Agencies for RPAs 50 and 51 is included in Section 4.

RPA Action 50 – Fish Population Status Monitoring: *The Action Agencies will enhance existing fish population status monitoring performed by fish management agencies through the specific actions listed below. In addition, ancillary population status and trend information is being obtained through several ongoing habitat and hatchery improvement projects.*

1. *Implement and maintain the Columbia River Basin passive integrated transponder (PIT)-Tag Information System. (Annually)*

   BPA continued implementation of six projects in 2009 in support of the Columbia Basin PIT-Tag Information System (PTAGIS). The primary support for this project comes from BPA project number 1990-080-00, which was continued in 2009. The project supported research that calls for the selection or diversion of specific PIT-tagged fish at any of the mainstem juvenile or adult fish facilities. PTAGIS provides coordination, set-up, operations, and maintenance for approximately one dozen NPCC Fish and Wildlife Program (FWP) or Anadromous Fish Evaluation Program (AFEP) projects throughout the fish migration season. The existing database will be revised to include information from interrogation systems that are being installed in tributaries to measure population-scale abundance and survival.

2. *Monitor adult returns at mainstem hydroelectric dams using both visual counts and the PIT-tag detection system (see Hydrosystem section). (Annually)*

In 2009, the Corps again implemented its adult fish count program as laid out in the FPP. Results are available in the *2009 Annual Fish Passage Report: Columbia and Snake Rivers*, available at *http://www.nwp.usace.army.mil/environment/FishData/docs/2009afpr.pdf*.

BPA continued implementation of three projects in 2009 for additional support of this RPA subaction. For example, the Lower Granite Dam Adult Trap Operations, BPA project number 2001-003-00, continued in 2009 for daily operation of the Lower Granite Dam adult trap to sample steelhead, spring/summer Chinook, and PIT-tagged fall Chinook (scales and length measurement) for run-reconstruction and transportation and life history studies. Fish with coded-wire-tags or PIT tags (if targeted) were diverted into the adult trap holding area for collection of timed samples (a percentage of all passing adults) for run reconstructions. Operation information was included in the adult trap annual report provided to BPA. This RPA is well covered through the Corps' adult fish count program and the BPA projects. Additional work is being implemented in 2010 for upper Columbia spring Chinook and steelhead.

3. *Monitor juvenile fish migrations at mainstem hydroelectric dams using smolt monitoring and the PIT-tag detection system (see Hydrosystem section). (Annually)*

BPA continued implementation of seven smolt monitoring projects in 2009 to address the needs of this RPA subaction. For example, the Smolt Monitoring by Non-Federal Entities project, BPA project number 1994-033-00, collected species, condition, and external mark detail from all sampled fish; condition and length data from a subsample of the smolts; and all incidental species caught in the samples. This RPA will be expanded and fully addressed in 2010 with additional PIT tagging of juvenile fish guided by a tagging plan.

4. *Fund status and trend monitoring as a component of the pilot studies in the Wenatchee, Methow, and Entiat river basins in the Upper Columbia River, the Lemhi and South Fork Salmon river basins, and the John Day River Basin to further advance the methods and information needed for assessing the status of fish populations. (Initiate in FY 2007-2009 Project Funding, review and modify annually to ensure that these projects continue to provide a means of evaluating the effectiveness of tributary mitigation actions).*

In 2009, nine BPA projects continued to be implemented, and one BPA project was initiated to support ongoing pilot studies. For example, the Integrated Status and Effectiveness Program projects, BPA project numbers 2003-010-00 and 2003-017-00, conducted monitoring to evaluate food web and life history responses to habitat change. The projects also conducted juvenile snorkel surveys in winter (30) and summer (42), sampling sites to evaluate population dynamics at restoration sites compared to unrestored sites. These 10 BPA monitoring projects are meeting population status monitoring needs in the John Day, Lemhi, and South Fork Salmon rivers. Additional monitoring is being developed within the Wenatchee, Entiat, and Methow to fully meet the requirements of this RPA subaction.

5. *Provide additional status monitoring to ensure a majority of Snake River B-Run steelhead populations are being monitored for population productivity and abundance. (Initiate by FY 2009, then annually)*

Ten projects were continued to assess B-run steelhead abundance and productivity. For example, the Idaho Monitoring and Evaluation Studies Project, BPA project number 1990-055-00, PIT-tagged juveniles in streams of the Middle Fork Salmon, South Fork Salmon, and Little Salmon rivers to estimate juvenile steelhead production and timing. The project also snorkeled streams to estimate juvenile densities in the Clearwater River and tributaries, and it collected DNA tissue samples in the Salmon River and Clearwater River tributaries to genotype and analyze genetic tissues. The Action Agencies are implementing additional BiOp monitoring projects in 2010 and 2011 identified in a regional collaboration effort with state and tribal entities that support this RPA.

6. *Review and modify existing Action Agencies' fish population status monitoring projects to improve their compliance with regional standards and protocols, and ensure they are prioritized and effectively focused on critical performance measures and populations. (Initiate in FY 2008, develop proposed modification in FY 2009, and implement modifications in FY 2010)*

   Forty-four BPA projects were continued that supported fish population status monitoring based on strategies developed through the Anadromous Salmonid Monitoring Strategy (ASMS) in 2009. Regional fish population status monitoring standards and protocol documentation tools were advanced through Pacific Northwest Aquatic Monitoring Partnership (PNAMP) in 2008 under project 2004-002-00 through management of the Protocol Library tool. The Action Agencies/NOAA Fisheries RME work groups recommendation report was reviewed as part of the ASMS and modified to support a regional strategy to meet the needs of the BiOp and ESA recovery.

7. *Fund marking of hatchery releases from Action Agencies funded facilities to enable monitoring of hatchery-origin fish in natural spawning areas and the assessment of status of wild populations. (Annually)*

   Twenty-four BPA projects were continued in 2009 that supported hatchery marking monitoring and research. For example, the Okanogan Basin Monitoring and Evaluation Program (OBMEP) project, BPA project number 2003-022-00, collected data on the abundance of out-migrating juvenile summer steelhead and summer/fall Chinook smolts and installed and tested the operation of a smolt trap in one location on the Okanogan River. The Grande Ronde Supplementation Operations and Maintenance (O&M) and Monitoring and Evaluation (M&E) on Lostine River project, BPA project number 1998-007-02, provided summary data in an annual report on the number of conventional and captive rearing program fish tagged; the average length (mm), weight (g), and condition factors (Fultons), with standard errors; and minimum and maximum values observed for each attribute. BPA project number 2008-740-00 was initiated to support additional marking under BPA-funded hatchery programs. Additional work is expected to occur in the future under this RPA as recommended in the Action Agencies/NOAA Fisheries RM&E Recommendations Report.

8. *Report available information on population viability metrics in annual and comprehensive evaluation reports. (Initiate in FY 2008)*

   All Action Agency population viability information was gathered and stored for future viability assessments. BPA identified placeholder project funds to support the synthesis of fish population data for annual and comprehensive reports, and the Action Agencies and NOAA Fisheries agreed to support a process where NOAA Fisheries would provide population viability information for future reports. Also, the RME Work Group recommended finalizing the NOAA Fisheries viable salmonid population (VSP) data dictionary in coordination with PNAMP and integrating those results into Action Agency project requirements. Current information on population abundance is provided in earlier sections of this report.

RPA Action 51 – Collaboration Regarding Fish Population Status Monitoring:

The Action Agencies will enhance existing fish populations status monitoring performed by fish management agencies through the following collaboration commitments:

1. *Support the coordination, data management, and annual synthesis of fish population metrics through Regional Data Repositories and reports (Annually)*

   Ten projects were continued to fully support annual synthesis of fish population data for reports. For example, the StreamNet Library Project, BPA project number 2008-505-00, supported participation in planning, development, and/or coordination meetings with regional projects and programs under the NPCC's FWP to help develop a regional data management framework, to establish data type and data service priorities, and to provide advice in the area of data management, as requested.

2. *Facilitate and participate in an ongoing collaboration process to develop a regional strategy for status and trend monitoring for key ESA fish populations (Initiate in FY 2008)*

   Two BPA projects were continued to support ongoing collaboration to develop regional strategies. In collaboration with NOAA Fisheries, the Action Agencies, and the NPCC, the NPCC FCRPS BiOp RME work groups completed a draft recommendation report. As part of the regional review and collaboration on this report, the Regional Strategy-Status/Trend project, BPA project number 2008-733-00, was funded to support a process to engage state and tribal fish managers through regional workshops to review existing status and trend monitoring and gaps in monitoring programs. This led to the development of the ASMS strategy in Skamania, Washington. The Action Agencies also supported the ongoing PNAMP coordination process through funding of BPA project number 2004-002-00 and contracted staff support in the PNAMP steering committee and fish population work group.

3. *Provide cost-shared funding support and staff participation in regional coordination forums such as the Pacific Northwest Aquatic Monitoring Partnership (PNAMP) fish population monitoring workgroup and the Northwest Environmental Data Network to advance regional standards and coordination for more efficient and robust monitoring and information management. (Annually)*

   Five BPA projects were continued in 2009 to fully provide cost sharing for staff support in regional monitoring and evaluation coordination. For example, the PNAMP Support Project, BPA project number 2004-002-00, facilitated coordination work at the program, subbasin, and regional level by providing personnel to serve as the lead staff, liaison, and point of contact for the PNAMP. This project supports coordination of PNAMP efforts to integrate resource monitoring programs of state, federal, tribal, local, and private organizations in the Pacific Northwest. This project also facilitates the transfer of information within PNAMP and across relevant organizations to establish and maintain strong relationships between science and management, and to promote and facilitate communication among organizations and disciplines. In 2009, BPA also provided contract support for facilitation of the Northwest Environmental Data (NED) Network forum to advance coordinated data management strategies. In addition to internal Action Agency staff support, technical experts were funded for participation in the PNAMP work group products. Action Agency staff also were active in the formation of the Northwest Information Sharing Executive Forum, which involved executives from multiple entities across the Pacific Northwest to advance the common goal of more efficient and robust monitoring and information sharing.

RME Strategy 2 – Hydrosystem RME (RPA Actions 52–55)

A comprehensive list of all actions implemented by the Action Agencies for RPAs 52 through 55 is included in Section 4. All but two RPA subactions are met by projects that either currently or soon will be in place. RPA subactions 52.6 and 55.3 are expected to involve additional action.

RPA Action 52 – Monitor and Evaluate Fish Performance within the FCRPS:

The Action Agencies will monitor the following biological responses and/or environmental attributes involved in passage through the hydrosystem, and report these estimates on an annual basis:

1. *Monitor and evaluate salmonid dam survival rates for a subset of FCRPS projects.*

   The effects of configuration and operation changes were evaluated at John Day Dam in 2009. Route-specific and dam survival were estimated at the dam for 30 percent and 40 percent spill operations and surface weir configuration.

   The Action Agencies addressed this RPA's subaction through implementation of three BPA projects that have successfully demonstrated that acquiring survival estimates is feasible using strategically located releases of smolts tagged with active tags (Juvenile Salmonid Acoustic Tags (JSATs) in these applications). However, the preferred experimental design has not yet been

selected. Two options are being considered, a single-dam format and a multi-dam format. The region is in the process of determining which experimental design is most appropriate. In 2009, under the AFEP program, a new multi-dam experimental design was developed (AFEP project SPE-06-2) that could substantially reduce costs and provide statistically sound dam survival estimates. In the Snake River, the single-dam method is moving forward under projects SPE-W-08 and SPE-W-05 and may soon be applied in dam survival standard tests.

2. *Monitor and evaluate juvenile salmonid in-river and system survival through the FCRPS, including estimates of differential post-Bonneville survival of transported fish relative to in-river fish (D-value) as needed.*

   Eight projects were continued that addressed this RPA's subaction. Tagged smolts entering and migrating through the FCRPS (Lower Granite through Bonneville dams) were used in 2009 to estimate survival and have been produced annually since 1994. NOAA Fisheries conducts the analysis under BPA project 1993-029-00 using fish PIT-tagged fish under the Smolt Monitoring Program, BPA project number 1987-127-00, and Comparative Survival Study (CSS), BPA project number 1996-020-00.

3. *Monitor and evaluate adult salmonid system survival upstream through the FCRPS.*

   Three projects were continued to fulfill this subaction. For example, the PTAGIS system, BPA project 1990-080-00, provides data on returning adults of known origin. In addition, NOAA Fisheries biologists conducted analyses and reported upstream passage survival for 2009.

4. *Provide additional PIT-tag marking of Upper Columbia River populations to provide ESU specific estimates of juvenile and adult survival through the Federal mainstem dams.*

   Two projects were continued to fully address this effort in 2009: BPA projects 2008-724-00 and 1987-127-00. Planning is ongoing for the extent of tagging and stock coverage required and will be specified in the tagging plan being developed under RPA action 52.6. The extent of tagging and stock coverage has not yet been specified. These populations would be incorporated into the annual system smolt and adult survival monitoring. Efforts being undertaken by public utility districts may supplement the federal effort.

5. *Assess the feasibility of PIT-tag marking of juvenile Snake River Sockeye Salmon for specific survival tracking of this ESU from the Stanley Basin to Lower Granite Dam and through the mainstem FCRPS projects.*

   Two projects, BPA project number 2008-724-00 and 1987-12-700, were continued to address this subaction. This work was initiated as a pilot study in 2009 to assess long-term needs with respect to precision levels and sample sizes for future work.

6. *Develop an action plan for conducting hydrosystem status monitoring (analytical approaches, tagging needs, methods, and protocols) in ongoing collaboration with the State and Federal fishery agencies and Tribes. This will be done in coordination with status monitoring needs and strategies being developed for estuary/ocean, habitat, hatcheries, and harvest. (Initiate in FY2009)*

   One BPA project was continued to support the baseline monitoring needs of this RPA. This RPA action will be addressed in FY2009 and FY2010 through development of a regional PIT-tagging plan, including input from the Action Agencies, NOAA Fisheries, other federal agencies, state, and tribal agencies.

7. *Cooperate with NOAA Fisheries, US v Oregon parties, Confederated Tribes of the Colville Reservation, and other co-managers to 1) review relevant information and identify factors (migration timing, spatial distribution, etc.) that might explain the differential conversion rates (BON to MCN) observed for UCR steelhead and spring Chinook salmon compared to SR steelhead and spring/summer Chinook salmon (see RPA Table 7 and **SCA - Adult Survival Estimates Appendix); 2) develop a monitoring plan to determine the most likely cause of these differential losses (considering the potential use of flat plate PIT-tag detectors in tributaries or fishery areas, additional adult detectors at The Dalles and John Day fishways, etc. to provide improved estimates of harvest or stray rates for improved conversion rate estimates in the future); and 3) implement the monitoring plan.*

   Three BPA projects were continued to support this RPA. The feasibility of using a tributary PIT antenna to detect adult salmon in the John Day River (see RPA action 52) was evaluated. The PIT

antenna withstood spring freshet flows and has been detecting PIT-tagged adult fish. Effectiveness monitoring was initiated in 2009 to determine the detection efficiency of the system.

Monitoring adult passage counts is a cornerstone monitoring activity that must be performed on an annual basis. Adult fish counting is typically performed 16 hours per day, during daylight hours, by either video or visual counting methods, at all of the Corps projects that pass fish. Adult fish counting will continue at a minimum on the schedule presented in Table 8.

Adult fish counts were conducted as called for in Table 8 of the RPA with the following exceptions: At The Dalles, John Day, McNary and Ice Harbor dams, adult fish were counted from April 1 through October 31, rather than the dates shown in Table 8. At Lower Granite, 24-hour counts were conducted from June 15 through September 30, rather than through August 31. All changes were fully coordinated during development of the Fish Passage Plan and through the FPOM work group process.

RPA Action 53 – Monitor and Evaluate Migration Characteristics and River Condition

1. *Monitor and estimate the abundance of smolts passing index dams.*

   Three BPA projects were continued in 2009 to address this subaction. For example, the Fish Passage Center project, BPA project number 1994-030-00, calculated passage indices at all collector dams, as well population estimates at Lower Granite Dam. NOAA Fisheries seeks improved smolt abundance estimates and expanded coverage at more dam monitoring sites.

2. *Monitor and describe the migration timing of smolts at index dams, identify potential problems, and evaluate implemented solutions.*

   Eleven BPA projects were continued in 2009 to fully address this subaction. For example, this was addressed by BPA's Smolt Monitoring Program (BPA project 1987-127-00). Data provided by this program were analyzed by the FPC, BPA project number 1994-030-00, and NOAA Fisheries, as well as a host of other regional fish management agencies. Additional evaluation of the Smolt Monitoring Program data is expected to determine the extent to which population-specific (PIT-tagged) data are needed to describe timing.

3. *Monitor and document the condition (e.g., descaling and injury) of smolts at all dams with juvenile bypass system (JBS) systems, identify potential problems, and evaluate implemented solutions.*

   Eight projects were continued to fully address this subaction. As in RPA action 53.2, the Smolt Monitoring Program monitored and documented fish condition in 2009. The FPC and other agencies provided analysis and implementation recommendations. The reduction in handling was the only potential problem identified that may be addressed in future operations.

4. *Monitor and enumerate adult salmonids passing through fishways in the FCRPS, identify potential problems, and evaluate implemented solutions.*

   In 2009, the Corps again implemented its adult fish count program as detailed in the FPP. Results are available in the *2009 Annual Fish Passage Report: Columbia and Snake Rivers*, available at *http://www.nwp.usace.army.mil/environment/FishData/docs/2009afpr.pdf.*

   Fishways were monitored on a regular basis, as per FPP specifications. Results are discussed in an annual Fishway Inspection Report prepared for each project. Fishways were also inspected by representatives from NOAA Fisheries and other agencies. Results of those inspections are available at http://www.fpc.org/documents/Fishway_Inspection_Reports.html.

   See also the discussion of adult passage improvements under RPA 28 above.

5. *In addition to current operations (generally April 10 – August 31), evaluate operation of the Bonneville (second powerhouse) PH2 corner collector from March 1 through start of spill as a potential means to provide a safer downstream passage route for steelhead kelts, and implement if warranted.*

An assessment of the March–April operation of the corner collector was completed in 2008. No further action was taken in 2009.

The Bonneville Corner Collector was operated beginning on April 3, 2009. This was seven days earlier than the start of operations as described in the 2008 BiOp. The April 3 start date was coordinated with the region through the TMT and FPOM processes. Discussions on future operation and evaluations are ongoing and will be addressed in the Kelt Management Plan (RPA 33).

RPA Action 54 – Monitor and Evaluate Effects of Configuration and Operation Actions

1. *Monitor and evaluate the effects of existing spillways, modifications, and operations on smolt survival.*

   An assessment of 30 percent vs. 40 percent spill and surface passage weirs was conducted at John Day Dam. The summer test of fall Chinook passage and survival was cut short due to breakage of avian array wires, allowing high levels of predation.

   The effects of configuration and operation changes on juvenile fish passage were evaluated at Little Goose, Lower Monumental, Ice Harbor, and McNary dams. Studies of direct injury were conducted at the Little Goose spillway weir and spillway.

   See the entries for RPA actions 18 through 25 for specific studies and results.

2. *Monitor and evaluate the effectiveness of traditional juvenile bypass systems and modifications to such, on smolt survival and condition.*

   An assessment of the Bonneville Second Powerhouse bypass system was conducted (see RPA action 18 above) and two projects were continued to monitor the long-term effectiveness of bypass systems. The AFEP regularly evaluates bypass performance as new systems are built or existing systems are upgraded. The passage and survival studies above also estimated the proportions collected by the bypass system and the resulting survival rates.

   See the entries for RPA actions 18 through 24 for specific studies and results.

3. *Monitor and evaluate the effectiveness of surface bypass structures and modifications on smolt survival and condition.*

   Surface passage weirs at John Day Dam and a BGS for the Corner Collector at Bonneville Second Powerhouse were evaluated.

   Route-specific passage and survival rates were estimated at Little Goose, Lower Monumental, Ice Harbor, and McNary dams to fully satisfy this subaction. (Copies of draft reports are under review and are available from the Corps.)

   See the entries for RPA actions 18 through 24 for specific studies and results.

4. *Monitor and evaluate the effectiveness of turbine operations and modifications on smolt survival and condition.*

   The Corps estimated route-specific passage and survival rates at Little Goose, Lower Monumental, Ice Harbor, McNary and John Day dams.

   At Bonneville Second Powerhouse, an assessment of turbine operations on fish injury and survival in the Juvenile Bypass System gatewells was conducted.

   A Biological Index Test was planned to evaluate operating turbines at the higher end of the 1 percent band at McNary Dam. The evaluation was canceled due to concerns of potential gatewell descaling raised in the SRWG forum. As a result of fish health concerns a gatewell descaling evaluation will be conducted in 2010 at McNary Dam.

5. *Monitor and evaluate overall dam passage with respect to modifications at projects (including forebay delay and survival).*

   Five Corps AFEP projects (at Little Goose, Lower Monumental, Ice Harbor, McNary and John Day dams), and two BPA projects, were continued to fully address this subaction through passage and survival studies, which estimate forebay and tailrace passage times and survival rates in the forebay.

6. *Monitor and evaluate the effectiveness of the juvenile fish transportation program and modifications to operations.*

In 2009, the Action Agencies continued to make progress on monitoring and evaluating the effectiveness of the juvenile fish transportation program; this included six BPA projects. Information resulting from 2009 RME will enable further progress in identifying the benefits of transportation and supporting adaptive management actions. Significant 2009 RME is as follows:

- **Spring Migrants:** The Action Agencies continued research to determine the potential of transportation to increase adult returns of anadromous salmon. A PIT-tag study to evaluate weekly SARs for natural spring Chinook and steelhead transported from Lower Granite Dam continued in 2009. More precise transportation data in the April time frame should help clarify effects of transportation on early migrating fish. More precise data in the May time frame should allow for correlation of physical and environmental factors to guide Action Agencies on appropriate triggers of how to operate transportation on an annual basis to maximize adult returns.

- **Summer Migrants:** In 2009, the Action Agencies continued implementing the 2007 fall Chinook salmon consensus proposal and long-term framework developed collaboratively with regional fish management agencies and tribes. This intensive research, monitoring, and evaluation effort for subyearling fall Chinook salmon will help determine the appropriate management strategy to optimize adult returns.

  In 2009, intensive RME efforts were conducted on Snake River fall Chinook salmon. These efforts are expected to provide information to evaluate early life history and migration behavior, the performance of hatchery fish as surrogates for wild fish, and the benefits of late season transportation, as well as to compare production fish groups' performance to wild and surrogate fish.

- **Sockeye transport:** In an effort to better estimate in-river survivals and SARs, a pilot study was initiated in 2009 to examine the relative survival of sockeye subject to transport, bypass, and spill. For this study, sockeye salmon smolts were PIT-tagged at Sawtooth hatchery in Idaho (n=52,833) and Oxbow Hatchery in Oregon (n=10,957). A total of 10,937 PIT-tagged sockeye salmon were released into Redfish Lake Creek, and 52,551 PIT-tagged sockeye salmon were released into the upper Salmon River. Approximately 70 percent of the PIT-tag codes were assigned to be diverted for transportation via barges, and 30 percent returned to the river; with the goal of achieving a 1:1 ratio of transported to in-river migration.

7. *Monitor and evaluate the effects of environmental conditions affecting juvenile fish survival.*

Seven projects were continued to fully address this subaction. Total dissolved gas, temperature, turbidity, and flow are considered key factors, and they are regularly monitored throughout the FCRPS. Many PIT-tagged fish migrating through the system from assorted projects provide response units for analyzing effects on smolt survival or migration characteristics. The FPC, NOAA Fisheries, and the CSS have conducted these types of probative analyses. The Corps funds the collection and recording of temperature and TDG data and index flow at dams. Data Access Real Time (DART) compiles and displays these and other environmental and fish data, as does the FPC.

8. *Monitor and evaluate the effectiveness of reducing predation toward improving juvenile fish survival.*

In 2009, ongoing research under CRFM and BPA FWP funding continued monitoring of avian predators and their colonies (O&M), dam angling, and estimates of annual exploitation of pikeminnow (modeling), in conjunction with juvenile dam survival studies.

9. *Investigate, evaluate and deploy alternative technologies and methodologies for fish passage and the RME Action.*

New passage technologies have been and will continue to be prototyped, tested, and ultimately deployed as part of the AFEP and CRFM. In 2009, a new spillway weir was installed and tested at

Little Goose Dam. Also in 2009, a second year of testing was conducted on two prototype spillway weirs at John Day Dam (see RPA 20 for details), and on the spillway weir that was installed at Lower Monumental Dam (see RPA 23 for details).

10. *Determine if actions directed at benefiting juveniles have an unintended effect on migrating adults (e.g., certain spill operations).*

    This issue is addressed at each project as need arises. The AFEP forum addresses this matter. No adult behavior studies were conducted in the Walla Walla district during 2009.

11. *Install and maintain adult PIT-tag detectors in fish ladders at key dams in the FCRPS and evaluate adult survival (conversion rates).*

    BPA continued the Adult Pit Detector Installation project in 2009. PIT-tag detectors are now installed in all key FCRPS ladders. However, currently there are no detectors at The Dalles and John Day dams. Tributary turn-off and straying between Bonneville and McNary dams is of concern when calculating conversion rates or upstream passage survival. If stream-based PIT detectors successfully function in the major tributaries in this reach, the need for additional ladder coverage could be circumvented. (Those systems were tested again in 2009).

12. *Monitor and evaluate the effects of fish ladder operations and configurations on adult passage rates.*

    Five projects were continued to fully address this subaction. This issue is addressed at each project as needed through the AFEP process.

13. *In addition to the current sluiceway operation (generally April 1–November 30), evaluate operation of The Dalles Dam sluiceway from March 1–March 31 and from December–December 15 as a potential means to provide a safer fallback passage route for overwintering steelhead and kelts, implement if warranted.*

    A second year of evaluation was initiated in December 2009 (and continued in March 2010). Results will be used to develop a long-term operation plan.

14. *Investigate surface-flow outlets during wintertime to provide safer fallback opportunity for over wintering steelhead (need will be determined by results of further research).*

    See RPA action 54.13 above. Also see entry for B2 corner collector.

RPA Action 55 – Investigate Hydro Critical Uncertainties and Investigate New Technologies: *The Action Agencies will fund selected research directed at resolving critical uncertainties that are pivotal in lifecycle model analyses.*

1. *Investigate and quantify delayed differential effects (D-value) associated with the transportation of smolts in the FCRPS as needed. (Initiate in FY 2007–2009 Projects)*

    Multiple projects (including nine BPA projects) were continued to fully address this subaction. Species coverage was expanded in 2009 to include sockeye. Other species will continue at some level, but the frequency of and sample size for acquiring estimates needs clarification for future years. This complements RPA 52.2, which calls for D-estimates to be incorporated into system survival evaluations. See discussion of RPA action 31 for further details.

2. *Investigate the post-Bonneville mortality effect of changes in fish arrival timing and transportation to below Bonneville. (Initiate in FY 2007–2009)*

    Multiple projects (including 10 BPA projects) were continued to fully address this subaction through review in the AFEP, with focus on Bonneville-Bonneville SARs (i.e. from Bonneville to the ocean and back to Bonneville). Recent NOAA Fisheries transport studies treat this issue with the expectation that the regional PIT Tagging Plan will fully address the details of this RPA. See discussion of RPA action 31 for further details.

3. *Conduct a workshop every other year with members of the Independent Scientific Advisory Board (ISAB) to review current research and monitoring approaches on post Bonneville mortality for transported and non-transported fish. (Initiate in FY 2009).*

   BPA and the Corps initiated a research project in 2008 and continued in 2009 to fully support this subaction. The workshop is in the early planning stages and will be held in the fall of 2010. The workshop will synthesize research results and analyses, identify further needs, and plan the direction of future research. In 2009, ISAB began review of the proposed 2010 studies for lower river survival and the estuary program.

4. *Investigate, describe and quantify key characteristics of the early life history of Snake River Fall Chinook Salmon in the mainstem Snake, Columbia, and Clearwater rivers. (Initiate in FY 2007-2009 Project).*

   Four BPA projects were continued to fully address this subaction. Studies have been funded by BPA for more than a decade, and complementary projects (such as radio tag investigations in Snake reservoirs) have been funded by the Corps under the AFEP. Additionally, ongoing transport studies have important life history implications. This has been a complex, multi-faceted set of investigations that have taken place over a number of years.

5. *Complete analysis and reporting of a multi-year (2000-2007) investigation on the effects of adult passage experience in the FCRPS on pre-spawning mortality (2008). Following reporting, SRWG will review the results and provide a recommendation on the need and nature of future research. Future research will be coordinated through the Regional Forum.*

   This action was completed in 2008. The final report is posted at *http://www.nwp.usace.army.mil/pm/e/reports/afep/system/SFS_Tech_Report_2009-4_Final.pdf*

6. *Continue development of state-of-the-art turbine units to obtain improved fish passage survival through turbines with the goal of using these new units in all future turbine rehabilitation or replacement programs.*

   In 2009, the Corps submitted a draft final report of the effects of rapid decompression, one of the major injury mechanisms to juvenile fish passing through turbine units, on tagged and untagged fish. Due to the possibility of biased results in that study, the Corps initiated a new study to determine whether effects of rapid decompression on tagged fish differ in type or degree from those on untagged fish.

   The Corps conducted physical studies at the Engineering Research and Development Center observational turbine model to determine alternatives for runner, stay vane, wicket gate and draft tube designs for a new turbine runner at Ice Harbor Dam. The Corps advertised a contract for design, manufacture and delivery of a fixed blade runner for Unit 2, with an option for manufacture and delivery of an adjustable blade runner for Unit 3.

   The Corps also completed a study of alternative methods of capturing fish that have passed through turbines, with study results recommending a direct capture device. Plans and specifications for that direct capture device were then developed. That device is now expected to be deployed at Ice Harbor Dam as part of the effectiveness testing of the new runner design.

7. *Investigate feasibility of developing PIT-tag detectors for spillways and turbines.*

   Two projects continued to fully address this subaction. BPA project number 1983-319-00 continued to address new detectors for spillways and turbines. Work in 2009 involved determining the feasibility of installing a PIT detector in the spillway at Bonneville and Ice Harbor dams, as well as the feasibility of installing detectors in the various surface spill weirs that are currently installed throughout the system.

8. *Evaluate new tagging technologies for use in improving the accuracy and assessing delayed or indirect hydro effects on juvenile or adult fish.*

   Through the Corps' Survival Methodologies Program, research was conducted on the effects of tagging juvenile Chinook salmon in an effort to improve surgical implantation techniques used for implanting acoustic transmitters. Utilizing this research as well as input from regional experts,

substantial progress was made on the standardization of surgical tagging protocols. A final protocol document is pending finalization in 2010. In addition to tagging protocols, standardization of methods for estimating dam passage survival was completed in 2009. This effort included extensive review by the region and the Independent Scientific Review Panel.

BPA funded three projects, including the Pacific Ocean Survival Tracking Project (POST), BPA project number 2003-114-00. This project continued the development of tags and methods in 2009 to determine delayed or indirect effects of hydro passage by looking in the estuary below Bonneville Dam and the ocean environment off the Pacific coast. Data from these efforts are presented in a variety of government reports and peer-reviewed journal articles.

9. *Assess the feasibility of developing PIT-tag detectors for use in natal streams and tributaries, or other locations, as appropriate to support more comprehensive and integrated All-H monitoring designs and assessments of stray rates.*

The feasibility of using a tributary PIT antenna to detect adult salmon in the John Day River was evaluated (see also RPA action 52.7). The PIT antenna withstood spring freshet flows and has been detecting PIT-tagged adult fish. (Effectiveness monitoring in New Marking Monitoring Techniques by BPA was initiated in 2009 and will be continued in 2010 to determine the detection efficiency of the system.)

The Corps supported efforts by NOAA Fisheries to develop a spillway PIT antenna design for Bonneville Dam. Dry tests were run on an existing spillway gate housed in the spillway repair pit. Work in 2009 will include assessing vibration and electro-magnetic fields on an operating gate.

RME Strategy 3 (RPA Actions 56–57)

A comprehensive list of all actions implemented by the Action Agencies for RPAs 56 and 57 is included in Section 4. For RPA 56 and 57, the RME Work Group identified additional monitoring to supplement this ongoing monitoring.

RPA Action 56 – Monitor and Evaluate Tributary Habitat Conditions and Limiting Factors:

The Action Agencies will:

1. *Implement research in select areas of the pilot study basins (Wenatchee, Methow and Entiat river basins in the Upper Columbia River, the Lemhi and South Fork Salmon river basins, and the John Day River Basin) to quantify the relationships between habitat conditions and fish productivity (limiting factors) to improve the development and parameterization of models used in the planning and implementation of habitat projects. These studies will be coordinated with the influence of hatchery programs in these habitat areas.*

Thirty BPA projects were continued and one was initiated by BPA; three projects by Reclamation were continued that have elements that support research in select areas of the pilot study basins (Wenatchee, Methow, and Entiat River basins in the upper Columbia River, the Lemhi and South Fork Salmon River basins, and the John Day River Basin) to quantify the relationships between habitat conditions and fish productivity (limiting factors) and improve the development and parameterization of models used in the planning and implementation of habitat projects. These studies provide a means of evaluating the effectiveness of tributary mitigation actions. The Integrated Status and Trend Monitoring Program (ISEMP) continued to implement action effectiveness studies as part of their research program for the pilot subbasins.

In the Methow River Basin, Reclamation has planned an intensive effectiveness monitoring program that will address the effects of actions intended to address the primary limiting factors there (lack of riparian/off-channel habitat and obstructions). This program began in 2009. Reclamation also conducted a series of meetings in 2007–2008 to finalize the Methow Study Plan. The study plan includes research on habitat limiting factors to fish production, and a Before, After, Control, Impact (BACI)-design study of a large channel rehabilitation project. An extensive PIT-tag array system was constructed on all major tributaries and the main river of the Methow Basin.

Reclamation also completed field work through a sub-contract with Idaho State University to assess fish food webs in the middle Methow River. Finally, Reclamation will provide PIT tags to the USFWS at the Winthrop NFH to tag and release large groups of hatchery fish, both to understand the potential effects of hatchery juveniles on stream-reared juvenile fish production and to use the releases to help estimate trap and detection efficiencies.

In addition, monitoring needed to infer relationships based on correlation among limiting factors, habitat actions, and productivity in support of RPA 3 (comprehensive evaluations) will also be addressed under RPAs 50.6 and 56.3.

2. *Implement habitat status and trend monitoring as a component of the pilot studies in the Wenatchee, Methow and Entiat river basins in the Upper Columbia River, the Lemhi and South Fork Salmon river basins, and the John Day River Basin. (Initiate in FY 2007-2009 Projects, annually review and modify annually to ensure that these project continue to provide a means of evaluating the effectiveness of tributary mitigation actions.)*

   Seven projects were continued that have elements that supported the implementation of habitat status and trend monitoring as a component of the pilot basin studies. For example, BPA project number 2003-017-00 evaluated multiple methodologies to assess salmonid habitat condition and implemented these standards in the in the Wenatchee, Methow and Entiat river basins in the upper Columbia River, the Lemhi and South Fork Salmon river basins, and the John Day River Basin. To further support this RPA, the ASMS strategy identified opportunities to expand habitat status and trend monitoring for one population per major population group.

3. *Facilitate and participate in an ongoing collaboration process to develop a regional strategy for limited habitat status and trend monitoring for key ESA fish populations. This monitoring strategy will be coordinated with the status monitoring needs and strategies being developed for hydropower, habitat, hatchery, harvest, and estuary/ocean.*

   Seven projects continued to be implemented in 2009 to support this RPA. Collaboration work groups for fish population and tributary habitat monitoring were formed in late 2008 and continued to make progress in 2009 on the ASMS that includes fish population and habitat monitoring for at least one population per major population group. Additional projects are being implemented in 2010 and 2011 to support this strategy and help meet this RPA.

RPA Action 57 – Evaluate the Effectiveness of Tributary Habitat Actions

The Action Agencies will evaluate the effectiveness of habitat actions through RME projects that support the testing and further development of relationships and models used for estimating habitat benefits. These evaluations will be coordinated with hatchery effectiveness studies.

1. *Action effectiveness pilot studies in the Entiat River Basin to study treatments to improve channel complexity and fish productivity.*

   BPA project numbers 2002-059-00 and 2003-017-00 were continued to support action effectiveness pilot studies in the Entiat River Basin to study treatments to improve channel complexity and fish productivity. Results of this project were shared in development of the ASMS strategy and upper Columbia River recovery strategy to support further implementation of habitat treatment actions.

2. *Pilot study in the Lemhi River Basin to study treatments to reduce entrainment and provide better fish passage flow conditions.*

   Two BPA projects were continued to fully address the pilot study in the Lemhi River Basin to study treatments to reduce entrainment and provide better fish passage flow conditions. The ISEMP project, BPA project number 200301700, successfully installed large Biomark PIT-tag arrays in the Lemhi and collected PIT-tag information for 2009. The project also continued to conduct habitat and fish population density monitoring to support the evaluation of treatments to reduce entrainment and provide better fish passage flow conditions.

3. *Action effectiveness pilot studies in Bridge Creek of the John Day River Basin to study treatments of channel incision and its effects on passage, channel complexity, and consequentially fish productivity.*

Two BPA projects were continued to fully support action effectiveness pilot studies in Bridge Creek of the John Day River Basin to study treatments of channel incision and its effects on passage, channel complexity, and, consequentially, fish productivity. The ISEMP project, BPA project number 2003-017-00, continued to evaluate changes in fish density relative to action implementation. Findings supported effectiveness of reintroduction of beavers on improving fish habitat condition as a treatment to channel incision.

4. *Project and watershed level assessments of habitat, habitat restoration and fish productivity in the Wenatchee, Methow and John Day basins.*

Seven BPA projects were continued and one was initiated to support project- and watershed-level assessments of habitat, habitat restoration, and fish productivity in the Wenatchee, Methow, and John Day river basins. For example, BPA project number 2003-017-00 completed assessment to develop common protocols for monitoring salmonid habitat conditions and fish juvenile density to support watershed assessments of habitat condition.

Reclamation continued its work through an interagency agreement with USGS to evaluate listed steelhead population changes in response to barrier removals in Beaver, Libby, and Gold creeks, which are tributaries in the Lower Methow River.

Reclamation's 2008 BiOp habitat program provided technical assistance to a suite of partners to help implement habitat improvement projects as defined by RPA Actions 34 and 35. Reclamation's Methow RME Study Plan under an interagency agreement with USGS (see RPA 56 above) evaluated the effectiveness of the M2 Reach habitat improvement actions in the mainstem Methow River.

In 2009, Reclamation and USGS continued the pretreatment monitoring phase of the project; this is designed to address specific questions about the response of target fish species (Chinook salmon, steelhead, and bull trout) to the restoration actions. Reclamation also led coordinated monitoring planning in the Methow Basin, including the development of a water quality monitoring program and an inventory of basinwide passage projects that will lead to an assessment in 2010. Meanwhile, Reclamation and USGS worked on models to predict the response to treatments.

5. *Action Agencies will convene a regional technical group to develop an initial set of relationships in FY 2008, and then annually convene the group to expand and refine models relating habitat actions to ecosystem function and salmon survival by incorporating research and monitoring results and other relevant information.*

The Tributary Habitat and Fish Population Work Group continued to meet in 2009 to evaluate survival models. However, the technical group did not include other technical staff from the co-managers (federal and state agencies and the tribes).

RME Strategy 4 (RPA Actions 58–61)

A comprehensive list is included in Section 4 for all actions implemented by the Action Agencies during 2009 for RPAs 58 through 61. Most of the RPA specifications either were fully covered by ongoing projects or would be fully covered with some additional work elements. Included after the RPA 61 description, below, is a synopsis of 2009 estuary and ocean RME results.

RPA Action 58 – Monitor and Evaluate Fish Performance in the Estuary and Plume

The Action Agencies will monitor biological responses and/or environmental attributes, and report in the following areas:

1. *Monitor and evaluate smolt survival and/or fitness in select reaches from Bonneville Dam through the estuary.*

Two Corps AFEP projects were continued to support this subaction. AFEP Project EST-02-01, A Study of Salmonid Survival and Behavior through the Columbia River Estuary Using Acoustic Tags,

directly addressed this RPA. During 2009, more than 15,000 juvenile salmon were tagged with miniaturized acoustic transmitters, released at several sites upstream of Bonneville Dam, and detected at seven acoustic telemetry arrays deployed across the lower Columbia River and estuary at locations ranging from the Bonneville Dam tailrace to the jetties at the mouth of the Columbia River. Data from the study were used to estimate survival rates of yearling and subyearling Chinook salmon and steelhead in various reaches of the lower river and estuary.

The BPA POST project also supported this RPA during 2009 by estimating survival rates in the lower river and estuary in conjunction with research on survival rates in the eastern Pacific Ocean.

To fully address this subaction, the Estuary/Ocean RME Subgroup recommended assessing the applicability and the feasibility of measuring the fitness of juvenile salmon at select locations in the lower Columbia River and estuary under AFEP project EST-09-P-0, or a new project.

2. *Develop an index and monitor and evaluate life history diversity of salmonid populations at representative locations in the estuary.*

During 2009, this subaction was addressed directly by AFEP project EST-09-P-01, Evaluation of Life History Diversity, Habitat Connectivity, and Survival Benefits Associated with Habitat Restoration Actions in the Lower Columbia River and Estuary. This project was initiated in part to address RPA action 58.2. Other projects collect juvenile salmon density data that are relevant to this subaction: BPA 2005-001-00 and BPA 2003-010-00.

3. *Monitor and evaluate juvenile salmonid growth rates and prey resources at representative locations in the estuary and plume.*

Four BPA projects were continued to fully address the RPA subaction. For example, in BPA projects 1998-014-00, Ocean Survival of Salmonids, and 2003-010-00, Historic Habitat Opportunities and Food-Web Linkages, data were collected on juvenile salmon growth and prey resources during cruises along transects in the nearshore ocean and plume, and research was conducted in estuarine wetlands. Data from these studies and others were used to assess how environmental effects in the estuary and ocean affect juvenile salmon survival and adult return rates.

4. *Monitor and evaluate temporal and spatial species composition, abundance, and foraging rates of juvenile salmonid predators at representative locations in the estuary and plume.*

Two BPA projects were continued to fully support this subaction. BPA project 1998-014-00, Ocean Survival of Salmonids, addressed the plume component of this RPA subaction. The estuary component was addressed through several projects that focused on avian and piscivorous predators. Additional relevant information is presented below as part of the predation RPAs 68-70. Annual surveys of predation on juvenile salmon are conducted, revealing the most common predators and, in some cases, lead to estimates of predation rates.

RPA Action 59 – Monitor and Evaluate Migration Characteristics and Estuary/Ocean Conditions

The Action Agencies will monitor and evaluate selected ecological attributes of the estuary, which include the following or equivalent:

1. *Map bathymetry and topography of the estuary as needed for RME.*

Three BPA projects were continued to fully address this subaction for mapping the channel; however, a gap exists until the bathymetry and topographic mapping are completed for the floodplain. For example, BPA project number 2003-007-00, Lower Columbia River/Estuary Ecosystem Monitoring, was pivotal to work throughout the estuary during 2009 to address this RPA subaction. Hydrographic surveys were conducted during 2008 and 2009 for BPA project number 2003-007-00, based on bathymetric data gaps identified and prioritized at a workshop in October 2007. Numerous other projects collected site-scale elevation data using realtime kinematic GPS. In addition, Light Detection and Ranging (LIDAR) data for topography were

processed for selected sites under AFEP Project EST-02-P-04, Cumulative Effects of Habitat Restoration.

2. *Establish a hierarchical habitat classification system based on hydrogeomorphology, ground-truth it with vegetation cover monitoring data, and map existing habitats.*

   One BPA project was continued to address this RPA subaction, which was a primary objective of BPA project number 2003-007-00, Lower Columbia River/Estuary Ecosystem Monitoring. Development of the classification system continued during 2009.

3. *Develop an index of habitat connectivity and apply it to each of the eight reaches of the study area.*

   During 2009, this subaction was addressed directly by AFEP project EST-09-P-01, Evaluation of Life History Diversity, Habitat Connectivity, and Survival Benefits Associated with Habitat Restoration Actions in the Lower Columbia River and Estuary. This project was initiated in part to address RPA action 59.3. Other projects collect habitat data that are relevant to this subaction include BPA project number 2003-007-00 and AFEP EST-02-P-04.

4. *Evaluate migration through and use of a subset of various shallow-water habitats from Bonneville Dam to the mouth toward understanding specific habitat use and relative importance to juvenile salmonids.*

   One Corps and three BPA projects were continued and another one was initiated to fully address this RPA subaction. For example, BPA project number 2005-001-00, Tidal Freshwater Monitoring, sampled juvenile salmon and associated fish communities in shallow (< 5m) habitats from Longview to Washougal, Washington. As determined from beach seines and trap nets, juvenile salmon can be found year-round in the shallow waters of the lower river and estuary. The data increased understanding of specific habitat use and the relative importance of these habitats to juvenile salmon.

5. *Monitor habitat conditions periodically, including water surface elevation, vegetation cover, plan community structure, primary and secondary productivity, substrate characteristics, dissolved oxygen, temperature, and conductivity, at representative locations in the estuary as established through RME.*

   Nine AFEP and BPA projects were continued that address this RPA subaction. For example, BPA project number 2003-007-00, Lower Columbia River/Estuary Ecosystem Monitoring, monitored habitat conditions at four sites in the reach between Bonneville Dam and Woodland, Washington. Monitored indicators included vegetation composition, percent cover, elevation, substrate, channel cross-sections, and water quality. The data characterized relationships among plant communities, elevation, and hydrology that help in understanding the ecological importance of lower river and estuary habitats.

RPA Action 60 – Monitor and Evaluate Habitat Actions in the Estuary

The Action Agencies will monitor and evaluate the effects of a representative set of habitat projects in the estuary, as follows:

1. *Develop a limited number of reference sites for typical habitats (e.g., tidal swamp, marsh, island, and tributary delta to use in action effectiveness evaluations).*

   Four BPA projects were continued to fully address this RPA subaction. In particular, BPA project number 2003-011-00, Lower Columbia River/Estuary Habitat Restoration, included a component to develop a suite of reference sites as part of action effectiveness monitoring in the lower Columbia River and estuary. Data were collected from four sites during 2009 to assess the structure, function, and condition of a suite of tidal freshwater wetland habitats. Combined with data from previous years, there are over 40 sites in the reference database. Reference site data will be compared with restoration site data to determine the effectiveness of habitat restoration (see RPAs 60.2 and 60.3).

2. *Evaluate the effects of selected individual habitat restoration actions at project sites relative to reference sites and evaluate post-restoration trajectories based on project-specific goals and objectives.*

   Ten projects, where site-scale restoration effectiveness monitoring took place, were continued to fully address this RPA subactions. For example, under BPA project number 2003-011-00, Lower Columbia River/Estuary Habitat Restoration, researchers intensively monitored water surface elevation, bathymetry and topography, substrate, vegetation composition and percent cover, and juvenile salmon density at three sites where tidal reconnections were restored: Mirror Lake, Scappoose Bottomlands, and Fort Clatsop. This and other projects showed that juvenile salmon typically access the newly restored areas once the opportunity is provided. Site-scale action effectiveness was also conducted under AFEP EST-02-P-04.

3. *Develop and implement a methodology to estimate the cumulative effects of habitat conservation and restoration projects in terms of cause-and-effect relationships between ecosystem and controlling factors, structures, and processes affecting salmon habitats and performance.*

   Six projects were continued to fully address this RPA subaction. This subaction was the primary focus of AFEP Project EST-02-P-04, Evaluating Cumulative Ecosystem Response to Habitat Restoration Projects in the Lower Columbia River and Estuary. This multi-year project (2004-2011) has developed and is applying a methodology to evaluate the cumulative effects of multiple habitat restoration projects intended to benefit ecosystems that support juvenile salmon in the lower Columbia River and estuary. During 2009, the levels-of-evidence approach and ecological theory underpinning the analysis, synthesis, and evaluation of cumulative effects were finalized, and a preliminary analysis of restoration cumulative effects was initiated.

RPA Action 61 – Investigate Estuary/Ocean Critical Uncertainties

The Action Agencies will fund selected research direct at resolving critical uncertainties that are pivotal in understanding estuary and ocean effects.

1. *Continue work to define the ecological importance of the tidal freshwater, estuary, plume, and nearshore ocean environments to the viability and recovery of listed salmonid populations in the Columbia River Basin.*

   Seven BPA projects were continued to address this RPA subaction. Implementation of this RPA subaction was organized by water body: tidal freshwater (BPA project number 2005-001-00, Estuary RME Tidal Freshwater); estuary (BPA project number 2003-010-00, Historic Habitat Opportunities and Food-Web Linkages); plume (BPA project number 1998-014-00, Ocean Survival of Salmonids); and nearshore ocean (BPA project number 2003-009-00, Canada-US Shelf Salmon Survival Study). Collectively, these multi-year projects and others investigated the relationships among juvenile salmon condition, growth, and survival indicators. Data showed the importance of understanding factors affecting salmon populations over the entire salmon life cycle.

2. *Continue work to define the causal mechanisms and migration/behavior characteristics affecting survival of juvenile salmon during their first weeks in the ocean.*

   Two BPA projects were continued to fully address this RPA subaction: BPA project number 1998-014-00, Ocean Survival of Salmonids, and BPA project number 2003-114-00, POST. As part of the research, juvenile salmon were sampled with trawls as the fish moved between riverine and marine waters; data on species, age class, abundance, stock origin, size, diet, etc. were collected to determine how juvenile salmon change as they move between environments.

3. *Investigate the importance of early life history of salmon populations in tidal fresh water of the lower Columbia River.*

   Four BPA projects were continued to fully address this RPA subaction. For example, BPA project numbers 2003-010-00, Historic Habitat Opportunities and Food-Web Linkages, and 2005-001-00, Estuary RME Tidal Freshwater, were particularly relevant to this RPA subaction. Monthly beach seine sampling showed that juvenile coho and Chinook salmon were present in shallow, tidal freshwater habitats in the lower Columbia River in the vicinity of the Sandy River Delta during all

seasons, including winter. Based on genetic analysis of stock of origin, possible source populations for these fish ranged from areas in the lower Columbia River to areas in the middle Columbia River and Snake River.

4. *Continue development of a hydrodynamic numerical model for the estuary and plume to support critical uncertainties investigations.*

Two BPA projects were continued to address this RPA subaction. For example, hydrodynamic modeling was conducted under BPA project numbers 1998-014-00, Ocean Survival of Salmonids, and 2003-010-00, Historic Habitat Opportunities and Food-Web Linkages. Modelers worked to develop an advanced observatory for the Pacific Northwest coastal margin, including the Columbia River estuary and plume. CORIE, a collaborative pilot environmental observation and forecasting system, served as the heart of the observatory with its modeling system, observation network, and cyber-infrastructure. Modeling was used to evaluate contemporary and future habitat changes caused by climatic and anthropogenic effects and to describe the temporal and spatial features of the Columbia River estuary and plume that are important for salmon in relation to ocean conditions.

Synopsis of 2009 Estuary and Ocean RME

Status and Trends Monitoring

NMFS (2010a) reported that "During the second half of 2009, the trend of cold ocean conditions that began in 2007 and continued through 2008, changed noticeably. After June, the ocean began to warm significantly, leading to detrimental changes in the pelagic food web and likely high mortality of juvenile salmonids." NMFS's ocean ecosystem indicators (*http://www.nwfsc.noaa.gov/research/divisions/fed/oeip/a-ecinhome.cfmh*) provide context critical to management decision-making in the Columbia River Basin.

Magie et al. (2010), operating a specially modified trawl with a "matrix" antenna designed to increase the detection rate of PIT-tagged fish in the Lower Columbia River Estuary (LCRE) at river kilometer 61-83, found mean survival rates from Lower Granite reservoir to Bonneville Dam during 2009 for yearling Chinook salmon and steelhead were 56 percent (SE = 2.8 percent) and 69 percent (SE = 6.2 percent), respectively. This sampling effort is significant because, since 1998, it has allowed survival estimation between John Day and Bonneville dams using PIT-tag detection data.

McMichael et al. (2010) reported that the preliminary 2009 survival estimate for yearling Chinook salmon from Bonneville Dam tailrace to the mouth of the Columbia River, pooled over all releases, was 0.78 (range = 0.74 to 0.85; SE 0.01). For steelhead, pooled survival was 0.53 (range = 0.47 to 0.60; SE 0.01). For subyearling Chinook salmon, pooled survival was 0.64 (range = 0.36 to 0.78; SE 0.01). The largest losses appeared to occur in the lower 50 km of the river for yearling Chinook salmon and the lower 86 km for steelhead. Mortality of subyearling Chinook salmon was fairly evenly distributed from Bonneville to the mouth. These data will support strategic management actions to reduce mortality rates for juvenile salmonids in the LCRE.

Jones et al. (2010) examined vegetation and elevation data collected at relatively undisturbed, emergent wetland sites throughout the LCRE. This monitoring provided important information on the condition of habitats supporting juvenile salmonids in the LCRE. As stated in the report, this research "…further developed the Columbia River Estuary Ecosystem Classification…collected bathymetry data, filling 12,600 acres of 14,235 acres identified as high and medium priority data gaps and needed for completing the Classification…convened a landcover workshop to discuss collection strategies for landcover data acquisition…collected datasets (such as vegetation, habitat, prey, and salmonids)…to characterize habitat, fish, and prey at all sites and assess year-to-year trends at previously sampled sites…characterized habitat and biological communities at 3 forested tidal freshwater wetlands…"

Action Effectiveness Research.

Johnson and Diefenderfer (eds) (2010) produced the sixth annual report of an eight-year project (2004 through 2011) to evaluate the cumulative effects of habitat restoration actions in the lower Columbia River and estuary. Selected key findings include: a) channel density is probably not a good indicator of habitat development where preexisting channels are present (e.g., Kandoll Farm), but it may be a useful for constructed wetland (e.g., the Crims Island restoration; b) during an intensive material-exchange study at Kandoll Farm during April 2009, inorganic suspended sediments were the predominant component of total suspended sediments during both spring- and neap-tides series; c) habitat opportunity for juvenile salmon can be evaluated by quantifying wetted area, frequency, and duration of inundation using a GIS-based time-area inundation index; and d) juvenile Chinook salmon were found at all historical breaches and created sites and, overall, were second in abundance to stickleback at these sites. These data will be among those used in a comprehensive evaluation of multiple restorations projects, estuary-wide in 2011.

Roegner et al. (2010) found that breaching caused an immediate return of full semi-diurnal tidal fluctuations to diked pastureland and, most importantly, juvenile salmonids quickly expanded into this newly available habitat and utilized prey items presumably produced within marshes at the restored site. Based on size and the timing of hatchery releases, they concluded most Chinook, chum, and coho salmon sampled in restored and reference sites were progeny from wild spawners. In addition, genetic data suggested Chinook salmon originating outside the study area had migrated from the mainstem into shallow tidal freshwater habitats and were utilizing restored wetland habitat. Increasing opportunity for juvenile rearing appears to benefit both wild populations and, for Chinook salmon at least, individuals from other watersheds.

During 2009, the Estuary Partnership and restoration partners continued: a) implementation of action effectiveness research at four project sites and b) development of a suite of reference sites in tidal marshes, swamps, and other estuary habitats having relatively undisturbed ecosystem structure and processes (LCREP 2010). This research will allow managers to assess action effectiveness both at the site- and landscape-scales as part of an adaptively managed habitat restoration program.

Johnson et al. (2010) performed a preliminary meta-analysis of action effectiveness data from seven sites in the LCRE. The seven restoration actions studied are generally producing favorable results in terms of vegetation changes, water temperature, sediment accretion, and juvenile salmon presence. Meta-analysis of Site Evaluation Cards (SECs), which are succinct summaries of project actions and monitoring results, revealed that preparing the SECs requires time, knowledgeable staff, and should be started early in the restoration planning process and updated as new information becomes available.

Critical Uncertainties Research.

Casillas (2009) and Sather (2009) presented data on the ecology of juvenile salmonids in estuarine and tidal freshwater areas, respectively, of the LCRE. In both estuarine and tidal freshwater areas, juvenile salmonids were present at all types of habitats sampled during all months of the year. Abundances peaked in spring. Genetic analysis revealed that many ESUs use LCRE habitats. Regardless of sampling month or site of capture, the diets of juvenile Chinook salmon were generally dominated by aquatic insects.

Casillas (2010) reported on the multi-disciplinary study of juvenile salmon ecology in the Columbia River Estuary and plume. The annual report for 2009 contains pertinent data from research on juvenile salmon catches in trawl surveys: field sampling in 2009; characterizing juvenile salmon in the Columbia River Estuary; biochemical measures of salmon growth; pathogens of juvenile salmon; juvenile salmon prey field sampling; modeling and analysis of plume circulation; and other topics.

From sampling juvenile salmon and zooplankton off the outer coast of Vancouver Island during 2008, Trudel et al. (2010) reported that "…our research shows that different populations of Columbia River

salmon move to different locations along the coastal zone where they establish their ocean feeding grounds and overwinter. We further show that ocean conditions experienced by juvenile Columbia River salmon vary among regions of the coast, with higher plankton productivity and temperatures off the west coast of Vancouver Island than in Southeast Alaska. Hence, different stocks of juvenile salmon originating from the Columbia River and Snake River are exposed to different ocean conditions and may respond differently to climate changes…Our analyses also demonstrate that the marine survival and production of Columbia River Chinook, coho, and sockeye salmon are strongly influenced by the growth conditions and food web quality off the west coast of Vancouver Island."

Morace et al. (2009) presented data on the effects of toxic contaminants on resident and salmonid fishes in the LCRE. They found, "Toxic contaminants are present in the Columbia River Basin; resident and anadromous fish utilizing these ecosystems are exposed to toxic contaminants, and their health is being compromised; urban and industrialized areas in the lower Columbia River are source areas for toxic contaminants for multiple fish stocks; and, a better understanding of the effects and associated sources and pathways of exposure to toxic contaminants is needed to develop reduction efforts and restore fish and ecosystem health."

Systema (2009) presented information on invasive species in the LCRE, including the invasion process, vectors, impacts, threats to the Pacific Northwest, and management actions. He recommended enhanced early detection and rapid response capabilities, vulnerability assessments at federal hydro and fish passage facilities, research on invasive species management, and resolution of permit issues.

RME Strategy 5 (RPA Action 62)

A comprehensive list of all actions implemented by the Action Agencies for RPA action 62 is included in Section *4. For RPA 62, the RME Work Group concluded that many subaction specifications were fully addressed; however, some additional monitoring was recommended to supplement ongoing monitoring.*

RPA Action 62 – Fund Selected Harvest Investigations

The Action Agencies will fund selected harvest investigations linked to FCRPS interests:

1. *Evaluate the feasibility of obtaining PIT-tag recoveries between Bonneville and McNary dams to determine whether recoveries can help refine estimates of in-river harvest rates and stray rates used to assess adult survival rates.*

   Nine BPA projects were continued and two were initiated to fully address this RPA subaction. For example, BPA project number 2008-508-00 evaluated run timing and upstream migration mortality of adult Chinook and sockeye salmon and steelhead through PIT-tagging at Bonneville Dam. A companion project, BPA project number 2008-502-00, Increase Zone 6 Tribal Fishery Monitoring, improved the monitoring and catch sampling of the Zone 6 tribal fisheries by increasing the sample rates and employing additional data collection methods, including PIT-tag technology.

2. *Evaluate methods to develop or expand use of selective fishing methods and gear.*

   Four projects were continued to fully address this RPA subaction. The Action Agencies support investigations of alternative gear and modifications to existing gear strategies for fisheries in the Columbia River Basin. They support development of selective gear methods to reduce hatchery surpluses consistent with HSRG recommendations. BPA project number 2007-249-00, Evaluate Live-Capture Fishing Gear for Salmon, focuses on evaluating the feasibility and efficacy of various live-capture selective fishing gears to harvest hatchery-origin Chinook while protecting natural-origin Chinook. In 2009, this project continued to test and evaluate impacts to existing gear and tested a modified pontoon fishwheel in the mainstem Columbia.

In addition to gear testing, selective fishing can involve modifications to time and area management. BPA project number 1993-060-00, Select Area Fisheries Enhancement, has investigated the use of off-channel terminal fishing locations in concert with hatchery rearing and acclimation protocols to offer commercial and sport fishers harvest opportunities even when conventional mainstem fisheries are severely constrained or eliminated because of ESA limitations.

3. *Evaluate post-release mortality rates for selected fisheries.*

Three BPA projects were continued to support this RPA. BPA project number 2007-249-00, Evaluate Live-Capture Fishing Gear for Salmon project, incorporated monitoring protocols to assess fish condition after capture, holding, and release. Results of these evaluations are presented in the project's 2008 annual report. This is identified as a high-priority area by the RME Work Group.

4. *Support coded-wire tagging and coded-wire tag recovery operations that inform survival, straying, and harvest rates of hatchery fish by stock, rearing facility, release treatment, and location.*

Fourteen BPA projects were continued to address this RPA subaction. BPA has funded the recovery and stock identification of coded-wire tags since the early 1980s. In 2008, four BPA-funded projects implemented recovery efforts in ocean and in-river fisheries as well as some limited spawning ground surveys. In addition, many hatchery O&M projects the Action Agencies fund contain resources directed toward the recovery and stock identification of coded wire tags. The RME Work Group encouraged additional sampling effort on the spawning grounds. This may require shifting some effort from the ocean fisheries to in-river monitoring. The RME Work Group also recommends that contracts include language to improve quality assurance/quality control (QA/QC), analysis, and data management.

5. *Investigate the feasibility of genetic stock identification monitoring techniques.*

Twenty five projects were continued and two were initiated to fully address this RPA subaction. For example, for BPA project number 2008-907-00, the Genetic Assessment of Columbia River Stocks, work began in 2008 to address single nucleotide polymorphism (SNP) discovery, genetic baseline expansion, genetic stock identification (GSI) to evaluate catch, and genetic stock identification of salmon and steelhead passing Bonneville Dam. These four projects are highly related because SNP markers are needed to complete species specific baselines, and these baselines are required to complete GSI for the ESA population diversity requirements to support viability risk assessments and the evaluation of the effects of actions on various populations.

RME Strategy 6 (RPA Actions 63–65)

A comprehensive list of all actions implemented by the Action Agencies for RPA actions 63 through 65 is included in Section 4. For RPAs 63 through 65, the RME Work Group concluded that some subactions were fully addressed; however, additional monitoring was recommended to supplement ongoing monitoring.

RPA Action 63 – Monitor Hatchery Effectiveness

The Action Agencies will continue to fund selected monitoring and evaluation of the effectiveness of Hatchery Actions. The evaluation of hatchery projects will be coordinated with the Tributary Habitat monitoring and evaluation program.

1. *Determine the effect that safety-net and conservation hatchery programs have on the viability and recovery of the targeted populations of salmon and steelhead. (Initiate in FY 2007–2009 Projects)*

Sixteen BPA projects were continued to address this RPA subaction. All ongoing BPA-funded safety-net and conservation program projects to implement RPAs 41 and 42 have monitoring and evaluation elements to evaluate effectiveness. In some cases, there is a separate project to monitor effects on the viability and recovery of targeted populations. For example, BPA project

number 1990-005-00 was implemented to monitor and assesses straying of adult summer steelhead and Chinook salmon returns from the Umatilla subbasin hatchery program. In cooperation with the Confederated Tribes of the Umatilla Indian Reservation (CTUIR), life history characteristics of hatchery-reared summer steelhead will be monitored, assessed, and compared to life history characteristics of naturally reared summer steelhead.

2. *Determine the effect that implemented hatchery reform actions have on the recovery of targeted salmon and steelhead populations.*

Two BPA Projects were continued to address this RPA subaction. In 2009, there were no projects that addressed this RPA for the Tucannon, Touchet, and Winthrop NFH steelhead programs. However, the USFWS is currently evaluating a means of implementing the reform recommendations at Winthrop NFH, WDFW will develop proposals in 2010 for evaluating implementation of the reform actions for the Tucannon and Touchet steelhead programs, with RME funding to be provided through the LSRCP. BPA project number 1989-098-00, Salmon Studies Idaho Rivers Project, was implemented to complete data analysis of brood year 2007 juvenile production by estimating the outmigration of naturally produced Chinook salmon collected in 2008 and 2009. The interim production comparison was completed, with products incorporated into annual progress reports.

RPA Action 64 – Investigate Hatchery Critical Uncertainties

1. *Continue to estimate the relative reproductive success of hatchery-origin salmon and steelhead compared to reproductive success of their natural-origin counterparts for ESA-listed spring/summer Chinook population in the Upper Grande Ronde, Lostine River, and Catherine Creek; listed spring Chinook in the Wenatchee River; and listed steelhead in the Hood River. Continue to fund the ongoing RRS feasibility study for Snake River fall Chinook to completion in 2009.*

Fourteen BPA projects were continued to support this RPA subaction. In 2009, BPA continued to fund relative reproductive success (RRS) studies for listed spring/summer Chinook salmon in the upper Grande Ronde River, Lostine River, and Catherine Creek; for listed spring Chinook in the Wenatchee River; for listed steelhead in the Hood River; and for listed fall Chinook in the Snake River. For example, BPA project number 1988-053-04 funded the installation of five downstream migrant screw traps in the Hood River subbasin, and a mark and recapture program was implemented at the traps. The mark and recapture program is used to estimate numbers of pre-smolt and smolt steelhead and Chinook salmon moving past pre-defined locations in the subbasin. The program recorded numbers of non-supplemented species of anadromous and resident salmon caught at five downstream migrant screw traps located in this subbasin.

The numbers are used to monitor the relative abundance of each species in the trap catch. BPA project number 1989-096-00 was implemented to collect tissues for genetic analysis. Data collection includes microsatellite genotyping, DNA sequencing, and other methods of examining and characterizing genetic variation within and among groups of salmon and steelhead. Data analyses included descriptive population genetic characterization for Tier 2 sites (gene-frequency monitoring), levels of variability, relative relationships among hatchery and wild populations, and changes in those parameters over time. Experimental design at other sites involves parentage analysis to document differences in reproductive success among hatchery fish, wild fish, and the progeny of captive parents.

2. *Determine if properly designed intervention programs using artificial production make a net positive contribution to recovery of listed populations.*

Thirty-nine projects were continued and one was initiated to fully address this RPA subaction. BPA project number 2003-060-00 conducted comparative genetic data analyses between and among all project samples by brood year. Temporal genetic variability within Snake River populations will be evaluated. Wild-origin adults from spawning grounds and other previous samples were sorted into single brood year samples based on scale ages and compared to same brood year wild juvenile samples and other brood year-specific project samples. The relative reproductive success

of Snake River hatchery and wild fall Chinook was evaluated against the proportions of hatchery and wild fall Chinook estimated to be on upper Snake River spawning grounds. The estimates for origins and relative abundance of potential natural spawners were made from data collected annually at the Lower Granite Dam adult trap. Reclamation provided PIT-tags to USFWS to aid in the assessment of a steelhead rearing strategy at Winthrop NFH. Reclamation also supported sampling at Rock Island for a separate study that will provide data for the Winthrop evaluation.

3. *In collaboration with the other entities responsible for steelhead mitigation in the Methow River, BPA will fund a new RRS study for ESA-listed steelhead in the Methow River. BPA will also fund a new RRS study for listed fall Chinook in the Snake River. NOAA Fisheries will provide technical assistance to the Action Agencies in development of conceptual study designs suitable for use by the Action Agencies in obtaining a contractor to implement the new studies.*

Three BPA projects were continued to fully support Subaction 3 of RPA 64. For example, BPA project number 1989-098-00, Salmon Studies in Idaho Rivers Project, estimated overall survival to Lower Granite Dam using the Survival Using Proportional Hazards (SURPH) model by life stage for juvenile Chinook salmon from Idaho Supplementation Studies (ISS) treatment and control streams based on PIT-tag detections at Lower Granite, Little Goose, and Lower Monumental dams on the Snake River and McNary Dam on the Columbia River. A video-type weir was installed and operated in Lake Creek. Net daily and maximum movements were analyzed to determine adult numbers. BPA project number 2007-403-00, Idaho Spring Chinook Captive Propagation Project, conducted research and collected data to evaluate behavioral characteristics of captively reared Chinook salmon and monitor anadromous Chinook salmon returns and redd development on the East Fork Salmon River and West Fork Yankee Fork. Genetic samples of juvenile Chinook salmon were collected to evaluate the spawning success of captively reared adults. Weirs were maintained to monitor anadromous Chinook migration in the East Fork of the Salmon River and to monitor spawning behavior of captively reared adults released to the study area in the East Fork of the Snake River.

Subsequent to RME workshops held in November 2009, WDFW developed a BiOp "fast track" proposal for an RRS study for ESA-listed steelhead in the Methow River. The proposal was submitted to the ISRP for scientific review, with implementation anticipated in 2010.

NOAA Fisheries is expected to proved technical assistance to BPA in 2010 during development of targeted solicitations for the new RRS studies for listed Snake River fall Chinook salmon.

RPA Action 65 – Investigate Hatchery Critical Uncertainties

The Action Agencies will fund research directed at resolving critical uncertainties:

1. *In the mainstem Snake River above the Lower Granite Dam, estimate the effectiveness/fitness in nature of hatchery-origin fall Chinook salmon from federally funded Snake River hatchery programs relative to natural origin Snake River fall Chinook.*

Five BPA projects were continued to support this RPA subaction. For example, BPA project number 1998-010-03 funded PIT-tagging of hatchery spring Chinook salmon (brood year 2008) produced by the Lostine River Conventional Program to estimate the survival and arrival timing of the conventional stock of Lostine River hatchery Chinook salmon for migration year 2010. The project also documented the distribution of fall Chinook salmon redds in the 100-mile reach of the Snake River, between Asotin, Washington, and Hells Canyon Dam. Redd surveys were conducted from a helicopter at weekly intervals, between mid-October and mid-December. Also during this time period, submersible cameras were used to locate redds in waters too deep to be effectively searched from the air. BPA project number 1998-010-04, Snake River Fall Chinook Spawning project, organized and implemented expanded spring Chinook redd counts and assessments in the Grande Ronde subbasin (Lostine, Catherine Creek, and upper Grande Ronde) and analyzed length and weight data for each Fall Chinook Acclimation Program (FCAP) release group. The Hatchery/Harvest RME Work Group identified this as a high-priority area to address in the future. The BPA plans to issue a targeted solicitation in 2010 for a new study to compare reproductive

success/fitness of hatchery origin Snake River fall Chinook to reproductive success/fitness of natural-origin fall Chinook.

2. *Estimate fall Chinook hatchery program effects on the productivity of the fall Chinook salmon ESU.*

   One BPA project was continued and one was initiated to address this RPA subaction. In addition, BPA projects associated with Subaction 1 of RPA 65 were implemented to support Subaction 2 by evaluating fall Chinook salmon productivity. The Hatchery/Harvest RME Work Group recommended additional research on Snake River fall Chinook RRS and effects of hatchery programs on productivity of the ESU, and BPA plans to issue a targeted solicitation for the studies in 2010.

3. *NOAA Fisheries will provide technical assistance to the Action Agencies in development of conceptual study designs suitable for use by the Action Agencies in obtaining a contractor to implement new studies.*

   NOAA Fisheries is expected to provide technical assistance to BPA in 2010 to support development of targeted solicitations for the new Snake River fall Chinook RRS study and any additional study or studies needed to estimate the effects of the fall Chinook hatchery programs on productivity of the ESU.

RME Strategy 7 (RPA Actions 66–70)

A comprehensive list of all actions implemented by the Action Agencies for RPA actions 66 through 69 is included in Section 4. For these RPAs, the RME Work Group concluded that most subactions were fully addressed; however, additional monitoring was recommended to supplement ongoing monitoring.

RPA Action 66 – Monitor and Evaluate the Caspian Tern Population in the Columbia River Estuary

The Action Agencies will monitor the tern population in the estuary and its impacts on outmigrating juvenile salmonids, as well as the effectiveness of the Caspian tern management plan.

One BPA project was continued to fully address this RPA subaction. BPA project number 1997-024-00, Avian Predation on Juvenile Salmonids project, provided for the monitoring of the Caspian tern colony on East Sand Island. Colony size, reproduction rates, diet composition, and predation rates were monitored to determine the effect of the colony on juvenile salmon. Results are further reported at *http://www.birdresearchnw.org*. The Action Agencies also funded Caspian tern monitoring at the alternate habitat sites identified in the Caspian Tern Management Plan.

East Sand Island

In 2009, the Action Agencies continued to monitor the Caspian tern colony located on East Sand Island in the Columbia River Estuary to evaluate their impacts on outmigrating juvenile salmonids. As in previous years, monitoring efforts focused on colony size, reproduction rates, diet composition, and salmonid predation rates. In addition, colony monitoring was done on newly created islands in central and southeastern Oregon.

In 2009, approximately 9,854 pairs of Caspian terns nested on East Sand Island, a slight decrease from the 2008 colony size. Marine forage fish (anchovies, etc.) continued to comprise the majority of the diet for the East Sand Island terns. However, the terns consumed approximately 6.4 million smolts (95 percent c.i. = 5.6 – 7.2 million) in 2009, which is a slight decrease over 2008 consumption, when terns nesting on East Sand Island consumed approximately 6.7 million juvenile salmonids.

Of the approximately 2.5 million PIT-tagged fish that were released into the Columbia River Basin in 2009, 1.5 percent (n = 38,336) were recovered on the East Sand Island tern colony. Of the 38,336 tags recovered, 58.6 percent were from steelhead, 37.9 percent were from Chinook salmon (including sub-yearlings and yearlings), 3.0 percent were from coho salmon, 0.4 percent were from sockeye salmon, and 0.1 percent were from sea-run cutthroat trout. Based on predation rates of PIT-tagged smolts, steelhead were the most susceptible salmonid species to East Sand Island tern predation in

2009, with predation rates in excess of 10 percent for many groups of tagged steelhead. Predation rates on wild populations of steelhead (in-river migrants originating up-river of Bonneville Dam) in 2009 (ca. 11.6 percent) were slightly higher than those observed in 2008 (ca. 9.7 percent; Collis et al. 2009) but similar to the four-year average of 11.3 percent (Collis et al. 2005, 2006, 2007, 2008, 2009).

Effectiveness Monitoring

Social attraction, tern decoys, and tern colony sounds were used in the spring 2009 to attract terns to all new islands, except Crump Lake. The social attraction was successful at attracting Caspian terns to the Fern Ridge Island but predation by bald eagles, peregrine falcons, and great horned owls, prevented terns from nesting on the constructed island in 2008 and 2009.

Crump Lake Island showed great success in 2008 (428 pairs of terns the first year available), and even better success in 2009. More than 700 pairs of terns utilized the new island as well as several thousand ring-bill and California gulls. Diet composition was greater than 80 percent tui chub, 19 percent introduced warm water fish, and only one sucker of unknown species was seen brought on colony. Monitoring by Oregon State University crew at Goose Lake (nearly 35 miles west of Crump Lake) verified that Caspian terns nesting at Crump Lake Island were foraging at least part time at Goose Lake. Eighteen terns that had been banded in the Columbia River Estuary were re-sighted on Crump Lake Island. Band re-sightings were also observed from the Mid Columbia colonies, Nevada, and San Francisco Bay.

At Summer Lake Wildlife Area, Caspian terns nested on both newly created islands. A total of 21 pairs utilized the new islands at Summer Lake with a 100 percent nest success, which has never previously reported for any Caspian tern colony. Diet composition at Summer Lake was very similar to Crump Lake Island birds with tui chub making up greater than 80 percent of the diet. Band re-sightings from East Sand Island were also found on both new islands (n=5) at Summer Lake.

RPA Action 67 – Monitor and Evaluate the Double-Crested Cormorant Population in the Columbia River Estuary

The Action Agencies will monitor the cormorant population in the estuary and its impacts on outmigrating juvenile salmonids and develop and implement a management plan to decrease predation rates, if warranted.

One BPA project was continued to fully address this RPA subaction. BPA project number 1997-024-00, Avian Predation on Juvenile Salmonids project, provided for the monitoring of the double-crested cormorant colony on East Sand Island. Colony size, reproduction rates, diet composition, and predation rates are monitored in order to determine the effect of the colony on juvenile salmon. Results are discussed below and further reported at *http://www.birdresearchnw.org*.

The Action Agencies also are funding assessments of the population status of Pacific Coast double-crested cormorants, the availability of suitable alternative nesting habitat outside the Columbia River Basin, and potential management approaches to decrease cormorant depredation of juvenile salmon in the Columbia River Basin should management of cormorants be determined to be warranted.

In 2009, the Action Agencies continued to monitor and conduct research on double-crested cormorants on East Sand Island in the Columbia River Estuary and to evaluate their impacts on out-migrating juvenile salmonids. As in previous years, monitoring efforts focused on colony size, reproduction rates, diet composition, and predation rates. In 2008 and 2009 addition, 39 radio transmitters were placed on cormorants and followed throughout the years. Results from this effort are still pending, but many of the radio-marked birds moved north to Puget Sound after breeding and some moved up river into the Portland area.

The double-crested cormorant colony on East Sand Island consisted of about 12,087 breeding pairs in 2009, a 10 percent increase in colony size compared to the previous year. Since monitoring began in 1997, the cormorant colony has increased by about 120 percent. Nesting success in 2009 (2.80

fledglings per breeding pair, a significant increase from 2008's 2.26 fledglings per breeding pair), was the highest productivity ever recorded at East Sand Island. As in previous years, salmonids comprise a small portion (9.2 percent) of the cormorant diet in 2009, while marine forage fish (i.e., northern anchovy) and estuarine resident fish (i.e., sculpin, flounder, minnows) comprise over 40 percent of the diet.

In 2009, cormorants nesting on East Sand Island consumed an estimated 11.1 million juvenile salmonids (95 percent c.i. = 7.7 – 14.5 million), compared to an estimated 6.4 million juvenile salmonids (95 percent c.i. = 5.6 – 7.2 million) consumed by terns nesting on East Sand Island.

An analysis of salmonid PIT tags detected at the double-crested cormorant colony on East Sand Island indicated that all species of anadromous salmonids (i.e., Chinook salmon, coho salmon, sockeye salmon, steelhead, and even sea-run cutthroat trout) from all run-types (fall, winter, summer, and spring), and from all tagged ESUs were susceptible to cormorant predation in 2009. The numbers of PIT tags from the various salmonid species and run-types that were recovered on the cormorant colony were roughly proportional to the relative availability of PIT-tagged salmonids released in the basin, suggesting that cormorant predation on salmonid smolts in the estuary was less selective than tern predation. Predation rates in excess of 10 percent and 30 percent, however, were observed for some groups of hatchery fall Chinook and hatchery coho salmon released downstream of Bonneville Dam. A comparison of per capita consumption rates of PIT-tagged fish between terns and cormorants nesting on East Sand Island suggests similar levels of take per nesting adult per colony, with an estimate of 1.5 and 1.8 PIT-tagged fish consumed per nesting tern and cormorant, respectively.

RPA Action 68 – Monitor and Evaluate Inland Avian Predators

The Action Agencies will monitor avian predator populations in the Mid-Columbia River and evaluate their impacts on outmigrating juvenile salmonids and develop and implement a management plan to decrease predations rates, if warranted.

One BPA project was continued to fully address this RPA subaction. BPA project number 1997-024-00, Avian Predation on Juvenile Salmonids, provided aerial surveys to identify any significant avian colonies located in the mid-Columbia River. This includes colonies like the Caspian tern colony on Crescent Island and the double-crested cormorant colony on Foundation Island, which are monitored to determine their effects on juvenile salmon. Reclamation funded a portion of this research to evaluate avian predation on Goose Island in Potholes Reservoir. The funding included sampling and tagging fish at Rock Island Dam. Inland avian monitoring was conducted at primary nesting sites and for overwintering double-crested cormorants throughout 2009. Colony size, reproduction rates, diet composition, and predation rates were monitored to determine the annual trend effect of the colonies on juvenile salmonids.

Caspian terns and double-crested cormorants are responsible for most losses of salmonid smolts to avian predators along the mid-Columbia River, specifically Caspian terns nesting on Crescent Island and double-crested cormorants nesting on Foundation Island, both in McNary Pool. The Caspian tern colony at Crescent Island consisted of 349 breeding pairs in 2009, the smallest the colony has been since monitoring commenced in 1997. Salmonid smolts represented 64 percent of the prey items for terns nesting on Crescent Island in 2009, similar to diet composition during 2000-2008. Based on bioenergetics calculations, consumption of juvenile salmonids by Crescent Island terns was about 360,000 smolts in 2009.

The largest Caspian tern colony on the Columbia Plateau in 2009 was on Goose Island in Potholes Reservoir, where about 486 pairs nested. Data on diet composition of terns nesting at the Potholes colony were limited to smolt PIT tags recovered on the colony after the nesting season. Recovered PIT tags indicated that the numbers of juvenile salmonids from the Columbia River consumed by terns nesting at this off-river colony were surprisingly high, particularly for steelhead from the endangered upper Columbia ESU. PIT tag recoveries on the Potholes tern colony indicated that over 15.5 percent

of upper Columbia steelhead passing Rock Island Dam in 2009 were consumed by Caspian terns nesting at this colony.

The only active double-crested cormorant colony on the mid-Columbia River during 2009 was on Foundation Island in McNary Pool, which consisted of about 310 nesting pairs. The largest cormorant colony on the Columbia Plateau, however, consisted of about 810 pairs that nested in trees at the north end of Potholes Reservoir. Both colonies have declined somewhat over the last four years, indicating that, in the short term, the cormorant breeding population in the region is not increasing. Based on limited diet data for cormorants nesting on Foundation Island, the proportion of salmonids in the diet was similar to 2007 and 2008. Smolt PIT tag recoveries on the Foundation Island cormorant colony were also similar in 2007, 2008, and 2009. The magnitude of smolt PIT tag recoveries at the Foundation Island colony suggests that the impact of cormorants nesting at this colony on survival of juvenile salmonids is comparable to that of Caspian terns nesting at the Crescent Island colony.

Stomach contents of 35 double-crested cormorants collected along the lower Snake River during the winter of 2009-10 indicated that salmonids comprised about 12.4 percent of the diet; most salmonids found in cormorant stomachs were from the ESA-listed run of Snake River fall Chinook. Surveys during winter 2009-10 indicated that less than 250 cormorants over-wintered along the lower Snake River; on average, only 20 percent were observed at one of the four lower Snake River dams. The highest concentrations of cormorants over-wintering along the lower Snake River during 2009-10 were observed between Ice Harbor Dam and the confluence with the Columbia River.

California and ring-billed gulls have nested in large numbers on islands on or near the mid-Columbia River, but these gulls have generally consumed few fish and even fewer juvenile salmonids. However, recent increases in numbers of smolt PIT tags recovered at the gull colony on Miller Rocks in The Dalles Pool, where about 4,600 pairs of gulls now nest, have raised concerns about the impact of gull predation on survival of salmonid smolts. In 2009, nearly 5,500 smolt PIT tags were deposited on the Miller Rocks colony by nesting gulls, compared to 4,211 tags in 2008. The increase in consumption of PIT-tagged smolts by Miller Rocks gulls likely reflects both an increase in size of the gull colony (numerical response) as well as an increase in foraging intensity at nearby John Day Dam and The Dalles Dam (functional response). The magnitude of predation on salmonid smolts by Miller Rocks gulls appears to be unique among gull colonies along the mid-Columbia River.

RPA Action 69 – Monitoring Related to Marine Mammal Predation

As part of RPA 69, the Corps continued to monitor sea lion predation at Bonneville Dam in 2009. For a more comprehensive summary of 2009 monitoring efforts, refer to the field report by Stansell et al. (2009).

1. *Estimate overall sea lion abundance immediately below Bonneville Dam. (Initiate in FY 2007-2009 Projects)*

   Two projects were continued to fully address this RPA subaction. From January 1 to May 31, 2009, the Corps continued to visually monitor the abundance of California sea lions below Bonneville Dam (Figure 9). In addition, a BPA-funded CRITFC project, BPA project number 2008-004-00, estimated general sea lion abundance while conducting in-river hazing on sea lions.

2. *Monitor the spatial and temporal distribution of sea lion predation attempts and estimate predation rates. (Initiate in FY 2007-2009 Projects)*

   Two projects were continued to fully address this RPA subaction. In 2009, the Corps continued land-based visual observations to monitor the expanded adult salmon catch estimate for the Bonneville Dam tailrace observation area. The Corps also monitored the date and location of individual sea lion predation attempts. The BPA-funded CRITFC project observed the total number of sea lion predation attempts and recorded their location and time.

   The expanded adult salmon catch estimate for the Bonneville Dam tailrace observation area was 2.4 percent (n=4,489) of the adult salmon run at Bonneville Dam from January 1 through May 31,

2009. The adjusted estimated catch was 2.7 percent of the run (n=4,960). California sea lions were the primary salmon predator, accounting for 90 percent (n=2,680) of the 2,980 observed catches. This percentage was lower than seen in previous years, as observed salmon catch by Steller sea lions increased from 0.3 percent (n=12) in 2007 to 10 percent (n=300) of total take in 2009 (see Table 13).

Chinook salmon were the most commonly identified prey species, making up about 89 percent (n=2,652) of observed adult salmon catch in 2009. The expanded Chinook catch estimate for the Bonneville Dam tailrace observation area was 1.7 percent (n=3,997) of the Chinook run through June 15, 2009. Note that this time period differs from the passage season used for total salmon estimates. This period includes the Columbia River spring Chinook passage season at Bonneville Dam, which extends beyond the period during which sea lions are present. Steelhead comprise approximately 11 percent (n=328) of observed adult salmon catch during the same period. Steelhead, which are present in the Bonneville Dam tailrace throughout the winter and spring, made up the majority of salmon catches until the spring Chinook salmon run began. Of the total pinniped catch for 2009, California sea lions took 90.2 percent of the Chinook and 87.8 percent of the steelhead (see Table 14).

Physical barriers, including SLEDs and FOG barriers, apparently prevented sea lions from entering the fishways, but acoustic deterrents installed near fishway entrances continued to have no visible effect on sea lions. During daylight hours, dam-based USDA Wildlife Services agents contracted by the Corps, and boat-based crews from ODFW, WDFW, and CRITFC used non-lethal pyrotechnics and rubber bullets to harass sea lions in the dam tailrace. Harassment appeared to temporarily alter the behavior of some sea lions but did not reverse the upward trend in predation estimates.

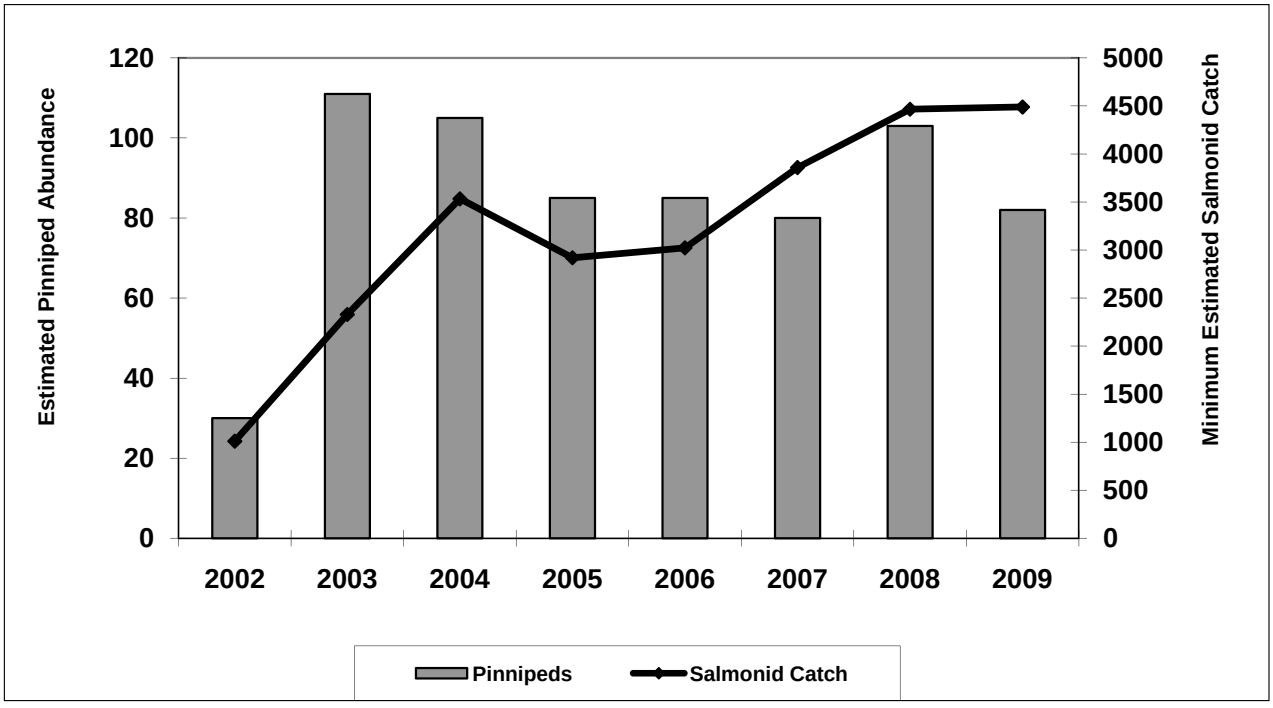

Figure 9. Estimated Minimum Number of Adult Salmonids Consumed by Pinnipeds and Estimated Total Number of Pinnipeds Observed at Bonneville Dam, January 1–May 31, from 2002 to 2009. *Note: In 2005, regular observations did not start until March 18. Pinnipeds observed included California sea lions, Steller sea lions, and harbor seals.*

Table 13. Bonneville Dam Salmonid Passage Catch Summary (2002–2009).

Year	Bonneville Dam Salmonid Passage (Jan. 1–May 31)	Observed Salmonid Catch		Expanded Salmonid Catch Estimate		Adjusted Salmonid Catch Estimate	
		Observed Catch	% of Run (1/1 to 5/31)	Estimated Catch	% of Run (1/1 to 5/31)	Estimated Catch	% of Run (1/1 to 5/31)
2002	281,785	448	0.2%	1,010	0.4%	—	—
2003	217,943	1,538	0.7%	2,329	1.1%	—	—
2004	186,770	1,324	0.7%	3,533	1.9%	—	—
2005	81,252	2,659	3.1%	2,920	3.5%	—	—
2006	105,063	2,718	2.5%	3,023	2.8%	3,401	3.1%
2007	88,476	3,569	3.9%	3,859	4.2%	4,355	4.7%
2008	147,534	4,243	2.8%	4,466	2.9%	4,927	3.2%
2009	186,060	2,960	1.6%	4,489	2.4%	4,960	2.7%

Note: Total salmonid passage counts include all adult salmonids that passed Bonneville Dam January 1–May 31. "Expanded" estimates correct for the fact that observers are not present at all locations at all times. "Adjusted" estimates further correct to account for catch events where the prey species could not be identified.

Table 14. California Sea Lion 2009 Catch Estimates: Chinook vs. Steelhead.

	Percent of Total Pinniped Catch Taken by California Sea Lions	Expanded Catch Estimate (California sea lions)
Chinook	90.2%	3,591
Steelhead	87.8%	424

With funding from BPA, ODFW and WDFW used four floating sea lion traps deployed along the PH2 corner collector to capture California sea lions. The sea lions were then weighed, branded, and released, or transferred to aquariums. Of the 20 California sea lions trapped in 2009, four were sent to aquariums, 14 were euthanized, five were processed (measured, weighed, marked with a three-digit brand, and given acoustic tags) and released, one was already branded (but given an acoustic tag). In addition, one California sea lion on the list for removal was trapped in Astoria in August 2009 and euthanized.

3. *Monitor the effectiveness of deterrent actions (e.g., exclusion gates, acoustics, harassment and other measures) and their timing of application on spring runs of anadromous fish passing Bonneville Dam. (Initiate in FY 2007-2009 Projects)*

The effectiveness of deterrent actions and the timing of application on spring runs was determined in 2009 through BPA- and Corps-funded efforts. Physical barriers were effective at preventing sea lions from entering the fishways, but acoustic deterrents installed near fishway entrances had no visible effect. Harassment with non-lethal pyrotechnics and rubber bullets appeared to temporarily alter the behavior of some sea lions, but did not reverse the upward trend in predation estimates.

RPA Action 70 – Monitoring Related to Piscivorous (Fish) Predation

A comprehensive list of all actions implemented by the Action Agencies for RPA action 70 is included in Section 4. For RPA 70, the RME Work Group concluded that the subactions were fully addressed.

1. *Continue to update and estimate the cumulative benefits of sustained removals of northern pikeminnow since 1990.*

   One BPA project was continued to fully address this RPA subaction. The NPMP, BPA project number 1990-07-700, contains an extensive biological evaluation component implemented primarily by ODFW. This program component annually collects and validates biological field data and updates the benefit model with the latest year's data. The 2009 estimated reduction in potential predation was 38 percent, based on the 2009 exploitation rate of 12.8 percent for pikeminnow 250 millimeters in fork length or larger and the cumulative effect of previous years removals.

2. *Continue to evaluate if inter and intra compensation is occurring.*

   One BPA project was continued to fully address this RPA subaction. The evaluation of the NPMP annually assesses whether compensation is occurring as a result of cumulative removals to date. The program evaluation showed no indication of compensation by smallmouth bass, walleye, or channel catfish.

3. *Evaluate the benefit of additional removals and resultant increase in exploitation rate's affect on reduction in predator mortality since the 2004 program incentive increase.*

   One BPA project was continued to fully address this RPA subaction. Exploitation rates since the implementation of the monetary incentive increase in 2004 have significantly exceeded the average exploitation rate of the previous 14 years. System-wide exploitation in 2009 of northern pikeminnow was 12.8 percent based on a numerical catch of 141,645 from a sport reward and dam angling fishery. A significant increase and resultant benefit have been observed since the monetary incentive program was increased in 2004. Some of this may be a result of additional tagging research and the validation of annual tag loss estimates.

4. *Develop a study plan to review, evaluate, and develop strategies to reduce non-indigenous piscivorous predation.*

   In December, 2009 the project sponsors submitted for review of the Independent Scientific Review Panel for the Northwest Power and Conservation Council the proposal titled "*Understanding the influence of predation by introduced fishes on juvenile salmonids in the Columbia River Basin: closing some knowledge gaps.*" Implementation of research activities can occur once this review is completed.

RME Strategy 8 (RPA Actions 71–72)

RPA Action 71 – Coordination

The Action Agencies will coordinate RME activities with other Federal, State and Tribal agencies on an ongoing annual basis.

1. *Organizing and supporting the Corps AFEP.*

   The Corps of Engineers has, since 1952, sponsored biological studies in an integrated, applied research program. These monitoring, research, and evaluation studies are managed under the AFEP.

   In 2009, the Corps again implemented the AFEP program. As usual, one of the major activities was the selection and development of experimental design and methodology of research projects to be carried out in 2010. This process was extensively coordinated with other federal agencies, states, and tribal interests through their involvement in the SRWG, which met several times

through the year. In December 2009, a three-day annual review, open to all interested parties, was held to present the results of AFEP research carried out during the year.

The AFEP program also includes the Fish Facility Design Review Work Group (FFDRWG) and the Fish Passage Operations and Maintenance (FPOM) work group. The FFDRWG provides ongoing review of fish facility design activities. The FPOM work group provides ongoing review of operational activities related to fish passage. All federal, state, and tribal fishery agencies are invited to participate in FFDRWG and FPOM meetings, both of which generally occur monthly.

Further information on the AFEP program, and on the research carried out in 2009 and planned for 20010, is available at *http://www.nww.usace.army.mil/planning/ep/fishres/afep-default.htm* and *http://www.nwp.usace.army.mil/pm/e/afep_docs.asp*

2. *Supporting and participating in the Council's Columbia River Basin Fish and Wildlife Program project planning and review efforts.*

BPA continued to work with Northwest Power and Conservation Council (Council) staff in coordinating its FWP's project planning and review efforts. In 2009, BPA and the Council initiated the process to conduct the RME and Artificial Production Categorical Review to support a comprehensive evaluation of the FWP's research and monitoring projects.

3. *Supporting the standardization and coordination of tagging and monitoring efforts through participation and leadership in regional coordination forums such as PNAMP.*

Four BPA projects and one Reclamation project were continued to fully support this subaction. For example, BPA project numbers 1994-033-00, 1996-020-00, 1996-043-00, and 2004-002-00 200721600, were continued to support RPA action 71.3. The PNAMP funding, BPA project number 2004-002-00 and 2007-216-00, supported this RPA action by coordinating and completing the PNAMP Tagging and Telemetry Monitoring project to evaluate tagging and telemetry work and make recommendations on field protocols and methods for fish tagging and telemetry field data collection techniques. The FPC, BPA project number 1994-033-00, continued to support the evaluation and synthesis of fish passage of tagged fish through the hydropower system.

Reclamation directly participated in PNAMP by providing full-time equivalents (FTE) for the PNAMP steering committee, and by continuing to provide funding for its two coordinators and database expert. Reclamation provided technical expertise for two major PNAMP tasks issued by the Northwest Environmental Information Sharing (NWEIS) executive forum, including development of a white paper on high-level indicators and planning for a region-wide data dictionary.

4. *Working with regional monitoring agencies to develop, cooperatively fund, and implement standard metrics, business practices, and information collection and reporting tools needed to cooperatively track and report on the status of regional fish improvement and fish monitoring projects.*

Ten BPA projects were continued and two were initiated to address this subaction. For example, in 2009, BPA project number 2004-002-00 initiated the PNAMP Integrated Status and Trend Monitoring demonstration project to support management of a regional master sample based on a Generated Random Tessellated Sample (GRTS) design to support efficient and statistically based monitoring designs for fish and habitat programs across the Northwest. PNAMP also supported further development of the Protocol Library tool and Monitoring Glossary that were incorporated into BPA and Council RME Categorical Review proposal tools to support standardization of indicators and metrics, as well as the respective data analysis and data collection methods. In addition, the PNAMP project also endorsed best business practices for documenting metadata for field data collection.

5. *Coordinating the further development and implementation of Hydrosystem, Tributary Habitat, Estuary/Ocean, Harvest, Hatchery, and Predation RME through leadership and participation in ongoing collaboration and review processes and workgroups.*

Four BPA projects were continued to fully support this RPA subaction. The ISEMP project, BPA project number 200301700, continued facilitation and coordination of the RME Tributary Habitat RME workgroup and provided staff time, developed monitoring inventories for the RME gap

assessment, and completed the RPA workgroup draft RPA Recommendation Report. This also coordinated the tributary RME work with the developing data management effort for the basin-wide RME through the Aquatic Resource Schema, and the Status Trend and Effectiveness Monitoring (STEM) Databank.

6. *Coordinating implementation with other appropriate regional collaboration processes. This includes coordination related to statutory provisions for the Federal government (BPA/Council), voluntary coordination among Federal agencies (Federal Caucus), and coordination with regional processes for Federal/non-Federal engagement (Technical Management Team (TMT), System Configuration Team (SCT), PNAMP, Northwest Environmental Data- Network (NED), and others.*

   Two BPA projects were continued and two were initiated to fully support this subaction. For example, BPA project numbers 2004-002-00 and 2008-733-00 were implemented to support regional collaboration processes. BPA funded the Columbia Basin Fish and Wildlife Authority (CBFWA) to support the regional workshops to support development of the Columbia Basin ASMS through collaboration of state, tribal, and federal entities. The workshops supported evaluation of the RME workgroup RME RPA Gap Assessment and Recommendation Report and helped fill gaps in tributary and VSP monitoring. The PNAMP Funding project, BPA project number 2004-002-00, provided funds for full-time staff support at PNAMP to facilitate and organize regional collaboration efforts on monitoring techniques and data management. This project supported the initiation of the ASMS data management strategy to be completed in 2010.

RPA Action 72 – Data Management

The Action Agencies will ensure that the information obtained under the auspices of the FCRPS RME Program is archived in appropriate data management systems.

1. *Continue to work with regional Federal, State and Tribal agencies to establish a coordinated and standardized information system network to support the RME program and related performance assessments. The coordination of this development will occur primarily through leadership, participation, and joint funding support in regional coordination forums such as the NED workgroup, and PNAMP and the ongoing RME pilot studies in the Wenatchee River, John Day River, Upper Salmon River, and Columbia River Estuary. (Initiate in FY 2007- 2009 Projects)*

   One Reclamation and eight BPA projects were continued to fully support this subaction. For example, BPA project number 2008-727-00 was implemented to support development of a coordinated and standardized information management network through use of a PNAMP data steward to help coordinate data management efforts in the region. This included the support for coordination of the Integrated Status and Trends Monitoring (ISTM) and Protocol Library tools and metadata standards white paper.

   Reclamation supported ongoing regional RME coordination through the PNAMP (see http://*www.pnamp.org* for information on PNAMP's 2009 accomplishments), completion of a major database to catalog monitoring protocols (Protocol Library), and the transfer of that technology to a NOAA Fisheries contractor to integrate protocols into a region-wide data dictionary that is being coordinated through PNAMP.

2. *Contribute funding for data system components that support the information management needs of individual Hydrosystem, Tributary Habitat, Estuary/Ocean, Harvest, Hatchery, and Predation RME. (Initiate in FY 2007-2009 Projects)*

   Three BPA projects were continued to address this subaction. The DART, BPA project number 1996-019-00, managed a second-tier database and Internet service. DART provides direct and timely public access to integrated Columbia River Basin environmental, operational, fishery, riverine, ocean, and climactic data resources for sound management of the Columbia River Basin resources and hydrosystem by federal, state, public, and private entities. This project also provides web support to PNAMP. Also, BPA project 2008-727-00 was supported by use of a PNAMP data steward to help coordinate data management efforts in the region. Additional recommendations for data stewards and technical support were identified by the RME Work Group.

3. *Participate in Northwest regional coordination and collaboration efforts such as the current PNAMP and NED efforts to develop and implement a regional management strategy for water, fish and habitat data. (Initiate in FY 2007-2009 Projects).*

   Five BPA projects were continued and three were initiated to fully support this subaction. For example, BPA project numbers 1988-108-04, 2004-002-00, and 1996-017-00 were implemented to support participation in coordination efforts to implement a regional data management strategy. The PNAMP funding for BPA project number 2004-002-00 supported staff for coordination or work sessions and regional collaboration discussion by the PNAMP Data Management Work Group to continue implementation of NED recommendations.

RME Strategy 9 (RPA Action 73)

RPA Action 73 – Implementation and Compliance Monitoring

The Action Agencies will use the project-level detail contained in the Action Agencies' Biological Opinion databases to track results and assess our progress in meeting programmatic level performance targets. This performance tracking will be reported through annual progress reports and the comprehensive reports scheduled for 2013 and 2016.

1. *Annually monitor the successful implementation of projects through standard procedures and requirements of contract oversight and management, and review of project deliverables and final reports.*

   The Action Agencies successfully implemented programs following government contracting requirements with quarterly and/or annual project implementation reporting. BPA continued to implement the Pisces program to track project implementation to support accordance and evaluations of project effectiveness.

2. *Maintain project and action level details for planning and reporting purposes. This approach will provide the most up-to-date information about the status of actions and projects being implemented.*

   BPA updated the Pisces program to track project implementation for all projects and started development of the BPA Dashboard and Taurus program to track action implementation for the FCRPS RPAs. Reclamation continued to assess and plan for the inclusion of its implementation data into a coordinated Action Agency database.

3. *Maintain a comprehensive habitat project tracking system where relevant project information is contained in an accessible comprehensive data system. The data system will contain project level information that is needed for both implementation and effectiveness monitoring. The system will include the set of minimum metrics and metadata for RME data design listed in Data Management Needs for Regional Project Tracking to Support Implementation and Effectiveness Monitoring (Katz et al. 2006). (Initiate in FY 2008)*

   In addition to implementing the Pisces program on all BPA-funded projects, BPA implemented nine projects that tracked and compiled standardized environmental resource project tracking data that could support effectiveness monitoring evaluation efforts. In 2009, the incorporation of Katz et al. (2006) metrics was initiated for Pisces but was delayed to ensure consistency with other NOAA Fisheries regional database tracking systems, which were in the process of validating Katz et al. (2006) metrics in the Pacific Coastal Salmon Recovery Fund (PCSRF) program. For BPA, the Katz et al. (2006) metrics will be reported for fiscal year 2010, with the exception of those metrics that NOAA Fisheries is in the process of updating. Additional work to further align tracking systems will continue in 2010.

   The Action Agencies have recorded project implementation and associated metric information for tributary habitat actions since implementation of tributary habitat actions became part of the FCRPS BiOp RPA in 2000. Examples of these data are presented in Section 4. These data currently are stored in the Pisces database for actions for which BPA provides funding and in a separate database for actions for which Reclamation provides technical assistance. Because these databases were developed in the early 2000s, they currently include only a subset of the metrics contained in Katz et al. (2006); however, most of these projects have already been integrated into

the NOAA Fisheries Pacific Northwest Salmon Habitat Restoration Project Tracking (PNSHP) database that is based on Katz et al. (2006) Further regional coordination by the Action Agencies on habitat implementation metrics is being pursued through PNAMP work groups.

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Acronyms, Abbreviations, and Glossary

The "Action Agencies" refers to Bonneville Power Administration, the U.S. Army Corps of Engineers, and the U.S. Bureau of Reclamation.

AFEP	Anadromous Fish Evaluation Program
ASMS	Anadromous Salmonid Monitoring Strategy
AWS	auxiliary water system
BA	Biological Assessment
BACI	Before, After, Control, Impact
BGS	behavioral guidance screen
BiOp	Biological Opinion
BIT	Biological Index Test
BPA	Bonneville Power Administration
BRZ	Boat Restricted Zone
CBFWA	Columbia Basin Fish and Wildlife Authority
cfs	cubic feet per second
CIG	Climate Impacts Group, University of Washington; is developing climate change streamflows for the Columbia River Basin
COMPASS	Comprehensive Fish Passage Model
COP	Configuration and Operational Plan
CORIE	
Corps	U.S. Army Corps of Engineers
CREST	Columbia River Estuary Study Taskforce
CRFG	Columbia River Forecast Group, formed by the Action Agencies and Fish Accord partners
CRFM	Columbia River Fish Mitigation
CRITFC	Columbia River Inter-tribal Fish Commission
CSS	Comparative Survival Study
CTCR	Confederated Tribes of the Colville Reservation
CTUIR	Confederated Tribes of the Umatilla Indian Reservation
CWA	Clean Water Act
DART	Data Access Real Time
DPS	Distinct Population Segment
EPA	U.S. Environmental Protection Agency
ERDC	Engineer Research and Development Center
ESA	Endangered Species Act
ESU	Evolutionary Significant Unit
ESP	Ensemble Streamflow Predicting
FCAP	Fall Chinook Acclimation Program
FCRPS	Federal Columbia River Power System
FFDRWG	Fish Facility Design Review Work Group
FGE	fish guidance efficiency
FOG	floating orifice gate
FOP	Fish Operations Plan
FPC	Fish Passage Center
FPOM	Fish Passage Operations and Maintenance
FPP	Fish Passage Plan
FTE	full-time equivalent
FWP	Fish and Wildlife Program
GBT	gas bubble trauma

GIS	geographical information system
GRTS	Generated Random Tessellated Sample
GSI	genetic stock identification
HGMP	Hatchery and Genetic Management Plan
HSRG	Hatchery Scientific Review Group
IDFG	Idaho Department of Fish and Game
IMW	intensively monitored watershed
ISAB	Independent Scientific Advisory Board
ISTM	Integrated Status and Trends Monitoring
ISEMP	Integrated Status and Trend Monitoring Program
ISS	Idaho Supplementation Studies
JBS	juvenile bypass system
JFF	juvenile fish facility
JSAT	Juvenile Salmonid Acoustic Tag
kaf	thousand acre-feet
kcfs	thousand cubic feet per second
ksfd	thousand second foot per day; k = kilo = thousand; ksfd = 1,000 cfs (cubic feet per second) per day. kfsd * 1.98347 = thousand acre-feet
LCRE	Lower Columbia River Estuary
LCREP	Lower Columbia River Estuary Partnership
LIDAR	light detection and ranging
LSRCP	Lower Snake River Compensation Plan
M&E	monitoring and evaluation
maf	million acre-feet
MCE	minimum control elevation
MOP	minimum operating pool
NED	Northwest Environmental Data
NEPA	National Environmental Policy Act
NFH	National Fish Hatchery
NPCC	Northwest Power and Conservation Council
NPMP	Northern Pikeminnow Management Plan
NPT	Nez Perce Tribe
NTS	non-treaty storage
NWEIS	Northwest Environmental Information Sharing
NWFSC	Northwest Fisheries Science Center
NWRFC	Northwest River Forecast Center
O&M	operations and maintenance
OBMEP	Okanogen Basin Monitoring and Evaluation Program
ODFW	Oregon Department of Fish and Wildlife
PCSRF	Pacific Coastal Salmon Recovery Fund
PH2	second powerhouse
PIT	Passive Integrated Transponder
PNAMP	Pacific Northwest Aquatic Monitoring Partnership
PNSHP	Pacific Northwest Salmon Habitat Restoration Project Tracking
POST	Pacific Ocean Survival Tracking Project
PTAGIS	PIT-Tag Information System
QA/QC	quality assurance/quality control
Reclamation	U.S. Bureau of Reclamation
rkm	river kilometer

RM	river mile
RME	research, monitoring, and evaluation
ROD	Record of Decision
RPA	Reasonable and Prudent Alternative
RRS	relative reproductive success
RSW	removable spillway weir
SAR	smolt-to-adult return
SBT	Shoshone-Bannock Tribe
SEC	Site Evaluation Cards
SLED	sea lion exclusion device
SNP	single nucleotide polymorphism
SOR	System Operational Request
SRWG	Studies Review Work Group
STEM	Status Trend and Effectiveness Monitoring
SURPH	Survival Using Proportional Hazards
SYSTDG	System Total Dissolved Gas
TDG	total dissolved gas
TMDL	total maximum daily load
TMT	Technical Management Team
TSP	Turbine Survival Program
TSW	top-spill weir
USDA	U.S. Department of Agriculture
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
VARQ	variable outflow flood control procedures
VSP	viable salmonid population
WDFW	Washington Department of Fish and Wildlife
WDOE	Washington Department of Ecology
WMP	Water Management Plan
WSF	Water Supply Forecast
YN	Yakama Nation

Endangered Species Act
Federal Columbia River Power System
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Project Tables for Reasonable and Prudent Alternative (RPA) Action Implementation

Attachment 1: Habitat, Hatchery, Predation Management, and RME Projects Completed or in Progress in 2009

Table 1 BPA Project List

Table 2 Reclamation Project List

Table 3 Corps Project List

Attachment 2: Summary of 2007-2009 Tributary Habitat Accomplishments, by Population

Attachment 3: Progress of Tributary Habitat Projects and Actions Identified for 2007-2009 Implementation in the FCRPS Biological Assessment, Attachment B.2.2-2, Tables 1-6

Table 1 Tributary Habitat Actions Identified for 2007-2009 Implementation in FCRPS BA, Attachment B.2.2-2, Tables 1a & b: Upper Columbia Spring Chinook & Steelhead

Table 2 Actions Identified for 2007-2009 Implementation in FCRPS BA, Attachment B.2.2-2, Table 2: Middle Columbia Steelhead

Table 3.1 Actions Identified for 2007-2009 Implementation in FCRPS BA, Attachment B.2.2-2, Table 3a: Snake River Steelhead

Table 3.2 Actions Identified for 2007-2009 Implementation in FCRPS BA, Attachment B.2.2-2, Table 3b: Snake River Spring/Summer Chinook

Table 4.1 Actions Identified for 2007-2009 Implementation in FCRPS BA, Attachment B.2.2-2, Table 4a: Snake River Spring/Summer Chinook

Table 4.2 Actions Identified for 2007-2009 Implementation in FCRPS BA, Attachment B.2.2-2, Table 4b: Snake River Summer/Winter Steelhead

Table 4.3 Actions Identified for 2007-2009 Implementation in FCRPS BA, Attachment B.2.2-2, Table 4c: Upper Columbia River Summer/Winter Steelhead

Table 5.1 Status of Completed and Ongoing 2007 FCRPS Biological Assessment Table 5a Tributary Habitat Actions Performed with Reclamation Technical Assistance

Table 5.2 Status of Completed and Ongoing 2007 FCRPS Biological Assessment Table 5b Tributary Habitat Actions Performed with Reclamation Technical Assistance

Table 5.3 Status of Completed 2007 FCRPS Biological Assessment Table 5a and 5b Replacement and Additional Actions Performed with Reclamation Technical Assistance

Table 5.4 Status of Ongoing 2007 FCRPS Biological Assessment Table 5a and 5b Replacement and Additional Tributary Habitat Actions Performed with Reclamation Technical Assistance

Table 6 Actions Identified for 2007-2009 Implementation in FCRPS BA, Attachment B.2.2-2, Table 6: Lower Columbia ESUs/DPSs

Attachment 4: Tributary Habitat Reports by the Bureau of Reclamation

Attachment 5: Action Agency 2009 Estuary Habitat Projects

Attachment 1: Habitat, Hatchery, Predation Management, and RM&E Projects Completed or in Progress in 2009

Attachment 1 - Table 1. BPA Project List

H-Section	BiOp Strategy	RPA #	RPA Subaction	Agency	Project #	Project Title	Start Date	Action Information Link
Habitat	Protect and Improve Tributary Habitat	34	All	BPA	1983-436-00	Umatilla Passage O&M	10/1/1983	http://www.cbfish.org/Project.mvc/Display/1983-436-00
Habitat	Protect and Improve Tributary Habitat	34	All	BPA	1984-021-00	Mainstem, Middle Fork, John Day Rivers Fish Habitat Enhancement Project	3/1/1984	http://www.cbfish.org/Project.mvc/Display/1984-021-00
Habitat	Protect and Improve Tributary Habitat	34	All	BPA	1984-025-00	ODFW Blue Mountain Oregon Fish Habitat Improvement	3/1/1984	http://www.cbfish.org/Project.mvc/Display/1984-025-00
Habitat	Protect and Improve Tributary Habitat	34	All	BPA	1987-100-01	Umatilla Anad Fish Hab – CTUIR	2/1/1987	http://www.cbfish.org/Project.mvc/Display/1987-100-01
Habitat	Protect and Improve Tributary Habitat	34	All	BPA	1987-100-02	Umatilla Subbasin Fish Habitat Improvement Project	10/1/1987	http://www.cbfish.org/Project.mvc/Display/1987-100-02
Habitat	Protect and Improve Tributary Habitat	34	All	BPA	1988-022-00	Umatilla Fish Passage Operations	1/1/1988	http://www.cbfish.org/Project.mvc/Display/1988-022-00
Habitat	Protect and Improve Tributary Habitat	34	All	BPA	1988-120-25	YKFP Management, Data, Habitat	10/1/1988	http://www.cbfish.org/Project.mvc/Display/1988-120-25
Habitat	Protect and Improve Tributary Habitat	34	All	BPA	1988-120-35	YKFP Klickitat Management, Data, and Habitat	5/1/1988	http://www.cbfish.org/Project.mvc/Display/1988-120-35
Habitat	Protect and Improve Tributary Habitat	34	All	BPA	1989-027-00	Power Repay Umatilla Basin Project	10/1/1989	http://www.cbfish.org/Project.mvc/Display/1989-027-00
Habitat	Protect and Improve Tributary Habitat	34	All	BPA	1992-009-00	Yakima Phase II/Huntsville Screen Operation & Maintenance	5/1/1992	http://www.cbfish.org/Project.mvc/Display/1992-009-00
Habitat	Protect and Improve Tributary Habitat	34	All	BPA	1992-026-01	Grand Ronde Model Watershed Program Habitat Restoration - Planning, Coordination and Implementation	5/1/1992	http://www.cbfish.org/Project.mvc/Display/1992-026-01

Attachment 1 - Table 1. BPA Project List

H-Section	BiOp Strategy	RPA #	RPA Subaction	Agency	Project #	Project Title	Start Date	Action Information Link
Habitat	Protect and Improve Tributary Habitat	34	All	BPA	1992-062-00	Yakama Nation - Riparian/Wetlands Restoration	4/1/1992	http://www.cbfish.org/Project.mvc/Display/1992-062-00
Habitat	Protect and Improve Tributary Habitat	34	All	BPA	1993-040-00	Fifteenmile Creek Habitat Restoration and Monitoring Project	10/1/1993	http://www.cbfish.org/Project.mvc/Display/1993-040-00
Habitat	Protect and Improve Tributary Habitat	34	All	BPA	1993-066-00	Oregon Fish Screens Project	1/1/1993	http://www.cbfish.org/Project.mvc/Display/1993-066-00
Habitat	Protect and Improve Tributary Habitat	34	All	BPA	1994-015-00	Idaho Fish Screening and Passage Improvements	7/1/1994	http://www.cbfish.org/Project.mvc/Display/1994-015-00
Habitat	Protect and Improve Tributary Habitat	34	All	BPA	1994-018-05	Continued Implementation of Prioritized Asotin Creek Watershed Habitat Projects	1/1/1994	http://www.cbfish.org/Project.mvc/Display/1994-018-05
Habitat	Protect and Improve Tributary Habitat	34	All	BPA	1994-018-06	Tucannon Stream and Riparian Protection, Enhancement, and Restoration	10/1/1994	http://www.cbfish.org/Project.mvc/Display/1994-018-06
Habitat	Protect and Improve Tributary Habitat	34	All	BPA	1994-018-07	Improve Habitat For Fall Chinook, Steelhead in the Lower Snake and Tucannon Subbasins	6/1/1994	http://www.cbfish.org/Project.mvc/Display/1994-018-07
Habitat	Protect and Improve Tributary Habitat	34	All	BPA	1994-042-00	Trout Creek Fish Habitat Restoration Project	2/1/1994	http://www.cbfish.org/Project.mvc/Display/1994-042-00
Habitat	Protect and Improve Tributary Habitat	34	All	BPA	1995-033-00	O&M Yakima Basin Fish Screens	5/1/1995	http://www.cbfish.org/Project.mvc/Display/1995-033-00
Habitat	Protect and Improve Tributary Habitat	34	All	BPA	1996-011-00	Walla Walla Juvenile and Adult Passage Improvements	9/1/2009	http://www.cbfish.org/Project.mvc/Display/1996-011-00
Habitat	Protect and Improve Tributary Habitat	34	All	BPA	1996-035-01	Yakama Reservation Watersheds Project	10/1/1996	http://www.cbfish.org/Project.mvc/Display/1996-035-01
abitat	Protect and Improve Tributary Habitat	34	All	BPA	1996-042-00	Restore and Enhance Anadromous Fish Populations and Habitat in Salmon Creek	8/1/1996	http://www.cbfish.org/Project.mvc/Display/1996-042-00

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H-Section	BiOp Strategy	RPA #	RPA Subaction	Agency	Project #	Project Title	Start Date	Action Information Link
Habitat	Protect and Improve Tributary Habitat	34	All	BPA	1996-046-01	Walla Walla River Basin Fish Habitat Enhancement	4/1/1996	http://www.cbfish.org/Project.mvc/Display/1996-046-01
Habitat	Protect and Improve Tributary Habitat	34	All	BPA	1996-077-02	Protect and Restore Lolo Creek Watershed	3/1/1996	http://www.cbfish.org/Project.mvc/Display/1996-077-02
Habitat	Protect and Improve Tributary Habitat	34	All	BPA	1996-077-05	Restore McComas Meadows/ Meadow Creek Watershed	3/1/1996	http://www.cbfish.org/Project.mvc/Display/1996-077-05
Habitat	Protect and Improve Tributary Habitat	34	All	BPA	1996-083-00	CTUIR Grande Ronde Subbasin Restoration Project	4/1/1996	http://www.cbfish.org/Project.mvc/Display/1996-083-00
Habitat	Protect and Improve Tributary Habitat	34	All	BPA	1997-051-00	Yakima Basin Side Channels	4/1/2001	http://www.cbfish.org/Project.mvc/Display/1997-051-00
Habitat	Protect and Improve Tributary Habitat	34	All	BPA	1997-056-00	Klickitat Watershed Enhancement	10/1/1997	http://www.cbfish.org/Project.mvc/Display/1997-056-00
Habitat	Protect and Improve Tributary Habitat	34	All	BPA	1998-019-00	Wind River Watershed	10/1/1999	http://www.cbfish.org/Project.mvc/Display/1998-019-00
Habitat	Protect and Improve Tributary Habitat	34	All	BPA	1998-021-00	Hood River Fish Habitat	10/1/1998	http://www.cbfish.org/Project.mvc/Display/1998-021-00
Habitat	Protect and Improve Tributary Habitat	34	All	BPA	1998-028-00	Trout Creek Watershed Restoration Project	4/1/1998	http://www.cbfish.org/Project.mvc/Display/1998-028-00
Habitat	Protect and Improve Tributary Habitat	34	All	BPA	1999-010-00	Pine Hollow/Jackknife Habitat	11/1/1999	http://www.cbfish.org/Project.mvc/Display/1999-010-00
Habitat	Protect and Improve Tributary Habitat	34	All	BPA	1999-016-00	Protect & Restore the Big Canyon Creek Watershed	5/1/1999	http://www.cbfish.org/Project.mvc/Display/1999-016-00
Habitat	Protect and Improve Tributary Habitat	34	All	BPA	1999-017-00	Protect and Restore Lapwai Creek Watershed	5/1/1999	http://www.cbfish.org/Project.mvc/Display/1999-017-00
Habitat	Protect and Improve Tributary Habitat	34	All	BPA	1999-019-00	Restore Salmon River (Challis, Idaho)	5/1/1999	http://www.cbfish.org/Project.mvc/Display/1999-019-00
Habitat	Protect and Improve Tributary Habitat	34	All	BPA	2000-001-00	Anadromous Fish Habitat & Pass	2/1/2000	http://www.cbfish.org/Project.mvc/Display/2000-001-00
Habitat	Protect and Improve Tributary Habitat	34	All	BPA	2000-015-00	Oxbow Conservation Area Management	4/28/2000	http://www.cbfish.org/Project.mvc/Display/2000-015-00

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H-Section	BiOp Strategy	RPA #	RPA Subaction	Agency	Project #	Project Title	Start Date	Action Information Link
Habitat	Protect and Improve Tributary Habitat	34	All	BPA	2000-031-00	North Fork John Day Basin Anadromous Fish Habitat Enhancement Project	4/1/2000	http://www.cbfish.org/Project.mvc/Display/2000-031-00
Habitat	Protect and Improve Tributary Habitat	34	All	BPA	2000-033-00	Walla Walla River Fish Passage Operations	1/1/2000	http://www.cbfish.org/Project.mvc/Display/2000-033-00
Habitat	Protect and Improve Tributary Habitat	34	All	BPA	2000-035-00	Rehabilitate Newsome Creek - S	12/1/2000	http://www.cbfish.org/Project.mvc/Display/2000-035-00
Habitat	Protect and Improve Tributary Habitat	34	All	BPA	2000-036-00	Protect And Restore Mill Creek	3/1/2000	http://www.cbfish.org/Project.mvc/Display/2000-036-00
Habitat	Protect and Improve Tributary Habitat	34	All	BPA	2001-021-00	15 Mile Creek Riparian Buffers	4/1/2001	http://www.cbfish.org/Project.mvc/Display/2001-021-00
Habitat	Protect and Improve Tributary Habitat	34	All	BPA	2002-013-01	Water Entity (RPA 151) NWPCC - Anadromous	10/1/2002	http://www.cbfish.org/Project.mvc/Display/2002-013-01
Habitat	Protect and Improve Tributary Habitat	34	All	BPA	2002-015-00	Provide Coordination and Technical Assistance to Watershed Councils and Individuals in Sherman County, Oregon	7/1/2002	http://www.cbfish.org/Project.mvc/Display/2002-015-00
Habitat	Protect and Improve Tributary Habitat	34	All	BPA	2002-019-00	Wasco Riparian Buffers	5/1/2002	http://www.cbfish.org/Project.mvc/Display/2002-019-00
Habitat	Protect and Improve Tributary Habitat	34	All	BPA	2002-034-00	Wheeler Co Riparian Buffers	5/1/2002	http://www.cbfish.org/Project.mvc/Display/2002-034-00
Habitat	Protect and Improve Tributary Habitat	34	All	BPA	2002-035-00	Gilliam Co Riparian Buffers	7/1/2002	http://www.cbfish.org/Project.mvc/Display/2002-035-00
Habitat	Protect and Improve Tributary Habitat	34	All	BPA	2002-050-00	Continued Riparian Buffer Projects on Couse/Tenmile and other Salmonid Bearing Streams in Asotin County	1/1/2002	http://www.cbfish.org/Project.mvc/Display/2002-050-00
Habitat	Protect and Improve Tributary Habitat	34	All	BPA	2002-059-00	Yankee Fork Salmon River Dredge Tailings Restoration Project	6/15/2002	http://www.cbfish.org/Project.mvc/Display/2002-059-00
Habitat	Protect and Improve Tributary Habitat	34	All	BPA	2002-061-00	Restore Potlatch R Watershed	9/1/2002	http://www.cbfish.org/Project.mvc/Display/2002-061-00

Attachment 1 - Table 1. BPA Project List

H-Section	BiOp Strategy	RPA #	RPA Subaction	Agency	Project #	Project Title	Start Date	Action Information Link
Habitat	Protect and Improve Tributary Habitat	34	All	BPA	2002-070-00	Lapwai Cr Anadromous Habitat	5/1/2002	http://www.cbfish.org/Project.mvc/Display/2002-070-00
Habitat	Protect and Improve Tributary Habitat	34	All	BPA	2002-072-00	Protect & Restore Red River Watershed	12/1/2002	http://www.cbfish.org/Project.mvc/Display/2002-072-00
Reporting	Protect and Improve Tributary Habitat	34	All	BPA	2003-022-00	CCT OBMEP	3/1/2003	http://www.cbfish.org/Project.mvc/Display/2003-022-00
Habitat	Protect and Improve Tributary Habitat	34	All	BPA	2007-034-00	Columbia Cascade Pump Screen Correction	8/15/2007	http://www.cbfish.org/Project.mvc/Display/2007-034-00
Habitat	Protect and Improve Tributary Habitat	34	All	BPA	2007-035-00	UPA Project - Methow Basin Riparian Enhancement	8/20/2007	http://www.cbfish.org/Project.mvc/Display/2007-035-00
Habitat	Protect and Improve Tributary Habitat	34	All	BPA	2007-055-00	Entiat River - UPA - Lower Entiat River Off-Channel Restoration Project	10/1/2006	http://www.cbfish.org/Project.mvc/Display/2007-055-00
Habitat	Protect and Improve Tributary Habitat	34	All	BPA	2007-064-00	Protect and Restore Slate Creek	9/1/2007	http://www.cbfish.org/Project.mvc/Display/2007-064-00
Habitat	Protect and Improve Tributary Habitat	34	All	BPA	2007-065-00	Coordinate and implement tributary habitat restoration in the Little Salmon River and lower Salmon River Idaho	5/1/2007	http://www.cbfish.org/Project.mvc/Display/2007-065-00
Habitat	Protect and Improve Tributary Habitat	34	All	BPA	2007-077-00	Hemlock Dam Removal	6/15/2007	http://www.cbfish.org/Project.mvc/Display/2007-077-00
Habitat	Protect and Improve Tributary Habitat	34	All	BPA	2007-086-00	UPA Wenatchee Subbasin Riparian Enhancement Proposal	9/27/2007	http://www.cbfish.org/Project.mvc/Display/2007-086-00
Habitat	Protect and Improve Tributary Habitat	34	All	BPA	2007-112-00	Teanaway Watershed - Protect critical habitat from development, reduce water temperatures and increase instream flows, restore habitat forming processes in the floodplain	1/7/2007	http://www.cbfish.org/Project.mvc/Display/2007-112-00

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H-Section	BiOp Strategy	RPA #	RPA Subaction	Agency	Project #	Project Title	Start Date	Action Information Link
Habitat	Protect and Improve Tributary Habitat	34	All	BPA	2007-113-00	Cowiche Restoration and Protection Project (Easement/Fee Simple Acquisition)	9/30/2007	http://www.cbfish.org/Project.mvc/Display/2007-113-00
Habitat	Protect and Improve Tributary Habitat	34	All	BPA	2007-127-00	Reestablish Connectivity and Restore Fish Habitat in the East Fork of the South Fork Salmon River Watershed	7/1/2007	http://www.cbfish.org/Project.mvc/Display/2007-127-00
Habitat	Protect and Improve Tributary Habitat	34	All	BPA	2007-145-00	Okanogan Livestock and Water	9/1/2007	http://www.cbfish.org/Project.mvc/Display/2007-145-00
Habitat	Protect and Improve Tributary Habitat	34	All	BPA	2007-172-00	UPA Project - MVID West Canal Diversion and Headworks	10/1/2006	http://www.cbfish.org/Project.mvc/Display/2007-172-00
Habitat	Protect and Improve Tributary Habitat	34	All	BPA	2007-194-00	Oak Flats Acquisition and Habitat Enhancement	10/1/2007	http://www.cbfish.org/Project.mvc/Display/2007-194-00
Habitat	Protect and Improve Tributary Habitat	34	All	BPA	2007-214-00	UPA Project - Fender Mill Floodplain Restoration – Phase 1	8/20/2007	http://www.cbfish.org/Project.mvc/Display/2007-214-00
Habitat	Protect and Improve Tributary Habitat	34	All	BPA	2007-217-00	Operation and Maintenance for Walla Walla Basin Passage Projects	1/1/2007	http://www.cbfish.org/Project.mvc/Display/2007-217-00
Habitat	Protect and Improve Tributary Habitat	34	All	BPA	2007-224-00	Implementation of the Okanogan Subbasin Plan. Initiate a Programmatic and Sequenced set of Key Habitat Restoration and Protection Actions	2/1/2007	http://www.cbfish.org/Project.mvc/Display/2007-224-00
Habitat	Protect and Improve Tributary Habitat	34	All	BPA	2007-231-00	UPA Entiat Subbasin Riparian Enhancement Program	9/17/2007	http://www.cbfish.org/Project.mvc/Display/2007-231-00
Habitat	Protect and Improve Tributary Habitat	34	All	BPA	2007-237-00	UPA Project - Elbow Coulee Floodplain Restoration	6/1/2007	http://www.cbfish.org/Project.mvc/Display/2007-237-00

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H-Section	BiOp Strategy	RPA #	RPA Subaction	Agency	Project #	Project Title	Start Date	Action Information Link
Habitat	Protect and Improve Tributary Habitat	34	All	BPA	2007-251-00	UPA Project - Methow Valley Irrigation District East Diversion Dam Replacement	10/1/2006	http://www.cbfish.org/Project.mvc/Display/2007-251-00
Habitat	Protect and Improve Tributary Habitat	34	All	BPA	2007-264-00	UPA Project - Programmatic Habitat Complexity Projects in the Methow River Subbasin	9/24/2007	http://www.cbfish.org/Project.mvc/Display/2007-264-00
Habitat	Protect and Improve Tributary Habitat	34	All	BPA	2007-268-00	Idaho Watershed Habitat Restoration Project via Custer Soil and Water Conservation District	6/1/2007	http://www.cbfish.org/Project.mvc/Display/2007-268-00
Habitat	Protect and Improve Tributary Habitat	34	All	BPA	2007-318-00	Entiat River - UPA - Knapp-Wham Hanan Detwiler Irrigation System Consolidation Project	6/8/2007	http://www.cbfish.org/Project.mvc/Display/2007-318-00
Habitat	Protect and Improve Tributary Habitat	34	All	BPA	2007-325-00	UPA Wenatchee Subbasin Complexity Proposal	9/27/2007	http://www.cbfish.org/Project.mvc/Display/2007-325-00
Habitat	Protect and Improve Tributary Habitat	34	All	BPA	2007-393-00	NPT Protect and Restore NE OR	7/1/2007	http://www.cbfish.org/Project.mvc/Display/2007-393-00
Habitat	Protect and Improve Tributary Habitat	34	All	BPA	2007-394-00	Idaho Watershed Habitat Restoration Lemhi County	8/1/2007	http://www.cbfish.org/Project.mvc/Display/2007-394-00
Habitat	Protect and Improve Tributary Habitat	34	All	BPA	2007-395-00	Protect and Restore the Upper Lochsa Watershed	5/1/2007	http://www.cbfish.org/Project.mvc/Display/2007-395-00
Habitat	Protect and Improve Tributary Habitat	34	All	BPA	2007-396-00	Walla Walla Basinwide Tributary Passage and Instream Flow	9/1/2007	http://www.cbfish.org/Project.mvc/Display/2007-396-00
Habitat	Protect and Improve Tributary Habitat	34	All	BPA	2007-397-00	John Day Tributary/Passage & Flow	2/1/2007	http://www.cbfish.org/Project.mvc/Display/2007-397-00
Habitat	Protect and Improve Tributary Habitat	34	All	BPA	2007-398-00	Yakima River Basinwide Tributary/Passage & Flow	6/1/2007	http://www.cbfish.org/Project.mvc/Display/2007-398-00
Habitat	Protect and Improve Tributary Habitat	34	All	BPA	2007-399-00	Upper Salmon Screen Tributary Passage	6/1/2007	http://www.cbfish.org/Project.mvc/Display/2007-399-00

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H-Section	BiOp Strategy	RPA #	RPA Subaction	Agency	Project #	Project Title	Start Date	Action Information Link
Habitat	Protect and Improve Tributary Habitat	34	All	BPA	2007-400-00	Wenatchee Basinwide Passage	6/1/2007	http://www.cbfish.org/Project.mvc/Display/2007-400-00
Habitat	Protect and Improve Tributary Habitat	36	All	BPA	1999-025-00	Sandy River Delta Habitat Restoration	7/1/1999	http://www.cbfish.org/Project.mvc/Display/1999-025-00
Habitat	Improve Fish Survival in Estuary Habitat	36	All	BPA	2003-011-00	Columbia R/Estuary Habitat	5/21/2003	http://www.cbfish.org/Project.mvc/Display/2003-011-00
Habitat	Improve Fish Survival in Estuary Habitat	36	All	BPA	2003-013-00	Grays River Watershed Restoration	5/15/2003	http://www.cbfish.org/Project.mvc/Display/2003-013-00
Hatchery	Ensure Funded Hatchery Programs are not Impeding Recovery	40	All	BPA	2008-712-00	Implement Hatchery Reform Action	10/1/2009	http://www.cbfish.org/Project.mvc/Display/2008-712-00
Hatchery	Execute on Safety Net and Conservation Objectives	41	All	BPA	1996-043-00	Johnson Creek Artificial Propagation Enhancement Project	1/1/1996	http://www.cbfish.org/Project.mvc/Display/1996-043-00
Hatchery	Execute on Safety Net and Conservation Objectives	41	All	BPA	2000-019-00	Tucannon River Spring Chinook Captive Broodstock Program	10/1/2000	http://www.cbfish.org/Project.mvc/Display/2000-019-00
Hatchery	Execute on Safety Net and Conservation Objectives	41	All	BPA	2007-402-00	Snake River Sockeye Salmon Captive Propagation	7/1/2007	http://www.cbfish.org/Project.mvc/Display/2007-402-00
Hatchery	Execute on Safety Net and Conservation Objectives	41	All	BPA	2007-403-00	ID Snake River Spr/Summer Chinook Captive Propagation	12/1/2007	http://www.cbfish.org/Project.mvc/Display/2007-403-00
Hatchery	Execute on Safety Net and Conservation Objectives	41	All	BPA	2007-404-00	OR Snake River Spring/Summer Chinook Salmon Captive Propagation	1/1/2007	http://www.cbfish.org/Project.mvc/Display/2007-404-00

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H-Section	BiOp Strategy	RPA #	RPA Subaction	Agency	Project #	Project Title	Start Date	Action Information Link
Hatchery	Execute on Safety Net and Conservation Objectives	42	All	BPA	2001-053-00	Reintroduction of Chum Salmon into Duncan Creek	10/1/2001	http://www.cbfish.org/Project.mvc/Display/2001-053-00
Hatchery	Execute on Safety Net and Conservation Objectives	42	All	BPA	2003-023-00	Chief Joseph Hatchery Program	7/1/2003	http://www.cbfish.org/Project.mvc/Display/2003-023-00
Hatchery	Execute on Safety Net and Conservation Objectives	42	All	BPA	2007-212-00	Develop a locally-adapted summer steelhead program to supplement natural production throughout the Okanogan River basin	7/1/2007	http://www.cbfish.org/Project.mvc/Display/2007-212-00
Hatchery	Execute on Safety Net and Conservation Objectives	42	All	BPA	2007-401-00	Kelt Reconditioning/ Reproductive Success	4/1/2007	http://www.cbfish.org/Project.mvc/Display/2007-401-00
Hatchery	Execute on Safety Net and Conservation Objectives	42	All	BPA	2007-402-00	Snake River Sockeye Salmon Captive Propagation	7/1/2007	http://www.cbfish.org/Project.mvc/Display/2007-402-00
Hatchery	Execute on Safety Net and Conservation Objectives	42	All	BPA	2008-458-00	Upper Columbia Steelhead Kelt Reconditioning	10/1/2007	http://www.cbfish.org/Project.mvc/Display/2008-458-00
Hatchery	Execute on Safety Net and Conservation Objectives	42	All	BPA	2008-710-00	Assess habitat potential for reintroduction of CR chum in tributaries below Bonneville Dam	5/1/2009	http://www.cbfish.org/Project.mvc/Display/2008-710-00
Predation Management	Implement Piscivorous Predation Control Measures	43	All	BPA	1990-077-00	Development of Systemwide Predator Control	1990	http://www.cbfish.org/Project.mvc/Display/1990-077-00
Predation Management	Implement Avian Predation Control Measures	45	All	BPA	1997-024-00	Avian Predation on Juvenile Salmonids	1997	http://www.cbfish.org/Project.mvc/Display/1997-024-00

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H-Section	BiOp Strategy	RPA #	RPA Subaction	Agency	Project #	Project Title	Start Date	Action Information Link
Predation Management	Implement Avian Predation Control Measures	46	All	BPA	1997-024-00	Avian Predation on Juvenile Salmonids	1997	http://www.cbfish.org/Project.mvc/Display/1997-024-00
Predation Management	Implement Avian Predation Control Measures	47	All	BPA	1997-024-00	Avian Predation on Juvenile Salmonids	1997	http://www.cbfish.org/Project.mvc/Display/1997-024-00
Predation Management	Implement Marine Mammal Control Measures	49	All	BPA	2008-003-00	Removal of Sea Lions at Bonneville Dam	2008	http://www.cbfish.org/Project.mvc/Display/2008-003-00
Predation Management	Implement Marine Mammal Control Measures	49	All	BPA	2008-004-00	Sea Lion Non-Lethal Hazing	2008	http://www.cbfish.org/Project.mvc/Display/2008-004-00
RM&E	Monitor the Status of Selected Fish Populations	50	4,5,6,7	BPA	198201301	Coded Wire Tag-Pacific States Marine Fisheries Commission (PSMFC)	2008	http://www.cbfish.org/Project.mvc/Display/198201301
RM&E	Monitor the Status of Selected Fish Populations	50	6,7	BPA	198201302	Coded Wire Tag-Oregon Department of Fish and Wildlife (ODFW)	2008	http://www.cbfish.org/Project.mvc/Display/198201302
RM&E	Monitor the Status of Selected Fish Populations	50	6,7	BPA	198201303	Coded Wire Tag-US Fish and Wildlife Service (USFWS)	2008	http://www.cbfish.org/Project.mvc/Display/198201303
RM&E	Monitor the Status of Selected Fish Populations	50	6,7	BPA	198201304	Coded Wire Tag-Washington Department of Fish and Wildlife (WDFW)	2008	http://www.cbfish.org/Project.mvc/Display/198201304
RM&E	Monitor the Status of Selected Fish Populations	50	6,7	BPA	198335000	Nez Perce Tribal Hatchery Operations and Maintenance (O&M)	2008	http://www.cbfish.org/Project.mvc/Display/198335000
RM&E	Monitor the Status of Selected Fish Populations	50	5,6,7	BPA	198335003	Nez Perce Tribal Hatchery Monitoring and Evaluation (M&E)	2008	http://www.cbfish.org/Project.mvc/Display/198335003
RM&E	Monitor the Status of Selected Fish Populations	50	6	BPA	198402500	Blue Mountain Fish Habitat Improvement	2008	http://www.cbfish.org/Project.mvc/Display/198402500

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H-Section	BiOp Strategy	RPA #	RPA Subaction	Agency	Project #	Project Title	Start Date	Action Information Link
RM&E	Monitor the Status of Selected Fish Populations	50	3,4,6,7	BPA	198712700	Smolt Monitoring by Non-Federal Entities	2008	http://www.cbfish.org/Project.mvc/Display/198712700
RM&E	Monitor the Status of Selected Fish Populations	50	6	BPA	198802200	Umatilla Fish Passage Operations	2008	http://www.cbfish.org/Project.mvc/Display/198802200
RM&E	Monitor the Status of Selected Fish Populations	50	4,6,7	BPA	198805303	Hood River Production Monitoring and Evaluation (M&E)-Warm Springs	2008	http://www.cbfish.org/Project.mvc/Display/198805303
RM&E	Monitor the Status of Selected Fish Populations	50	6,7	BPA	198805304	Hood River Production Monitor and Evaluation (M&E)-Oregon Department of Fish and Wildlife (ODFW)	2008	http://www.cbfish.org/Project.mvc/Display/198805304
RM&E	Monitor the Status of Selected Fish Populations	50	7	BPA	198805307	Hood River Production Operations and Maintenance (O&M)-Warm Springs	2008	http://www.cbfish.org/Project.mvc/Display/198805307
RM&E	Monitor the Status of Selected Fish Populations	50	6,7	BPA	198805308	Hood River Production Operations and Maintenance (O&M) and Powerdale	2008	http://www.cbfish.org/Project.mvc/Display/198805308
RM&E	Monitor the Status of Selected Fish Populations	50	1,3,6	BPA	198902401	Evaluate Umatilla Juvenile Salmonid Outmigration	2008	http://www.cbfish.org/Project.mvc/Display/198902401
RM&E	Monitor the Status of Selected Fish Populations	50	5,6,7	BPA	198909800	Salmon Studies in Idaho Rivers-Idaho Department of Fish and Game (IDFG)	2008	http://www.cbfish.org/Project.mvc/Display/198909800
RM&E	Monitor the Status of Selected Fish Populations	50	4	BPA	198910700	Statistical Support For Salmon	2008	http://www.cbfish.org/Project.mvc/Display/198910700
RM&E	Monitor the Status of Selected Fish Populations	50	1,7	BPA	199000500	Umatilla Hatchery Monitoring and Evaluation (M&E)	2008	http://www.cbfish.org/Project.mvc/Display/199000500

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H-Section	BiOp Strategy	RPA #	RPA Subaction	Agency	Project #	Project Title	Start Date	Action Information Link
RM&E	Monitor the Status of Selected Fish Populations	50	4	BPA	199004400	Coeur D'Alene Reservation Fisheries Habitat	2008	http://www.cbfish.org/Project.mvc/Display/199004400
RM&E	Monitor the Status of Selected Fish Populations	50	5,6,7	BPA	199005500	Idaho Steelhead Monitoring and Evaluation (M&E) Studies	2008	http://www.cbfish.org/Project.mvc/Display/199005500
RM&E	Monitor the Status of Selected Fish Populations	50	1	BPA	199008000	Columbia Basin Pit-Tag Information	2008	http://www.cbfish.org/Project.mvc/Display/199008000
RM&E	Monitor the Status of Selected Fish Populations	50	1,3,5	BPA	199102800	Pit Tagging Wild Chinook	2008	http://www.cbfish.org/Project.mvc/Display/199102800
RM&E	Monitor the Status of Selected Fish Populations	50	4,5,6	BPA	199107300	Idaho Natural Production Monitoring. Clearwater, Lochsa, Selway, SF Clearwater, Chamberlain, EF Salmon, Lemhi, Little Salmon, Lower MF Salmon, NF Salmon, Pahsimeroi, Panther Cr, Secesh, SF Salmon, Upper MF Salmon, Upper Salmon	2008	http://www.cbfish.org/Project.mvc/Display/199107300
RM&E	Monitor the Status of Selected Fish Populations	50	6	BPA	199202604	Grand Ronde Early Life History of Spring Chinook and Steelhead	2008	http://www.cbfish.org/Project.mvc/Display/199202604
RM&E	Monitor the Status of Selected Fish Populations	50	2	BPA	199302900	Survival Estimate for Passage through Snake and Columbia River Dams and Reservoirs	2008	http://www.cbfish.org/Project.mvc/Display/199302900
RM&E	Monitor the Status of Selected Fish Populations	50	5	BPA	199303701	ID Steelhead M&E Studies	2008	http://www.cbfish.org/Project.mvc/Display/199303701
RM&E	Monitor the Status of Selected Fish Populations	50	3	BPA	199403300	Fish Passage Center	2008	http://www.cbfish.org/Project.mvc/Display/199403300

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H-Section	BiOp Strategy	RPA #	RPA Subaction	Agency	Project #	Project Title	Start Date	Action Information Link
RM&E	Monitor the Status of Selected Fish Populations	50	6,7	BPA	199506325	Yakima River Monitoring and Evaluation-Yakima/Klickitat Fisheries Project (YKFP)	2008	http://www.cbfish.org/Project.mvc/Display/199506325
RM&E	Monitor the Status of Selected Fish Populations	50	6,7	BPA	199506335	Klickitat River Monitoring and Evaluation-Yakima/Klickitat Fisheries Project (YKFP)	2008	http://www.cbfish.org/Project.mvc/Display/199506335
RM&E	Monitor the Status of Selected Fish Populations	50	1,3,5,6,7	BPA	199602000	Comparative Survival Study (CSS)	2008	http://www.cbfish.org/Project.mvc/Display/199602000
RM&E	Monitor the Status of Selected Fish Populations	50	6	BPA	199603501	Yakama Reservation Watershed Project	2008	http://www.cbfish.org/Project.mvc/Display/199603501
RM&E	Monitor the Status of Selected Fish Populations	50	6,7	BPA	199604300	Johnson Creek Artificial Propagation Enhancement	2008	http://www.cbfish.org/Project.mvc/Display/199604300
RM&E	Monitor the Status of Selected Fish Populations	50	6,7	BPA	199701501	Imnaha River Smolt Monitoring	2008	http://www.cbfish.org/Project.mvc/Display/199701501
RM&E	Monitor the Status of Selected Fish Populations	50	6	BPA	199703000	Chinook Salmon Adult Abundance Monitoring	2008	http://www.cbfish.org/Project.mvc/Display/199703000
RM&E	Monitor the Status of Selected Fish Populations	50	6,7	BPA	199800702	Grande Ronde Supplementation Operations and Maintenance (O&M) and Monitoring and Evaluation (M&E) on Lostine River	2008	http://www.cbfish.org/Project.mvc/Display/199800702
RM&E	Monitor the Status of Selected Fish Populations	50	6,7	BPA	199800703	Grande Ronde Supplementation O&M on Catherine Creek/Upper Grande Ronde River	2008	http://www.cbfish.org/Project.mvc/Display/199800703
RM&E	Monitor the Status of Selected Fish Populations	50	6	BPA	199801003	Spawning Distribution of Snake River Fall Chinook Salmon	2008	http://www.cbfish.org/Project.mvc/Display/199801003

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H-Section	BiOp Strategy	RPA #	RPA Subaction	Agency	Project #	Project Title	Start Date	Action Information Link
RM&E	Monitor the Status of Selected Fish Populations	50	4,6	BPA	199801600	Escapement and Productivity of Spring Chinook and Steelhead	2008	http://www.cbfish.org/Project.mvc/Display/199801600
RM&E	Monitor the Status of Selected Fish Populations	50	6,7	BPA	199801900	Wind River Watershed	2008	http://www.cbfish.org/Project.mvc/Display/199801900
RM&E	Monitor the Status of Selected Fish Populations	50	6	BPA	200003900	Walla Walla River Basin Monitoring and Evaluation (M&E)	2008	http://www.cbfish.org/Project.mvc/Display/200003900
RM&E	Monitor the Status of Selected Fish Populations	50	1,2	BPA	200100300	Adult Pit Detector Installation	2008	http://www.cbfish.org/Project.mvc/Display/200100300
RM&E	Monitor the Status of Selected Fish Populations	50	6	BPA	200203200	Snake River Fall Chinook Salmon Life History Investigations	2008	http://www.cbfish.org/Project.mvc/Display/200203200
RM&E	Monitor the Status of Selected Fish Populations	50	6	BPA	200205300	Asotin Creek Salmon Population Assessment	2008	http://www.cbfish.org/Project.mvc/Display/200205300
RM&E	Monitor the Status of Selected Fish Populations	50	4,5,6	BPA	200301700	Integrated Status and Effectiveness Monitoring Program (ISEMP)	2008	http://www.cbfish.org/Project.mvc/Display/200301700
RM&E	Monitor the Status of Selected Fish Populations	50	4,6	BPA	200302200	Okanogan Basin Monitoring & Evaluation Program (OBMEP)	2008	http://www.cbfish.org/Project.mvc/Display/200302200
RM&E	Monitor the Status of Selected Fish Populations	50	4,6	BPA	200303900	Monitor and Evaluate (M&E) Reproductive Success and Survival in Wenatchee River	2008	http://www.cbfish.org/Project.mvc/Display/200303900
RM&E	Monitor the Status of Selected Fish Populations	50	6	BPA	200305400	Evaluate the Relative Reproductive Success of Hatchery-Origin and Wild-Origin Steelhead Spawning Naturally in the Hood River	2008	http://www.cbfish.org/Project.mvc/Display/200305400
RM&E	Monitor the Status of Selected Fish Populations	50	2,5	BPA	200500200	Lower Granite Dam Adult Trap Operations	2008	http://www.cbfish.org/Project.mvc/Display/200500200

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H-Section	BiOp Strategy	RPA #	RPA Subaction	Agency	Project #	Project Title	Start Date	Action Information Link
RM&E	Monitor the Status of Selected Fish Populations	50	6,7	BPA	200708300	Grande Ronde Supplementation Monitoring and Evaluation (M&E) on Catherine Creek/Upper Grande Ronde River	2008	http://www.cbfish.org/Project.mvc/Display/200708300
RM&E	Monitor the Status of Selected Fish Populations	50	5,6	BPA	200723300	Distribution and Abundance Monitoring of Oncorhynchus mykiss within the Lower Clearwater Subbasin	2008	http://www.cbfish.org/Project.mvc/Display/200723300
RM&E	Monitor the Status of Selected Fish Populations	50	6	BPA	200733700	Oregon Plan Monitoring of Steelhead Status, Trend, and Habitat in the Grande Ronde River Subbasin	2008	http://www.cbfish.org/Project.mvc/Display/200703700
RM&E	Monitor the Status of Selected Fish Populations	50	6	BPA	200733700	Oregon Plan Monitoring of Steelhead Status, Trend, and Habitat in the Grande Ronde River Subbasin	2008	http://www.cbfish.org/Project.mvc/Display/200703700
RM&E	Monitor the Status of Selected Fish Populations	50	6	BPA	200740300	Spring Chinook Captive Propagation-Idaho	2008	http://www.cbfish.org/Project.mvc/Display/200740300
RM&E	Monitor the Status of Selected Fish Populations	50	6,7	BPA	200740400	Spring Chinook Captive Propagation-Oregon	2008	http://www.cbfish.org/Project.mvc/Display/200740400
RM&E	Monitor the Status of Selected Fish Populations	50	6	BPA	200830600	Deschutes fall Chinook research	2008	http://www.cbfish.org/Project.mvc/Display/200830600
RM&E	Monitor the Status of Selected Fish Populations	50	3,6	BPA	200831100	Natural Production Management and Monitoring	2008	http://www.cbfish.org/Project.mvc/Display/200831100
RM&E	Monitor the Status of Selected Fish Populations	50	3	BPA	200872400	Pittag Sr Sockeye-Uc Sp.Chnook	2008	http://www.cbfish.org/Project.mvc/Display/200872400

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H-Section	BiOp Strategy	RPA #	RPA Subaction	Agency	Project #	Project Title	Start Date	Action Information Link
RM&E	Monitor the Status of Selected Fish Populations	50	4	BPA	200900200	Status and Trend Annual Reporting	2009	http://www.cbfish.org/Project.mvc/Display/200900200
RM&E	Monitor the Status of Selected Fish Populations	51	1,3	BPA	198201301	Coded Wire Tag-Pacific States Marine Fisheries Commission (PSMFC)	2008	http://www.cbfish.org/Project.mvc/Display/198201301
RM&E	Monitor the Status of Selected Fish Populations	51	1	BPA	198201304	Coded Wire Tag-Washington Department of Fish and Wildlife (WDFW)	2008	http://www.cbfish.org/Project.mvc/Display/198201304
RM&E	Monitor the Status of Selected Fish Populations	51	1,3	BPA	198810804	StreamNet - Coordinated Information System (CIS)/ Northwest Environmental Database (NED)	2008	http://www.cbfish.org/Project.mvc/Display/198810804
RM&E	Monitor the Status of Selected Fish Populations	51	1	BPA	198909800	Salmon Studies in Idaho Rivers-Idaho Department of Fish and Game (IDFG)	2008	http://www.cbfish.org/Project.mvc/Display/198909800
RM&E	Monitor the Status of Selected Fish Populations	51	1,3	BPA	199403300	Fish Passage Center	2008	http://www.cbfish.org/Project.mvc/Display/199403300
RM&E	Monitor the Status of Selected Fish Populations	51	1,3	BPA	199604300	Johnson Creek Artificial Propagation Enhancement	2008	http://www.cbfish.org/Project.mvc/Display/199604300
RM&E	Monitor the Status of Selected Fish Populations	51	1	BPA	199703000	Chinook Salmon Adult Abundance Monitoring	2008	http://www.cbfish.org/Project.mvc/Display/199703000
RM&E	Monitor the Status of Selected Fish Populations	51	1,2,3	BPA	200400200	Pacific Northwest Aquatic Monitoring Program (PNAMP) Coordination	2008	http://www.cbfish.org/Project.mvc/Display/200400200
RM&E	Monitor the Status of Selected Fish Populations	51	3	BPA	200721600	Pacific NW Aquatic Monitoring Program (PNAMP) Research, Monitoring and Evaluation (RM&E) Design and Protocols	2008	http://www.cbfish.org/Project.mvc/Display/200721600

Attachment 1 - Table 1. BPA Project List

H-Section	BiOp Strategy	RPA #	RPA Subaction	Agency	Project #	Project Title	Start Date	Action Information Link
RM&E	Monitor the Status of Selected Fish Populations	51	1	BPA	200740700	Upper Snake River Tribes Regional Coord	2008	http://www.cbfish.org/Project.mvc/Display/200740700
RM&E	Monitor the Status of Selected Fish Populations	51	1,3	BPA	200850500	Streamnet Library	2008	http://www.cbfish.org/Project.mvc/Display/200850500
RM&E	Monitor the Status of Selected Fish Populations	51	1	BPA	200860700	Nutrient Enhancement Project	2008	http://www.cbfish.org/Project.mvc/Display/200860700
RM&E	Monitor the Status of Selected Fish Populations	51	2	BPA	200873300	Regional Strategy-Status/Trend	2008	http://www.cbfish.org/Project.mvc/Display/200873300
RM&E	Hydrosystem RM&E	52	2	BPA	198331900	New Marking Monitoring Techniques	2008	http://www.cbfish.org/Project.mvc/Display/198331900
RM&E	Hydrosystem RM&E	52	1,2,3,4,5,7	BPA	198712700	Smolt Monitoring by Non-Federal Entities	2008	http://www.cbfish.org/Project.mvc/Display/198712700
RM&E	Hydrosystem RM&E	52	2	BPA	198909800	Salmon Studies in Idaho Rivers-Idaho Department of Fish and Game (IDFG)	2008	http://www.cbfish.org/Project.mvc/Display/198909800
RM&E	Hydrosystem RM&E	52	2	BPA	199102800	Pit Tagging Wild Chinook	2008	http://www.cbfish.org/Project.mvc/Display/199102800
RM&E	Hydrosystem RM&E	52	1,3	BPA	199105100	Modeling and Evaluation Statistical Support for Life-Cycle Studies	2008	http://www.cbfish.org/Project.mvc/Display/199105100
RM&E	Hydrosystem RM&E	52	2	BPA	199302900	Survival Estimate for Passage through Snake and Columbia River Dams and Reservoirs	2008	http://www.cbfish.org/Project.mvc/Display/199302900
RM&E	Hydrosystem RM&E	52	6	BPA	199403300	Fish Passage Center	2008	http://www.cbfish.org/Project.mvc/Display/199403300
RM&E	Hydrosystem RM&E	52	2	BPA	199602000	Comparative Survival Study (CSS)	2008	http://www.cbfish.org/Project.mvc/Display/199602000

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H-Section	BiOp Strategy	RPA #	RPA Subaction	Agency	Project #	Project Title	Start Date	Action Information Link
RM&E	Hydrosystem RM&E	52	7	BPA	200302200	Okanogan Basin Monitoring & Evaluation Program (OBMEP)	2008	http://www.cbfish.org/Project.mvc/Display/200302200
RM&E	Hydrosystem RM&E	52	1,2	BPA	200304100	Evaluate Delayed (Extra) Mortality Associated with Passage of Yearling Chinook Salmon through Snake River Dams	2008	http://www.cbfish.org/Project.mvc/Display/200304100
RM&E	Hydrosystem RM&E	52	2	BPA	200311400	Pacific Ocean Survey Tracking (POST)	2008	http://www.cbfish.org/Project.mvc/Display/200311400
RM&E	Hydrosystem RM&E	52	3,7	BPA	200500200	Lower Granite Dam Adult Trap Operations	2008	http://www.cbfish.org/Project.mvc/Display/200500200
RM&E	Hydrosystem RM&E	52	4,5	BPA	200872400	Pittag Sr Sockeye-Uc Sp.Chinook	2008	http://www.cbfish.org/Project.mvc/Display/200872400
RM&E	Hydrosystem RM&E	52	6	BPA	200902000	UW-CBR Internal Statistical / Technical Support to BPA (Skalski)	2009	http://www.cbfish.org/Project.mvc/Display/200902000
RM&E	Hydrosystem RM&E	53	5	BPA	198331900	New Marking Monitoring Techniques	2008	http://www.cbfish.org/Project.mvc/Display/198331900
RM&E	Hydrosystem RM&E	53	1,2,3,4	BPA	198712700	Smolt Monitoring by Non-Federal Entities	2008	http://www.cbfish.org/Project.mvc/Display/198712700
RM&E	Hydrosystem RM&E	53	2,3	BPA	198909800	Salmon Studies in Idaho Rivers-Idaho Department of Fish and Game (IDFG)	2008	http://www.cbfish.org/Project.mvc/Display/198909800
RM&E	Hydrosystem RM&E	53	2,3	BPA	199005500	Idaho Steelhead Monitoring and Evaluation (M&E) Studies	2008	http://www.cbfish.org/Project.mvc/Display/199005500
RM&E	Hydrosystem RM&E	53	2,3	BPA	199102800	Pit Tagging Wild Chinook	2008	http://www.cbfish.org/Project.mvc/Display/199102800
RM&E	Hydrosystem RM&E	53	1,2	BPA	199102900	Research, monitoring, and evaluation of emerging issues and measures to recover the Snake River fall Chinook salmon ESU	2008	http://www.cbfish.org/Project.mvc/Display/199102900

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H-Section	BiOp Strategy	RPA #	RPA Subaction	Agency	Project #	Project Title	Start Date	Action Information Link
RM&E	Hydrosystem RM&E	53	1,2	BPA	199105100	Modeling and Evaluation Statistical Support for Life-Cycle Studies	2008	http://www.cbfish.org/Project.mvc/Display/199105100
RM&E	Hydrosystem RM&E	53	1,2,3	BPA	199403300	Fish Passage Center	2008	http://www.cbfish.org/Project.mvc/Display/199403300
RM&E	Hydrosystem RM&E	53	2,3	BPA	199602000	Comparative Survival Study (CSS)	2008	http://www.cbfish.org/Project.mvc/Display/199602000
RM&E	Hydrosystem RM&E	53	2	BPA	199602100	Gas Bubble Disease Monitoring	2008	http://www.cbfish.org/Project.mvc/Display/199602100
RM&E	Hydrosystem RM&E	53	2,3	BPA	200304100	Evaluate Delayed (Extra) Mortality Associated with Passage of Yearling Chinook Salmon through Snake River Dams	2008	http://www.cbfish.org/Project.mvc/Display/200304100
RM&E	Hydrosystem RM&E	53	1,2,3	BPA	200850600	Smolt Monitoring Video Feasibility Project	2008	http://www.cbfish.org/Project.mvc/Display/200850600
RM&E	Hydrosystem RM&E	54	1,9,13,14	BPA	198331900	New Marking Monitoring Techniques	2008	http://www.cbfish.org/Project.mvc/Display/198331900
RM&E	Hydrosystem RM&E	54	5,6,7	BPA	198712700	Smolt Monitoring by Non-Federal Entities	2008	http://www.cbfish.org/Project.mvc/Display/198712700
RM&E	Hydrosystem RM&E	54	1,5,6,7,8,9,10,12	BPA	198909800	Salmon Studies in Idaho Rivers-Idaho Department of Fish and Game (IDFG)	2008	http://www.cbfish.org/Project.mvc/Display/198909800
RM&E	Hydrosystem RM&E	54	1,5,6,7,8,10,12	BPA	199005500	Idaho Steelhead Monitoring and Evaluation (M&E) Studies	2008	http://www.cbfish.org/Project.mvc/Display/199005500
RM&E	Hydrosystem RM&E	54	8	BPA	199007700	Development of Systemwide Predator Control	2008	http://www.cbfish.org/Project.mvc/Display/199007700
RM&E	Hydrosystem RM&E	54	6,7,8,10,12,	BPA	199102800	Pit Tagging Wild Chinook	2008	http://www.cbfish.org/Project.mvc/Display/199102800

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H-Section	BiOp Strategy	RPA #	RPA Subaction	Agency	Project #	Project Title	Start Date	Action Information Link
RM&E	Hydrosystem RM&E	54	2,7	BPA	199302900	Survival Estimate for Passage through Snake and Columbia River Dams and Reservoirs	2008	http://www.cbfish.org/Project.mvc/Display/199302900
RM&E	Hydrosystem RM&E	54	2,13	BPA	199403300	Fish Passage Center	2008	http://www.cbfish.org/Project.mvc/Display/199403300
RM&E	Hydrosystem RM&E	54	1	BPA	199602000	Comparative Survival Study (CSS)	2008	http://www.cbfish.org/Project.mvc/Display/199602000
RM&E	Hydrosystem RM&E	54	5,6,7,8, 10,12	BPA	199602000	Comparative Survival Study (CSS)	2008	http://www.cbfish.org/Project.mvc/Display/199602000
RM&E	Hydrosystem RM&E	54	8	BPA	199702400	Avian Predation on Juvenile Salmonids	2008	http://www.cbfish.org/Project.mvc/Display/199702400
RM&E	Hydrosystem RM&E	54	11	BPA	200100300	Adult Pit Detector Installation	2008	http://www.cbfish.org/Project.mvc/Display/200100300
RM&E	Hydrosystem RM&E	54	1,5,6,7,8,12	BPA	200304100	Evaluate Delayed (Extra) Mortality Associated with Passage of Yearling Chinook Salmon through Snake River Dams	2008	http://www.cbfish.org/Project.mvc/Display/200304100
RM&E	Hydrosystem RM&E	54	9	BPA	200753500	Physical and Biological Testing of a Flow Velocity Enhancement System (FVES)	2008	http://www.cbfish.org/Project.mvc/Display/200753500
RM&E	Hydrosystem RM&E	55	4,5,7,8,9	BPA	198331900	New Marking Monitoring Techniques	2008	http://www.cbfish.org/Project.mvc/Display/198331900
RM&E	Hydrosystem RM&E	55	1,2,4	BPA	198712700	Smolt Monitoring by Non-Federal Entities	2008	http://www.cbfish.org/Project.mvc/Display/198712700
RM&E	Hydrosystem RM&E	55	1,2	BPA	198909800	Salmon Studies in Idaho Rivers-Idaho Department of Fish and Game (IDFG)	2008	http://www.cbfish.org/Project.mvc/Display/198909800
RM&E	Hydrosystem RM&E	55	1,2	BPA	199005500	Idaho Steelhead Monitoring and Evaluation (M&E) Studies	2008	http://www.cbfish.org/Project.mvc/Display/199005500

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H-Section	BiOp Strategy	RPA #	RPA Subaction	Agency	Project #	Project Title	Start Date	Action Information Link
RM&E	Hydrosystem RM&E	55	1,2	BPA	199102800	Pit Tagging Wild Chinook	2008	http://www.cbfish.org/Project.mvc/Display/199102800
RM&E	Hydrosystem RM&E	55	4	BPA	199102900	Research, monitoring, and evaluation of emerging issues and measures to recover the Snake River fall Chinook salmon ESU	2008	http://www.cbfish.org/Project.mvc/Display/199102900
RM&E	Hydrosystem RM&E	55	2	BPA	199403300	Fish Passage Center	2008	http://www.cbfish.org/Project.mvc/Display/199403300
RM&E	Hydrosystem RM&E	55	1,2	BPA	199602000	Comparative Survival Study (CSS)	2008	http://www.cbfish.org/Project.mvc/Display/199602000
RM&E	Hydrosystem RM&E	55	4	BPA	200203200	Snake River Fall Chinook Salmon Life History Investigations	2008	http://www.cbfish.org/Project.mvc/Display/200203200
RM&E	Hydrosystem RM&E	55	1,2	BPA	200304100	Evaluate Delayed (Extra) Mortality Associated with Passage of Yearling Chinook Salmon through Snake River Dams	2008	http://www.cbfish.org/Project.mvc/Display/200304100
RM&E	Hydrosystem RM&E	55	1,2,8	BPA	200311400	Pacific Ocean Survey Tracking (POST)	2008	http://www.cbfish.org/Project.mvc/Display/200311400
RM&E	Hydrosystem RM&E	55	1,2	BPA	200500200	Lower Granite Dam Adult Trap Operations	2008	http://www.cbfish.org/Project.mvc/Display/200500200
RM&E	Hydrosystem RM&E	55	1,2,5	BPA	200872400	Pittag Sr Sockeye-Uc Sp.Chinook	2008	http://www.cbfish.org/Project.mvc/Display/200872400
RM&E	Tributary Habitat RM&E	56	1	BPA	198335003	Nez Perce Tribal Hatchery Monitoring and Evaluation (M&E)	2008	http://www.cbfish.org/Project.mvc/Display/198335003
RM&E	Tributary Habitat RM&E	56	1,2	BPA	198402100	John Day Habitat Enhancement	2008	http://www.cbfish.org/Project.mvc/Display/198402100
RM&E	Tributary Habitat RM&E	56	1,2	BPA	198402500	Blue Mountain Fish Habitat Improvement	2008	http://www.cbfish.org/Project.mvc/Display/198402500

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H-Section	BiOp Strategy	RPA #	RPA Subaction	Agency	Project #	Project Title	Start Date	Action Information Link
RM&E	Tributary Habitat RM&E	56	1	BPA	198805303	Hood River Production Monitoring and Evaluation (M&E)-Warm Springs	2008	http://www.cbfish.org/Project.mvc/Display/198805303
RM&E	Tributary Habitat RM&E	56	1	BPA	198805304	Hood River Production Monitor and Evaluation (M&E)-Oregon Department of Fish and Wildlife (ODFW)	2008	http://www.cbfish.org/Project.mvc/Display/198805304
RM&E	Tributary Habitat RM&E	56	1	BPA	198902401	Evaluate Umatilla Juvenile Salmonid Outmigration	2008	http://www.cbfish.org/Project.mvc/Display/198902401
RM&E	Tributary Habitat RM&E	56	1	BPA	198909800	Salmon Studies in Idaho Rivers-Idaho Department of Fish and Game (IDFG)	2008	http://www.cbfish.org/Project.mvc/Display/198909800
RM&E	Tributary Habitat RM&E	56	1	BPA	199005500	Idaho Steelhead Monitoring and Evaluation (M&E) Studies	2008	http://www.cbfish.org/Project.mvc/Display/199005500
RM&E	Tributary Habitat RM&E	56	1	BPA	199202604	Grand Ronde Early Life History of Spring Chinook and Steelhead	2008	http://www.cbfish.org/Project.mvc/Display/199202604
RM&E	Tributary Habitat RM&E	56	1	BPA	199401805	Asotin Creek Enhancement and Restoration	2008	http://www.cbfish.org/Project.mvc/Display/199401805
RM&E	Tributary Habitat RM&E	56	1	BPA	199401806	Tucannon Stream and Riparian Restoration	2008	http://www.cbfish.org/Project.mvc/Display/199401806
RM&E	Tributary Habitat RM&E	56	1	BPA	199404200	Trout Creek Operations and Maintenance (O&M)	2008	http://www.cbfish.org/Project.mvc/Display/199404200
RM&E	Tributary Habitat RM&E	56	1	BPA	199506335	Klickitat River Monitoring and Evaluation-Yakima/Klickitat Fisheries Project (YKFP)	2008	http://www.cbfish.org/Project.mvc/Display/199506335
RM&E	Tributary Habitat RM&E	56	1	BPA	199602000	Comparative Survival Study (CSS)	2008	http://www.cbfish.org/Project.mvc/Display/199602000
RM&E	Tributary Habitat RM&E	56	1,3	BPA	199603501	Yakama Reservation Watershed Project	2008	http://www.cbfish.org/Project.mvc/Display/199603501

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H-Section	BiOp Strategy	RPA #	RPA Subaction	Agency	Project #	Project Title	Start Date	Action Information Link
RM&E	Tributary Habitat RM&E	56	1	BPA	199701501	Imnaha River Smolt Monitoring	2008	http://www.cbfish.org/Project.mvc/Display/199701501
RM&E	Tributary Habitat RM&E	56	1	BPA	199705600	Klickitat Watershed Enhancement	2008	http://www.cbfish.org/Project.mvc/Display/199705600
RM&E	Tributary Habitat RM&E	56	1	BPA	199801003	Spawning Distribution of Snake River Fall Chinook Salmon	2008	http://www.cbfish.org/Project.mvc/Display/199801003
RM&E	Tributary Habitat RM&E	56	1	BPA	199801900	Wind River Watershed	2008	http://www.cbfish.org/Project.mvc/Display/199801900
RM&E	Tributary Habitat RM&E	56	1	BPA	200003900	Walla Walla River Basin Monitoring and Evaluation (M&E)	2008	http://www.cbfish.org/Project.mvc/Display/200003900
RM&E	Tributary Habitat RM&E	56	1,3	BPA	200203200	Snake River Fall Chinook Salmon Life History Investigations	2008	http://www.cbfish.org/Project.mvc/Display/200203200
RM&E	Tributary Habitat RM&E	56	1,2	BPA	200205900	Yankee Fork Salmon River Restoration	2008	http://www.cbfish.org/Project.mvc/Display/200205900
RM&E	Tributary Habitat RM&E	56	1	BPA	200206100	Potlatch River Watershed Restoration	2008	http://www.cbfish.org/Project.mvc/Display/200206100
RM&E	Tributary Habitat RM&E	56	3	BPA	200206800	Evaluate Stream Habitat-Nez Perce Tribe Watershed Monitoring and Evaluation (M&E) Plan.	2008	http://www.cbfish.org/Project.mvc/Display/200206800
RM&E	Tributary Habitat RM&E	56	1,2	BPA	200301700	Integrated Status and Effectiveness Monitoring Program (ISEMP)	2008	http://www.cbfish.org/Project.mvc/Display/200301700
RM&E	Tributary Habitat RM&E	56	1	BPA	200303900	Monitor and Evaluate (M&E) Reproductive Success and Survival in Wenatchee River	2008	http://www.cbfish.org/Project.mvc/Display/200303900
RM&E	Tributary Habitat RM&E	56	3	BPA	200400200	Pacific Northwest Aquatic Monitoring Program (PNAMP) Coordination	2008	http://www.cbfish.org/Project.mvc/Display/200400200

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H-Section	BiOp Strategy	RPA #	RPA Subaction	Agency	Project #	Project Title	Start Date	Action Information Link
RM&E	Tributary Habitat RM&E	56	1,2	BPA	200708300	Grande Ronde Supplementation Monitoring and Evaluation (M&E) on Catherine Creek/Upper Grande Ronde River	2008	http://www.cbfish.org/Project.mvc/Display/200708300
RM&E	Tributary Habitat RM&E	56	1	BPA	200712700	East Fork of South Fork Salmon River Passage Restoration	2008	http://www.cbfish.org/Project.mvc/Display/200712700
RM&E	Tributary Habitat RM&E	56	1	BPA	200715600	Snake River Sockeye Captive Propagation	2008	http://www.cbfish.org/Project.mvc/Display/200715600
RM&E	Tributary Habitat RM&E	56	1	BPA	200723300	Distribution and Abundance Monitoring of Oncorhynchus mykiss within the Lower Clearwater Subbasin	2008	http://www.cbfish.org/Project.mvc/Display/200723300
RM&E	Tributary Habitat RM&E	56	1	BPA	200733200	Mitigation of Marine-Derived Nutrient Loss in Central Idaho	2008	http://www.cbfish.org/Project.mvc/Display/200733200
RM&E	Tributary Habitat RM&E	56	3	BPA	200740200	Snake River Sockeye Captive Propagation	2008	http://www.cbfish.org/Project.mvc/Display/200740200
RM&E	Tributary Habitat RM&E	56	1,2	BPA	200847100	Upper Columbia Nutrient Supplementation	2008	http://www.cbfish.org/Project.mvc/Display/200847100
RM&E	Tributary Habitat RM&E	56	1,2	BPA	200900300	Upper Columbia Habitat Restoration	2009	http://www.cbfish.org/Project.mvc/Display/200900300
RM&E	Tributary Habitat RM&E	57	4	BPA	198402100	John Day Habitat Enhancement	2008	http://www.cbfish.org/Project.mvc/Display/198402100
RM&E	Tributary Habitat RM&E	57	4	BPA	198402500	Blue Mountain Fish Habitat Improvement	2008	http://www.cbfish.org/Project.mvc/Display/198402500
RM&E	Tributary Habitat RM&E	57	4	BPA	199404200	Trout Creek Operations and Maintenance (O&M)	2008	http://www.cbfish.org/Project.mvc/Display/199404200
RM&E	Tributary Habitat RM&E	57	4	BPA	199604000	Mid-Columbia Reintroduction Feasibility Study	2008	http://www.cbfish.org/Project.mvc/Display/199604000

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H-Section	BiOp Strategy	RPA #	RPA Subaction	Agency	Project #	Project Title	Start Date	Action Information Link
RM&E	Tributary Habitat RM&E	57	2,4	BPA	200201301	Water Entity - Water Transaction Program	2008	http://www.cbfish.org/Project.mvc/Display/200201301
RM&E	Tributary Habitat RM&E	57	1,2,3,4	BPA	200205900	Yankee Fork Salmon River Restoration	2008	http://www.cbfish.org/Project.mvc/Display/200205900
RM&E	Tributary Habitat RM&E	57	1,3,4	BPA	200301700	Integrated Status and Effectiveness Monitoring Program (ISEMP)	2008	http://www.cbfish.org/Project.mvc/Display/200205900
RM&E	Tributary Habitat RM&E	57	4	BPA	200708300	Grande Ronde Supplementation Monitoring and Evaluation (M&E) on Catherine Creek/Upper Grande Ronde River	2008	http://www.cbfish.org/Project.mvc/Display/200708300
RM&E	Tributary Habitat RM&E	57	4	BPA	200873300	Regional Strategy-Status/Trend	2008	http://www.cbfish.org/Project.mvc/Display/200873300
RM&E	Tributary Habitat RM&E	57	4	BPA	200900300	Upper Columbia Habitat Restoration	2009	http://www.cbfish.org/Project.mvc/Display/200900300
RM&E	Tributary Habitat RM&E	57	5	BPA	200901400	Biomonitoring of Fish Habitat Enhancement	2009	http://www.cbfish.org/Project.mvc/Display/200901400
RM&E	Estuary Habitat RM&E	58	3,4	BPA	199801400	Ocean Survival of Salmonids	2008	http://www.cbfish.org/Project.mvc/Display/199801400
RM&E	Estuary Habitat RM&E	58	3,4	BPA	200300700	Lower Columbia River Estuary Ecosystem Monitoring	2008	http://www.cbfish.org/Project.mvc/Display/200300700
RM&E	Estuary Habitat RM&E	58	2,3	BPA	200301000	Historic Habitat Food Web Link	2008	http://www.cbfish.org/Project.mvc/Display/200301000
RM&E	Estuary Habitat RM&E	58	1	BPA	200311400	Pacific Ocean Survey Tracking (POST)	2008	http://www.cbfish.org/Project.mvc/Display/200311400
RM&E	Estuary Habitat RM&E	58	2,3	BPA	200500100	Tidal Freshwater Monitoring	2008	http://www.cbfish.org/Project.mvc/Display/200500100
RM&E	Estuary Habitat RM&E	59	1,2,4,5	BPA	200300700	Lower Columbia River Estuary Ecosystem Monitoring	2008	http://www.cbfish.org/Project.mvc/Display/200300700

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H-Section	BiOp Strategy	RPA #	RPA Subaction	Agency	Project #	Project Title	Start Date	Action Information Link
RM&E	Estuary Habitat RM&E	59	4	BPA	200301000	Historic Habitat Food Web Link	2008	http://www.cbfish.org/Project.mvc/Display/200301000
RM&E	Estuary Habitat RM&E	59	1,5	BPA	200301100	Columbia River Estuary Habitat Restoration	2008	http://www.cbfish.org/Project.mvc/Display/200301100
RM&E	Estuary Habitat RM&E	59	1	BPA	200500100	Tidal Freshwater Monitoring	2008	http://www.cbfish.org/Project.mvc/Display/200500100
RM&E	Estuary Habitat RM&E	59	4,5	BPA	200500100	Tidal Freshwater Monitoring	2008	http://www.cbfish.org/Project.mvc/Display/200500100
RM&E	Estuary Habitat RM&E	60	1,2	BPA	200300700	Lower Columbia River Estuary Ecosystem Monitoring	2008	http://www.cbfish.org/Project.mvc/Display/200300700
RM&E	Estuary Habitat RM&E	60	1,2,3	BPA	200301100	Columbia River Estuary Habitat Restoration	2008	http://www.cbfish.org/Project.mvc/Display/200301100
RM&E	Estuary Habitat RM&E	60	2	BPA	200301300	Grays River Watershed Assessment	2008	http://www.cbfish.org/Project.mvc/Display/200301300
RM&E	Estuary Habitat RM&E	60	1,2	BPA	200500100	Tidal Freshwater Monitoring	2008	http://www.cbfish.org/Project.mvc/Display/200500100
RM&E	Estuary Habitat RM&E	60	2	BPA	200751300	Eelgrass Enhancement And Restoration	2008	http://www.cbfish.org/Project.mvc/Display/200751300
RM&E	Estuary Habitat RM&E	61	4	BPA	199801400	Ocean Survival of Salmonids	2008	http://www.cbfish.org/Project.mvc/Display/199801400
RM&E	Estuary Habitat RM&E	61	1,2	BPA	199801400	Ocean Survival of Salmonids	2008	http://www.cbfish.org/Project.mvc/Display/199801400
RM&E	Estuary Habitat RM&E	61	1,3	BPA	200300700	Lower Columbia River Estuary Ecosystem Monitoring	2008	http://www.cbfish.org/Project.mvc/Display/200300700
RM&E	Estuary Habitat RM&E	61	1,2	BPA	200300900	Canada-USA Shelf Salmon Survival Study	2008	http://www.cbfish.org/Project.mvc/Display/200300900
RM&E	Estuary Habitat RM&E	61	1,3,4	BPA	200301000	Historic Habitat Food Web Link	2008	http://www.cbfish.org/Project.mvc/Display/200301000
RM&E	Estuary Habitat RM&E	61	3	BPA	200301100	Columbia River Estuary Habitat Restoration	2008	http://www.cbfish.org/Project.mvc/Display/200301100

Attachment 1 - Table 1. BPA Project List

H-Section	BiOp Strategy	RPA #	RPA Subaction	Agency	Project #	Project Title	Start Date	Action Information Link
RM&E	Estuary Habitat RM&E	61	1,2	BPA	200311400	Pacific Ocean Survey Tracking (POST)	2008	http://www.cbfish.org/Project.mvc/Display/200311400
RM&E	Estuary Habitat RM&E	61	1,3	BPA	200500100	Tidal Freshwater Monitoring	2008	http://www.cbfish.org/Project.mvc/Display/200500100
RM&E	Estuary Habitat RM&E	61	1	BPA	200727500	Impact of American Shad in the Columbia River	2008	http://www.cbfish.org/Project.mvc/Display/200727500
RM&E	Estuary Habitat RM&E	61	3	BPA	200902000	UW-CBR Internal Statistical / Technical Support to BPA (Skalski)	2009	http://www.cbfish.org/Project.mvc/Display/200902000
RM&E	Harvest RM&E	62	4	BPA	198201301	Coded Wire Tag-Pacific States Marine Fisheries Commission (PSMFC)	2008	http://www.cbfish.org/Project.mvc/Display/198201301
RM&E	Harvest RM&E	62	4	BPA	198201302	Coded Wire Tag-Oregon Department of Fish and Wildlife (ODFW)	2008	http://www.cbfish.org/Project.mvc/Display/198201302
RM&E	Harvest RM&E	62	4	BPA	198201303	Coded Wire Tag-US Fish and Wildlife Service (USFWS)	2008	http://www.cbfish.org/Project.mvc/Display/198201303
RM&E	Harvest RM&E	62	4	BPA	198201304	Coded Wire Tag-Washington Department of Fish and Wildlife (WDFW)	2008	http://www.cbfish.org/Project.mvc/Display/198201304
RM&E	Harvest RM&E	62	4,5	BPA	198335000	Nez Perce Tribal Hatchery Operations and Maintenance (O&M)	2008	http://www.cbfish.org/Project.mvc/Display/198335000
RM&E	Harvest RM&E	62	1,4,5	BPA	198335003	Nez Perce Tribal Hatchery Monitoring and Evaluation (M&E)	2008	http://www.cbfish.org/Project.mvc/Display/198335003
RM&E	Harvest RM&E	62	1,4	BPA	198805303	Hood River Production Monitoring and Evaluation (M&E)-Warm Springs	2008	http://www.cbfish.org/Project.mvc/Display/198805303
RM&E	Harvest RM&E	62	5	BPA	198805304	Hood River Production Monitor and Evaluation (M&E)-Oregon Department of Fish and Wildlife (ODFW)	2008	http://www.cbfish.org/Project.mvc/Display/198805304

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H-Section	BiOp Strategy	RPA #	RPA Subaction	Agency	Project #	Project Title	Start Date	Action Information Link
RM&E	Harvest RM&E	62	4,5	BPA	198805307	Hood River Production Operations and Maintenance (O&M)-Warm Springs	2008	http://www.cbfish.org/Project.mvc/Display/198805307
RM&E	Harvest RM&E	62	5	BPA	198909600	Genetic Monitoring and Evaluation (M&E) Program for Salmon and Steelhead	2008	http://www.cbfish.org/Project.mvc/Display/198909600
RM&E	Harvest RM&E	62	1,5	BPA	198909800	Salmon Studies in Idaho Rivers-Idaho Department of Fish and Game (IDFG)	2008	http://www.cbfish.org/Project.mvc/Display/198909800
RM&E	Harvest RM&E	62	4	BPA	199000500	Umatilla Hatchery Monitoring and Evaluation (M&E)	2008	http://www.cbfish.org/Project.mvc/Display/199000500
RM&E	Harvest RM&E	62	5	BPA	199005500	Idaho Steelhead Monitoring and Evaluation (M&E) Studies	2008	http://www.cbfish.org/Project.mvc/Display/199005500
RM&E	Harvest RM&E	62	2	BPA	199306000	Select Area Fisheries Enhancement	2008	http://www.cbfish.org/Project.mvc/Display/199306000
RM&E	Harvest RM&E	62	4,5	BPA	199506325	Yakima River Monitoring and Evaluation-Yakima/Klickitat Fisheries Project (YKFP)	2008	http://www.cbfish.org/Project.mvc/Display/199506325
RM&E	Harvest RM&E	62	5	BPA	199506335	Klickitat River Monitoring and Evaluation-Yakima/Klickitat Fisheries Project (YKFP)	2008	http://www.cbfish.org/Project.mvc/Display/199506335
RM&E	Harvest RM&E	62	1,5	BPA	199604300	Johnson Creek Artificial Propagation Enhancement	2008	http://www.cbfish.org/Project.mvc/Display/199604300
RM&E	Harvest RM&E	62	1,4,5	BPA	199701501	Imnaha River Smolt Monitoring	2008	http://www.cbfish.org/Project.mvc/Display/199701501
RM&E	Harvest RM&E	62	5	BPA	199703000	Chinook Salmon Adult Abundance Monitoring	2008	http://www.cbfish.org/Project.mvc/Display/199703000
RM&E	Harvest RM&E	62	5	BPA	199703800	Listed Stock Chinook Salmon Gamete Preservation	2008	http://www.cbfish.org/Project.mvc/Display/199703800

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H-Section	BiOp Strategy	RPA #	RPA Subaction	Agency	Project #	Project Title	Start Date	Action Information Link
RM&E	Harvest RM&E	62	5	BPA	199800702	Grande Ronde Supplementation Operations and Maintenance (O&M) and Monitoring and Evaluation (M&E) on Lostine River	2008	http://www.cbfish.org/Project.mvc/Display/199800702
RM&E	Harvest RM&E	62	5	BPA	199801600	Escapement and Productivity of Spring Chinook and Steelhead	2008	http://www.cbfish.org/Project.mvc/Display/199801600
RM&E	Harvest RM&E	62	5	BPA	200203000	Salmonid Progeny Markers	2008	http://www.cbfish.org/Project.mvc/Display/200203000
RM&E	Harvest RM&E	62	5	BPA	200205300	Asotin Creek Salmon Population Assessment	2008	http://www.cbfish.org/Project.mvc/Display/200205300
RM&E	Harvest RM&E	62	4	BPA	200206000	Nez Perce Harvest Monitoring on Snake and Clearwater Rivers	2008	http://www.cbfish.org/Project.mvc/Display/200206000
RM&E	Harvest RM&E	62	5	BPA	200303900	Monitor and Evaluate (M&E) Reproductive Success and Survival in Wenatchee River	2008	http://www.cbfish.org/Project.mvc/Display/200303900
RM&E	Harvest RM&E	62	5	BPA	200305000	Evaluate the Reproductive Success of Wild and Hatchery Steelhead in Natural and Hatchery Environments	2008	http://www.cbfish.org/Project.mvc/Display/200305000
RM&E	Harvest RM&E	62	5	BPA	200305400	Evaluate the Relative Reproductive Success of Hatchery-Origin and Wild-Origin Steelhead Spawning Naturally in the Hood River	2008	http://www.cbfish.org/Project.mvc/Display/200305400
RM&E	Harvest RM&E	62	5	BPA	200306000	Evaluate the Relative Reproductive Success of Wild and Hatchery Origin Snake River Fall Chinook Spawners Upstream of Lower Granite Dam	2008	http://www.cbfish.org/Project.mvc/Display/200306000

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H-Section	BiOp Strategy	RPA #	RPA Subaction	Agency	Project #	Project Title	Start Date	Action Information Link
RM&E	Harvest RM&E	62	2	BPA	200708300	Grande Ronde Supplementation Monitoring and Evaluation (M&E) on Catherine Creek/Upper Grande Ronde River	2008	http://www.cbfish.org/Project.mvc/Display/200708300
RM&E	Harvest RM&E	62	2	BPA	200724900	Evaluation of Live Capture Gear	2008	http://www.cbfish.org/Project.mvc/Display/200724900
RM&E	Harvest RM&E	62	1	BPA	200740100	Kelt Reconditioning and Reproductive Success Evaluation Research	2008	http://www.cbfish.org/Project.mvc/Display/200740100
RM&E	Harvest RM&E	62	5	BPA	200740400	Spring Chinook Captive Propagation-Oregon	2008	http://www.cbfish.org/Project.mvc/Display/200740400
RM&E	Harvest RM&E	62	2,3,4	BPA	200810500	Selective Gear Deployment	2008	http://www.cbfish.org/Project.mvc/Display/200810500
RM&E	Harvest RM&E	62	5	BPA	200831000	White River supplementation	2008	http://www.cbfish.org/Project.mvc/Display/200831000
RM&E	Harvest RM&E	62	5	BPA	200831100	Natural Production Management and Monitoring	2008	http://www.cbfish.org/Project.mvc/Display/200831100
RM&E	Harvest RM&E	62	1	BPA	200850200	Expanded Tribal Catch Sampling	2008	http://www.cbfish.org/Project.mvc/Display/200850200
RM&E	Harvest RM&E	62	1	BPA	200850800	Power Analysis Catch Sampling Rates	2008	http://www.cbfish.org/Project.mvc/Display/200850800
RM&E	Harvest RM&E	62	5	BPA	200890700	Genetic Assessment of Columbia River Stocks	2008	http://www.cbfish.org/Project.mvc/Display/200890700
RM&E	Harvest RM&E	62	1,3,4	BPA	200890800	FCRPS Water Studies & Passage of Adult Salmon & Steelhead	2008	http://www.cbfish.org/Project.mvc/Display/200890800
RM&E	Hatchery RM&E	63	1	BPA	198335003	Nez Perce Tribal Hatchery Monitoring and Evaluation (M&E)	2008	http://www.cbfish.org/Project.mvc/Display/198335003

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H-Section	BiOp Strategy	RPA #	RPA Subaction	Agency	Project #	Project Title	Start Date	Action Information Link
RM&E	Hatchery RM&E	63	1	BPA	198909600	Genetic Monitoring and Evaluation (M&E) Program for Salmon and Steelhead	2008	http://www.cbfish.org/Project.mvc/Display/198909600
RM&E	Hatchery RM&E	63	1	BPA	198909800	Salmon Studies in Idaho Rivers-Idaho Department of Fish and Game (IDFG)	2008	http://www.cbfish.org/Project.mvc/Display/198909800
RM&E	Hatchery RM&E	63	1,2	BPA	199202604	Grand Ronde Early Life History of Spring Chinook and Steelhead	2008	http://www.cbfish.org/Project.mvc/Display/199202604
RM&E	Hatchery RM&E	63	2	BPA	199305600	Advance Hatchery Reform Research	2008	http://www.cbfish.org/Project.mvc/Display/199305600
RM&E	Hatchery RM&E	63	1	BPA	199604300	Johnson Creek Artificial Propagation Enhancement	2008	http://www.cbfish.org/Project.mvc/Display/199604300
RM&E	Hatchery RM&E	63	1	BPA	199703000	Chinook Salmon Adult Abundance Monitoring	2008	http://www.cbfish.org/Project.mvc/Display/199703000
RM&E	Hatchery RM&E	63	1	BPA	199800702	Grande Ronde Supplementation Operations and Maintenance (O&M) and Monitoring and Evaluation (M&E) on Lostine River	2008	http://www.cbfish.org/Project.mvc/Display/199800702
RM&E	Hatchery RM&E	63	1	BPA	199800703	Grande Ronde Supplementation O&M on Catherine Creek/Upper Grande Ronde River	2008	http://www.cbfish.org/Project.mvc/Display/199800703
RM&E	Hatchery RM&E	63	1	BPA	199800704	Grande Ronde Spring Chinook on Lostine/Catherine Creek/ Upper Grande Ronde Rivers	2008	http://www.cbfish.org/Project.mvc/Display/199800704
RM&E	Hatchery RM&E	63	1	BPA	199801600	Escapement and Productivity of Spring Chinook and Steelhead	2008	http://www.cbfish.org/Project.mvc/Display/199801600
RM&E	Hatchery RM&E	63	1	BPA	200105300	Reintroduction of Chum in Duncan Creek	2008	http://www.cbfish.org/Project.mvc/Display/200105300

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H-Section	BiOp Strategy	RPA #	RPA Subaction	Agency	Project #	Project Title	Start Date	Action Information Link
RM&E	Hatchery RM&E	63	1	BPA	200708300	Grande Ronde Supplementation Monitoring and Evaluation (M&E) on Catherine Creek/Upper Grande Ronde River	2008	http://www.cbfish.org/Project.mvc/Display/200708300
RM&E	Hatchery RM&E	63	1	BPA	200740200	Snake River Sockeye Captive Propagation	2008	http://www.cbfish.org/Project.mvc/Display/200740200
RM&E	Hatchery RM&E	63	1	BPA	200740300	Spring Chinook Captive Propagation-Idaho	2008	http://www.cbfish.org/Project.mvc/Display/200740300
RM&E	Hatchery RM&E	63	1	BPA	200740400	Spring Chinook Captive Propagation-Oregon	2008	http://www.cbfish.org/Project.mvc/Display/200740400
RM&E	Hatchery RM&E	63	1	BPA	200871000	Development of an Integrated strategy for Chum Salmon Restoration in the tributaries below Bonneville Dam	2008	http://www.cbfish.org/Project.mvc/Display/200871000
RM&E	Hatchery RM&E	64	2	BPA	198335000	Nez Perce Tribal Hatchery Operations and Maintenance (O&M)	2008	http://www.cbfish.org/Project.mvc/Display/198335000
RM&E	Hatchery RM&E	64	1,2,3	BPA	198335003	Nez Perce Tribal Hatchery Monitoring and Evaluation (M&E)	2008	http://www.cbfish.org/Project.mvc/Display/198335003
RM&E	Hatchery RM&E	64	2	BPA	198343500	Umatilla Hatchery Satellite Fac O&M	2008	http://www.cbfish.org/Project.mvc/Display/198343500
RM&E	Hatchery RM&E	64	2	BPA	198805301	Northeast Oregon Hatchery Master Plan	2008	http://www.cbfish.org/Project.mvc/Display/198805301
RM&E	Hatchery RM&E	64	1,2	BPA	198805303	Hood River Production Monitoring and Evaluation (M&E)-Warm Springs	2008	http://www.cbfish.org/Project.mvc/Display/198805303
RM&E	Hatchery RM&E	64	1,2	BPA	198805304	Hood River Production Monitor and Evaluation (M&E)-Oregon Department of Fish and Wildlife (ODFW)	2008	http://www.cbfish.org/Project.mvc/Display/198805304

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H-Section	BiOp Strategy	RPA #	RPA Subaction	Agency	Project #	Project Title	Start Date	Action Information Link
RM&E	Hatchery RM&E	64	1,2	BPA	198805307	Hood River Production Operations and Maintenance (O&M)-Warm Springs	2008	http://www.cbfish.org/Project.mvc/Display/198805307
RM&E	Hatchery RM&E	64	1,2	BPA	198805308	Hood River Production Operations and Maintenance (O&M) and Powerdale	2008	http://www.cbfish.org/Project.mvc/Display/198805308
RM&E	Hatchery RM&E	64	1,2	BPA	198909600	Genetic Monitoring and Evaluation (M&E) Program for Salmon and Steelhead	2008	http://www.cbfish.org/Project.mvc/Display/198909600
RM&E	Hatchery RM&E	64	2	BPA	198909800	Salmon Studies in Idaho Rivers-Idaho Department of Fish and Game (IDFG)	2008	http://www.cbfish.org/Project.mvc/Display/198909800
RM&E	Hatchery RM&E	64	2	BPA	199000500	Umatilla Hatchery Monitoring and Evaluation (M&E)	2008	http://www.cbfish.org/Project.mvc/Display/199000500
RM&E	Hatchery RM&E	64	2	BPA	199000501	Umatilla Basin Natural Production Monitoring and Evaluation (M&E)	2008	http://www.cbfish.org/Project.mvc/Display/199000501
RM&E	Hatchery RM&E	64	1,2	BPA	199202604	Grand Ronde Early Life History of Spring Chinook and Steelhead	2008	http://www.cbfish.org/Project.mvc/Display/199202604
RM&E	Hatchery RM&E	64	2	BPA	199506325	Yakima River Monitoring and Evaluation-Yakima/Klickitat Fisheries Project (YKFP)	2008	http://www.cbfish.org/Project.mvc/Display/199506325
RM&E	Hatchery RM&E	64	2	BPA	199604300	Johnson Creek Artificial Propagation Enhancement	2008	http://www.cbfish.org/Project.mvc/Display/199604300
RM&E	Hatchery RM&E	64	2	BPA	199701501	Imnaha River Smolt Monitoring	2008	http://www.cbfish.org/Project.mvc/Display/199701501
RM&E	Hatchery RM&E	64	2	BPA	199703000	Chinook Salmon Adult Abundance Monitoring	2008	http://www.cbfish.org/Project.mvc/Display/199703000

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H-Section	BiOp Strategy	RPA #	RPA Subaction	Agency	Project #	Project Title	Start Date	Action Information Link
RM&E	Hatchery RM&E	64	2	BPA	199703800	Listed Stock Chinook Salmon Gamete Preservation	2008	http://www.cbfish.org/Project.mvc/Display/199703800
RM&E	Hatchery RM&E	64	1,2	BPA	199800702	Grande Ronde Supplementation Operations and Maintenance (O&M) and Monitoring and Evaluation (M&E) on Lostine River	2008	http://www.cbfish.org/Project.mvc/Display/199800702
RM&E	Hatchery RM&E	64	1,2	BPA	199800703	Grande Ronde Supplementation O&M on Catherine Creek/Upper Grande Ronde River	2008	http://www.cbfish.org/Project.mvc/Display/199800703
RM&E	Hatchery RM&E	64	1,2	BPA	199800704	Grande Ronde Spring Chinook on Lostine/Catherine Creek/ Upper Grande Ronde Rivers	2008	http://www.cbfish.org/Project.mvc/Display/199800704
RM&E	Hatchery RM&E	64	2	BPA	199801003	Spawning Distribution of Snake River Fall Chinook Salmon	2008	http://www.cbfish.org/Project.mvc/Display/199801003
RM&E	Hatchery RM&E	64	2	BPA	199801004	Monitor and Evaluate (M&E) Performance of Juvenile Snake River Fall Chinook Salmon from Fall Chinook Acclimation Project	2008	http://www.cbfish.org/Project.mvc/Display/199801004
RM&E	Hatchery RM&E	64	2	BPA	200001900	Tucannon River Spring Chinook Captive Brood	2008	http://www.cbfish.org/Project.mvc/Display/200001900
RM&E	Hatchery RM&E	64	2	BPA	200203000	Salmonid Progeny Markers	2008	http://www.cbfish.org/Project.mvc/Display/200203000
RM&E	Hatchery RM&E	64	2	BPA	200203100	Growth Modulation in Salmon Supplementation	2008	http://www.cbfish.org/Project.mvc/Display/200203100

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H-Section	BiOp Strategy	RPA #	RPA Subaction	Agency	Project #	Project Title	Start Date	Action Information Link
RM&E	Hatchery RM&E	64	1,2	BPA	200303900	Monitor and Evaluate (M&E) Reproductive Success and Survival in Wenatchee River	2008	http://www.cbfish.org/Project.mvc/Display/200303900
RM&E	Hatchery RM&E	64	2	BPA	200305000	Evaluate the Reproductive Success of Wild and Hatchery Steelhead in Natural and Hatchery Environments	2008	http://www.cbfish.org/Project.mvc/Display/200305000
RM&E	Hatchery RM&E	64	1,2	BPA	200305400	Evaluate the Relative Reproductive Success of Hatchery-Origin and Wild-Origin Steelhead Spawning Naturally in the Hood River	2008	http://www.cbfish.org/Project.mvc/Display/200305400
RM&E	Hatchery RM&E	64	1,2,3	BPA	200306000	Evaluate the Relative Reproductive Success of Wild and Hatchery Origin Snake River Fall Chinook Spawners Upstream of Lower Granite Dam	2008	http://www.cbfish.org/Project.mvc/Display/200306000
RM&E	Hatchery RM&E	64	2	BPA	200306300	Natural Reproductive Success and Demographic Effects of Hatchery-Origin Steelhead in Abernathy Creek, Washington	2008	http://www.cbfish.org/Project.mvc/Display/200306300
RM&E	Hatchery RM&E	64	1,2	BPA	200708300	Grande Ronde Supplementation Monitoring and Evaluation (M&E) on Catherine Creek/Upper Grande Ronde River	2008	http://www.cbfish.org/Project.mvc/Display/200708300
RM&E	Hatchery RM&E	64	2	BPA	200729900	Investigation of Relative Reproductive Success of Stray Hatchery & Wild Steelhead & Influence of Hatchery Strays on Natural Productivity in Deschutes	2008	http://www.cbfish.org/Project.mvc/Display/200729900

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H-Section	BiOp Strategy	RPA #	RPA Subaction	Agency	Project #	Project Title	Start Date	Action Information Link
RM&E	Hatchery RM&E	64	2,3	BPA	200740100	Kelt Reconditioning and Reproductive Success Evaluation Research	2008	http://www.cbfish.org/Project.mvc/Display/200740100
RM&E	Hatchery RM&E	64	2	BPA	200740200	Snake River Sockeye Captive Propagation	2008	http://www.cbfish.org/Project.mvc/Display/200740200
RM&E	Hatchery RM&E	64	2	BPA	200740300	Spring Chinook Captive Propagation-Idaho	2008	http://www.cbfish.org/Project.mvc/Display/200740300
RM&E	Hatchery RM&E	64	2	BPA	200740400	Spring Chinook Captive Propagation-Oregon	2008	http://www.cbfish.org/Project.mvc/Display/200740400
RM&E	Hatchery RM&E	64	2	BPA	200831000	White River supplementation	2008	http://www.cbfish.org/Project.mvc/Display/200831000
RM&E	Hatchery RM&E	64	2	BPA	200831100	Natural Production Management and Monitoring	2008	http://www.cbfish.org/Project.mvc/Display/200831100
RM&E	Hatchery RM&E	64	2	BPA	200845800	Steelhead Kelt Reconditioning	2008	http://www.cbfish.org/Project.mvc/Display/200845800
RM&E	Hatchery RM&E	64	2	BPA	200900100	Expand Multispecies Acclimation Wenatchee/Methow	2009	http://www.cbfish.org/Project.mvc/Display/200900100
RM&E	Hatchery RM&E	65	1,2,3	BPA	199102900	Research, monitoring, and evaluation of emerging issues and measures to recover the Snake River fall Chinook salmon ESU	2008	http://www.cbfish.org/Project.mvc/Display/199102900
RM&E	Hatchery RM&E	65	1,2	BPA	199801003	Spawning Distribution of Snake River Fall Chinook Salmon	2008	http://www.cbfish.org/Project.mvc/Display/199801003
RM&E	Hatchery RM&E	65	1,2	BPA	199801004	Monitor and Evaluate (M&E) Performance of Juvenile Snake River Fall Chinook Salmon from Fall Chinook Acclimation Project	2008	http://www.cbfish.org/Project.mvc/Display/199801004

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H-Section	BiOp Strategy	RPA #	RPA Subaction	Agency	Project #	Project Title	Start Date	Action Information Link
RM&E	Hatchery RM&E	65	1,2,5	BPA	200306000	Evaluate the Relative Reproductive Success of Wild and Hatchery Origin Snake River Fall Chinook Spawners Upstream of Lower Granite Dam	2008	http://www.cbfish.org/Project.mvc/Display/200306000
RM&E	Predation Management RM&E	66		BPA	199702400	Avian Predation on Juvenile Salmonids	2008	http://www.cbfish.org/Project.mvc/Display/199702400
RM&E	Predation Management RM&E	67		BPA	199702400	Avian Predation on Juvenile Salmonids	2008	http://www.cbfish.org/Project.mvc/Display/199702400
RM&E	Predation Management RM&E	68		BPA	199702400	Avian Predation on Juvenile Salmonids	2008	http://www.cbfish.org/Project.mvc/Display/199702400
RM&E	Predation Management RM&E	69	1,2,3	BPA	200800400	Sea Lion Non-Lethal Hazing and Monitoring	2008	http://www.cbfish.org/Project.mvc/Display/200800400
RM&E	Predation Management RM&E	70	1,2,3	BPA	199007700	Development of Systemwide Predator Control	2008	http://www.cbfish.org/Project.mvc/Display/199007700
RM&E	Predation Management RM&E	70	4	BPA	200871900	Research Non-Indigenous Actions	2008	http://www.cbfish.org/Project.mvc/Display/200871900
RM&E	Coordination and Data Management	71	4	BPA	198201301	Coded Wire Tag-Pacific States Marine Fisheries Commission (PSMFC)	2008	http://www.cbfish.org/Project.mvc/Display/198201301
RM&E	Coordination and Data Management	71	4	BPA	198810804	StreamNet - Coordinated Information System (CIS)/ Northwest Environmental Database (NED)	2008	http://www.cbfish.org/Project.mvc/Display/198810804
RM&E	Coordination and Data Management	71	3,4	BPA	199403300	Fish Passage Center	2008	http://www.cbfish.org/Project.mvc/Display/199403300
RM&E	Coordination and Data Management	71	3	BPA	199604300	Johnson Creek Artificial Propagation Enhancement	2008	http://www.cbfish.org/Project.mvc/Display/199604300
RM&E	Coordination and Data Management	71	4	BPA	200300700	Lower Columbia River Estuary Ecosystem Monitoring	2008	http://www.cbfish.org/Project.mvc/Display/200300700

Attachment 1 - Table 1. BPA Project List

H-Section	BiOp Strategy	RPA #	RPA Subaction	Agency	Project #	Project Title	Start Date	Action Information Link
RM&E	Coordination and Data Management	71	4,5	BPA	200301700	Integrated Status and Effectiveness Monitoring Program (ISEMP)	2008	http://www.cbfish.org/Project.mvc/Display/200301700
RM&E	Coordination and Data Management	71	4	BPA	200302200	Okanogan Basin Monitoring & Evaluation Program (OBMEP)	2008	http://www.cbfish.org/Project.mvc/Display/200301700
RM&E	Coordination and Data Management	71	4,5,6	BPA	200307200	Habitat and Biodiversity Information System for Columbia River Basin	2008	http://www.cbfish.org/Project.mvc/Display/200307200
RM&E	Coordination and Data Management	71	3,4,5,6	BPA	200400200	Pacific Northwest Aquatic Monitoring Program (PNAMP) Coordination	2008	http://www.cbfish.org/Project.mvc/Display/200400200
RM&E	Coordination and Data Management	71	5	BPA	200500100	Tidal Freshwater Monitoring	2008	http://www.cbfish.org/Project.mvc/Display/200500100
RM&E	Coordination and Data Management	71	3	BPA	200721600	Pacific NW Aquatic Monitoring Program (PNAMP) Research, Monitoring and Evaluation (RM&E) Design and Protocols	2008	http://www.cbfish.org/Project.mvc/Display/200721600
RM&E	Coordination and Data Management	71	4	BPA	200740300	Spring Chinook Captive Propagation-Idaho	2008	http://www.cbfish.org/Project.mvc/Display/200740300
RM&E	Coordination and Data Management	71	4	BPA	200850500	Streamnet Library	2008	http://www.cbfish.org/Project.mvc/Display/200850500
RM&E	Coordination and Data Management	71	4	BPA	200873300	Regional Strategy-Status/Trend	2008	http://www.cbfish.org/Project.mvc/Display/200873300
RM&E	Coordination and Data Management	72	1,3	BPA	198201301	Coded Wire Tag-Pacific States Marine Fisheries Commission (PSMFC)	2008	http://www.cbfish.org/Project.mvc/Display/198201301
RM&E	Coordination and Data Management	72	1,2,3	BPA	198810804	StreamNet - Coordinated Information System (CIS)/ Northwest Environmental Database (NED)	2008	http://www.cbfish.org/Project.mvc/Display/198810804
RM&E	Coordination and Data Management	72	2	BPA	199601900	Data Access in Real Time (DART)	2008	http://www.cbfish.org/Project.mvc/Display/199601900

Attachment 1 - Table 1. BPA Project List

H-Section	BiOp Strategy	RPA #	RPA Subaction	Agency	Project #	Project Title	Start Date	Action Information Link
RM&E	Coordination and Data Management	72	1,3	BPA	199803100	Implement Wy - Kan - Ush - Mi Wa - Kis	2008	http://www.cbfish.org/Project.mvc/Display/199803100
RM&E	Coordination and Data Management	72	1	BPA	200301700	Integrated Status and Effectiveness Monitoring Program (ISEMP)	2008	http://www.cbfish.org/Project.mvc/Display/200301700
RM&E	Coordination and Data Management	72	1,3	BPA	200400200	Pacific Northwest Aquatic Monitoring Program (PNAMP) Coordination	2008	http://www.cbfish.org/Project.mvc/Display/200400200
RM&E	Coordination and Data Management	72	1	BPA	200500100	Tidal Freshwater Monitoring	2008	http://www.cbfish.org/Project.mvc/Display/200500100
RM&E	Coordination and Data Management	72	1,3	BPA	200850500	Streamnet Library	2008	http://www.cbfish.org/Project.mvc/Display/200850500
RM&E	Coordination and Data Management	72	1	BPA	200872700	Regional Data Management Support and Coordination	2008	http://www.cbfish.org/Project.mvc/Display/200872700
RM&E	Coordination and Data Management	72	2	BPA	200872700	Regional Data Management Support and Coordination	2008	http://www.cbfish.org/Project.mvc/Display/200872700
RM&E	Implementation and Compliance Monitoring	73	1,2,3	None identified	None identified	BPA	None identified	

H-Section	BiOp Strategy	RPA #	RPA Subaction	Agency	Project #	Project Title	Start Date
Habitat	Protect and Improve Tributary Habitat	34	All	Reclamation	4313	Entiat River Tributary Assessment	5/29/2008
Habitat	Protect and Improve Tributary Habitat	34	All	Reclamation	4321	Roaring Creek Diversion	8/27/2008
Habitat	Protect and Improve Tributary Habitat	34	All	Reclamation	4326	Keystone Canyon Project	1/29/2007
Habitat	Protect and Improve Tributary Habitat	34	All	Reclamation	4339	Below the Bridge (Moody Canyon) ELJ (Bridge to Bridge Restoration, Phase 4)	4/1/2007
Habitat	Protect and Improve Tributary Habitat	34	All	Reclamation	4341	Stormy Creek Culvert Replacement	6/15/2008
Habitat	Protect and Improve Tributary Habitat	34	All	Reclamation	4357	Entiat National Fish Hatchery (ENFH) Habitat Channel (Bridge to Bridge Restoration, Phase 5)	1/14/2008
Habitat	Protect and Improve Tributary Habitat	34	All	Reclamation	4391	Knapp Wham Diversion Replacement (Phase 2)	4/16/2009
Habitat	Protect and Improve Tributary Habitat	34	All	Reclamation	4392	Bridge to Bridge Phase III	4/16/2009

H-Section	BiOp Strategy	RPA #	RPA Subaction	Agency	Project #	Project Title	Start Date
Habitat	Protect and Improve Tributary Habitat	34	All	Reclamation	4399	Tyee Restoration Project (Stillwater complexity project)	8/13/2009
Habitat	Protect and Improve Tributary Habitat	34	All	Reclamation	4327	Orodell Diversion Fish Passage Enhancement Project	9/24/2007
Habitat	Protect and Improve Tributary Habitat	34	All	Reclamation	4317	Middle Fork Rock Replacement Projects	1/19/2009
Habitat	Protect and Improve Tributary Habitat	34	All	Reclamation	4318	CTWSRO (MCA) Middle Fork Forrest Reach Assessment	9/18/2007
Habitat	Protect and Improve Tributary Habitat	34	All	Reclamation	4319	CTWSRO Oxbow Reach Assessment (MCA)	9/5/2007
Habitat	Protect and Improve Tributary Habitat	34	All	Reclamation	4345	Boulder Creek Ranch Diversion	7/25/2008
Habitat	Protect and Improve Tributary Habitat	34	All	Reclamation	4411	Austin Ranch Diversion	10/9/2009
Habitat	Protect and Improve Tributary Habitat	34	All	Reclamation	4412	Lower Clear Creek Diversion	10/9/2009
Habitat	Protect and Improve Tributary Habitat	34	All	Reclamation	4314	Grant SWCD-Stout Diversion (UPJD RM 214.3)	3/31/2008

H-Section	BiOp Strategy	RPA #	RPA Subaction	Agency	Project #	Project Title	Start Date
Habitat	Protect and Improve Tributary Habitat	34	All	Reclamation	4323	Kennedy (UPJD RM 209) and Murray (UPJD RM 210.2) Ditch Diversions	1/24/2008
Habitat	Protect and Improve Tributary Habitat	34	All	Reclamation	4347	Fry-Ingle Diversion	7/28/2008
Habitat	Protect and Improve Tributary Habitat	34	All	Reclamation	4348	Cummings Creek Pump	6/28/2008
Habitat	Protect and Improve Tributary Habitat	34	All	Reclamation	4349	Eddington Ditch Diversion (Page Pump Station- UPJD RM 231.7)	7/28/2008
Habitat	Protect and Improve Tributary Habitat	34	All	Reclamation	4350	Oliver Ditch # 47 (UPJD RM 253.3) Diversion (combined with Oliver #48 in 2008)	7/28/2008
Habitat	Protect and Improve Tributary Habitat	34	All	Reclamation	4351	Oliver Ditch # 48 (UPJD RM 253.2) Diversion (combined with Oliver # 47 in 2008)	7/28/2008
Habitat	Protect and Improve Tributary Habitat	34	All	Reclamation	4353	Oliver Ditch # 49 Diversion (UPJD RM 252.3)	7/28/2008
Habitat	Protect and Improve Tributary Habitat	34	All	Reclamation	4369	Grant SWCD- Cummings River Ditch Diversion (UPJD RM 222.5)	2/4/2008
Habitat	Protect and Improve Tributary Habitat	34	All	Reclamation	4388	Blanchette Habitat Project	12/15/2009

H-Section	BiOp Strategy	RPA #	RPA Subaction	Agency	Project #	Project Title	Start Date
Habitat	Protect and Improve Tributary Habitat	34	All	Reclamation	4398	Panama Pipeline Appraisal Study	12/18/2008
Habitat	Protect and Improve Tributary Habitat	34	All	Reclamation	4405	Lower Deardorf Diversion	8/21/2009
Habitat	Protect and Improve Tributary Habitat	34	All	Reclamation	4406	Upper Deardorf Diversion	8/21/2009
Habitat	Protect and Improve Tributary Habitat	34	All	Reclamation	4407	East Fork Canyon Creek Diversion	8/21/2009
Habitat	Protect and Improve Tributary Habitat	34	All	Reclamation	4408	Dovenberg Pump Station	8/31/2009
Habitat	Protect and Improve Tributary Habitat	34	All	Reclamation	4409	Beech Creek Moore Diversion	8/31/2009
Habitat	Protect and Improve Tributary Habitat	34	All	Reclamation	4413	Dad's Creek #1 Siphon	10/7/2009
Habitat	Protect and Improve Tributary Habitat	34	All	Reclamation	4414	Dad's Creek #2 Winegar Diversion	10/7/2009
Habitat	Protect and Improve Tributary Habitat	34	All	Reclamation	4415	Dad's Creek #3 CTWSRO Diversion	10/7/2009

H-Section	BiOp Strategy	RPA #	RPA Subaction	Agency	Project #	Project Title	Start Date
Habitat	Protect and Improve Tributary Habitat	34	All	Reclamation	4416	UJD Forrest Property RM 264.7 Enhancement	5/18/2009
Habitat	Protect and Improve Tributary Habitat	34	All	Reclamation	4328	L-1 Diversion	4/1/2008
Habitat	Protect and Improve Tributary Habitat	34	All	Reclamation	4378	Upper Lemhi River Flow Enhancement / Eighteenmile Creek Reconnect	10/16/2006
Habitat	Protect and Improve Tributary Habitat	34	All	Reclamation	4386	Lemhi River, Little Springs Creek Restoration	2/12/2008
Habitat	Protect and Improve Tributary Habitat	34	All	Reclamation	4387	Wimpey Creek- 2 Diversion Replacement	2/11/2009
Habitat	Protect and Improve Tributary Habitat	34	All	Reclamation	4403	L-47 Diversion	8/4/2008
Habitat	Protect and Improve Tributary Habitat	34	All	Reclamation	4404	L-45 Diversion Replacement	2/14/2008
Habitat	Protect and Improve Tributary Habitat	34	All	Reclamation	4417	Big Timber Flow Enhancement	5/30/2003
Habitat	Protect and Improve Tributary Habitat	34	All	Reclamation	4034	MVID East Canal Diversion Dam	9/13/2002

H-Section	BiOp Strategy	RPA #	RPA Subaction	Agency	Project #	Project Title	Start Date
Habitat	Protect and Improve Tributary Habitat	34	All	Reclamation	4035	MVID West Canal Diversion Dam	9/13/2002
Habitat	Protect and Improve Tributary Habitat	34	All	Reclamation	4262	Rockview-Fender Mills Phase I Side Channel Reconnection	5/12/2005
Habitat	Protect and Improve Tributary Habitat	34	All	Reclamation	4263	Upper Beaver Creek Side Channel Reconnection	5/3/2005
Habitat	Protect and Improve Tributary Habitat	34	All	Reclamation	4330	Poorman Cutoff Road Culvert	2/15/2008
Habitat	Protect and Improve Tributary Habitat	34	All	Reclamation	4395	Operskalski Complexity	12/19/2008
Habitat	Protect and Improve Tributary Habitat	34	All	Reclamation	4396	Heath Middle Pond Fish Passage	1/23/2009
Habitat	Protect and Improve Tributary Habitat	34	All	Reclamation	4401	Barclay Fish Return Gates	11/2/2009
Habitat	Protect and Improve Tributary Habitat	34	All	Reclamation	4402	Little Barkley Pipe	11/11/2009
Habitat	Protect and Improve Tributary Habitat	34	All	Reclamation	4420	Little Chewuch Streamflow Improvement	10/15/2009

H-Section	BiOp Strategy	RPA #	RPA Subaction	Agency	Project #	Project Title	Start Date
Habitat	Protect and Improve Tributary Habitat	34	All	Reclamation	4324	Big Springs Creek 7-8 Diversion Enhancement	8/1/2007
Habitat	Protect and Improve Tributary Habitat	34	All	Reclamation	4389	Hooper Lane Culverts	12/23/2009
Habitat	Protect and Improve Tributary Habitat	34	All	Reclamation	4400	Big Springs Creek 3 Diversion Enhancement	7/2/2008
Habitat	Protect and Improve Tributary Habitat	34	All	Reclamation	4410	Big Springs Creek 1 Diversion Enhancement	7/2/2008
Habitat	Protect and Improve Tributary Habitat	34	All	Reclamation	4238	East Fork 15 Fish Diversion	3/9/2004
Habitat	Protect and Improve Tributary Habitat	34	All	Reclamation	4239	East Fork Salmon River-EF 13 Diversion	3/9/2004
Habitat	Protect and Improve Tributary Habitat	34	All	Reclamation	4240	East Fork Salmon River-EF 13 Headgate	3/9/2004
Habitat	Protect and Improve Tributary Habitat	34	All	Reclamation	4246	East Fork Salmon River-EF 14 Headgate	2/16/2006
Habitat	Protect and Improve Tributary Habitat	34	All	Reclamation	4247	East Fork Salmon River-EF 14 Diversion	2/16/2006

H-Section	BiOp Strategy	RPA #	RPA Subaction	Agency	Project #	Project Title	Start Date
Habitat	Protect and Improve Tributary Habitat	34	All	Reclamation	4248	East Fork Salmon River-EF 16 Headgate	2/16/2006
abitat	Protect and Improve Tributary Habitat	34	All	Reclamation	4249	East Fork Salmon River EF 16 Diversion	2/16/2006
Habitat	Protect and Improve Tributary Habitat	34	All	Reclamation	4342	Pole Creek Diversion Enhancement	9/10/2008
Habitat	Protect and Improve Tributary Habitat	34	All	Reclamation	4287	Nason Creek MCA Project (Oxbow Reconnection)	7/21/2006
Habitat	Protect and Improve Tributary Habitat	34	All	Reclamation	4336	Nason 1- Ray Rock Springs	2/11/2008
Habitat	Protect and Improve Tributary Habitat	34	All	Reclamation	4338	Icicle ID Screen Replacement and Barrier Removal	8/18/2006
Habitat	Protect and Improve Tributary Habitat	34	All	Reclamation	4361	Peshastin Pipeline	4/2/2007
Habitat	Protect and Improve Tributary Habitat	34	All	Reclamation	4390	Upper Chumstick Barriers	12/15/2009
Habitat	Protect and Improve Tributary Habitat	34	All	Reclamation	4393	Chumstick Culverts Replacement 2009 (17)	4/16/2009

H-Section	BiOp Strategy	RPA #	RPA Subaction	Agency	Project #	Project Title	Start Date
Habitat	Protect and Improve Tributary Habitat	34	All	Reclamation	4394	Mission Creek Reconfiguration Projects (2)	4/16/2009
Habitat	Protect and Improve Tributary Habitat	34	All	Reclamation	4418	Cashmere Ponds Project	9/9/2008
RM&E	Tributary Habitat RM&E	56	All	Reclamation	4797	Fish Pop Genetics	2008
RM&E	Tributary Habitat RM&E	56	All	Reclamation	4887	Methow Fish Prod, Food Webs	2008
RM&E	Tributary Habitat RM&E	56	All	Reclamation	4806	Landscape Classification	2009
RM&E	Tributary Habitat RM&E	57	All	Reclamation	4887	Methow Channel Restoration Fish Productivity Response	2008
RM&E	Tributary Habitat RM&E	57	All	Reclamation	4806	Landscape Influences on Stream Condition	2009
RM&E	Tributary Habitat RM&E	65	All	Reclamation	4797	Fish Pop Genetics	2008
RM&E	Coordination and Data Management	71	All	Reclamation	4930	PNAMP	2008

H-Section	BiOp Strategy	RPA #	RPA Subaction	Agency	Project #	Project Title	Start Date
RM&E	Coordination and Data Management	72	All	Reclamation	4930	PNAMP	2008

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H-Section	BiOp Strategy	RPA #	RPA Subaction	Agency	Project #	Project Title	Start Date	Action Information Link
RM&E	Hydrosystem RM&E	52	1	COE	SPE-06-2	Comparative Performance of Acoustic - Tagged and PIT - Tagged Juvenile Salmonids		
RM&E	Hydrosystem RM&E	52	1	COE	SPE-P-08-3	Studies of Surface Spill at John Day Dam		
RM&E	Hydrosystem RM&E	52	1	COE	SPE-W-04-2	Juvenile Survival and Passage at Little Goose Dam		
RM&E	Hydrosystem RM&E	52	1	COE	SPE-W-05-1	Passage, survival, and approach patterns of juvenile salmonids at McNary Dam		
RM&E	Hydrosystem RM&E	52	1	COE	SPE-W-08-4	Fish passage and survival at Lower Monumental Dam and Ice Harbor Dam		
RM&E	Hydrosystem RM&E	52	3, 7	COE	ADS-00-4	Investigation of Fate of Fish; Straying in Adult Salmon and Steelhead (RM&E)		

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H-Section	BiOp Strategy	RPA #	RPA Subaction	Agency	Project #	Project Title	Start Date	Action Information Link
RM&E	Hydrosystem RM&E	53	5	COE	ADS-P-00-6	Evaluation of Steelhead Kelt and Overwintering Summer Steelhead Downstream Passage Through Columbia and Snake River dams		
RM&E	Hydrosystem RM&E	54	2	COE	SPE-P-08-2	Condition and Gatewell Retention Time Evaluation for Subyearling Chinook (Spring Creek Hatchery Origin & Run - of - the - River) through FGE modified units at the Second Powerhouse Bonneville Dam		
RM&E	Hydrosystem RM&E	54	4	COE	TSP-05-1	Pressure Investigations to Support Biological Index Testing		
RM&E	Hydrosystem RM&E	54	6	COE	TPE-W-00-06	Analyze the Benefits of Transporting Lower Snake River Juvenile Fall Chinook Salmon		

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H-Section	BiOp Strategy	RPA #	RPA Subaction	Agency	Project #	Project Title	Start Date	Action Information Link
RM&E	Hydrosystem RM&E	54	6	COE	TPE-W-04-1	Determine the Seasonal Effects of Transporting fish from the Snake River to optimize a Transportation Strategy		
RM&E	Hydrosystem RM&E	54	8	COE	AVS-08–01	Evaluate Management Measures and Develop Baseline Information on Double - crested Cormorants Directed at Reducing the Impact of Their Predation on Salmonid Smolts in the Columbia River Estuary		
RM&E	Hydrosystem RM&E	54	8	COE	AVS-W-03-01	Evaluate the Impact of Avian Predation on Salmonid Smolts from the Columbia and Snake Rivers		
RM&E	Hydrosystem RM&E	54	8	COE	AVS-W-03-01	Electronic Recovery of PIT Tags from Piscivorous Bird Colonies in the Columbia River Basin		

Attachment 1 - Table 2. Corps Project List

H-Section	BiOp Strategy	RPA #	RPA Subaction	Agency	Project #	Project Title	Start Date	Action Information Link
RM&E	Hydrosystem RM&E	54	9	COE	ADS-00-4	Investigation of Fate of Fish; Straying in Adult Salmon and Steelhead (RM&E)		
RM&E	Hydrosystem RM&E	54	9	COE	SPE-06-2	Comparative Performance of Acoustic - Tagged and PIT - Tagged Juvenile Salmonids		
RM&E	Hydrosystem RM&E	54	12	COE	ADS-00-1	Evaluation of Adult Salmon and Steelhead Delay and Fallback at Snake and Columbia River Dams		
RM&E	Hydrosystem RM&E	54	13	COE	ADS-P-00-6	Evaluation of Steelhead Kelt and Overwintering Summer Steelhead Downstream Passage Through Columbia and Snake River dams		

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H-Section	BiOp Strategy	RPA #	RPA Subaction	Agency	Project #	Project Title	Start Date	Action Information Link
RM&E	Hydrosystem RM&E	54	14	COE	ADS-P-00-6	Evaluation of Steelhead Kelt and Overwintering Summer Steelhead Downstream Passage Through Columbia and Snake River dams		
RM&E	Hydrosystem RM&E	54	1, 2,3,4,5, 9	COE	SPE-P-08-3	Studies of Surface Spill at John Day Dam		
RM&E	Hydrosystem RM&E	54	1, 2,3,4,5, 9	COE	SPE-W-04-2	Juvenile Survival and Passage at Little Goose Dam.		
RM&E	Hydrosystem RM&E	54	1, 2,3,4,5, 9	COE	SPE-W-05-1	Passage, Survival, and Approach Patterns of Juvenile Salmonids at McNary Dam		
RM&E	Hydrosystem RM&E	54	1, 2,3,4,5, 9	COE	SPE-W-08-4	Fish passage and survival at Lower Monumental Dam and Ice Harbor Dam		
RM&E	Hydrosystem RM&E	54	3, 9	COE	SPE-P-08-1	Evaluation of a Behavioral Guidance Structure at Bonneville Dam Second Powerhouse		

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H-Section	BiOp Strategy	RPA #	RPA Subaction	Agency	Project #	Project Title	Start Date	Action Information Link
RM&E	Hydrosystem RM&E	55	1	COE	TPE-W-00-06	Analyze the Benefits of Transporting Lower Snake River Juvenile Fall Chinook Salmon		
RM&E	Hydrosystem RM&E	55	1	COE	TPE-W-04-1	Determine the Seasonal Effects of Transporting fish from the Snake River to optimize a Transportation Strategy		
RM&E	Hydrosystem RM&E	55	2	COE	EST-02-01	A Study of Salmonid Survival and Behavior through the Columbia River Estuary Using Acoustic Tags		
RM&E	Hydrosystem RM&E	55	2	COE	TPE-W-00-06	Analyze the Benefits of Transporting Lower Snake River Juvenile Fall Chinook Salmon		
RM&E	Hydrosystem RM&E	55	2	COE	TPE-W-04-1	Determine the Seasonal Effects of Transporting fish from the Snake River to optimize a Transportation Strategy		

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H-Section	BiOp Strategy	RPA #	RPA Subaction	Agency	Project #	Project Title	Start Date	Action Information Link
RM&E	Hydrosystem RM&E	55	4	COE	EST-02-01	A Study of Salmonid Survival and Behavior through the Columbia River Estuary Using Acoustic Tags		
RM&E	Hydrosystem RM&E	55	4	COE	TPE-W-00-06	Analyze the Benefits of Transporting Lower Snake River Juvenile Fall Chinook Salmon		
RM&E	Hydrosystem RM&E	55	6	COE	TSP-05-1	Pressure Investigations to Support Biological Index Testing		
RM&E	Hydrosystem RM&E	55	8	COE	SPE-06-2	Comparative Performance of Acoustic - Tagged and PIT - Tagged Juvenile Salmonids		
RM&E	Hydrosystem RM&E	55	9	COE	ADS-00-4	Investigation of Fate of Fish; Straying in Adult Salmon and Steelhead (RM&E)		
RM&E	Estuary Habitat RM&E	58	1	COE	EST-02-01	A Study of Salmonid Survival and Behavior through the Columbia River Estuary Using Acoustic Tags		

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H-Section	BiOp Strategy	RPA #	RPA Subaction	Agency	Project #	Project Title	Start Date	Action Information Link
RM&E	Estuary Habitat RM&E	58	1	COE	EST-09-P-new	Evaluation of Life History Diversity, Habitat Connectivity, and Survival Benefits Associated with Habitat Restoration Actions in the Lower Columbia River and Estuary		
RM&E	Estuary Habitat RM&E	58	2	COE	EST-09-P-new	Evaluation of Life History Diversity, Habitat Connectivity, and Survival Benefits Associated with Habitat Restoration Actions in the Lower Columbia River and Estuary		
RM&E	Estuary Habitat RM&E	59	1	COE	AER7	JBH Tide Gate Replacement		
RM&E	Estuary Habitat RM&E	59	3	COE	AER7	JBH Tide Gate Replacement		
RM&E	Estuary Habitat RM&E	59	4	COE	EST-02-01	A Study of Salmonid Survival and Behavior through the Columbia River Estuary Using Acoustic Tags		
RM&E	Estuary Habitat RM&E	59	5	COE	STM3	Tides and Currents		

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H-Section	BiOp Strategy	RPA #	RPA Subaction	Agency	Project #	Project Title	Start Date	Action Information Link
RM&E	Estuary Habitat RM&E	59	5	COE	STM4	ODEQ Ambient Water Quality Monitoring		
RM&E	Estuary Habitat RM&E	59	5	COE	STM5	USGS Discharge and WQ Monitoring		
RM&E	Estuary Habitat RM&E	59	5	COE	STM6	WDOE Ambient WQ Monitoring		
RM&E	Estuary Habitat RM&E	59	1, 5	COE	EST-02-P-04	Evaluating Cumulative Ecosystem Response to Habitat Restoration Projects in the Lower Columbia River and Estuary		
RM&E	Estuary Habitat RM&E	59	2,3	COE	EST-09-P-new	Evaluation of Life History Diversity, Habitat Connectivity, and Survival Benefits Associated with Habitat Restoration Actions in the Lower Columbia River and Estuary		
RM&E	Estuary Habitat RM&E	60	2	COE	AER5	Pile Structure Evaluation Coal Creek		
RM&E	Estuary Habitat RM&E	60	2	COE	AER9	Tenasillahe Island Monitoring		

Attachment 1 - Table 2. Corps Project List

H-Section	BiOp Strategy	RPA #	RPA Subaction	Agency	Project #	Project Title	Start Date	Action Information Link
RM&E	Estuary Habitat RM&E	60	1, 2, 3	COE	EST-02-P-04	Evaluating Cumulative Ecosystem Response to Habitat Restoration Projects in the Lower Columbia River and Estuary		
RM&E	Estuary Habitat RM&E	60	2, 3	COE	AER10	Monitoring at Smith and Bybee Lakes		
RM&E	Estuary Habitat RM&E	60	2, 3	COE	AER12	Ramsey Lake Project Monitoring		
RM&E	Estuary Habitat RM&E	60	2, 3	COE	AER7	JBH Tide Gate Replacement		
RM&E	Estuary Habitat RM&E	60	2, 3	COE	AER8	Crims Island Monitoring		
RM&E	Estuary Habitat RM&E	61	1	COE	EST-02-01	A Study of Salmonid Survival and Behavior through the Columbia River Estuary Using Acoustic Tags		
RM&E	Estuary Habitat RM&E	61	3	COE	EST-02-P-04	Evaluating Cumulative Ecosystem Response to Habitat Restoration Projects in the Lower Columbia River and Estuary		

Attachment 1 - Table 2. Corps Project List

H-Section	BiOp Strategy	RPA #	RPA Subaction	Agency	Project #	Project Title	Start Date	Action Information Link
RM&E	Estuary Habitat RM&E	61	4	COE	STM3	Tides and Currents		
RM&E	Estuary Habitat RM&E	61	4	COE	STM5	USGS Discharge and WQ Monitoring		
RM&E	Estuary Habitat RM&E	61	2, 3	COE	EST-02-01	A Study of Salmonid Survival and Behavior through the Columbia River Estuary Using Acoustic Tags		
RM&E	Predation Mgmt RM&E	68		COE	AVS-W-03-01	Electronic Recovery of PIT Tags from Piscivorous Bird Colonies in the Columbia River Basin		
RM&E	Predation Mgmt RM&E	68		COE	AVS-W-03-01	Evaluate the Impact of Avian Predation on Salmonid Smolts from the Columbia and Snake Rivers		

Attachment 2: Summary of 2007 to 2009 Tributary Habitat Accomplishments, by Population

Attachment 2 summarizes metrics at the population level for tributary habitat measures implemented with funding from BPA or with technical assistance from Reclamation in 2007 through 2009. BPA uses Pisces, a contract management system, to track and record planned and actual work accomplishments. Reclamation metrics included here were summarized from the detailed metrics reported in Attachment 3, Tables 5.2 and 5.3. Further detail of work accomplished can be found in BPA's Report Center Habitat Metrics Report, available at http://www.efw.bpa.gov/IntegratedFWP/reportcenter.aspx.

NOTE: Metrics in this attachment may be reported twice if they are located in areas used by Chinook and steelhead.

2007-2009 Completed Metrics (BPA and USBR)			Water Quantity	Entrainment	Passage		Channel Complexity	Water Quality Riparian Protection and Enhancement		
ESU/DPS	MPG	Population	CFS protected	# of screens addressed	# of barriers addressed	Stream miles with improved access	Stream miles improved	Stream miles protected	Riparian acres improved	Riparian acres protected
Snake River Spring/Summer-run Chinook Salmon ESU	Dry Clearwater	Lapwai/Big Canyon			4	27.6	0.0		440.7	
		Polatch River							36.8	
		Upper South Fork Clearwater			7	29.5	2.0		3.6	
	Grande Ronde / Imnaha	Catherine Creek			2	23.5				
		Grande Ronde River upper mainstem			1	52.8	3.1		58.5	

2007-2009 Completed Metrics (BPA and USBR)			Water Quantity	Entrainment	Passage		Channel Complexity	Water Quality Riparian Protection and Enhancement		
ESU/DPS	MPG	Population	CFS protected	# of screens addressed	# of barriers addressed	Stream miles with improved access	Stream miles improved	Stream miles protected	Riparian acres improved	Riparian acres protected
		Imnaha River mainstem							250	
		Lostine River	52.2		1	5.0	1.9		51	
	Lower Snake	Asotin Creek							23.5	
		Tucannon River		5				29.5		591.0
	Middle Fork Salmon River	Camas Creek					0.1			
		Marsh Creek		2						
	South Fork Salmon River	East Fork South Fork Salmon River			3	15.6				
		Little Salmon River			3	20.8				

2007-2009 Completed Metrics (BPA and USBR)			Water Quantity	Entrainment	Passage		Channel Complexity	Water Quality Riparian Protection and Enhancement		
ESU/DPS	MPG	Population	CFS protected	# of screens addressed	# of barriers addressed	Stream miles with improved access	Stream miles improved	Stream miles protected	Riparian acres improved	Riparian acres protected
	Upper Salmon River	East Fork Salmon River		1			2.0			
		Lemhi River	103.5	8	5	147.0				
		Pahsimeroi River	29.6	4	1	1.0				
		Salmon River lower mainstem below Redfish Lake	29.6	3	2	3.0				
		Salmon River upper mainstem above Redfish Lake	54.1	3	1	3.0			7.0	
		Valley Creek		3	1	3.0				
	Wet Clearwater	Lochsa River			4	4.5			8.5	
		Lolo Creek			5	11.7	0.1			

2007-2009 Completed Metrics (BPA and USBR)			Water Quantity	Entrainment	Passage		Channel Complexity	Water Quality Riparian Protection and Enhancement		
ESU/DPS	MPG	Population	CFS protected	# of screens addressed	# of barriers addressed	Stream miles with improved access	Stream miles improved	Stream miles protected	Riparian acres improved	Riparian acres protected
Snake River Spring/Summer-run Chinook Salmon ESU Total			**269.0**	**29.0**	**40.0**	**348.0**	**9.2**	**29.5**	**879.6**	**591.0**
Upper Columbia River Spring-run Chinook Salmon ESU	Upper Columbia / East Slope Cascades	Entiat River	0.3	1	1				2.0	
		Methow River	97.1		2	33.1	4.3	1.0	32.3	135.0
		Wenatchee River			3	0.8	0.1		2.1	
Upper Columbia River Spring-run Chinook Salmon ESU Total			**97.4**	**1.0**	**6.0**	**33.9**	**4.4**	**1.0**	**36.4**	**135.0**
Middle Columbia River Steelhead DPS	Cascades Eastern Slope Tributaries	Deschutes River - eastside	3.5	1				60.5	156.0	864.8
		Deschutes River - westside	3.8					20.1	20.0	652.4

2007-2009 Completed Metrics (BPA and USBR)			Water Quantity	Entrainment	Passage		Channel Complexity	Water Quality Riparian Protection and Enhancement		
ESU/DPS	MPG	Population	CFS protected	# of screens addressed	# of barriers addressed	Stream miles with improved access	Stream miles improved	Stream miles protected	Riparian acres improved	Riparian acres protected
		Fifteenmile Creek (winter run)	11.0					25.9		513.7
		Klickitat River			4	6.0			7.3	
	John Day River	John Day River lower mainstem tributaries		24	17	61.5	0.4	64.9	184	954.9
		John Day River upper mainstem	9.8	38	20	66.4	8.2	10.5	441.8	203.1
		Middle Fork John Day River	14.5	3	14	83.0	9.0	11.0	221.6	250.0
		North Fork John Day River			1	2.5		13.4	134.1	762.0
		South Fork John Day River		2	3	7.0	0.2	16.0	21	237.0

2007-2009 Completed Metrics (BPA and USBR)			Water Quantity	Entrainment	Passage		Channel Complexity	Water Quality Riparian Protection and Enhancement		
ESU/DPS	MPG	Population	CFS protected	# of screens addressed	# of barriers addressed	Stream miles with improved access	Stream miles improved	Stream miles protected	Riparian acres improved	Riparian acres protected
	Umatilla and Walla Walla River	Touchet River	1.9	1	1	100.0	2.5			
		Umatilla River	2.1		3	13.0	43.3	14.2	1053.9	7.0
		Walla Walla River	3.1	1	2	30.0	0.2		9	
	Yakima River Group	Naches River	4.4	12	1	0.5	0.3		160	
		Satus Creek			1	93.0		168.0	0	8,062.0
		Toppenish		1	1	50.0	1.5	3.2	360	98.0
		Yakima River upper mainstem	16.3	3	5	16.0	0.1	15.0	6.8	55.0

2007-2009 Completed Metrics (BPA and USBR)			Water Quantity	Entrainment	Passage		Channel Complexity	Water Quality Riparian Protection and Enhancement		
ESU/DPS	MPG	Population	CFS protected	# of screens addressed	# of barriers addressed	Stream miles with improved access	Stream miles improved	Stream miles protected	Riparian acres improved	Riparian acres protected
Middle Columbia River Steelhead DPS Total			**70.3**	**86**	**73.0**	**528.9**	**65.6**	**422.7**	**2,775.5**	**12,659.9**
Snake River Basin Steelhead DPS	Clearwater River	Clearwater River lower mainstem			4	27.6	0.0		477.5	
		Lochsa River			4	4.5			8.5	
		Lolo Creek			5	11.7	0.1		0	
		South Fork Clearwater River			7	29.5	2.0		3.6	
	Grande Ronde River	Grande Ronde River lower mainstem tributaries			2	11.5			10	
		Grande Ronde River upper mainstem			4	81.3	7.0		173.4	
		Joseph Creek			2	10.3	8.0		11	

2007-2009 Completed Metrics (BPA and USBR)			Water Quantity	Entrainment	Passage		Channel Complexity	Water Quality Riparian Protection and Enhancement		
ESU/DPS	MPG	Population	CFS protected	# of screens addressed	# of barriers addressed	Stream miles with improved access	Stream miles improved	Stream miles protected	Riparian acres improved	Riparian acres protected
		Wallowa River	52.2		1	5.0	1.9		51	
	Imnaha River	Imnaha River							250	
	Lower Snake	Asotin Creek							269.8	
		Tucannon River		5				29.5		591.0
	Salmon River	Big, Camas, and Loon Creek					0.1			
		East Fork Salmon River	13.2	2	1	2.0	2.0			
		Lemhi River	103.5	8	5	147.0				
		Middle Fork Salmon River upper mainstem		2						
		Little Salmon and Rapid River			3	20.8				

2007-2009 Completed Metrics (BPA and USBR)			Water Quantity	Entrainment	Passage		Channel Complexity	Water Quality Riparian Protection and Enhancement		
ESU/DPS	MPG	Population	CFS protected	# of screens addressed	# of barriers addressed	Stream miles with improved access	Stream miles improved	Stream miles protected	Riparian acres improved	Riparian acres protected
		Pahsimeroi River	46.0	6	2	2.0				
		Salmon River upper mainstem	54.1	6	2	6.0			7.0	
		South Fork Salmon River			3	15.6				
Snake River Basin Steelhead DPS Total			**269.0**	**29.0**	**45.0**	**374.8**	**21.1**	**29.5**	**1,261.8**	**591.0**
Upper Columbia River Steelhead DPS	Upper Columbia / East Slope Cascades	Entiat River	0.3	1	1		1.4		2.0	
		Methow River	97.1		2	33.1	4.6	1.0	32.3	135.0
		Okanogan River	80.1		7	14.0	0.2	1.1	35.4	103.5
		Wenatchee River		5	15	20.4	1.6		2.7	

2007-2009 Completed Metrics (BPA and USBR)			Water Quantity	Entrainment	Passage		Channel Complexity	Water Quality Riparian Protection and Enhancement		
ESU/DPS	MPG	Population	CFS protected	# of screens addressed	# of barriers addressed	Stream miles with improved access	Stream miles improved	Stream miles protected	Riparian acres improved	Riparian acres protected
Upper Columbia River Steelhead DPS Total			**177.5**	**6.0**	**25.0**	**67.5**	**7.7**	**2.1**	**72.4**	**238.5**

Attachment 3: Progress of Projects and Actions Identified for 2007-2009 Implementation in the FCRPS Biological Assessment, Attachment B.2.2-2, Tables 1-6

The Action Agencies committed to provide funding and technical assistance for specific tributary habitat projects as listed in Attachment B.2.2-2, Tables 1-6, of the FCRPS Biological Assessment. These projects were used as the basis for estimating changes in habitat quality for specific populations and established an initial performance standard for annual progress reporting. The tables in Attachment 3 describe the 2007, 2008, and 2009 implementation progress of the projects identified for implementation in the FCRPS Biological Assessment. Accomplishments may be reported more than once if they benefit both Chinook and steelhead.

Attachment 3 - Table 1. Tributary Habitat Actions Identified for 2007-2009 Implementation in FCRPS BA, Attachment B.2.2-2, Tables 1a & b: Upper Columbia Spring Chinook & Steelhead

Upper Columbia Spring Chinook & Steelhead (*NOTE: Projects that benefit multiple ESUs/DPSs or populations are reported more than once)*				
Population	**Project #**	**Project Title & Short Description**	**2007–09 Action Description**	**FY07-09 Progress**
Entiat River	200703400	Columbia Cascade Pump Screen Correction This project proposes to start a voluntary compliance pump screen correction program in the Methow, Entiat, and Wenatchee River basins in order to reduce juvenile fish losses due to entrapment in water diversions.	Install Fish Screen	Project work focused in Okanogan subbasin; future Entiat work pending inventory, assessment and prioritization.
	200705500	Entiat River - UPA - Lower Entiat River Off-Channel Restoration Project The Lower Entiat River Off-Channel enhancement project will provide 0.28 miles of off-channel habitat to benefit Upper Columbia ESA listed steelhead, spring Chinook, and bull trout. An irrigation channel will be enhanced for rearing and spawning habitat.	Develop Pond	Contract in FY10
			Increase Instream Habitat Complexity	
			Install Fish Passage Structure	
			Plant Vegetation	
	200723100	UPA Entiat Subbasin Riparian Enhancement Program Riparian projects are being proposed in the Entiat	Install Fence	1.0 riparian mile planted along Indian Creek
			Maintain Vegetation	

Attachment 3 - Table 1. Tributary Habitat Actions Identified for 2007-2009 Implementation in FCRPS BA, Attachment B.2.2-2, Tables 1a & b: Upper Columbia Spring Chinook & Steelhead

Upper Columbia Spring Chinook & Steelhead (*NOTE: Projects that benefit multiple ESUs/DPSs or populations are reported more than once)*				
Population	**Project #**	**Project Title & Short Description**	**2007–09 Action Description**	**FY07-09 Progress**
		subbasin to benefit Upper Columbia spring Chinook, steelhead and bull trout. Funding is requested for Tillicum Creek Fence and programmatic riparian projects.	Plant Vegetation	
	200731800	Entiat River - UPA - Knapp-Wham Hanan Detwiler Irrigation System Consolidation Project Consolidation of the Knapp-Wham and Hanan Detwiler irrigation systems will eliminate partial fish passage barriers associated with 2 surface water diversions, add instream habitat within the lower Entiat River, and enhance instream flows via water saved.	Develop Alternative Water Source	5 new wells drilled
			Increase Instream Habitat Complexity	
			Install Well	
			Remove/Install Diversion	Replaced Knapp-Wham and Keystone fish screens, Hanan-Detwiller fish screen complex decommissioned. Conserved over 1600 acre-ft/yr and 5 cfs of flow. 5.8 miles primary stream reach improved.
Methow River	200501000	Macpherson Side Channel on the Chewuch River	Install Fish Passage Structure	Replaced undersized culvert to allow access to 0.5 miles instream habitat, enhanced 2000 feet meandering channel.
	200600700	Little Bridge Creek Fence	Install Fence	Installed 0.5 miles riparian fencing.
	200703400	Columbia Cascade Pump Screen Correction This project proposes to start a voluntary compliance pump screen correction program in the Methow, Entiat, and Wenatchee River basins in order to reduce juvenile fish losses due to entrapment in water diversions.	Install Fish Screen	Project work focused on Okanogan; Methow pending inventory, assessment, prioritization.

Attachment 3 - Table 1. Tributary Habitat Actions Identified for 2007-2009 Implementation in FCRPS BA, Attachment B.2.2-2, Tables 1a & b: Upper Columbia Spring Chinook & Steelhead

Upper Columbia Spring Chinook & Steelhead (*NOTE: Projects that benefit multiple ESUs/DPSs or populations are reported more than once)*				
Population	**Project #**	**Project Title & Short Description**	**2007–09 Action Description**	**FY07-09 Progress**
	200703500	UPA Project - Methow Basin Riparian Enhancement MSRF proposes to partner with Bureau of Reclamation and Methow Conservancy to identify and prioritize riparian enhancement projects that will add value to passage, access and conservation projects. All projects will focus on TES species and habitat.	Install Fence	5.15 miles riparian fencing installed; 5.8 riparian miles planted.
			Plant Vegetation	
	200717200	UPA Project - MVID West Canal Diversion and Headworks Move POD 175' upstream by installing new concrete diversion headworks, realign 150' of West Canal intake and build new access road to connect new headworks, construct permanent channel-spanning natural rock roughened channel permanent diversion.	Install Fish Passage Structure	Project under consideration to assess fish benefits.
			Operate and Maintain Habitat/Passage	
			Plant Vegetation	
			Remove/Install Diversion	
	200721400	UPA Project - Fender Mill Floodplain Restoration - Phase 1. Restore natural channel process, reestablish side channel rearing habitat, restore-improve riparian forest habitat, add wood complexes in main stem, install rock structure to keep majority of flow in main stem, breach existing levee, connect side channels.	Create, Restore, and/or Enhance Wetland	Implementation deferred.
			Increase Instream Habitat Complexity	
			Operate and Maintain Habitat/Passage	
			Plant Vegetation	Treated 0.45 riparian miles.

Attachment 3 - Table 1. Tributary Habitat Actions Identified for 2007-2009 Implementation in FCRPS BA, Attachment B.2.2-2, Tables 1a & b: Upper Columbia Spring Chinook & Steelhead

Upper Columbia Spring Chinook & Steelhead (*NOTE: Projects that benefit multiple ESUs/DPSs or populations are reported more than once)*				
Population	**Project #**	**Project Title & Short Description**	**2007–09 Action Description**	**FY07-09 Progress**
	200723700	UPA Project - Elbow Coulee Floodplain Restoration This project would eliminate a dike; open an existing side channel and floodplain; reconnect a wetland; and use large woody debris and boulders to split flows. These would increase habitat complexity and create more dynamic habitats for listed salmonids.	Create, Restore, and/or Enhance Wetland	Dike notching, sill construction, and minimal channel improvements completed.
			Enhance Floodplain	
			Increase Instream Habitat Complexity	
			Operate and Maintain Habitat/Passage	
			Plant Vegetation	
			Realign, Connect, and/or Create Channel	
			Upland Erosion and Sedimentation Control	
	200725100	UPA Project - Methow Valley Irrigation District East Diversion Dam Replacement This project will remove the present channel-spanning irrigation diversion dam and replace it with a reinforced earth and rock wing dam parallel to the thalweg. This project will also re-open 1/4 mile of side channel habitat blocked by a pushup berm.	Operate and Maintain Habitat/Passage	Conducted value engineering on proposed action, developed permit and consultation materials, developed materials for construction bids, and negotiated landowner agreements. Implementation deferred until FY2010.
			Plant Vegetation	
			Realign, Connect, and/or Create Channel	
			Remove/Install Diversion	

Attachment 3 - Table 1. Tributary Habitat Actions Identified for 2007-2009 Implementation in FCRPS BA, Attachment B.2.2-2, Tables 1a & b: Upper Columbia Spring Chinook & Steelhead

Upper Columbia Spring Chinook & Steelhead (*NOTE: Projects that benefit multiple ESUs/DPSs or populations are reported more than once)*				
Population	**Project #**	**Project Title & Short Description**	**2007–09 Action Description**	**FY07-09 Progress**
	200726400	UPA Project - Programmatic Habitat Complexity Projects in the Methow River Subbasin These projects would eliminate dikes, open side channels, and enhance floodplain connectivity at various sites in the Methow subbasin. Identification and ranking to be based on MIHRP study.	Realign, Connect, and/or Create Channel	Installed LWD structure and improved complexity on 0.07 miles of Big Valley Reach; completed permitting, design, and contracting for 2010 implementation to increase instream complexity and reconnect side channels.
	200201301	Water Entity Fund water right transactions that restore streamflows and focused riparian easements on critical fish-bearing Columbia Basin tributaries. Implemented as the Columbia Basin Water Transactions Program (CBWTP) in a partnership between BPA and NFWF.	Acquire Water Instream	63 cfs and 8047 acre-ft. of water flow protected; 132 total miles/69 primary miles of stream reach improved.
			Develop and Negotiate Water Right Transaction	
			Install Flow Measuring Device	
			Land Purchase	Conservation easements to protect 1 mile riparian habitat.
	200810400	Land & Water Acquisition	Land Purchase	Completed White property land purchase to protect 30 upland and 3.5 riparian acres, and 0.55 riparian miles.
Wenatchee River	200703400	Columbia Cascade Pump Screen CorrectionThis project proposes to start a voluntary compliance pump screen correction program in the Methow, Entiat, and Wenatchee River basins in order to reduce juvenile fish losses due to entrapment in water diversions.	Install Fish Screen	Project work focused in Okanogan; Wenatchee pending inventory, assessment, prioritization.

Attachment 3 - Table 1. Tributary Habitat Actions Identified for 2007-2009 Implementation in FCRPS BA, Attachment B.2.2-2, Tables 1a & b: Upper Columbia Spring Chinook & Steelhead

Upper Columbia Spring Chinook & Steelhead (*NOTE: Projects that benefit multiple ESUs/DPSs or populations are reported more than once)*				
Population	**Project #**	**Project Title & Short Description**	**2007–09 Action Description**	**FY07-09 Progress**
	200704200	UPA Wenatchee Passage Program To replace 9 barrier culverts in Alder Creek, Clear Creek and Beaver Creek with fish-friendly structures to provide 4.0 miles of spawning and rearing habitat for ESA listed Upper Columbia steelhead.	Install Fish Passage Structure	Combined into new project 200740000.
			Remove/Modify Dam	
	200708500	UPA Nason Creek Oxbow Reconnection Project Project proposes to install two bottomless arch culverts in SR 207 to successfully reconnect 0.64 miles of historic oxbow habitat to the main channel Nason Creek. This project will increase Spring Chinook salmonid abundance by 25-50% in the Nason A.U.	Install Fish Passage Structure	Combined into new project 200740000.
	200708600	UPA Wenatchee Subbasin Riparian Enhancement Proposal The Wenatchee Riparian proposal will involve planting native vegetation and fencing to establish a properly functioning riparian buffer in the Wenatchee Assessment Units. This project will benefit Upper Columbia steelhead, spring Chinook and bull trout.	Install Fence	Treated 0.66 riparian miles.
			Maintain Vegetation	
			Plant Vegetation	
	200723100	Entiat River Riparian Restoration Exclude livestock from portions of Tillicum and Indian Creeks to protect approximately 0.5 miles of streambanks and riparian vegetation along steelhead spawning areas.	Install Fence Plant Vegetation	Installed 1 mile riparian fencing and planted 0.7 miles riparian vegetation.

Attachment 3 - Table 1. Tributary Habitat Actions Identified for 2007-2009 Implementation in FCRPS BA, Attachment B.2.2-2, Tables 1a & b: Upper Columbia Spring Chinook & Steelhead

Upper Columbia Spring Chinook & Steelhead (*NOTE: Projects that benefit multiple ESUs/DPSs or populations are reported more than once)*				
Population	**Project #**	**Project Title & Short Description**	**2007–09 Action Description**	**FY07-09 Progress**
	200728300	UPA Wenatchee Subbasin Access Proposal Forty three (43) potential fish passage barrier structures are being proposed for funding to benefit Upper Columbia spring Chinook, steelhead and bull trout. Emphasis is on replacing the Mill Creek Culvert near the mouth of Peshastin Creek.	Install Fish Passage Structure	Combined into new project 200740000.
	200732500	UPA Wenatchee Subbasin Complexity Proposal Five potential complexity projects are being proposed for funding to benefit Upper Columbia spring Chinook, steelhead and bull trout. Funds are also requested for unidentified potential complexity projects to assist in meeting UPA metric goals.	Realign, Connect, and/or Create Channel	0.1 mile stream complexity improved; Completed alternatives and feasibility analyses, survey and design, contract packages for 2010 implementation to improve fish passage and treatment of instream habitat.
	200740000	Wenatchee River Subbasin Fish Passage Enhancement (combination of 200704200, 2000708500, & 200728300)	Install Fish Passage Structure	Installed 2 fish passage culverts to provide access to 0.8 mile of oxbow habitat in Nason Creek; initiated replacement of 12 fish barrier culverts for 2010 completion.
Okanogan River	199604200	Restore and Enhance Anadromous Fish Populations and Habitat in Salmon Creek This project is directed at reconnecting a productive tributary of the Okanogan River, Salmon Creek. This project involves a water lease with the Okanogan Irrigation District and construction of a low flow channel within the lower reach.	Acquire Water Instream	
			Develop and Negotiate Water Right Transaction	
			Install Well	

Attachment 3 - Table 1. Tributary Habitat Actions Identified for 2007-2009 Implementation in FCRPS BA, Attachment B.2.2-2, Tables 1a & b: Upper Columbia Spring Chinook & Steelhead

Upper Columbia Spring Chinook & Steelhead (*NOTE: Projects that benefit multiple ESUs/DPSs or populations are reported more than once)*				
Population	**Project #**	**Project Title & Short Description**	**2007–09 Action Description**	**FY07-09 Progress**
			Realign, Connect, and/or Create Channel	Constructed low flow channel in lower Salmon Creek to add 8 miles instream habitat with boulder weirs to provide resting pools for migrating adults and two rock toes to prevent streambank erosion.
	200000100	Anadromous Fish Habitat & Passage The Tribe proposes continuing habitat rehabilitation efforts to decrease sediment loads and improve passage for anadromous steelhead and salmon. In addition, monitoring and evaluation efforts will assess effectiveness of ongoing activities.	Develop Alternative Water Source	1.6 miles riparian planting, 2.4 miles riparian fencing installed, fish passage structures installed to improve access to 15 miles instream habitat; recontoured 0.5 mile abandoned road and relocated livestock corrals to reduce sedimentation, installed structure to maintain adequate flow to 0.15 miles pool habitat, 200 acres protected through Omak Creek land purchase.
			Install Fence	
	200714500	Okanogan Livestock and Water Provide a cost share program to assist producers in developing offsite water for livestock and provide assistanc fencing riparian areas. Allowing producers to respond to and prevent complaints.	Develop Alternative Water Source	Completed 2 spring developments, 6 off-site watering facilities, 4,380 feet of pipeline, 4 rock crossings, and 2 hardened watering points .
			Install Fence	Installed 1.1 miles riparian fencing.
			Plant Vegetation	Planted native species on Saltsman property.
	200722400	Implementation of the Okanogan Subbasin Plan. Initiate a Programmatic and Sequenced set of Key Habitat Restoration and Protection Actions The integration of science into management,	Acquire Water Instream	Installed 0.2 miles riparian fencing, planted 0.5 riparian miles, treated 0.3 riparian miles noxious weeds.

Attachment 3 - Table 1. Tributary Habitat Actions Identified for 2007-2009 Implementation in FCRPS BA, Attachment B.2.2-2, Tables 1a & b: Upper Columbia Spring Chinook & Steelhead

Upper Columbia Spring Chinook & Steelhead (*NOTE: Projects that benefit multiple ESUs/DPSs or populations are reported more than once)*				
Population	**Project #**	**Project Title & Short Description**	**2007–09 Action Description**	**FY07-09 Progress**
		decision-making and recommended actions is an essential task for resource managers. This phased and programmatic plan is the centerpiece for mitigation, recovery and conservation in the Okanogan R & the Province.	Enhance Floodplain	
			Plant Vegetation	
			Realign, Connect, and/or Create Channel	
			Upland Erosion and Sedimentation Control	
	200201301	Water Entity Fund water right transactions that restore streamflows and focused riparian easements on critical fish-bearing Columbia Basin tributaries. Implemented as the Columbia Basin Water Transactions Program (CBWTP) in a partnership between BPA and NFWF.	Acquire Water Instream	Annual protection of 700 acre-ft and 25 cfs of water.
			Develop and Negotiate Water Right Transaction	
			Install Flow Measuring Device	
			Land Purchase	

Attachment 3 - Table 2. Actions Identified for 2007-2009 Implementation in FCRPS BA, Attachment B.2.2-2, Table 2: Middle Columbia Steelhead

Middle Columbia Steelhead				
Population	**Project #**	**Project Title & Short Description**	**2007-09 Action Description**	**FY07-09 Progress**
Multiple populations	200201301	Water Entity (Rpa 151) Nwppc Fund water right transactions that restore streamflows and focused riparian easements on critical fish-bearing Columbia Basin tributaries. Implemented as the Columbia Basin Water Transactions Program (CBWTP) in a partnership between BPA and NFWF.	Acquire Water Instream	10,982 acre-ft/yr and 52 cfs of water flow protected in 2007-09 for Middle Columbia River steelhead.
Klickitat River (above BON)	199705600	Klickitat Watershed Enhancement This project (KWEP) restores, enhances, and protects watershed health to aid recovery of native salmonid stocks in the Klickitat subbasin. Implemented by the Yakama Nation Fisheries Program and funded by BPA, KWEP addresses FWP goals and objectives.	Create, Restore, and/or Enhance Wetland	Installed fish passage structure (culverts) to provide access to 6 miles instream habitat.
			Develop Alternative Water Source	
			Enhance Floodplain	
			Increase Instream Habitat Complexity	
			Install Fence	
			Install Fish Passage Structure	
			Install Flow Measuring Device	
			Maintain Vegetation	

Attachment 3 - Table 2. Actions Identified for 2007-2009 Implementation in FCRPS BA, Attachment B.2.2-2, Table 2: Middle Columbia Steelhead

Middle Columbia Steelhead				
Population	**Project #**	**Project Title & Short Description**	**2007-09 Action Description**	**FY07-09 Progress**
			Operate and Maintain Habitat/Passage	
			Plant Vegetation	
			Realign, Connect, and/or Create Channel	
			Upland Erosion and Sedimentation Control	
			Decommission Road	
			Enhance Nutrients Instream	
			Improve/Relocate Road	
			Remove vegetation	
			Remove Debris	
	198812035	YKFP Klickitat Management, Data, and Habitat Proposal provides for all YN management functions associated with the Yakima/Klickitat Fisheries Project including project planning, O&M, research, data management, and habitat improvement and acquisition actions in the Klickitat Subbasin.	Habitat improvement	Klickitat Master Plan under development, primary work involves fish population research, fish habitat inventory, development of management alternatives and coordination of preliminary design, permitting, and cost projections associated with proposed Master Plan actions.
			Lease Land	

Attachment 3 - Table 2. Actions Identified for 2007-2009 Implementation in FCRPS BA, Attachment B.2.2-2, Table 2: Middle Columbia Steelhead

Middle Columbia Steelhead				
Population	**Project #**	**Project Title & Short Description**	**2007-09 Action Description**	**FY07-09 Progress**
Fifteen Mile Creek (above TDA)	200102100	15 Mile Creek Riparian Buffers This proposal develops riparian buffer systems on streams in the Fifteenmile Subbasin and other direct tributaries to the Columbia River in northern Wasco County. Implementation of buffer plans developed under this proposal are fully funded by USDA.	Riparian Enhancement	513 riparian acres and 25 riparian miles protected through CCRP/CREP agreements.
	199304000	Fifteenmile Creek Habitat Restoration and Monitoring Project Provide continued operation and maintenance on previously installed fencing and instream habitat, monitor the success of all restoration efforts, and begin implementation to improve instream habitat complexity within the Fifteenmile Creek Subbasin.	Develop Alternative Water Source	Installed 1 mile of riparian fencing to protect approximately 0.5 mile of stream and 20 riparian acres.
			Increase Instream Habitat Complexity	
			Install Fence	
			Maintain Vegetation	
			Operate and Maintain Habitat/Passage	
Eastside Deschutes (above TDA)	199404200	Trout Creek Fish Habitat Restoration ProjectConstruction, O&M, and M&E of numerous new and existing instream and riparian habitat restoration projects; Monitoring and Evaluation of summer steelhead smolt production and adult return. M&E of instream and riparian habitat restoration activities.	Develop Alternative Water Source	1.0 miles of stream channel and floodplain restoration; conserved 35 acre-ft flow; maintained approximately 120 miles riparian fencing.
			Enhance Floodplain	
			Maintain Vegetation	

Attachment 3 - Table 2. Actions Identified for 2007-2009 Implementation in FCRPS BA, Attachment B.2.2-2, Table 2: Middle Columbia Steelhead

Middle Columbia Steelhead				
Population	**Project #**	**Project Title & Short Description**	**2007-09 Action Description**	**FY07-09 Progress**
			Realign, Connect, and/or Create Channel	
	199802800	Trout Creek Watershed Restoration Project Implementation of numerous riparian and upland habitat improvement projects on private lands in the Trout Creek watershed, Deschutes Basin. Monitoring and evaluation of current and past projects.	Enhance Floodplain	Screened 82 acre-ft./yr and conserved 130 acre-ft/yr of water; protected 29 acres riparian habitat.
			Plant Vegetation	
			Realign, Connect, and/or Create Channel	
			Remove/Install Diversion	
			Install Pipeline	
	200201900	Wasco Riparian Buffers This proposal develops riparian buffer systems in southern Wasco County in the lower Deschutes and lower John Day subbasins of the Columbia Plateau Province. Implementation of buffer plans developed under this proposal is fully funded.	Riparian Enhancement	1268 riparian acres protected through CCRP/CREP agreements.
At least 1 John Day MPG population (above John Day dam)	200201900	Wasco Riparian Buffers This proposal develops riparian buffer systems in southern Wasco County in the lower Deschutes and lower John Day subbasins of the Columbia Plateau Province. Implementation of buffer plans developed under this proposal is fully funded by USDA.	Riparian Enhancement	148 riparian acres protected through CCRP/CREP agreements.

Attachment 3 - Table 2. Actions Identified for 2007-2009 Implementation in FCRPS BA, Attachment B.2.2-2, Table 2: Middle Columbia Steelhead

Middle Columbia Steelhead				
Population	**Project #**	**Project Title & Short Description**	**2007-09 Action Description**	**FY07-09 Progress**
	198402100	Mainstem, Middle Fork, John Day Rivers Fish Habitat Enhancement Project This project was initiated on July 1, 1984, (BPA) contract number DE A179-84 BP17460 and allows for initial landowner contacts, agreement development, project design, budgeting, and implementation for anadromous fish habitat on private lands.	Develop Alternative Water Source	58 structures installed, 0.77 mile stream complexity improved, 92 miles riparian fencing installed, protected 1140 riparian acres and 53 riparian miles, planted 5.5 miles of riparian vegetation.
			Increase Instream Habitat Complexity	
			Install Fence	
			Operate and Maintain Habitat/Passage	
			Plant Vegetation	
			Remove vegetation	
	199306600	Oregon Fish Screens Project The project provides immediate and long-term protection for anadromous and resident fish species in the John Day, Umatilla, and Walla Walla basins by the installation or replacement of out dated fish protection and passage devices on irrigation diversions.	Install Fish Passage Structure	Improved access to 158 miles instream habitat, replaced over 60 fish screens.
			Install Fish Screen	
			Operate and Maintain Habitat/Passage	
			Remove/Install Diversion	
	199801800	John Day Watershed RestorationContinue implementation of protection and restoration actions, planned under the John Day Subbasin Plan, to improve water quality, water quantity, and riparian	Develop Alternative Water Source	3.5 miles habitat accessed.
			Increase Instream Habitat Complexity	

Attachment 3 - Table 2. Actions Identified for 2007-2009 Implementation in FCRPS BA, Attachment B.2.2-2, Table 2: Middle Columbia Steelhead

Middle Columbia Steelhead				
Population	**Project #**	**Project Title & Short Description**	**2007-09 Action Description**	**FY07-09 Progress**
		habitat, and to eliminate passage barriers for anadromous and resident fish.	Install Fish Passage Structure	
			Maintain Vegetation	
			Plant Vegetation	
			Remove/Install Diversion	
			Remove vegetation	
			Install Pipeline	
	199901000	Pine Hollow/Jackknife Habitat Implement practices to reduce erosion, flooding, and protect critical areas in the stream corridor which will allow natural recovery of riparian vegetation and channel stability in the Pine Hollow and Jackknife watersheds.	Develop Alternative Water Source	
			Install Fence	
			Plant Vegetation	
			Upland Erosion and Sedimentation Control	
			Remove vegetation	
	200001500	Oxbow Conservation Area Management The 1,022-acre Oxbow Conservation Area project is a mitigation property acquired by the CTWSRO through BPA funding. This proposal aims to continue the O&M, M&E, and habitat improvement projects on this valuable anadromous fish property.	Develop and Negotiate Water Right Transaction	2.3 miles riparian fencing installed; 4 miles riparian vegetation planted; 0.2 miles riparian weed control and vegetation management; 0.5 miles improved stream complexity; 180 riparian acres protected.
			Increase Instream Habitat Complexity	
			Install Fence	

Attachment 3 - Table 2. Actions Identified for 2007-2009 Implementation in FCRPS BA, Attachment B.2.2-2, Table 2: Middle Columbia Steelhead

Middle Columbia Steelhead				
Population	**Project #**	**Project Title & Short Description**	**2007-09 Action Description**	**FY07-09 Progress**
			Install Fish Passage Structure	
			Install Fish Screen	
			Maintain Vegetation	
			Operate and Maintain Habitat/Passage	
			Plant Vegetation	
			Realign, Connect, and/or Create Channel	
			Remove vegetation	
			Conduct Controlled Burn	
	200003100	North Fork John Day Basin Anadromous Fish Habitat Enhancement ProjectIncrease habitat for Chinook salmon and steelhead on private and public-owned lands via implementing fencing, off-stream water development, revegetation, culvert replacement, pool development, mine tailing removal and large wood placement projects.	Enhance Floodplain	2.6 miles riparian fencing installed; 380 riparian acres and 1.3 riparian miles protected through lease; 7.4 miles riparian vegetation planted.
			Increase Instream Habitat Complexity	
			Install Fence	
			Install Fish Passage Structure	
			Maintain Vegetation	
			Plant Vegetation	
			Lease Land	

Attachment 3 - Table 2. Actions Identified for 2007-2009 Implementation in FCRPS BA, Attachment B.2.2-2, Table 2: Middle Columbia Steelhead

Middle Columbia Steelhead				
Population	**Project #**	**Project Title & Short Description**	**2007-09 Action Description**	**FY07-09 Progress**
			Remove Mine Tailings	
	200104101	Forrest Conservation Area Management The Forrest Conservation Area consists of 4,232 acres and contains 8.5 miles of critical fish habitat in the Upper Mainstem and Middle Fork John Day River systems. Management prioritizes protection of fish, wildlife and their associated habitats.	Develop and Negotiate Water Right Transaction	35 instream structures installed to increase habitat complexity; 1.15 miles stream complexity improved; improved access to 5.3 miles habitat; 4.0 miles riparian vegetation planted.
			Increase Instream Habitat Complexity	
			Install Fish Passage Structure	
			Install Fish Screen	
			Maintain Vegetation	
			Operate and Maintain Habitat/Passage	
			Plant Vegetation	
			Remove vegetation	
			Conduct Controlled Burn	
			Investigate Trespass	
	200201500	Provide Coordination and Technical Assistance to Watershed Councils and Individuals in Sherman County, Oregon.	Riparian Enhancement	51 riparian acres, 12.6 riparian miles, and 301 upland acres protected through CCRP/CREP Agreements.

Attachment 3 - Table 2. Actions Identified for 2007-2009 Implementation in FCRPS BA, Attachment B.2.2-2, Table 2: Middle Columbia Steelhead

Middle Columbia Steelhead				
Population	**Project #**	**Project Title & Short Description**	**2007-09 Action Description**	**FY07-09 Progress**
	200203400	Wheeler Co Riparian Buffers This proposal will provide technical support and planning needed to implement riparian buffer contracts (CREP) on streams within Wheeler County. Riparian buffers address many of the limiting factors identified in the John Day Sub-basin Plan.	Riparian Enhancement	125 riparian acres and 13.6 riparian miles protected through CCRP/CREP Agreements.
	200203500	Gilliam Co Riparian Buffers We seek BPA funding to continue our riparian buffer position. This job entails making 10-15 year contracts with private landowners to establish riparian areas. Non-BPA monies are then leveraged to develop, maintain and enhance fish and wildlife resources.	Riparian Enhancement	382 riparian acres and 25 riparian miles protected through CCRP/CREP Agreements.
Umatilla River (above John Day dam)	198343600	Umatilla Passage O&M Westland Irrigation District, as contractor to Bonneville Power Administration, and West Extension Irrigation District, as subcontractor to Westland, provide labor, equipment, and material necessary for the operation, care, and maintenance of fish facilities.	Operate and Maintain Habitat/Passage	Annual O&M at 17 sites to ensure that ladders, bypasses, screen sites. and trap facilities operate according to design criteria.
	198710001	Umatilla Anadromous Fish Habitat - CTUIR instream and riparian habitat restoration for fisheries and wildlife in the Umatilla River Basin.	Develop Alternative Water Source	170 instream structures installed to increase habitat complexity; 41.6 miles stream complexity improved; 13 miles instream habitat accessed; 7.5 riparian acres planted; 16 riparian miles treated with noxious weed control; 3.5 miles riparian fencing installed.
			Increase Instream Habitat Complexity	

Attachment 3 - Table 2. Actions Identified for 2007-2009 Implementation in FCRPS BA, Attachment B.2.2-2, Table 2: Middle Columbia Steelhead

Middle Columbia Steelhead				
Population	**Project #**	**Project Title & Short Description**	**2007-09 Action Description**	**FY07-09 Progress**
			Install Fence	
			Maintain Vegetation	
			Operate and Maintain Habitat/Passage	
			Plant Vegetation	
			Remove/Modify Dam	
			Remove vegetation	
			Lease Land	
	198710002	Umatilla Subbasin Fish Habitat Improvement Project The ongoing Umatilla Subbasin Fish Habitat Improvement Project (19871-100-02) is aimed at protecting (where possible) and enhancing/rehabilitating (where required), degraded fish habitat on private lands using passive and active restoration techniques.	Develop Alternative Water Source	3.25 miles riparian fencing installed; 7 riparian acres protected through cooperative agreements/leases/easements; 3.7 riparian miles planted, 0.1 riparian miles treated for exotic vegetation.
			Develop and Negotiate Water Right Transaction	
			Increase Instream Habitat Complexity	
			Install Fence	
			Maintain Vegetation	

Attachment 3 - Table 2. Actions Identified for 2007-2009 Implementation in FCRPS BA, Attachment B.2.2-2, Table 2: Middle Columbia Steelhead

Middle Columbia Steelhead				
Population	**Project #**	**Project Title & Short Description**	**2007-09 Action Description**	**FY07-09 Progress**
			Operate and Maintain Habitat/Passage	
			Plant Vegetation	
			Realign, Connect, and/or Create Channel	
			Remove/Modify Dam	
			Improve/Relocate Road	
			Remove vegetation	
			Lease Land	
	198802200	Umatilla Fish Passage Operations Increase survival of migrating juvenile and adult salmon and steelhead in the Umatilla Basin by operating passage facilities, flow enhancement measures, trapping facilities, and transport equipment to provide adequate passage conditions.	Operate and Maintain Habitat/Passage	Trap and haul of 7,100 migrants; passage facility operation and maintenance oversight.
			Trap and Haul	
	198902700	Power Repay Umatilla Basin Project Provide reimbursement of power costs to Umatilla Electric Cooperative and Pacific Power & Light Company for the Umatilla Basin Project pumping plants that provide Columbia River water to irrigators in exchange for Umatilla River water left instream.	Acquire Water Instream	Ongoing utility reimbursements.

Attachment 3 - Table 2. Actions Identified for 2007-2009 Implementation in FCRPS BA, Attachment B.2.2-2, Table 2: Middle Columbia Steelhead

Middle Columbia Steelhead				
Population	**Project #**	**Project Title & Short Description**	**2007-09 Action Description**	**FY07-09 Progress**
Walla Walla River (above MCN)	199601100	Walla Walla Juvenile and Adult Passage Improvements Provide safe passage for migrating juvenile and adult salmonids in the Walla Walla Subbasin by constructing and maintaining passage facilities at irrigation diversion dams and canals and other passage barriers.	Install Fish Screen	Fish passage structures installed — 30 miles instream habitat accessed. Project work now combined with 2007-396-00 .
	199604601	Walla Walla River Basin Fish Habitat EnhancementThe proposed project is a continued effort by the CTUIR to protect and restore habitat critical to the recovery of salmonid fish populations in the Walla Walla River Basin.	Increase Instream Habitat Complexity	14 instream structures installed to increase habitat complexity; 0.22 mile stream complexity improved; 0.75 mile riparian fencing installed; 0.5 riparian acres planted.
			Maintain Vegetation	
			Plant Vegetation	
	200003300	Walla Walla River Fish Passage Operations Increase survival of migrating salmonids in the Walla Walla Basin by coordinating the overall passage program including monitoring passage conditions and operation of passage facilities and transport equipment to provide adequate passage conditions.	Operate and Maintain Habitat/Passage	261 fish trapped and hauled.
			Trap and Haul	
	200203600	Restore Walla Walla River Flow Irrigation efficiency and shallow aquifer recharge will improve Walla Walla River flows on flow -impaired priority restoration reaches at times of the year that are critical for steelhead, spring Chinook, and bull trout passage and habitat use.	Develop and Negotiate Water Right Transaction	Project work merged into 2007-396-00 Walla Walla Basinwide Tributary Passage and Flow Project — new intake and fish screens and fish passage structure installed to access 100 miles of habitat .
			Install Pipeline	
			Install Sprinkler	

Attachment 3 - Table 2. Actions Identified for 2007-2009 Implementation in FCRPS BA, Attachment B.2.2-2, Table 2: Middle Columbia Steelhead

Middle Columbia Steelhead				
Population	**Project #**	**Project Title & Short Description**	**2007-09 Action Description**	**FY07-09 Progress**
	200721700	Operation and Maintenance for Walla Walla Basin Passage Projects Operation and maintenance of BPA-Constructed fish passage facilities in the Walla Walla Sub-basin.	Operate and Maintain Habitat/Passage	Annual O&M at Garden City/Lowden No. 2 Diversion Consolidation and Fish Passage Project, Gardena Fish Screens and related equipment, Gardena Ladder and related equipment, Little Walla Walla River fish screen facility, Nursery Bridge fish ladder.
At least 1 populations: - Satus Creek (above MCN) - Toppenish Creek (above MCN) - Naches River (above MCN) - Upper Mainstem Yakima (above MCN)	199206200	Yakama Nation - Riparian/Wetlands Restoration Continue implementation on YN Wetlands/Riparian Restoration Project by protecting and restoring native floodplain habitats along anadromous fish-bearing waterways in the agricultural area of the Yakama Reservation (~2,000 acres per year).	Maintain Vegetation	60 riparian acres and 35 upland acres improved through controlled burn; 98 riparian acres and 183 upland acres protected.
			Operate and Maintain Habitat/Passage	
			Plant Vegetation	
			Remove Debris	
			Lease Land	
	199603501	Yakama Reservation Watersheds Project The YRWP works to restore natural function to the Satus, Toppenish and Ahtanum Watersheds. Our restoration and monitoring efforts take a comprehensive approach to the restoration of habitat for fisheries resources including steelhead and bull trout.	Enhance Floodplain	1.5 miles stream complexity improved; 18 miles riparian fencing and 1.1 miles upland fencing installed; access improved to 143 miles of fish habitat; 1 fish screen installed; 8,062 riparian acres, 56 riparian miles, and 72,559 upland acres protected through lease.
			Increase Instream Habitat Complexity	
			Install Fence	
			Plant Vegetation	
			Realign, Connect, and/or Create Channel	
			Lease Land	

Attachment 3 - Table 2. Actions Identified for 2007-2009 Implementation in FCRPS BA, Attachment B.2.2-2, Table 2: Middle Columbia Steelhead

Middle Columbia Steelhead				
Population	**Project #**	**Project Title & Short Description**	**2007-09 Action Description**	**FY07-09 Progress**
	198812025	YKFP Management, Data, Habitat Proposal provides for all YN management functions associated with the Yakima/Klickitat Fisheries Project including project planning, O&M, research, data management, and habitat improvement and acquisition actions in the Yakima Subbasin.	Increase Instream Habitat Complexity	20 instream structures installed to increase habitat complexity.
			Plant Vegetation	
	199200900	Yakima Phase II/Huntsville Screen Operation & Maintenance Continue to provide operation and maintenance to BPA's Phase II Fish Screen Facilities to ensure they provide maximum protection to all species and life stages of fish. This O&M function will include the addition of the Manastash basin facilities.	Operate and Maintain Habitat/Passage	Annual maintenance to provide properly functioning Yakima and Walla Walla Phase II fish protection facilities.
	199503300	O&M Yakima Basin Fish Screens This proposal provides for continuation of funding for the existing comprehensive operation & maintenance program by Reclamation of BPA owned Yakima Phase II fish screening and trapping facilities.	Operate and Maintain Habitat/Passage	Routine O&M and annual maintenance to provide properly functioning fish screens.
	200202501	Yakima Tributary Access & Habitat Program The Yakima Tributary Access and Habitat Program intends to: a) screen diversion structures; b) provide for fish passage at man-made barriers; c) assist landowners improve stream habitat; and, d) coordinate the acquisition of riparian buffer easements.	Create, Restore, and/or Enhance Wetland	0.11 mile of stream complexity improved; 15 instream structures installed to increase habitat complexity; 1.5 miles of habitat accessed; installed Hanson fish screen; removed upper Lust diversion; installed Eslinger/Sorenson Parke Cr pipeline.
			Develop Alternative Water Source	
			Enhance Floodplain	
			Increase Instream Habitat Complexity	

Attachment 3 - Table 2. Actions Identified for 2007-2009 Implementation in FCRPS BA, Attachment B.2.2-2, Table 2: Middle Columbia Steelhead

Middle Columbia Steelhead				
Population	**Project #**	**Project Title & Short Description**	**2007-09 Action Description**	**FY07-09 Progress**
			Install Fence	
			Install Fish Passage Structure	
			Install Fish Screen	
			Install Well	
			Maintain Vegetation	
			Plant Vegetation	
			Realign, Connect, and/or Create Channel	
			Remove/Install Diversion	
			Install Pipeline	
	200300100	Manastash Crk Passage & Screening The Manastash Creek Project will provide fish passage, diversion screening and seek instream flow to support fish recovery in the Yakima Basin. This proposal is for Phase 1: screening/passage. Phase 2: instream flow will be a second proposal.	Install Fish Passage Structure	Design and permitting for Manastash & Keats Jensen diversions, BPA/Water User MOA signed for Barnes Road facilities. Project merged into 2007-398-00 Yakima Basinwide Tributary Passage and Flow on 7/02/07.
			Install Fish Screen	
			Maintain Vegetation	
			Operate and Maintain Habitat/Passage	
			Plant Vegetation	
			Remove/Modify Dam	

Attachment 3 - Table 2. Actions Identified for 2007-2009 Implementation in FCRPS BA, Attachment B.2.2-2, Table 2: Middle Columbia Steelhead

Middle Columbia Steelhead				
Population	**Project #**	**Project Title & Short Description**	**2007-09 Action Description**	**FY07-09 Progress**
			Install Pipeline	
	200702000	Manastash Instream Flow Enhancement This proposal seeks to enhance instream flow by working with water users to implement irrigation conveyance and on-farm water use efficiency projects, to trust water to the creek and investigate diversion timing to assist steelhead migration.	Acquire Water Instream	0.25 mile stream complexity improved, 5 instream structures installed, fish screens installed at six sites, 0.16 mile riparian vegetation planted, Pott Dam removal/modification with 1.5 miles habitat accessed Project merged into 2007-398-00 Yakima Basinwide Tributary Passage and Flow on 7/02/07.
			Develop and Negotiate Water Right Transaction	
			Install Well	
			Install Pipeline	
			Install Sprinkler	
	200711300	Cowiche Restoration and Protection Project (Easement/Fee Simple Acquisition) The goal of this project is to protect stream and riparian habitat, and floodplain functions along the Cowiche Creek. The project will acquire conservation easements protecting more than five miles of critical, high quality, steelhead and coho habitat.	Lease Land	Project closed — Funds transferred to Oak Flats on the Naches.
	199705100	Yakima Basin Side Channels We will replace problematic irrigation diversions and culverts in the lower North Fork and Mid-mainstem John Day Watersheds with fish-friendly structures that ensure fish passage and improve riparian habitat while efficiently meeting land managers' needs.	Land Purchase	Conducting real property reviews for habitat acquisitions.
			Develop and Negotiate Water Right Transaction	

Attachment 3 - Table 2. Actions Identified for 2007-2009 Implementation in FCRPS BA, Attachment B.2.2-2, Table 2: Middle Columbia Steelhead

Middle Columbia Steelhead				
Population	**Project #**	**Project Title & Short Description**	**2007-09 Action Description**	**FY07-09 Progress**
Naches River	200719400	Oak Flats Acquisition and Habitat Enhancement Acquire a 357 acre multi-parcel site on the Naches River to protect from rural development and enhance 3.0 miles of streamside riparian habitat. Site supports Chinook salmon and Federally threatened mid-Columbia summer steelhead and bull trout.	Acquire Water Instream	Environmental land audit completed; acquisition deferred as a result of MOA and hazardous materials work.
			Enhance Floodplain	
			Plant Vegetation	
			Remove/Modify Dam	
			Remove Debris	
Yakima River upper mainstem	200711200	Teanaway Watershed - Protect critical habitat from development, reduce water temperatures and increase instream flows, restore habitat forming processes in the floodplain. Teanaway watershed supports viable salmonid populations with complex spatial structure and diversity. Maximizing abundance and productivity of focal species requires protecting critical habitat, augmenting instream flows, & restoring floodplain functions.	Acquire Water Instream	58 structures installed on Indian and Jack Creeks; increased complexity of 0.08 miles of fish habitat; improved access to 8.8 miles of fish habitat; completed Conservation Plan for the Teanaway Tract.
			Develop and Negotiate Water Right Transaction	
			Increase Instream Habitat Complexity	
			Install Fence	
			Maintain Vegetation	
			Operate and Maintain Habitat/Passage	
			Plant Vegetation	

Attachment 3 - Table 3.1. Actions Identified for 2007-2009 Implementation in FCRPS BA, Attachment B.2.2-2, Table 3a: Snake River Steelhead

Snake River Steelhead				
Population	**Project #**	**Project Title & Short Description**	**2007-09 Action Description**	**FY07-09 Progress**
Multiple	200201301	Water Entity Fund water right transactions that restore streamflows and focused riparian easements on critical fish-bearing Columbia Basin tributaries. Implemented as the Columbia Basin Water Transactions Program (CBWTP) in a partnership between BPA and NFWF.	Acquire Water Instream	25,250 acre-ft/yr and 237 cfs of water flow protected.
	199202601	Grand Ronde Model Watershed Program Habitat Restoration - Planning, Coordination and Implementation The project coordinates BPA funded restoration activities in the Grande Ronde and Imnaha Subbasins working with tribes, agencies and landowners. The project annually implements 10-20 habitat restoration projects. Project also to consider including habitat actions proposed in Wallowa, Lostine, & Joseph Cr. watersheds (200710500, 200711600, 200724500).	Increase Instream Habitat Complexity	Treated 5.6 miles of riparian road/trail and 1.7 miles of upland road/trail; installed 196 structures to increase complexity to 10.3 stream miles; fenced 0.02 riparian miles and 3.48 upland miles; improved access to 49 miles of fish habitat; planted 2.2 miles riparian vegetation; added 0.6 miles stream channel.
			Install Fence	
			Install Fish Passage Structure	
			Plant Vegetation	
			Realign, Connect, and/or Create Channel	
	199608300	CTUIR Grande Ronde Subbasin Restoration Project The CTUIR Grande Ronde Subbasin Restoration Project plans, designs, implements, maintains, and monitors habitat enhancement and restoration	Create, Restore, and/or Enhance Wetland	Added 18 LWD structures to increase habitat complexity in 1 mile of Meadow Creek; 13.85 miles riparian vegetation planted.
			Install Fence	
			Plant Vegetation	

Attachment 3 - Table 3.1. Actions Identified for 2007-2009 Implementation in FCRPS BA, Attachment B.2.2-2, Table 3a: Snake River Steelhead

Snake River Steelhead				
Population	**Project #**	**Project Title & Short Description**	**2007-09 Action Description**	**FY07-09 Progress**
		projects in the Grande Ronde Subbasin. Planned FY 2007-09 projects include Meadow Cr, End Cr, Ladd Cr, and main GR.	Realign, Connect, and/or Create Channel	
Grande Ronde upper mainstem Catherine Creek	198402500	ODFW Blue Mountain Oregon Fish Habitat Improvement This project works with landowners, and other government and quasi-governmental agencies to protect and enhance habitat for federal ESA listed fish in the Blue Mountain Province of Oregon.	Create, Restore, and/or Enhance Wetland	490 instream structures installed in 4.4 miles of End Creek, Meadow Creek, and Ladd Creeks to increase habitat complexity; 0.4 riparian miles fenced; 14.2 miles of riparian vegetation planted; channel improvements to add 8.8 stream miles in End, Meadow, and Ladd Creeks.
			Increase Instream Habitat Complexity	
			Install Fence	
			Plant Vegetation	
			Realign, Connect, and/or Create Channel	
Lostine River Imnaha River Big Sheep Creek	200739300	NPT Protect and Restore NE OR Funding for Coordination, Planning, Design, Implementation. Initially the funds were placed under 200724500. Established a new project for the Wallowa and Imnaha watersheds.	Decommission Road	Improved access to 9.1 miles fish habitat and planted 11 miles riparian vegetation in Joseph Creek watershed.
			Enhance Floodplain	
			Increase Instream Habitat Complexity	
			Install Fence	
			Install Fish Passage Structure	
			Maintain Vegetation	
			Plant Vegetation	

Attachment 3 - Table 3.1. Actions Identified for 2007-2009 Implementation in FCRPS BA, Attachment B.2.2-2, Table 3a: Snake River Steelhead

Snake River Steelhead				
Population	**Project #**	**Project Title & Short Description**	**2007-09 Action Description**	**FY07-09 Progress**
			Realign, Connect, and/or Create Channel	
			Remove vegetation	
Asotin Creek (extirpated)	199401805	Continued Implementation of Prioritized Asotin Creek Watershed Habitat Projects On-going project for prioritizing & implementing on-the-ground habitat projects for wild steelhead & Chinook salmon in Asotin watershed. Bull trout also benefit from this ridge-top-to-ridge-top approach with match from private landowners & other grants.	Install Fence	Installed 2.36 miles riparian and 1 mile upland fencing; 2.5 miles riparian vegetation planted.
			Plant Vegetation	
			Practice No-till and Conservation Tillage Systems	
	200205000	Continued Riparian Buffer Projects on Couse/Tenmile and other Salmonid Bearing Streams in Asotin County On-going project to continue implementation of prioritized habitat protection on private property for ESA listed steelhead, Chinook salmon and bull trout as identified in the Asotin Subbasin Plan. Cost share provided by private landowners & other sources.	Install Fence	Installed 4.9 miles riparian and 3.5 miles upland fencing; 1.75 miles riparian vegetation planted; 1,272.4 upland acres improved with no-till conservation systems; erosion and sedimentation control on 95.6 upland acres.
			Plant Vegetation	
			Practice No-till and Conservation Tillage Systems	
			Upland Erosion and Sedimentation Control	
Tucannon River	199401806	Tucannon Stream and Riparian Protection, Enhancement, and Restoration Implement habitat protection, enhancement, and recovery strategies to support Subbasin Plan identified ESA focal, cultural significant and species of interest recovery within the Tucannon Subbasin.	Increase Instream Habitat Complexity	29.5 riparian miles protected through CREP agreements.
			Lease Land	

Attachment 3 - Table 3.1. Actions Identified for 2007-2009 Implementation in FCRPS BA, Attachment B.2.2-2, Table 3a: Snake River Steelhead

Snake River Steelhead				
Population	**Project #**	**Project Title & Short Description**	**2007-09 Action Description**	**FY07-09 Progress**
	199401807	Improve Habitat For Fall Chinook, Steelhead in the Lower Snake and Tucannon Subbasins To obtain funding to continue with the districts effort to reduce soil erosion on the uplands and along the streams of Garfield County to improve water quality and fish habitat.	Plant Vegetation Remove vegetation Upland Erosion and Sedimentation Control	3,787 upland acres improved through erosion and sediment control and no-till conservation systems.
Multiple populations (Lemhi, Pahsimeroi, and Salmon River upper mainstem)	199401500	Idaho Fish Screening and Passage Improvements Provide management and operational support for a capital construction program dedicated to the protection of anadromous fish from loss in water diversions, improve fish passage at diversions for juvenile and adult anadromous fish, and improve stream flow conditions where possible.	Install Fish Screen Remove/Install Diversion	New headgates and fish screens installed at four sites on Wimpy and Big Spring creeks; two unscreened diversions consolidated into one screened ditch and accessed 3 miles of habitat.
Little Salmon River	200706500	Coordinate and implement tributary habitat restoration in the Little Salmon River and lower Salmon River Idaho Implement fish habitat restoration on private lands dominated by agricultural practices using cost sharing by Bonneville, Idaho Pacific Coast Salmon Recovery Funds, Idaho Water Quality Program for Agriculture, and landowner participation.	Install Fence Plant Vegetation Remove vegetation Remove/Install Diversion	Squaw Creek culvert replacement accessed 11 miles of habitat.
Little Salmon River	200706400	Protect and Restore Slate Creek Restore and protect the Slate Creek Watershed for the benefit of both resident and anadromous fish using an overall watershed approach. Restoration and	Decommission Road Plant Vegetation Remove vegetation	Little Slate Creek culvert replacement improved access to 5.3 miles fish habitat.

Attachment 3 - Table 3.1. Actions Identified for 2007-2009 Implementation in FCRPS BA, Attachment B.2.2-2, Table 3a: Snake River Steelhead

Snake River Steelhead				
Population	**Project #**	**Project Title & Short Description**	**2007-09 Action Description**	**FY07-09 Progress**
		protection efforts will be done cooperatively with the Nez Perce National Forest.	Upland Erosion and Sedimentation Control	
Secesh River South Fork Salmon River	200712700	Reestablish Connectivity and Restore Fish Habitat in the East Fork of the South Fork Salmon River Watershed This project will reestablish fish passage through a 30-foot tall cascade using natural channel design and rehabilitate one mile of fish habitat through an anthropogenically degraded reach of the upper mainstem East Fork of the South Fork Salmon River.	Enhance Floodplain	Addressed 3 passage barriers and improved access to 15.6 miles fish habitat.
			Increase Instream Habitat Complexity	
			Install Fish Passage Structure	
			Plant Vegetation	
East Fork Salmon River Pahsimeroi River Salmon River upper mainstem	200726800	Idaho Watershed Habitat Restoration Project via Custer Soil and Water Conservation District The project scope is to implement high priority action items to maintain, enhance and restore fish habitat and fish passage in the priority stream segments of the upper Salmon Basin area within the administrative boundaries of the Custer SWCD.	Install Fence	Improved habitat complexity in 2.1 stream miles; installed nine instream structures in Herd and Slate creeks; 6.4 miles riparian and 1.8 miles upland fencing installed; 2.3 miles riparian vegetation planted; addressed diversions at 3 locations; improved access to 3 miles fish habitat.
			Remove/Install Diversion	
			Remove/Modify Dam	
Lemhi River & Pahsimeroi	200739400	Idaho Watershed Habitat Restoration Lemhi County This project merged coordination, planning, design and implementation work from 1992-026-03 effective on 2/26/2007.	Acquire Water Instream	Addressed diversions at 3 locations; improved access to 2.5 miles fish habitat; installed 0.2 miles of riparian fencing.
			Install Fence	
			Install Fish Passage Structure	
			Install Fish Screen	

Attachment 3 - Table 3.1. Actions Identified for 2007-2009 Implementation in FCRPS BA, Attachment B.2.2-2, Table 3a: Snake River Steelhead

Snake River Steelhead				
Population	**Project #**	**Project Title & Short Description**	**2007-09 Action Description**	**FY07-09 Progress**
Salmon River lower mainstem	199901900	Restore Salmon River (Challis, Idaho) Passive restoration by securing easements will assist restoration efforts via the Corps 206 Program. The development of side channels will help create a more naturally functioning floodplain, provide a wide array of environmental and ecological benefit.	Investigate Trespass	Visitation log to investigate Stark property conservation values.
Yankee Creek	200205900	Yankee Fork Salmon River Dredge Tailings Restoration Project Restore natural river channel characteristics, floodplain function, hydraulic and sediment regimes, and aquatic habitat within the dredged reach of the YFSR, initially by redistributing dredge tailings piles from the floodplain.	Plant Vegetation	Inventory, assessment, monitoring being conducted prior to on-the-ground work.
			Remove Mine Tailings	

Attachment 3 - Table 3.2. Actions Identified for 2007-2009 Implementation in FCRPS BA, Attachment B.2.2-2, Table 3b: Snake River Spring/Summer Chinook

Snake River Spring/Summer Chinook				
Population	**Project #**	**Project Title & Short Description**	**2007-09 Action Description**	**FY07-08 Progress**
Multiple	200201301	Water Entity Fund water right transactions that restore streamflows and focused riparian easements on critical fish-bearing Columbia Basin tributaries. Implemented as the Columbia Basin Water Transactions Program (CBWTP) in a partnership between BPA and NFWF.	Acquire Water Instream	25,256 acre-ft/yr and 237 cfs of water flow protected in Lemhi, Lostine, Pahsimeroi, and Salmon River lower and upper mainstem watersheds.
	199202601	Grand Ronde Model Watershed Program Habitat Restoration - Planning, Coordination and Implementation The project coordinates BPA funded restoration activities in the Grande Ronde and Imnaha Subbasins working with tribes, agencies and landowners. The project annually implements 10-20 habitat restoration projects. Project also to consider including habitat actions proposed in Wallowa, Lostine, & Joseph Cr. watersheds (200710500, 200711600, 200724500).	Increase Instream Habitat Complexity Install Fence Install Fish Passage Structure Plant Vegetation Realign, Connect, and/or Create Channel	3.6 miles upland fencing installed in Lick Cr. Watershed; improved access to 23 miles of Catherine Creek, 2.8 miles of upper Grande Ronde River, and 5 miles of the Lostine River; relocated 1.6 miles of draw bottom road in upper Grande Ronde; increased habitat complexity in 1.6 miles of Bear Creek and 0.7 miles of Lostine/Wallowa River; installed 21 structures to create meanders and add 0.1 miles stream channel in upper Grande Ronde floodplain; installed 13 structures and created 0.1 miles stream channel in Lostine/Wallowa River; planted 1.6 miles riparian vegetation in upper Grande Ronde.
	199608300	CTUIR Grande Ronde Subbasin Restoration Project The CTUIR Grande Ronde Subbasin Restoration Project plans, designs, implements, maintains, and monitors habitat enhancement and restoration projects in the Grande Ronde Subbasin.	Create, Restore, and/or Enhance Wetland Install Fence Plant Vegetation	Planted 1.8 miles riparian vegetation in Meadow Creek and Longley Meadows; added 18 LWD structures in Meadow Creek to increase complexity for 1 miles of fish habitat .

Attachment 3 - Table 3.2. Actions Identified for 2007-2009 Implementation in FCRPS BA, Attachment B.2.2-2, Table 3b: Snake River Spring/Summer Chinook

Snake River Spring/Summer Chinook				
Population	**Project #**	**Project Title & Short Description**	**2007-09 Action Description**	**FY07-08 Progress**
		Planned FY 2007-09 projects include Meadow Cr, End Cr, Ladd Cr, and main GR.	Realign, Connect, and/or Create Channel	
Grande Ronde upper mainstem Catherine Creek	198402500	ODFW Blue Mountain Oregon Fish Habitat Improvement This project works with landowners, and other government and quasi-governmental agencies to protect and enhance habitat for federal ESA listed fish in the Blue Mountain Province of Oregon.	Create, Restore, and/or Enhance Wetland	Installed 150 structures to improve complexity in 0.5 miles of Meadow Creek; installed 91 structures to improve complexity in 1.2 miles of Wallowa River; installed 0.4 miles riparian fencing in Catherine Creek; planted 1.8 miles of riparian vegetation in Catherine Creek, upper Grande Ronde, and Lostine watersheds; added 1.0 miles channel habitat in upper Grande Ronde and Lostine rivers.
			Increase Instream Habitat Complexity	
			Install Fence	
			Plant Vegetation	
			Realign, Connect, and/or Create Channel	
Lostine River Imnaha River Big Sheep Creek	200739300	NPT Protect and Restore NE OR Funding for Coordination, Planning, Design, Implementation. Initially the funds were placed under 200724500. Established a new project for the Wallowa and Imnaha watersheds.	Decommission Road	Funding secured to implement the Tamarack culvert replacement; prepared designs for the City of Lostine and Sheep Ridge diversions on the Lostine River; Camp Creek diversion project design underway; contract executed for Carrol Creek culvert replacement.
			Enhance Floodplain	
			Increase Instream Habitat Complexity	
			Install Fence	
			Install Fish Passage Structure	
			Maintain Vegetation	
			Plant Vegetation	

Attachment 3 - Table 3.2. Actions Identified for 2007-2009 Implementation in FCRPS BA, Attachment B.2.2-2, Table 3b: Snake River Spring/Summer Chinook

Snake River Spring/Summer Chinook				
Population	**Project #**	**Project Title & Short Description**	**2007-09 Action Description**	**FY07-08 Progress**
			Realign, Connect, and/or Create Channel	
			Remove vegetation	
Asotin Creek (extirpated)	199401805	Continued Implementation of Prioritized Asotin Creek Watershed Habitat Projects On-going project for prioritizing & implementing on-the-ground habitat projects for wild steelhead & Chinook salmon in Asotin watershed. Bull trout also benefit from this ridge-top-to-ridge-top approach with match from private landowners & other grants.	Install Fence	Fenced 2.36 riparian and 0.6 upland miles; 2.5 miles riparian vegetation planted; 2,778.2 upland acres improved through no-till conservation systems.
			Plant Vegetation	
			Practice No-till and Conservation Tillage Systems	
	200205000	Continued Riparian Buffer Projects on Couse/Tenmile and other Salmonid Bearing Streams in Asotin County On-going project to continue implementation of prioritized habitat protection on private property for ESA listed steelhead, Chinook salmon and bull trout as identified in the Asotin Subbasin Plan. Cost share provided by private landowners & other sources.	Install Fence	4.9 miles riparian and 3.5 miles upland fencing installed; 1.0 stream miles fenced; 1.8 miles riparian vegetation planted; 1,272.4 upland acres improved with no-till conservation systems; erosion and sedimentation control on 95.6 upland acres.
			Plant Vegetation	
			Practice No-till and Conservation Tillage Systems	
			Upland Erosion and Sedimentation Control	
Tucannon River	199401806	Tucannon Stream and Riparian Protection, Enhancement, and Restoration Implement habitat protection, enhancement, and recovery strategies to support Subbasin Plan identified ESA focal, cultural significant and species of interest recovery within the Tucannon Subbasin.	Increase Instream Habitat Complexity	Fish screens installed at five diversions; 590 riparian acres (29.47 riparian miles) protected through CREP extensions.
			Lease Land	

Attachment 3 - Table 3.2. Actions Identified for 2007-2009 Implementation in FCRPS BA, Attachment B.2.2-2, Table 3b: Snake River Spring/Summer Chinook

Snake River Spring/Summer Chinook				
Population	**Project #**	**Project Title & Short Description**	**2007-09 Action Description**	**FY07-08 Progress**
	199401807	Improve Habitat For Fall Chinook, Steelhead in the Lower Snake and Tucannon Subbasins To obtain funding to continue with the districts effort to reduce soil erosion on the uplands and along the streams of Garfield County to improve water quality and fish habitat.	Plant Vegetation	3,787 upland acres improved through erosion and sediment control and no-till conservation systems.
			Remove vegetation	
			Upland Erosion and Sedimentation Control	
Multiple (Lemhi, Pahsimeroi, Upper Salmon mainstem, Valley Creek)	199401500	Idaho Fish Screening and Passage Improvements Provide management and operational support for a capital construction program dedicated to the protection of anadromous fish from loss in water diversions, improve fish passage at diversions for juvenile and adult anadromous fish, and improve stream flow conditions where possible.	Install Fish Screen	Addressed one irrigation diversion structure and installed fish screens at five locations.
			Remove/Install Diversion	
Little Salmon River	200706500	Coordinate and implement tributary habitat restoration in the Little Salmon River and lower Salmon River Idaho Implement fish habitat restoration on private lands dominated by agricultural practices using cost sharing by Bonneville, Idaho Pacific Coast Salmon Recovery Funds, Idaho Water Quality Program for Agriculture, and landowner participation.	Install Fence	Replace Squaw Creek culvert to improve access to 11 miles of habitat.
			Plant Vegetation	
			Remove vegetation	
			Remove/Install Diversion	
	200706400	Protect and Restore Slate Creek Restore and protect the Slate Creek Watershed for the benefit of both resident and anadromous fish using an overall watershed approach. Restoration and	Decommission Road	Replaced Little Slate Creek culvert to improve access to 5.3 miles of habitat.
			Plant Vegetation	
			Remove vegetation	

Attachment 3 - Table 3.2. Actions Identified for 2007-2009 Implementation in FCRPS BA, Attachment B.2.2-2, Table 3b: Snake River Spring/Summer Chinook

Snake River Spring/Summer Chinook				
Population	**Project #**	**Project Title & Short Description**	**2007-09 Action Description**	**FY07-08 Progress**
		protection efforts will be done cooperatively with the Nez Perce National Forest.	Upland Erosion and Sedimentation Control	
Secesh River South Fork Salmon River	200712700	Reestablish Connectivity and Restore Fish Habitat in the East Fork of the South Fork Salmon River Watershed This project will reestablish fish passage through a 30-foot tall cascade using natural channel design and rehabilitate one mile of fish habitat through an anthropogenically degraded reach of the upper mainstem East Fork of the South Fork Salmon River.	Enhance Floodplain	Addressed five migration barriers to improve access to 15.6 miles of habitat.
			Increase Instream Habitat Complexity	
			Install Fish Passage Structure	
			Plant Vegetation	
East Fork Salmon River Pahsimeroi River Salmon River upper mainstem	200726800	Idaho Watershed Habitat Restoration Project via Custer Soil and Water Conservation District The project scope is to implement high priority action items to maintain, enhance and restore fish habitat and fish passage in the priority stream segments of the upper Salmon Basin area within the administrative boundaries of the Custer SWCD.	Install Fence	Installed 6.4 miles riparian and 1.8 miles upland fencing; installed nine instream structures and improved 2.1 miles of habitat; addressed irrigation diversions to improve access to 2 miles fish habitat; planted 2.3 miles riparian vegetation.
			Remove/Install Diversion	
			Remove/Modify Dam	
Lemhi River	200739400	Idaho Watershed Habitat Restoration Lemhi County Move funds for coordination, planning, design and implementation from 1992-026-03, Upper Salmon Basin Watershed Project.	Acquire Water Instream	Installed 0.2 miles of riparian fencing; addressed three irrigation diversion structures to improve access to 2.5 miles fish habitat.
			Install Fence	
			Install Fish Passage Structure	
			Install Fish Screen	

Attachment 3 - Table 3.2. Actions Identified for 2007-2009 Implementation in FCRPS BA, Attachment B.2.2-2, Table 3b: Snake River Spring/Summer Chinook

Snake River Spring/Summer Chinook				
Population	**Project #**	**Project Title & Short Description**	**2007-09 Action Description**	**FY07-08 Progress**
Salmon River lower mainstem	199901900	Restore Salmon River (Challis, Idaho) Passive restoration by securing easements will assist restoration efforts via the Corps 206 Program. The development of side channels will help create a more naturally functioning floodplain, provide a wide array of environmental and ecological benefit.	Investigate Trespass	Visitation log to investigate Stark property conservation values.
Yankee Creek	200205900	Yankee Fork Salmon River Dredge Tailings Restoration Project Restore natural river channel characteristics, floodplain function, hydraulic and sediment regimes, and aquatic habitat within the dredged reach of the YFSR, initially by redistributing dredge tailings piles from the floodplain.	Plant Vegetation	Inventory, assessment, and monitoring being conducted prior to on-the-ground work.
			Remove Mine Tailings	

Tables 4.1, 4.2, and 4.3 — Actions Identified for 2008-2009 Implementation in FCRPS BA, Attachment B.2.2-2, Tables 4a-c

Tables 4a-c in the FCRPS BA indicated tributary habitat actions the Action Agencies could implement in the 2008 and 2009 timeframe if funding was expanded beyond the initial 2007–2009 Fish and Wildlife Program funding levels. The expanded funding was targeted to address specific limiting factors for populations with the greatest biological needs for improvement. Tables 4.1, 4.2, and 4.3 list the projects that received expanded funding levels to implement these or similar suites of actions and any actual metrics that were completed.

Attachment 3 - Table 4.1. Actions Identified for 2008-2009 Implementation in FCRPS BA, Attachment B.2.2-2, Table 4a: Snake River Spring/Summer Chinook

Snake River Spring/Summer Chinook				
MPG	**Population**	**Primary Limiting Factor(s) by AU**	**Action Description**	**FY08-09 Progress**
Grande Ronde	Catherine Creek	In-channel characteristics	In-stream enhancement, LWD, modify/enhance channel	GRMW/Umatilla Tribe contract, Ladd Creek/Land Marsh Channel Reconstruction and Wetland Restoration Project. Completed NEPA, permitting and design for FY10/11 implementation to excavate new channels, rehabilitate old channels, place LWD.
			Opportunistic channel enhancement	
		Riparian / Floodplain	livestock exclusion/reveg/weed control/expand streamside buffers/levee or road mod/restore meadows	GRMW/USFS contract, Riparian Fencing and Water Development project. Developed alternate livestock watering systems in Little Catherine Creek, Prong Creek, Scout Creek, and Indian Creek; executed contracts to develop alternative livestock watering systems in Fly Creek and Warm Springs Creek in FY10.
			wetland project development	
			riparian fencing (FS)	GRMW/USFS contract, Riparian Fencing and Water Development project. Installed 4 miles livestock exclosure fencing in Little Catherine Creek, Lick Creek and tributary, and Corral Creek; executed contracts to install exclosure fencing in SF Catherine Creek and Camp Creek in 2010.
			road obliteration/sediment reduction (FS)	

Attachment 3 - Table 4.1. Actions Identified for 2008-2009 Implementation in FCRPS BA, Attachment B.2.2-2, Table 4a: Snake River Spring/Summer Chinook

Snake River Spring/Summer Chinook				
MPG	**Population**	**Primary Limiting Factor(s) by AU**	**Action Description**	**FY08-09 Progress**
		Fish Passage	culverts/irrigation diversion improvements	GRMW contract, Catherine Creek State Diversion Fish Passage project: fish ladder construction and diversion modification to access 22 miles habitat. Smutz Draw culvert replacement to access 1.5 miles habitat.
			Catherine Creek State Diversion Fish Passage	
			Catherine Creek Diversion Townley-Dobin	GRMW contract, Townley-Dobbin and Mill Creek Fish Passage Project: permitting and design in FY09, contract in place for FY10 construction of Townley-Dobbin fishway, diversion structure modification, and headgate/j-hook installation. Completed environmental review, permitting, design and installation of Mill Creek rock vortex weir to improve access to 2 miles habitat.
			Catherine Creek Davis Dams Fish Passage (design)	GRMW contract, permitting and design initiated.
			Scout Creek Culvert Replacement (design)	GRMW contract, design pending completion of USFS review.
	Upper Grande Ronde	In-channel characteristics	End Creek Restoration - Phase IV	GRMW/Umatilla Tribe contract, End Creek Restoration. McDonald Creek restoration channel segments and spring channels added 0.4 mile stream habitat.
			Willow Ck channel improvement /wetland restoration (new)	
			Indian Ck channel enhancement and wetland restoration	GRMW/USFS contract, Riparian Fencing and Water Development project. Alternative livestock watering system developed in Indian Creek.
		Riparian / Floodplain	Indian/Little Indian riparian fencing/water development-start in 09, continue through 15 (FS)	GRMW/USFS contract, Riparian Fencing and Water Development project. Alternative livestock watering system developed in Indian Creek.

Attachment 3 - Table 4.1. Actions Identified for 2008-2009 Implementation in FCRPS BA, Attachment B.2.2-2, Table 4a: Snake River Spring/Summer Chinook

Snake River Spring/Summer Chinook				
MPG	**Population**	**Primary Limiting Factor(s) by AU**	**Action Description**	**FY08-09 Progress**
		Passage	culverts/irrigation diversion improvements	GRMW/Umatilla Tribe contract, End Creek Restoration Project — McDonald Creek Headgate removal accessed 5 miles habitat.
		In-channel characteristics	Upper GR River mine tailings (FS)	GRMW/USFS Upper Grande Ronde Mine Tailings contract: planning, permitting, design, and implementation to remove/recontour mile tailings. Treated 38 riparian acres and 7.5 wetland acres over 2.5 mile stream reach.
			Fly Ck (FS)	GRMW/USFS contract, Fly Creek Stream Restoration: planning, permitting, design in FY09, implementation in FY10.
			UGR/Fly/Sheep Ck riparian fencing + water development- 2009 (FS)	GRMW/USFS contract, Riparian Fencing and Water Development project: permitting and design in FY08, implementation in FY09.
			Camp Carson erosion control 2008 (FS)	Cancelled — lack of fish benefits.
	Wallowa	Lack of passage - Lack of access to diversity of habitats,	Fish Passage Improvements	GRMW contract, Deer Creek Culvert Replacement to improve access to 2.5 miles steelhead habitat.
Middle Fork Salmon	Big Creek	Sediment effects on rearing and spawning success - lack of intersticial space, reduced pool volume, reduced spawning success	Road Decommissioning, Road Improvement, Culvert Removal / Replacement, Riparian Restoration near Mining Sites, Weed Management, Silvicultural BMPs	Expanded the geographic scope and budget of project 2007-127-000 East Fork of South Fork Salmon River Passage Restoration to include Big Creek watershed habitat improvements. Implementation to begin in FY10 and expanded implementation in FY11/12.

Attachment 3 - Table 4.1. Actions Identified for 2008-2009 Implementation in FCRPS BA, Attachment B.2.2-2, Table 4a: Snake River Spring/Summer Chinook

Snake River Spring/Summer Chinook				
MPG	**Population**	**Primary Limiting Factor(s) by AU**	**Action Description**	**FY08-09 Progress**
		Migration Barriers associated with roads and mining activities	Assess stream crossings and anthropogenic migration barriers to determine actions necessary for salmonid passage. Provide for salmonid passage at identified passage barriers (e.g., culvert replacement)	
South Fork Salmon River	South Fork Salmon River mainstem	Sediment effects on rearing and spawning success - lack of inter-sticial space, reduced pool volume, reduced spawning success	Road Decommissioning, Road Improvement, Culvert Removal / Replacement, Riparian Restoration, Mine rehabilitation	BPA expanded funding to project 200712700, Reestablish Connectivity and Restore Fish Habitat in the East Fork of the South Fork Salmon River Watershed. Conducted assessment, inventory, and prioritization of habitat opportunities for subsequent implementation. Completed planning, design, environmental review, and permitting and recontoured over 20 miles of road.
		Migration Barriers	Assess stream crossings and anthropogenic migration barriers to determine actions necessary for salmonid passage. Provide for salmonid passage at identified passage barriers. The Stibnite-Glory Hole passage project is a priority.	Funding through 200712700 (see above). Stibnite-Glory Hole passage project cancelled, replaced with watershed-scale assessment of passage barriers (culverts), channel complexity, and floodplain reconnection opportunities, and prioritized road decommissioning. Implementation in FY09 and beyond based on inventory and assessment and pending environmental review and permitting. Addressed migration barriers on Parks Creek, Salt Creek, and Profile Creek to improve access to 15.6 miles fish habitat.
	Secesh River	Sediment effects on rearing and spawning success - lack of intersticial space, reduced pool volume, reduced spawning success	Road Decommissioning, Road Improvement, Culvert Removal / Replacement, Weed Management, Silvacultural BMPs	Funding included in expanded funding to 200712700. See above.

Attachment 3 - Table 4.2. Actions Identified for 2007-2009 Implementation in FCRPS BA, Attachment B.2.2-2, Table 4b: Snake River Summer/Winter Steelhead

Snake River Summer/Winter Steelhead				
Population	**Assessment Unit (AU)**	**Primary Limiting Factor(s) (PLF) by AU**	**Action Description**	**FY08-09 Progress**
Upper Grande Ronde	Mid Grande Ronde River and Tributaries	In-channel characteristics	End Creek Restoration - Phase IV	GRMW contract, End Creek Restoration. McDonald Creek restoration channel segments and spring channels added 0.4 mile stream habitat.
			Willow Ck channel improvement /wetland restoration (new)	
			Indian Ck channel enhancement and wetland restoration	GRMW/USFS contract, Riparian Fencing and Water Development project. Alternative livestock watering system developed in Indian Creek.
		Riparian / Floodplain	Indian/Little Indian Riparian fencing/water development 2009 start (FS)	GRMW/USFS contract, Riparian Fencing and Water Development project. Alternative livestock watering system developed in Indian Creek.
	Upper Grande Ronde and Tributaries	In-channel characteristics	Upper GR River mine tailings (FS)	GRMW/USFS Upper Grande Ronde Mine Tailings contract: planning, permitting, design, and implementation to remove/recontour mile tailings. Treated 38 riparian acres and 7.5 wetland acres over 2.5 mile stream reach.
			Fly Ck (FS)	GRMW/USFS contract, Fly Creek Stream Restoration: planning, permitting, design in FY09, implementation in FY10.
		Sediment	Camp Carson erosion control (FS)	Cancelled — lack of fish benefits.
	Catherine Creek	In-channel characteristics	In-stream enhancement, LWD, modify/enhance channel	GRMW/Umatilla Tribe contract, Ladd Creek/Land Marsh Channel Reconstruction and Wetland Restoration Project. Completed NEPA, permitting and design for FY10/11 implementation to excavate new channels, rehabilitate old channels, place LWD.

Attachment 3 - Table 4.2. Actions Identified for 2007-2009 Implementation in FCRPS BA, Attachment B.2.2-2, Table 4b: Snake River Summer/Winter Steelhead

Snake River Summer/Winter Steelhead				
Population	**Assessment Unit (AU)**	**Primary Limiting Factor(s) (PLF) by AU**	**Action Description**	**FY08-09 Progress**
		Riparian / Floodplain	livestock exclusion/reveg/weed control/expand streamside buffers/levee or road mod/restore meadows	GRMW/USFS contract, Riparian Fencing and Water Development project. Developed alternate livestock watering systems in Little Catherine Creek, Prong Creek, Scout Creek, and Indian Creek; executed contracts to develop alternative livestock watering systems in Fly Creek and Warm Springs Creek in FY10.
			wetland project development	
			Catherine Ck road obliteration/sediment reduction 2009 start (FS)	
		Fish Passage	culverts/irrigation diversion improvements	GRMW contract, Catherine Creek State Diversion Fish Passage project: fish ladder construction and diversion modification to access 22 miles habitat. Smutz Draw culvert replacement to access 1.5 miles habitat.
			Catherine Creek State Diversion Fish Passage	
			Catherine Creek Diversion Townley-Dobin	GRMW contract, Townley-Dobbin and Mill Creek Fish Passage Project: permitting and design in FY09, contract in place for FY10 construction of Townley-Dobbin fishway, diversion structure modification, and headgate/j-hook installation. Completed environmental review, permitting, design and installation of Mill Creek rock vortex weir to improve access to 2 miles habitat.
			Catherine Creek Davis Dams Fish Passage (design)	GRMW contract, permitting and design initiated.
			Scout Creek Culvert Replacement (design)	Design pending completion of USFS review.

Attachment 3 - Table 4.2. Actions Identified for 2007-2009 Implementation in FCRPS BA, Attachment B.2.2-2, Table 4b: Snake River Summer/Winter Steelhead

Snake River Summer/Winter Steelhead				
Population	**Assessment Unit (AU)**	**Primary Limiting Factor(s) (PLF) by AU**	**Action Description**	**FY08-09 Progress**
Lochsa	Crooked Fork	Connectivity - Lack of access to diversity of habitats	Culvert Replacement or Removal	BPA funding for project 200739500, Protect and Restore the Lochsa River beginning in 2007; budget expanded by $756k/year beginning in FY09. Completed road and culvert risk assessment in the upper Lochsa. Addressed migration barriers in Haskell and NF Spruce creeks to improve access to 3.8 miles fish habitat.
		Sediment effects on rearing and spawning success - lack of interstitial space, reduced pool volume, reduced spawning success	Road Removal and Improvement/ Land Acquisition	Project 200739500. Decommissioned 8 miles of road in Rock Creek. Prepared designs for 373 road decommissioning in 2010.
		Temperature and Instream Habitat-poor quality pools and structure	Revegetation to allow for woody debris recruitment and riparian area cover. Land Acquisition	Project 200739500. Revegetated 38.8 acres; treated 50 acres of exotic/noxious weeds.
	Middle Lochsa North Face Tributaries (from Post Office to Bald Mountain)	Loss of riparian vegetation and complexity, lack of shade, loss of nutrients	Riparian Rehabilitation	Project 200739500: 67 acres of riparian planting.
		Lack of passage - Lack of access to diversity of habitats,	Culvert Replacement or Removal	Project 200739500: Replaced Indian Graves culvert (2.5 miles) and East Fork Indian Graves culvert to improve access to 5.0 miles fish habitat.
		Sediment effects on rearing and spawning success - lack of interstitial space, reduced pool volume,	Road Decommissioning, Culvert Removal / Replacement, Noxious Weed Control	Project 200739500: Decommissioned 12 miles road; treated 7 acres of exotic/invasive plants.

Attachment 3 - Table 4.2. Actions Identified for 2007-2009 Implementation in FCRPS BA, Attachment B.2.2-2, Table 4b: Snake River Summer/Winter Steelhead

Snake River Summer/Winter Steelhead				
Population	**Assessment Unit (AU)**	**Primary Limiting Factor(s) (PLF) by AU**	**Action Description**	**FY08-09 Progress**
		reduced spawning success		
		Temperature	Road Removal, Riparian Rehabilitation	Project 200739500: see above.
	Lower Lochsa (Fish Creek to Pete King Creek)	Loss of riparian vegetation and complexity, lack of shade, loss of nutrients	Riparian Rehabilitation	Project 200739500: No on the ground implementation in this AU. Implementation planning for 2010 and beyond.
		Lack of passage - Lack of access to diversity of habitats	Culvert Replacement or Removal, Remove engineered instream structures	
		Temperature	Road Removal, Riparian Rehabilitation	
		Sediment effects on rearing and spawning success - lack of interstitial space, reduced pool volume, reduced spawning success	Road Decommissioning, Culvert Removal / Replacement, Noxious Weed Control	
Lolo Creek	Musselshell Creek	Sediment from roads, timber harvest, cattle grazing, and historic mining - effects on rearing and spawning success, interstitial space	Road Decommissioning and road drainage improvements, Weed Control	BPA funding for project 199607702, Protect and Restore the Lolo Creek Watershed — budget expanded by $100K/year beginning in FY09: Weed treatment on 3 riparian miles/30 riparian acres.

Attachment 3 - Table 4.2. Actions Identified for 2007-2009 Implementation in FCRPS BA, Attachment B.2.2-2, Table 4b: Snake River Summer/Winter Steelhead

Snake River Summer/Winter Steelhead				
Population	**Assessment Unit (AU)**	**Primary Limiting Factor(s) (PLF) by AU**	**Action Description**	**FY08-09 Progress**
		and pool volume		
		Loss of riparian vegetation and complexity - lack of stream shading resulting in elevated temperatures	Riparian Rehabilitation & Large Woody Debris	Protect 200 acres of meadow; installed 1 mile fencing along stream.
		Lack of passage - Lack of access to diversity of habitats	Musselshell Tunnel/ Stream Relocation, Culvert Replacement	Removed culvert upstream of mining Musselshell Tunnel to improve access to 21 miles of habitat once Tunnel barrier is addressed.
	Yoosa Creek	Sediment from roads, timber harvest, cattle grazing, and historic mining - effects on rearing and spawning success, interstitial space and pool volume	Road Decommissioning and road drainage improvements, Weed Control	Project 199607702: Replaced Mox Creek culverts to improve access to 2.5 miles fish habitat.
	Lolo Creek	Sediment from roads, timber harvest, cattle grazing,- effects on rearing and spawning success, interstitial space and pool volume	Road obliteration and road drainage improvements	Project 199607702: Decommissioned 48 miles of road in Yakus and Lolo Creeks (White-White Road).
		Reduced channel complexity from streamside roads, reduced LWD & historic	Riparian Rehabilitation & Large Woody Debris	

Attachment 3 - Table 4.2. Actions Identified for 2007-2009 Implementation in FCRPS BA, Attachment B.2.2-2, Table 4b: Snake River Summer/Winter Steelhead

Snake River Summer/Winter Steelhead				
Population	**Assessment Unit (AU)**	**Primary Limiting Factor(s) (PLF) by AU**	**Action Description**	**FY08-09 Progress**
		dredge mining		
		Loss of riparian vegetation and complexity - lack of stream shading resulting in elevated temperatures	Riparian planting	
		Lack of passage - Lack of access to diversity of habitats	Culvert Replacement, Eldorado Falls Adjustment	Project 199607702: Rat Creek culvert replacement improved access to 4.3 miles habitat.
Selway River	O'Hara Creek	Sediment from roads, timber harvest, cattle grazing - effects on rearing and spawning success, interstitial space and pool volume	Road Decommissioning and road drainage improvements, Weed Control	No tributary habitat improvement projects funded by BPA in the Selway River. Implementation planned for 2010-13.
		Loss of riparian vegetation and complexity - lack of stream shading resulting in elevated temperatures	Riparian Rehabilitation & Large Woody Debris	
	Lower Selway River	Sediment from roads - effects on rearing and spawning success, interstitial space and pool volume	Riparian Rehabilitation & Sediment Filters	
		Lack of passage - Lack of access to diversity of habitats	Culvert Replacement	

Attachment 3 - Table 4.2. Actions Identified for 2007-2009 Implementation in FCRPS BA, Attachment B.2.2-2, Table 4b: Snake River Summer/Winter Steelhead

Snake River Summer/Winter Steelhead				
Population	**Assessment Unit (AU)**	**Primary Limiting Factor(s) (PLF) by AU**	**Action Description**	**FY08-09 Progress**
South Fork Clearwater River	Newsome Creek	Channel Morphology - Channel straightened, lack of pools, lack of pool depth, lack of complexity, lack of cover	Channel / Riparian Rehabilitation	BPA funding for Project 200003500, Rehabilitate Newsome Creek — budget expanded by $321k/year beginning in FY08: design and contract preparation completed for implementation of 2.4 miles of stream restoration in 2010-13.
		Loss of riparian vegetation and complexity – dredge mine effects, lack of shade, loss of nutrients	Channel / Riparian Rehabilitation	Project 200003500: Design and contraction preparation completed for 5-10 acres riparian planting.
		Lack of passage - Lack of access to diversity of habitats	Culvert Replacement	Project 200003500: Mare Creek and Mule Creek culvert replacements to improve access to 6 miles habitat.
		Sediment effects on rearing and spawning success - lack of interstitial space, reduced pool volume, reduced spawning success	Road Decommissioning, Road Improvement, Culvert Removal / Replacement	Project 200003500: Improved 19.5 road miles; decommissioned 18 road miles.
	Meadow Creek	Sediment effects on rearing and spawning success - lack of interstitial space, reduced pool volume, reduced spawning success	Road Decommissioning, Soil Restoration, Culvert Removal / Replacement, Weed Control	BPA funding for Project 199607705, Restore McComas Meadows/Meadow Creek Watershed — budget expanded by $200k/year beginning in FY08: 2.5 riparian miles and 43.9 upland miles of road treated/removed.
		Lack of passage - Lack of access to diversity of habitats	Culvert Replacement	Project 199607705: Covert & Rock Creek culvert replacements to improve access to 3.5 miles habitat.

Attachment 3 - Table 4.2. Actions Identified for 2007-2009 Implementation in FCRPS BA, Attachment B.2.2-2, Table 4b: Snake River Summer/Winter Steelhead

Snake River Summer/Winter Steelhead				
Population	**Assessment Unit (AU)**	**Primary Limiting Factor(s) (PLF) by AU**	**Action Description**	**FY08-09 Progress**
		Loss of riparian vegetation and complexity - lack of large woody debris recruitment resulting in lack of habitat complexity	Riparian Rehabilitation	Project 199607705: 4 miles riparian vegetation planted.
		Loss of riparian vegetation and complexity - lack of stream shading resulting in elevated temperatures	Riparian Rehabilitation	See above.
	Mill Creek	Lack of passage - Lack of access to diversity of habitats	Culvert Replacement	BPA funding for Project 200003600, Protect and Restore Mill Creek — budget expanded by $150k/year beginning in FY08: Hepner Creek and Merton Creek culvert replacements to improve access to 8 miles habitat.
		Loss of riparian vegetation and complexity - lack of large woody debris recruitment resulting in lack of habitat complexity	Riparian Rehabilitation	Project 200003600: 2.0 miles riparian vegetation planted.
		Loss of riparian vegetation and complexity - lack of stream shading resulting in elevated temperatures	Riparian Rehabilitation	See above.

Attachment 3 - Table 4.2. Actions Identified for 2007-2009 Implementation in FCRPS BA, Attachment B.2.2-2, Table 4b: Snake River Summer/Winter Steelhead

Snake River Summer/Winter Steelhead				
Population	**Assessment Unit (AU)**	**Primary Limiting Factor(s) (PLF) by AU**	**Action Description**	**FY08-09 Progress**
	American River	Channel Morphology - Channel straightened, lack of pools, lack of pool depth, lack of complexity, lack of cover	Channel / Riparian Rehabilitation on Telephone, Whitaker, & Queen Creeks. BLM proposed restoration of American River.	No tributary habitat improvement projects funded by BPA for 2007-09 implementation in the American River AU. Implementation planned for 2010 and beyond.
		Loss of riparian vegetation and complexity - dredge mine effects, lack of shade, loss of nutrients	Channel / Riparian Rehabilitation on Telephone, Whitaker, & Queen Creeks	
		Lack of passage - Lack of access to diversity of habitats	Culvert Replacement	
		Sediment effects on rearing and spawning success - lack of interstitial space, reduced pool volume, reduced spawning success	Road Decommissioning, Road Improvement, Culvert Removal / Replacement, Weed Control	
		Riparian and channel alteration from floodplain/riparian development	Maines Estate Land Acquisition / Conservation Easements	
	Crooked River	Channel Morphology - Channel straightened, lack of pools, lack of pool depth, lack of complexity, lack of cover	Channel / Riparian Rehabilitation, includes both BPA proposals and FS Stewardship actions	No tributary habitat improvement projects funded by BPA for 2007-09 implementation in the Crooked River AU. Implementation planned in 2010 and beyond.

Attachment 3 - Table 4.2. Actions Identified for 2007-2009 Implementation in FCRPS BA, Attachment B.2.2-2, Table 4b: Snake River Summer/Winter Steelhead

Snake River Summer/Winter Steelhead				
Population	**Assessment Unit (AU)**	**Primary Limiting Factor(s) (PLF) by AU**	**Action Description**	**FY08-09 Progress**
		Loss of riparian vegetation and complexity - dredge mine effects, lack of shade, loss of nutrients	Channel / Riparian Rehabilitation, includes both BPA proposals and FS Stewardship actions	
		Lack of passage - Lack of access to diversity of habitats	Culvert Replacement	
		Sediment effects on rearing and spawning success - lack of interstitial space, reduced pool volume, reduced spawning success	Road Decommissioning, Road Improvement, Culvert Removal / Replacement, Weed Control	
	Red River	Channel Morphology - Channel straightened, lack of pools, lack of pool depth, lack of complexity, lack of cover	Channel / Riparian Rehabilitation	BPA funding for Project 200207200, Protect and Restore Red River Watershed — budget expanded by $198k/year beginning in FY08. Initiated Red River stream restoration on 2 miles (planned completion in 2010); installed 41 instream structures; added 0.1 miles stream channel at Red River narrows.
		Loss of riparian vegetation and complexity - dredge mine effects, lack of shade, loss of nutrients	Channel / Riparian Rehabilitation	See above.
		Lack of passage - Lack of access to diversity of habitats	Culvert Replacement	Project 200207200: Replace #1709 culvert to improve access to 5.0 miles habitat.

Attachment 3 - Table 4.2. Actions Identified for 2007-2009 Implementation in FCRPS BA, Attachment B.2.2-2, Table 4b: Snake River Summer/Winter Steelhead

Snake River Summer/Winter Steelhead				
Population	**Assessment Unit (AU)**	**Primary Limiting Factor(s) (PLF) by AU**	**Action Description**	**FY08-09 Progress**
		Sediment effects on rearing and spawning success - lack of interstitial space, reduced pool volume, reduced spawning success	Road Decommissioning, Road Improvement, Culvert Removal / Replacement, Weed Control	Project 200207200: 1.0 riparian mile and 20 upland miles of road decommissioned.
		Riparian and channel alteration from floodplain/riparian development	Red River Meadows Land Acquisition / Conservation Easements	Project 200207200: Began implementation of Red River restoration on 2 stream miles (planned completion in 2010); installed 41 instream structures; added 0.1 miles stream channel at Red River narrows.
Big Creek	Entire Big Creek Watershed	Chemical Pollution From Mining Activities	Mine Rehabilitation and Riparian Restoration	No action implemented in Big Creek. Implementation planned for 2010 and beyond.
		Sediment effects on rearing and spawning success - lack of interstitial space, reduced pool volume, reduced spawning success	Road Decommissioning, Road Improvement, Culvert Removal / Replacement, Riparian Restoration near Mining Sites, Weed Management, Silvicultural BMPs	

Attachment 3 - Table 4.2. Actions Identified for 2007-2009 Implementation in FCRPS BA, Attachment B.2.2-2, Table 4b: Snake River Summer/Winter Steelhead

Snake River Summer/Winter Steelhead				
Population	**Assessment Unit (AU)**	**Primary Limiting Factor(s) (PLF) by AU**	**Action Description**	**FY08-09 Progress**
		Migration Barriers associated with roads and mining activities	Assess stream crossings and anthropogenic migration barriers to determine actions necessary for salmonid passage. Provide for salmonid passage at identified passage barriers (e.g., culvert replacement)	See above.
Secesh River	Entire Secesh Basin	Sediment effects on rearing and spawning success - lack of interstitial space, reduced pool volume, reduced spawning success	Road Decommissioning, Road Improvement, Culvert Removal / Replacement, Weed Management, Silvicultural BMPs	BPA expanded funding to Project 200712700, Reestablish Connectivity and Restore Fish Habitat in the East Fork of the South Fork Salmon River Watershed. Conducted assessment, inventory, and prioritization of habitat opportunities. Projects initiated to decommission 15-30 road miles beginning in FY 09.
South Fork Salmon	EFSF Salmon and tribs	Sediment effects on rearing and spawning success - lack of interstitial space, reduced pool volume, reduced spawning success	Road Decommissioning, Road Improvement, Culvert Removal / Replacement, Riparian Restoration, Mine rehabilitation	BPA expanded funding to Project 200712700, Reestablish Connectivity and Restore Fish Habitat in the East Fork of the South Fork Salmon River Watershed. Conducted assessment, inventory, and prioritization of habitat opportunities.
		Migration Barriers	Assess stream crossings and anthropogenic migration barriers to determine actions necessary for salmonid passage. Provide for salmonid passage at identified passage barriers. The Stibnite-Glory Hole passage project is a priority.	Funding through 200712700 (see above). Stibnite-Glory Hole passage project cancelled, replaced with watershed-scale assessment of passage barriers (culverts), channel complexity and floodplain reconnection opportunities, and prioritized road decommissioning. Replaced Salt, Parks, and Profile creeks culverts to improve access to 15 miles of habitat.

Attachment 3 - Table 4.2. Actions Identified for 2007-2009 Implementation in FCRPS BA, Attachment B.2.2-2, Table 4b: Snake River Summer/Winter Steelhead

Snake River Summer/Winter Steelhead				
Population	**Assessment Unit (AU)**	**Primary Limiting Factor(s) (PLF) by AU**	**Action Description**	**FY08-09 Progress**
		Heavy Metal Contamination	Mine oversight and management to protect and restore water quality and fish habitat. Riparian, floodplain, and wetland restoration.	See above.

Attachment 3 - Table 4.3. Actions Identified for 2007-2009 Implementation in FCRPS BA, Attachment B.2.2-2, Table 4c: Upper Columbia River Summer/Winter Steelhead

Upper Columbia River Summer/Winter Steelhead				
Population	**Assessment Unit (AU)**	**Primary Limiting Factor(s) by AU**	**Action Description**	**FY08 Progress**
Okanogan River	Omak Creek MSA	Passage-culverts	provide passage at barriers	Colville Tribe Accord Agreement: approximately $850k budget increase in FY08 (Projects 2000-00-100 Omak Creek Anadromous Fish Habitat and Passage, 1996-042-00 Restore Salmon Creek Anadromous Fish, 2007-224-00 Okanogan Subbasin Habitat Implementation Program). 200 acres purchased along Omak Creek to protect 0.5 riparian miles, added 8 miles of stream channel in lower Salmon Creek; installed 2.7 riparian miles and 0.7 upland miles fencing; planted 2.1 miles riparian vegetation, increased complexity in 1.2 miles of fish habitat; replaced or removed culverts to improve access to 14 miles habitat.
	Small Trib Creeks Combined mSA	Riparian and floodplain function	land acquisition	
	Salmon Creek	Low stream flow	water acquisition	
		In-channel habitat quantity*	Salmon Creek Project funded under 2007-09 F&W Pgm Funding Decision. Potential to fund water acquisition through the Water Entity/CBWTP.	
		Passage-flow barrier in lower reach	improve water management/channel reconstruction	
	Loup Loup Creek	Low stream flow	improve water management	
		Riparian and floodplain function	water conservation	
		Passage- flow barrier in lower reach	provide passage at barriers	

Attachment 3 - Table 5.1. Status of Completed and Ongoing 2007 FCRPS Biological Assessment Table 5a Tributary Habitat Actions Performed with Reclamation Technical Assistance

Table 5.1 contains metric and metric values for actions completed in 2007-2009 and ongoing actions that will continue into 2010 and later with technical assistance provided by Reclamation. Ongoing actions are those with no date in the "Action End Date" column. Some of the actions in table 5.1 complement some of the BPA-funded projects listed in Attachment 3, Tables 1 to 4. The following abbreviations apply. Streamflow: streamflow protected under state law. Stream length: stream length affected. Type (channel access): D, diversion; C, culvert. Type (channel complexity): R, restore main channel function; S, side channel reconnection. Extent of barrier: P, partial (upstream access seasonably inaccessible prior to action); F, full (absolutely no passage prior to action). Access: miles made accessible to next upstream full or partial barrier. Stream miles affected by screen: miles between action location and next diversion. Complexity miles: length of instream habitat treated after action completed.

Attachment 3 - Table 5.1. Status of Completed and Ongoing 2007 FCRPS Biological Assessment Table 5a Tributary Habitat Actions Performed with Reclamation Technical Assistance

BiOp ID	Subbasin	Limiting Factor	Project Title	Short Description	Latitude	Longitude	Action Start Date	Action End Date	Streamflow		Type	Access		Entrainment				Comp-lexity (Miles)
									Stream Flow (cfs)	Stream Length (miles)		Extent of Barrier	Access (Miles)	Number of Screens Replaced	Screened Discharge (cfs)	Screened Discharge (A-F/yr)	Stream Miles Affected	
Upper Columbia River Steelhead and Spring Chinook Salmon																		
4391	Entiat	Channel Access	Knapp Wham Diversion Replacement (Phase 2)	This project is part of the larger Knapp-Wham/Hanan Detwiler Ditch consolidation. It is the replacement of a push-up dam with a permanent diversion for the KW ditch. Benefits associated with the completed action and evaluated by the expert panel address a different limiting factor (access) than identified in the 2007 FCRPS BA (streamflow) owing to action changes based on landowner input.	47 41 42	120 19 13	4/16/2009	10/15/2009			D	P	22					
4034	Methow	Channel Access	MVID East Canal Diversion Dam	Will replace the structure with a new one located at the original point of diversion. The upstream location will allow a much less obtrusive structure that will not require a constructed fishway for passage. Barrier removed and access metric obtained in 2008; completion of headworks scheduled for 2010.	48 25 08	120 08 25	9/13/2002				D	P	246.3					
4035	Methow	Channel Access	MVID West Canal Diversion Dam	Design and construct a new diversion structure and headgate that would prevent entry and minimize the effects of MVD's operations on listed salmonids. Designs completed in 2007; completion pending landowner decisions; completed replacement and additional actions considered by the expert panel for this subbasin for the 2007-2009 implementation cycle are listed in table 5.3; ongoing replacement and additional	48 22 13	120 11 38	9/13/2002				D	P	120.3					

Attachment 3 - Table 5.1. Status of Completed and Ongoing 2007 FCRPS Biological Assessment Table 5a Tributary Habitat Actions Performed with Reclamation Technical Assistance

BiOp ID	Subbasin	Limiting Factor	Project Title	Short Description	Latitude	Longitude	Action Start Date	Action End Date	Streamflow		Type	Access		Entrainment				Comp-lexity (Miles)
									Stream Flow (cfs)	Stream Length (miles)		Extent of Barrier	Access (Miles)	Number of Screens Replaced	Screened Discharge (cfs)	Screened Discharge (A-F/yr)	Stream Miles Affected	
				actions initiated in 2007-2009 that will be considered by expert panels upon completion are listed in table 5.4.														
4261	Methow	Channel Complexity	Elbow Coulee Side Channel Restoration	The objective of this geomorphology project is to restore off-channel rearing habitat in a side channel off the mainstem Twisp River.	48 22 47	120 14 20	5/4/2005	9/29/2008			S							0.5
4260	Methow	Channel Complexity	Jennings Habitat Complexity Project	The purpose of the project is to reconnect the floodplain to the river and establish off-channel habitat.	48 22 03	120 18 39	1/23/2006	10/11/2006			S							1
4263	Methow	Channel Complexity	Upper Beaver Creek Side Channel Reconnection	This geomorphology project involves re-connecting a former beaver pond area and channel to the existing Beaver Creek channel in the Methow subbasin, with the objective of providing off-channel rearing habitat and floodplain connectivity. Deferred pending landowner decision and response; completed replacement and additional actions considered by the expert panel for this subbasin for the 2007-2009 implementation cycle are listed in table 5.3; ongoing replacement and additional actions initiated in 2007-2009 that will be considered by expert panels upon completion are listed in table 5.4.	48 23 45	120 02 45	5/3/2005				S							0.5
	Methow	Channel Complexity	Buckley Floodplain Restoration	This project will provide off-channel rearing habitat and improve floodplain connectivity by providing flow and fish access to a series of existing ponds. Deferred pending landowner decision and response; completed replacement and additional actions considered by the expert panel for this subbasin for the 2007-2009 implementation cycle are listed in table 5.3; ongoing replacement and additional actions initiated in 2007-2009														

Attachment 3 - Table 5.1. Status of Completed and Ongoing 2007 FCRPS Biological Assessment Table 5a Tributary Habitat Actions Performed with Reclamation Technical Assistance

BiOp ID	Subbasin	Limiting Factor	Project Title	Short Description	Latitude	Longitude	Action Start Date	Action End Date	Streamflow		Type	Access		Entrainment				Comp-lexity (Miles)
									Stream Flow (cfs)	Stream Length (miles)		Extent of Barrier	Access (Miles)	Number of Screens Replaced	Screened Discharge (cfs)	Screened Discharge (A-F/yr)	Stream Miles Affected	
				that will be considered by expert panels upon completion are listed in table 5.4.														
	Methow	Channel Complexity	Lower Eight Mile	Floodplain restoration in middle Chewuch River deferred pending landowner decision and response; completed replacement and additional actions considered by the expert panel for this subbasin for the 2007-2009 implementation cycle are listed in table 5.3; ongoing replacement and additional actions initiated in 2007-2009 that will be considered by expert panels upon completion are listed in table 5.4.													
	Methow	Channel Complexity	Windhaven Reach	Side Channel Reconnection in lower Chewuch River deferred pending landowner decision and response; completed replacement and additional actions considered by the expert panel for this subbasin for the 2007-2009 implementation cycle are listed in table 5.3; ongoing replacement and additional actions initiated in 2007-2009 that will be considered by expert panels upon completion are listed in table 5.4.													
	Methow	Channel Complexity	Lehman Reach Projects	Side channel reconnection and ground water /irrigation water utilization in middle Methow River deferred pending landowner decision and response; completed replacement and additional actions considered by the expert panel for this subbasin for the 2007-2009 implementation cycle are listed in table 5.3; ongoing replacement and additional actions initiated in 2007-2009 that will be considered by expert panels upon completion													

Attachment 3 - Table 5.1. Status of Completed and Ongoing 2007 FCRPS Biological Assessment Table 5a Tributary Habitat Actions Performed with Reclamation Technical Assistance

BiOp ID	Subbasin	Limiting Factor	Project Title	Short Description	Latitude	Longitude	Action Start Date	Action End Date	Streamflow		Type	Access		Entrainment				Comp-lexity (Miles)
									Stream Flow (cfs)	Stream Length (miles)		Extent of Barrier	Access (Miles)	Number of Screens Replaced	Screened Discharge (cfs)	Screened Discharge (A-F/yr)	Stream Miles Affected	
				are listed in table 5.4.														
	Methow	Channel Complexity	McNae Island Channel Restoration	Channel restoration below MVID East Diversion deferred pending landowner decision and response; completed replacement and additional actions considered by the expert panel for this subbasin for the 2007-2009 implementation cycle are listed in table 5.3; ongoing replacement and additional actions initiated in 2007-2009 that will be considered by expert panels upon completion are listed in table 5.4.													

Snake River Steelhead and Spring/Summer Chinook Salmon

4328	Lemhi	Channel Access	L-1 Diversion	Evaluation of alternatives and development of conceptual design for a pump system and/or diversion weir is requested. Conceptual designs prepared in 2008; completion pending landowner decisions; completed replacement and additional actions considered by the expert panel for this subbasin for the 2007-2009 implementation cycle are listed in table 5.3; ongoing replacement and additional actions initiated in 2007-2009 that will be considered by expert panels upon completion are listed in table 5.4.	45 10 69	113 53 15	4/1/2008				D	P	1					
4021	Lemhi	Channel Access	L-3A0 Diversion Replacement	The existing gravel push-up dam spanning the Lemhi River has no provisions for fish passage and can be an impediment during low streamflow conditions.	45 09 37	113 50 23	4/16/2002	7/27/2005			D	P	1					
4209	Lemhi	Channel Access	Lemhi River-L-44 Diversion Consolidation	The L-44 and 45 irrigation diversions on the upper Lemhi River are typical rock, push-up diversion structures. Elimination of one diversion berm (l-44) and replacement of the other	44 49 46	113 36 37	5/13/2004	8/13/2005			D	P	0.5					

Attachment 3 - Table 5.1. Status of Completed and Ongoing 2007 FCRPS Biological Assessment Table 5a Tributary Habitat Actions Performed with Reclamation Technical Assistance

BiOp ID	Subbasin	Limiting Factor	Project Title	Short Description	Latitude	Longitude	Action Start Date	Action End Date	Streamflow		Type	Access		Entrainment				Comp-lexity (Miles)
									Stream Flow (cfs)	Stream Length (miles)		Extent of Barrier	Access (Miles)	Number of Screens Replaced	Screened Discharge (cfs)	Screened Discharge (A-F/yr)	Stream Miles Affected	
				(L-45) with a single, consolidated structure will ensure fish passage during variable flows.														
	Lemhi	Channel Access	L-7 Wasteway Ditch Fish Screen	The L-7 ditch is located on the Lemhi River, Lemhi County, Idaho. Presently adult salmon and steelhead that are migrating up the Lemhi River are being attracted into the return flow from the L-7 irrigation ditch system. A barrier or screen located near the ditch outlet is needed to prevent fish from entering the ditch system. Deferred pending landowner decision and response; completed replacement and additional actions considered by the expert panel for this subbasin for the 2007-2009 implementation cycle are listed in table 5.3; ongoing replacement and additional actions initiated in 2007-2009 that will be considered by expert panels upon completion are listed in table 5.4.														
4342	Upper Salmon	Channel Access	Pole Creek Diversion Enhancement	Pole Creek Diversion is a wooden structure check board to raise the level of the creek for diversion into an irrigation ditch. There is a fish ladder associated with the diversion that local biologists feel is a barrier to fish movement. Deferred pending landowner decision and response; completed replacement and additional actions considered by the expert panel for this subbasin for the 2007-2009 implementation cycle are listed in table 5.3; ongoing replacement and additional actions initiated in 2007-2009 that will be considered by expert panels upon completion are listed in table 5.4.	43 54 35	114 45 26	9/10/2008											

Attachment 3 - Table 5.1. Status of Completed and Ongoing 2007 FCRPS Biological Assessment Table 5a Tributary Habitat Actions Performed with Reclamation Technical Assistance

BiOp ID	Subbasin	Limiting Factor	Project Title	Short Description	Latitude	Longitude	Action Start Date	Action End Date	Streamflow		Type	Access		Entrainment				Comp-lexity (Miles)
									Stream Flow (cfs)	Stream Length (miles)		Extent of Barrier	Access (Miles)	Number of Screens Replaced	Screened Discharge (cfs)	Screened Discharge (A-F/yr)	Stream Miles Affected	
4239	Upper Salmon	Channel Access	East Fork Salmon River-EF 13 Diversion	This project would construct a permanent diversion structure. Fish passage around the site will be provided. Deferred pending landowner decision and response; completed replacement and additional actions considered by the expert panel for this subbasin for the 2007-2009 implementation cycle are listed in table 5.3; ongoing replacement and additional actions initiated in 2007-2009 that will be considered by expert panels upon completion are listed in table 5.4.	44 08 45	114 23 26	3/9/2004				D	P	1					
4247	Upper Salmon	Channel Access	East Fork Salmon River-EF 14 Diversion	EF 14 is an irrigation diversion with a gravel push-up dam. The diversion is unstable and must be re-built several times each year. This project would construct a more permanent rock diversion structure, along with a fish screen that meets NOAA Fisheries criteria. Deferred pending landowner decision and response; completed replacement and additional actions considered by the expert panel for this subbasin for the 2007-2009 implementation cycle are listed in table 5.3; ongoing replacement and additional actions initiated in 2007-2009 that will be considered by expert panels upon completion are listed in table 5.4.	44 08 33	114 24 07	2/16/2006				D	P	1.2					

Attachment 3 - Table 5.1. Status of Completed and Ongoing 2007 FCRPS Biological Assessment Table 5a Tributary Habitat Actions Performed with Reclamation Technical Assistance

BiOp ID	Subbasin	Limiting Factor	Project Title	Short Description	Latitude	Longitude	Action Start Date	Action End Date	Streamflow		Type	Access		Entrainment				Comp-lexity (Miles)
									Stream Flow (cfs)	Stream Length (miles)		Extent of Barrier	Access (Miles)	Number of Screens Replaced	Screened Discharge (cfs)	Screened Discharge (A-F/yr)	Stream Miles Affected	
4249	Upper Salmon	Channel Access	East Fork Salmon River EF 16 Diversion	EF 16 is an irrigation diversion with a gravel push-up dam. The diversion is unstable and must be rebuilt several times each year. This project would consolidate three diversions by building a more permanent rock diversion structure, building a new fish screen and new headgate structure. Deferred pending landowner decision and response; completed replacement and additional actions considered by the expert panel for this subbasin for the 2007-2009 implementation cycle are listed in table 5.3; ongoing replacement and additional actions initiated in 2007-2009 that will be considered by expert panels upon completion are listed in table 5.4.	44 07 31	114 25 39	2/16/2006				D	P	1.9					
4410	Pahsimeroi	Channel Access	Big Springs Creek 1 Diversion Enhancement	This project proposes to remove the existing wooden check structure and replace it with a structure that would allow fish passage at all times, while allowing the irrigators to continue diverting water. Scheduled for completion in 2010; completed replacement and additional actions considered by the expert panel for this subbasin for the 2007-2009 implementation cycle are listed in table 5.3; ongoing replacement and additional actions initiated in 2007-2009 that will be considered by expert panels upon completion are listed in table 5.4.	44 36 55	113 57 54	7/2/2008				D	P	2.5					
	Pahsimeroi	Channel Access	Big Springs #2	Replace gravel push-up structure with a structure passable to migrating fish. Combined with Big Springs #1; completed replacement and additional actions considered by the expert panel for this subbasin for the 2007-2009 implementation cycle are listed in table 5.3; ongoing														

Attachment 3 - Table 5.1. Status of Completed and Ongoing 2007 FCRPS Biological Assessment Table 5a Tributary Habitat Actions Performed with Reclamation Technical Assistance

BiOp ID	Subbasin	Limiting Factor	Project Title	Short Description	Latitude	Longitude	Action Start Date	Action End Date	Streamflow		Type	Access		Entrainment				Comp-lexity (Miles)
									Stream Flow (cfs)	Stream Length (miles)		Extent of Barrier	Access (Miles)	Number of Screens Replaced	Screened Discharge (cfs)	Screened Discharge (A-F/yr)	Stream Miles Affected	
				replacement and additional actions initiated in 2007-2009 that will be considered by expert panels upon completion are listed in table 5.4.														
Mid-Columbia River Steelhead																		
4296	John Day Middle Fork	Channel Access	Smith Ditch Diversion	Historically a pushup dam was required for the irrigator to divert at the full water right rate. A concrete headgate structure with two slide headgates controls the flow into the ditch. The Grant SWCD anticipates installing a typical lay-flat stanchion dam at this site with fish passage. Construction is targeted for 2008.	44 40 57	118 45 47	10/18/2006	8/1/2008			D	P	1					
4292	John Day Middle Fork	Channel Access	North Ditch Diversion	The diversion has an 18-inch, open-ended CMP pipe for a headgate which is regulated by placing boards and plastic across the opening. The instream part of the structure is composed of large rocks and gravels. The diversion will be replaced by a lay-flat stanchion dam by the GSWCD.	44 35 18	118 26 27	10/11/2006	8/15/2007			D	P	24					
4295	John Day Middle Fork	Channel Access	South Ditch Diversion (MFJDR)	The diversion has an 18-inch, open-ended CMP pipe for a headgate which is regulated by placing boards and plastic across the opening. The instream part of the structure is composed of large rocks. The diversion will be replaced by a lay-flat stanchion dam by the GSWCD.	44 35 53	118 28 10	10/13/2006	8/15/2007			D	F	2					
4293	John Day Middle Fork	Channel Access	Upper Clear Creek Diversion	The diversion has an 18-inch, open-ended CMP pipe for a headgate which is regulated by placing boards and plastic across the opening. The instream part of the structure is composed of large rocks, boards, and plastic supported	44 34 37	118 29 35	10/13/2006	8/15/2007			D	P	14					

Attachment 3 - Table 5.1. Status of Completed and Ongoing 2007 FCRPS Biological Assessment Table 5a Tributary Habitat Actions Performed with Reclamation Technical Assistance

BiOp ID	Subbasin	Limiting Factor	Project Title	Short Description	Latitude	Longitude	Action Start Date	Action End Date	Streamflow		Type	Access		Entrainment				Comp-lexity (Miles)
									Stream Flow (cfs)	Stream Length (miles)		Extent of Barrier	Access (Miles)	Number of Screens Replaced	Screened Discharge (cfs)	Screened Discharge (A-F/yr)	Stream Miles Affected	
				by steel fence posts. The diversion will be replaced by a lay-flat stanchion dam by the GSWCD.														
4294	John Day Middle Fork	Channel Access	Vinegar Creek Diversion	The instream part of the structure is composed of 2-4 foot boulders on the permanent part of the structure with smaller rocks, debris, boards, and plastic on the part that is hand built each year. The diversion will be replaced by a modified version of a lay-flat stanchion dam by the GSWCD.	44 37 49	118 29 59	10/13/2006	8/15/2007			D	P	7					
4345	John Day Middle Fork	Channel Access	Boulder Creek Ranch Diversion	The Boulder Creek Ranch Diversion is about 15 miles Northwest of Austin Junction, Oregon, on Big Boulder Creek. Big Boulder Creek is a major tributary to the Middle Fork John Day River. The instream part of the structure is composed of large cobble and traps. Scheduled for completion in 2010.	44 40 26	118 43 01	7/25/2008				D	P	13					
4272	John Day Middle Fork	Channel Complexity	TNC MF John Day Habitat Improvement Project-Phase I	The Nature Conservancy has asked Reclamation for technical assistance in design and planning for a variety of habitat improvements on their Dunstan Homestead Preserve property on the Middle Fork John Day. Phase I of the project will be to determine the feasibility and then the ultimate design and planning for three side channel projects.	44 40 00	118 42 34	5/23/2005	8/15/2007			R							0.64
4368	John Day Middle Fork	Channel Complexity	TNC MF John Day Habitat Improvement Project -Phase II	TNC has asked Reclamation for technical assistance for design of a subset of projects proposed in the Aquatic and Flood Restoration Plan for Dustan Homestead Preserve (Claire Fields, 2004) in order to build partnerships and refine designs, permitting process, construction techniques, construction costs, and monitoring protocols for these restoration elements.	44 40 00	118 42 34	5/20/2005	10/30/2007			R							1.25

Attachment 3 - Table 5.1. Status of Completed and Ongoing 2007 FCRPS Biological Assessment Table 5a Tributary Habitat Actions Performed with Reclamation Technical Assistance

BiOp ID	Subbasin	Limiting Factor	Project Title	Short Description	Latitude	Longitude	Action Start Date	Action End Date	Streamflow		Type	Access		Entrainment				Comp-lexity (Miles)
									Stream Flow (cfs)	Stream Length (miles)		Extent of Barrier	Access (Miles)	Number of Screens Replaced	Screened Discharge (cfs)	Screened Discharge (A-F/yr)	Stream Miles Affected	
				Each element has future application elsewhere on the Dustan Preserve, as well as elsewhere in the upper Middle Fork John Day watershed.														
4283	John Day Middle Fork	Channel Complexity	Big Boulder Habitat Improvement Project	The Nature Conservancy and the Oregon Department of Fish and Wildlife, acting as advisor to landowner Les Zaitz, have asked Reclamation for technical assistance in design and planning for channel reconfiguration and large wood placements on Big Boulder Creek.	44 40 22	118 42 59	9/6/2005	7/15/2008			R							0.83
4273	John Day Middle Fork	Channel Complexity	Dead Cow Gulch Access and Habitat Improvement Project	Dead Cow Gulch is currently blocked to fish passage near its mouth by two culverts. The channel has also been moved to a different path which further limits access and available habitat. This project would reroute the stream into a more natural alignment and eliminate the culverts as a barrier.	44 36 27	118 32 50	2/14/2005	10/30/2007			R	F	1.5					0.2
4299	John Day Upper Main	Channel Access	Blue Mountain Diversion	The structure consists of concrete wing walls and a concrete sill about 15 feet wide and 80-100 feet long, with a total vertical drop of 6-7 feet at low flow. The GSWCD is proposing to rebuild the channel grade using a series of weirs to raise the water level to the sill of the dam and then create a passageway over or through the flash board part of the dam.	44 24 39	119 07 42	10/11/2006	8/15/2007			D	F	0.5					
4303	John Day Upper Main	Channel Access	Morgan Ditch Diversion (Reynold's Creek)	There is a functioning slide headgate, and the instream part of the structure is composed of large rocks and logs. The diversion will be replaced by a lay-flat stanchion dam by the GSWCD.	44 24 42	118 33 34	10/11/2006	8/15/2007			D	P	0.85					

Attachment 3 - Table 5.1. Status of Completed and Ongoing 2007 FCRPS Biological Assessment Table 5a Tributary Habitat Actions Performed with Reclamation Technical Assistance

BiOp ID	Subbasin	Limiting Factor	Project Title	Short Description	Latitude	Longitude	Action Start Date	Action End Date	Streamflow		Type	Access		Entrainment				Comp-lexity (Miles)
									Stream Flow (cfs)	Stream Length (miles)		Extent of Barrier	Access (Miles)	Number of Screens Replaced	Screened Discharge (cfs)	Screened Discharge (A-F/yr)	Stream Miles Affected	
4297	John Day Upper Main	Channel Access	Axe Ditch Diversion-Reynolds Creek	There is not a functioning headgate and the instream part of the structure is composed of large rocks, tarps, steel posts, and logs. The diversion will be replaced by a lay-flat stanchion dam by the GSWCD.	44 25 01	118 32 40	1/19/2007	8/15/2007			D	F	11					
4304	John Day Upper Main	Channel Access	Panama Ditch Diversion	The diversion structure is a typical gravel pushup dam which has to be constructed and maintained with heavy equipment. The Grant SWCD anticipates installing a typical lay-flat stanchion dam at this site with fish passage. Construction is targeted for 2008.	44 25 00	119 03 18	10/18/2006	8/15/2008			D	F	7					
4300	John Day Upper Main	Channel Access	Bower's/Lemon's Ditch Diversion	The diversion structure is a typical gravel pushup dam which has to be constructed and maintained with heavy equipment. The Grant SWCD anticipates installing a typical lay-flat stanchion dam at this site with fish passage. Construction is targeted for 2008	44 24 40	119 07 02	10/18/2006	8/15/2008			D	F	10.5					
4302	John Day Upper Main	Channel Access	Long Box Diversion	The diversion structure is a gravel and large rock pushup dam. The Grant SWCD anticipates installing a typical lay-flat stanchion dam at this site with fish passage. Construction is targeted for 2008.	44 27 18	119 25 33	10/18/2006	8/15/2008			D	P	1					
4298	John Day Upper Main	Channel Access	Beech Creek Crossing	A dam in Beech Creek allows the water in Panama Ditch to flow into and back out of Beech Creek. The Grant SWCD anticipates installing an inverted siphon to carry the Panama Ditch water under Beech Creek and modifications to the dam in Beech Creek to divert Beech Creek water and allow passage. Construction is targeted for 2008.	44 25 32	119 06 35	10/18/2006	8/15/2008			D	F	6					

Attachment 3 - Table 5.1. Status of Completed and Ongoing 2007 FCRPS Biological Assessment Table 5a Tributary Habitat Actions Performed with Reclamation Technical Assistance

BiOp ID	Subbasin	Limiting Factor	Project Title	Short Description	Latitude	Longitude	Action Start Date	Action End Date	Streamflow		Type	Access		Entrainment				Comp-lexity (Miles)
									Stream Flow (cfs)	Stream Length (miles)		Extent of Barrier	Access (Miles)	Number of Screens Replaced	Screened Discharge (cfs)	Screened Discharge (A-F/yr)	Stream Miles Affected	
4301	John Day Upper Main	Channel Access	Hufstader Pump Station	The pump station will serve lands at the far end of the Eddington Ditch. Eddington Ditch diverts water from the John Day River 4.3 river miles upstream from the site of the proposed pump station. The Grant SWCD anticipates installing a pump station and associated delivery piping. Construction is targeted for 2008.	44 43 24	119 27 37	10/18/2006	4/15/2008			D	P						
4323	John Day Upper Main	Channel Access	Kennedy (UPJD RM 209) and Murray (UPJD RM 210.2) Ditch Diversions	The diversion structures are typical gravel pushup dams which have to be constructed and maintained with heavy equipment. The Grant SWCD anticipates installing two pump stations and associated pipelines to eliminate the instream structures. Scheduled for completion in 2010	44 29 13	119 33 21	1/24/2008		3.8	1.3	D	F	1					
4369	John Day Upper Main	Channel Access	Grant SWCD-Cummings River Ditch Diversion (UPJD RM 222.5)	The Cummings River Diversion project is located 12 miles west of Mt. Vernon on the John Day River at river mile 226. The diversion structure is a typical gravel and large rock pushup dam which has to be constructed and maintain with heavy equipment.	44 26 07	119 18 56	2/4/2008	8/15/2009			D	F	1					
	John Day Upper Main	Channel Access	Diversion, Bridge Creek Diversion	Replace the current dam with a lay-flat stanchion type dam. The new structure would incorporate fish passage meeting current criteria. This project was identified incorrectly in the 2007 FCRPS BA; completed replacement and additional actions for this subbasin for the 2007-2009 implementation cycle are listed in table 5.3; ongoing replacement and additional actions initiated in 2007-2009 and pending completion are listed in table 5.4.													
4314	John Day Upper Main	Channel Access	Grant SWCD-Stout Diversion (UPJD RM 214.3)	The Grant SWCD anticipates installing a typical lay-flat stanchion dam in the side channel and a grade control	44 27 54	119 29 32	3/31/2008	8/15/2009			D	F	1					

Attachment 3 - Table 5.1. Status of Completed and Ongoing 2007 FCRPS Biological Assessment Table 5a Tributary Habitat Actions Performed with Reclamation Technical Assistance

BiOp ID	Subbasin	Limiting Factor	Project Title	Short Description	Latitude	Longitude	Action Start Date	Action End Date	Streamflow		Type	Access		Entrainment				Comp-lexity (Miles)
									Stream Flow (cfs)	Stream Length (miles)		Extent of Barrier	Access (Miles)	Number of Screens Replaced	Screened Discharge (cfs)	Screened Discharge (A-F/yr)	Stream Miles Affected	
				structure in the main channel.														
4350	John Day Upper Main	Channel Access	Oliver Ditch # 47 (UPJD RM 253.3) Diversion (combined with Oliver #48 in 2008)	The Oliver Ditch # 47 Diversion project is located 4.5 miles east of John Day on the John Day River at river mile 253.3. Scheduled for completion in 2010.	44 25 25	118 51 50	7/28/2008				D	F	1					
4351	John Day Upper Main	Channel Access	Oliver Ditch # 48 (UPJD RM 253.2) Diversion (combined with Oliver # 47 in 2008)	The Oliver Ditch # 48 Diversion project is located 4.5 miles east of John Day on the John Day River at river mile 253.2. Scheduled for completion in 2010.	44 25 19	118 51 50	7/28/2008				D	P	0.1					
4353	John Day Upper Main	Channel Access	Oliver Ditch # 49 Diversion (UPJD RM 252.3)	The Oliver Ditch # 49 Diversion project is located four miles east of John Day on the John Day River at river mile 252.3. Preliminary review of the water rights indicates this diversion has a water right for diversion of 2.3 cfs. This structure is a full barrier at low flow to all life stages but at higher flows, when the dam is partially washed out, it is partially a barrier. Scheduled for completion in 2010.	44 25 14	118 52 36	7/28/2008				D	F	1					
4349	John Day Upper Main	Channel Access	Eddington Ditch Diversion (Page Pump Station-UPJD RM 231.7)	The Eddington Ditch Diversion project is located 6 miles west of Mt. Vernon on the John Day River at river mile 233. The diversion structure is a typical gravel pushup dam which has to be constructed and maintain with heavy equipment. One partially functioning slide headgate controls flow into the ditch.	44 25 44	119 12 44	7/28/2008	8/15/2009			D	F	1					
4305	John Day Upper Main	Channel Complexity	CTWSRO Reach 8 Habitat Design	The work will involve design of features to improve habitat. The river is partially constrained by levees resulting in a fairly straight, wide, and shallow cross section. The proposed project is to remove the levees and strategically place large wood to increase channel complexity, narrow the channel,	44 27 33	118 41 52	10/13/2006	8/1/2007			R							0.15

Attachment 3 - Table 5.1. Status of Completed and Ongoing 2007 FCRPS Biological Assessment Table 5a Tributary Habitat Actions Performed with Reclamation Technical Assistance

BiOp ID	Subbasin	Limiting Factor	Project Title	Short Description	Latitude	Longitude	Action Start Date	Action End Date	Streamflow		Type	Access		Entrainment				Comp-lexity (Miles)
									Stream Flow (cfs)	Stream Length (miles)		Extent of Barrier	Access (Miles)	Number of Screens Replaced	Screened Discharge (cfs)	Screened Discharge (A-F/yr)	Stream Miles Affected	
				and stimulate natural increases in sinuosity.														

Attachment 3 - Table 5.2. Status of Completed and Ongoing 2007 FCRPS Biological Assessment Table 5b Tributary Habitat Actions Performed with Reclamation Technical Assistance

Table 5.2 contains metric and metric values for actions completed in 2007-2009 and ongoing actions that will continue into 2010 and later with technical assistance provided by Reclamation. Ongoing actions are those with no date in the "Action End Date" column. Some of the actions in table 5.2 supplement some of the BPA-funded projects listed in Attachment 3, Tables 1 to 4. Actions in Table 5.2 were not considered in NOAA Fisheries' 2008 FCRPS BiOp jeopardy analysis and provide benefits above and beyond those denoted in the 2007 FCRPS BA. Benefits for actions completed by 2009 were considered by expert panels. The following abbreviations apply. Streamflow: streamflow protected under state law. Stream length: stream length affected. Type (channel access): D, diversion; C, culvert. Type (channel complexity): R, restore main channel function; S, side channel reconnection. Extent of barrier: P, partial (upstream access seasonably inaccessible prior to action); F, full (absolutely no passage prior to action). Access: miles made accessible to next upstream full or partial barrier. Stream miles affected by screen: miles between action location and next diversion. Complexity miles: length of instream habitat treated after action completed.

Attachment 3 - Table 5.2. Status of Completed and Ongoing 2007 FCRPS Biological Assessment Table 5b Tributary Habitat Actions Performed with Reclamation Technical Assistance

BiOp ID	Subbasin	Limiting Factor	Project Title	Short Description	Latitude	Longitude	Action Start Date	Action End Date	Streamflow		Type	Access		Entrainment				Comp-lexity (Miles)
									Stream Flow (cfs)	Stream Length (miles)		Extent of Barrier	Access (Miles)	Number of Screens Replaced	Screened Discharge (cfs)	Screened Discharge (A-F/yr)	Stream Miles Affected	
Upper Columbia River Steelhead and Spring Chinook Salmon																		
4341	Entiat	Channel Access	Stormy Creek Culvert Replacement	This project will address two barrier culverts on Stormy Creek. Scheduled for completion in the 2010-2012 Implementation cycle.			6/15/2008											
4194	Entiat	Channel Access	Knapp-Wham/Hannon Detweiler Ditch Consolidation (Phases 1&3)	Consolidation of two ditches with diversions that constitute barriers with one diversion reconfigured to better pass ESA-listed anadromous species.	47 41 11	120 18 55	10/31/2003	10/15/2007			D	P						
4339	Entiat	Channel Complexity	Below the Bridge (Moody Canyon) ELJ (Bridge to Bridge Restoration, Phase 4)	Complexity Project in the lower Entiat River.	47 39 51	120 15 48	4/1/2007	1/15/2009			R							0.4
4357	Entiat	Channel Complexity	Entiat National Fish Hatchery (ENFH) Habitat Channel (Bridge to Bridge Restoration, Phase 5)	The USFWS and Reclamation are collaborating on a multi-faceted project at the ENFH that incorporates existing infrastructure into a new project to provide off-channel spawning and rearing habitat for ESA-listed species. Conceptual designs initiated in 2008; continued progress pending landowner decision and response.	47 41 51	120 19 18	1/14/2008				S							0.3
4399	Entiat	Channel Complexity	Tyee Restoration Project (Stillwater complexity project)	Alterations at the Tyee Restoration Project include the construction of levees with rip-rap. Scheduled for completion in the 2010-2012 Implementation cycle.			8/13/2009				R							0.47

Attachment 3 - Table 5.2. Status of Completed and Ongoing 2007 FCRPS Biological Assessment Table 5b Tributary Habitat Actions Performed with Reclamation Technical Assistance

BiOp ID	Subbasin	Limiting Factor	Project Title	Short Description	Latitude	Longitude	Action Start Date	Action End Date	Streamflow		Type	Access		Entrainment				Comp-lexity (Miles)
									Stream Flow (cfs)	Stream Length (miles)		Extent of Barrier	Access (Miles)	Number of Screens Replaced	Screened Discharge (cfs)	Screened Discharge (A-F/yr)	Stream Miles Affected	
4326	Entiat	Channel Complexity	Keystone Canyon Project	This project consists of an existing push-up diversion structure replacement and habitat improvement/floodplain connectivity features. The goal of this project is to meet the BiOp Metric requirement for adding habitat complexity to the Entiat River to improve spawning and rearing habitat quantity and quality for native endangered fish species. The habitat need identified in the subbasin plan and by local biologists for the lower Entiat River is deep, slow-water habitat (pools), localized pockets of depth, velocity and substrate diversity leading to increased habitat diversity, and retention of spawning size gravels on the channel edges for steelhead (Water Resource Inventory Area (WRIA) 46 Management Plan). The objective of the work under this scope of work is to provide an evaluation of a selected alternative through an Alternative Evaluation Report (AER) for floodplain reconnection and/or in-channel restoration structures, which will provide sufficient analysis results to complete a construction funding proposal. This project was completed by the Yakama Nation as part of their Fish Accord. Reclamation provided survey data.	47 39 54	120 16 05	1/29/2007	2009			S							0.2
4329	Entiat	Channel Complexity	Harrison Side Channel (Bridge to Bridge Restoration, Phases 2 and 3)	The purpose of this project is to connect secondary channels at about three locations at varying elevations along the main channel.	47 40 12	120 17 29	6/26/2007	11/15/2008			S							0.5

Attachment 3 - Table 5.2. Status of Completed and Ongoing 2007 FCRPS Biological Assessment Table 5b Tributary Habitat Actions Performed with Reclamation Technical Assistance

BiOp ID	Subbasin	Limiting Factor	Project Title	Short Description	Latitude	Longitude	Action Start Date	Action End Date	Streamflow		Type	Access		Entrainment				Comp-lexity (Miles)
									Stream Flow (cfs)	Stream Length (miles)		Extent of Barrier	Access (Miles)	Number of Screens Replaced	Screened Discharge (cfs)	Screened Discharge (A-F/yr)	Stream Miles Affected	
4340	Entiat	Channel Complexity	Milne Diversion Project (Bridge to Bridge and Beyond Project # 1)	This is the first project in the lower Entiat River resulting from TSC's Reach Study. It will be multiple instream habitat structures including one that also replaces an irrigation push-up dam.	47 39 57	120 16 36	8/25/2006	10/15/2007			R							0.3
4284	Wenatchee	Channel Access	Three Mission Creek Projects: Miller, Turnbull and Jurgins	Miller and Turnbull: Repair and installation of low-stage log weirs to re-establish plunge pool habitat and thalweg and increase complexity. Jurgins: Install a low-stage rock weir with large woody debris to provide plunge pool habitat, control bank erosion, increase complexity, and re-establish thalweg.	47 27 26	120 29 27	6/26/2006	10/15/2006			D	P	10	2				
4217	Wenatchee	Channel Access	Gagnon Diversion Project	This project will address a partial barrier to listed salmonids in the Wenatchee River near Cashmere, Washington, by eliminating the need for annual maintenance and periodic re-excavation of a side channel used as a source for irrigation withdrawal.	47 32 01	120 31 47	9/9/2004	9/15/2006			D	P	10					
4255	Wenatchee	Channel Access	Alder Creek Culvert Passage Project # 1 (formerly Alder Creek #2 Culvert Passage Project)	This culvert is a barrier to fish passage because of the outfall velocities associated with it. This project will consist of a detailed analysis of the culvert using WDFW protocol and replacing it as necessary.	47 51 09	120 39 36	2/17/2006	8/23/2007			C	P	4.3					
4308	Wenatchee	Channel Access	WPP Alder Creek 2 & 3	This project proposes to replace a culvert on Alder Creek that doesn't meet current WDFW and NOAA Fisheries passage criteria. It carries a paved county road over Alder Creek and will be analyzed as both a retrofit and replacement.	47 50 56	120 39 27	1/18/2007	7/23/2007			C	P	1					

Attachment 3 - Table 5.2. Status of Completed and Ongoing 2007 FCRPS Biological Assessment Table 5b Tributary Habitat Actions Performed with Reclamation Technical Assistance

BiOp ID	Subbasin	Limiting Factor	Project Title	Short Description	Latitude	Longitude	Action Start Date	Action End Date	Streamflow		Type	Access		Entrainment				Comp-lexity (Miles)
									Stream Flow (cfs)	Stream Length (miles)		Extent of Barrier	Access (Miles)	Number of Screens Replaced	Screened Discharge (cfs)	Screened Discharge (A-F/yr)	Stream Miles Affected	
4306	Wenatchee	Channel Access	WPP Beaver Creek 3 Culvert Replacements	This project will address three barrier culverts on Beaver Creek by replacing the existing culverts with modular bridges with a span of less than 30 feet.	47 49 24	120 37 22	1/19/2007	10/15/2008			C	P	2					
4258	Wenatchee	Channel Complexity	Wenatchee Watershed Fluvial Habitat Restoration Plan (WWFHRP)-Nason Ck TA&Ras	The deliverable of this RFP will be a Wenatchee Watershed Fluvial Habitat Restoration Plan Scope of Work. A draft of the plan will be required by May 31, 2007.			9/26/2005	7/15/2008										
4265	Wenatchee	Channel Complexity	Gagnon CMZ Project	This project proposes to create (excavate) a backchannel feature (along the floodplain of the Gagnon CMZ Site) to link the existing pond to the main stream, thus providing high flow salmonid refuge habitat.	47 32 00	120 30 19	11/14/2005	11/15/2007			S							0.2
4193	Wenatchee	Channel Access, Channel Complexity, Entrainment	Jones Shotwell Ditch	This project would bring the Jones Shotwell Ditch Company's fish screen into compliance with NOAA Fisheries criteria.	47 29 37	120 25 25	2/2/2004	2/15/2008			D	P	100	1				0.2
4331	Methow	Channel Access	Redshirt Project	This project will address an irrigation-related barrier on Beaver Creek by constructing a rock weir structure. The expert panel evaluated this project only for Upper Columbia steelhead	48 23 01	120 02 58	7/20/2006	10/26/2007			D	P	4					
4330	Methow	Channel Access	Poorman Cutoff Road Culvert	Replacement of culvert. The expert panel evaluated this project only for Upper Columbia steelhead	48 21 50	120 20 19	2/15/2008	10/15/2009			C	F	3					
4325	Methow	Channel Complexity	Big Valley Reach Assessment	This study will address cumulative project impacts, river stability, and habitat assessment for a six- to 10-mile reach of the mainstem Methow River.			10/2/2006	3/31/2008										
4333	Methow	Channel Complexity	Big Valley Light Heath	This project will provide better connection and access from the Methow River to a spring creek and pond on the Heath property.	48 30 28	120 15 33	1/19/2007	8/29/2008			S							1

Attachment 3 - Table 5.2. Status of Completed and Ongoing 2007 FCRPS Biological Assessment Table 5b Tributary Habitat Actions Performed with Reclamation Technical Assistance

BiOp ID	Subbasin	Limiting Factor	Project Title	Short Description	Latitude	Longitude	Action Start Date	Action End Date	Streamflow		Type	Access		Entrainment				Comp-lexity (Miles)
									Stream Flow (cfs)	Stream Length (miles)		Extent of Barrier	Access (Miles)	Number of Screens Replaced	Screened Discharge (cfs)	Screened Discharge (A-F/yr)	Stream Miles Affected	
	Methow	Channel Complexity	Lower Eightmile Floodplain Restoration	Project deferred pending landowner decision and response.														
	Methow	Channel Complexity	Patterson Pond Reconnect	Project deferred pending landowner decision and response.														
4262	Methow	Channel Complexity	Rockview-Fender Mills Phase I Side Channel Reconnection	The objective of this side channel restoration project is to provide approximately 1/4 mile of off-channel rearing habitat and restore floodplain connectivity.	48 32 34	120 19 20	5/12/2005	5/15/2009			S							0.25

Mid-Columbia River Steelhead

4319	John Day Middle Fork	Channel Complexity	CTWSRO Oxbow Reach Assessment (MCA)	Channel Reconfiguration. The ultimate goal of this reach assessment is a diagnostic investigation of the main processes that transport and store water, wood, and sediment at the habitat reach scale of the river system; and an integration of hydrologic, hydraulic, geomorphic, and biologic conditions of the system to establish an environmental baseline through a matrix of pathways of effects and indicators of those effects. The proximate goal is to formulate a multiple working hypothesis for guiding restoration and protection activities at the reach scale based on an established baseline environmental conditions quantified through channel conditions and dynamics indicators and the reach sequencing of restoration and preservation project areas. Scheduled for completion in the 2010			9/5/2007												

Attachment 3 - Table 5.2. Status of Completed and Ongoing 2007 FCRPS Biological Assessment Table 5b Tributary Habitat Actions Performed with Reclamation Technical Assistance

BiOp ID	Subbasin	Limiting Factor	Project Title	Short Description	Latitude	Longitude	Action Start Date	Action End Date	Streamflow		Type	Access		Entrainment				Comp-lexity (Miles)
									Stream Flow (cfs)	Stream Length (miles)		Extent of Barrier	Access (Miles)	Number of Screens Replaced	Screened Discharge (cfs)	Screened Discharge (A-F/yr)	Stream Miles Affected	
4318	John Day Middle Fork	Channel Complexity	CTWSRO (MCA) Middle Fork Forrest Reach Assessment	Channel Reconfiguration. The ultimate goal of this reach assessment is a diagnostic investigation of the main processes that transport and store water, wood, and sediment at the habitat reach scale of the river system; and an integration of hydrologic, hydraulic, geomorphic, and biologic conditions of the system to establish an environmental baseline through a matrix of pathways of effects and indicators of those effects. The proximate goal is to formulate a multiple working hypothesis for guiding restoration and protection activities at the reach scale based on an established baseline of environmental conditions quantified through channel conditions and dynamics indicators and the reach sequencing of restoration and preservation project areas. This assessment effort will serve as a foundation for subsequent project design packages. Scheduled for completion in the 2010.			9/18/2007												
4419	John Day	Channel Complexity	CTWRSO (MCA Study) Middle Fork and Upper John Day River Tributary Assessments	Tributary assessments provide baseline physical and biological conditions for approximately 23 river miles (RM) of the Middle Fork John Day River and three miles of the Upper John Day River, located in Grant County, Oregon. The purpose of this report is to develop restoration and protection strategies based on a sound assessment of channel processes.			5/12/2006	5/16/2008										

Attachment 3 - Table 5.3. Status of Completed 2007 FCRPS Biological Assessment Table 5a and 5b Replacement and Additional Tributary Habitat Actions Performed with Reclamation Technical Assistance

Table 5.3 contains metric and metric values for actions completed in 2007-2009 with technical assistance provided by Reclamation in addition to those identified in Tables 5a or 5b of the 2007 FCRPS BA. Some of the actions in table 5.3 may supplement or complement some of the BPA-funded projects listed in Attachment 3, Tables 1 to 4. The following abbreviations apply. Streamflow: streamflow protected under state law. Stream length: stream length affected. Type (channel access): D, diversion; C, culvert. Type (channel complexity): R, restore main channel function; S, side channel reconnection. Extent of barrier: P, partial (upstream access seasonably inaccessible prior to action); F, full (absolutely no passage prior to action). Access: miles made accessible to next upstream full or partial barrier. Stream miles affected by screen: miles between action location and next diversion. Complexity miles: length of instream habitat treated after action completed.

Attachment 3 - Table 5.3. Status of Completed 2007 FCRPS Biological Assessment Table 5a and 5b Replacement and Additional Tributary Habitat Actions Performed with Reclamation Technical Assistance

BiOp ID	Subbasin	Limiting Factor	Project Title	Short Description	Latitude	Longitude	Action Start Date	Action End Date	Streamflow		Type	Access		Entrainment				Comp-lexity (Miles)
									Stream Flow (cfs)	Stream Length (miles)		Extent of Barrier	Access (Miles)	Number of Screens Replaced	Screened Discharge (cfs)	Screened Discharge (A-F/yr)	Stream Miles Affected	
Upper Columbia River Steelhead and Spring Chinook Salmon																		
4285	Entiat	Channel Complexity	Bridge to Bridge Phase 1	Entails installation of instream structures, adjustments to canal intake to change water velocities to improve off-channel fish habitat and maintain existing irrigation canal, installation of a water-tight slide gate on irrigation intake pipe, fish improvements to the irrigation canal outfall, and riparian planting.	47 40 09	120 17 05	6/27/2006	11/15/2007			R							0.2
4313	Entiat	Channel Complexity	Entiat River Tributary Assessment	Channel Geomorphology	47 44 09	120 21 46	5/29/2008	1/15/2009										
4009	Methow	Channel Access	Fulton Diversion	The diversion structure is adequate, but the fishway will be redesigned and replaced with a more effective version.	48 29 13	120 10 54	11/1/2002	2/23/2007			D	P	30.1					
4270	Methow	Channel Complexity	Methow Subbasin Geomorphic Assessment	This investigation will provide data on the fluvial geomorphologic characteristics of the Methow Subbasin.			5/12/2005	9/30/2007										

Attachment 3 - Table 5.3. Status of Completed 2007 FCRPS Biological Assessment Table 5a and 5b Replacement and Additional Tributary Habitat Actions Performed with Reclamation Technical Assistance

BiOp ID	Subbasin	Limiting Factor	Project Title	Short Description	Latitude	Longitude	Action Start Date	Action End Date	Streamflow		Type	Access		Entrainment				Comp-lexity (Miles)
									Stream Flow (cfs)	Stream Length (miles)		Extent of Barrier	Access (Miles)	Number of Screens Replaced	Screened Discharge (cfs)	Screened Discharge (A-F/yr)	Stream Miles Affected	
4395	Methow	Channel Complexity	Operskalski Complexity	The Operskalski property includes roughly 1000 feet of Beaver Creek that is being severely impacted by livestock. The channel segment is low in large wood and has a severely eroded right bank due to loss of riparian vegetation from cattle trampling and over-grazing. The left bank is in good condition but is beginning to deteriorate. A stream habitat assessment concludes that there is good spawning habitat potential for steelhead. The objective of the project is to improve habitat complexity in this segment by adding large wood complexes, replanting the cattle-damaged stream bank and protecting the project by constructing about 1000 feet of fencing. An off-channel water source for the cattle may also be needed.	48 22 56	120 02 58	12/19/2008	10/15/2009			S							0.25
4162	Methow	Streamflow	Chewuch Basin Water Acquisition	Compensation for curtailed irrigation water uses from the Chewuch River allows limited irrigation to continue while meeting NOAA Fisheries "ESA flows" in the Chewuch River in dry years from RM 7.9 to 0.7.	48 34 13	120 10 28	10/1/2006	9/30/2008	16.1	7.2	A							
4257	Wenatchee	Channel Access	Mill Creek Culvert Passage Project	This project will consist of either adding passage to the existing culvert or replacing it.	47 30 39	120 37 56	2/23/2006	5/1/2007			C	F	2.3					
4379	Wenatchee	Channel Access	Two Mission Creek Projects-2007	Two projects to improve passage in Mission Creek	47 29 18	120 29 05	6/26/2007	10/15/2007			C	P		2				
4256	Wenatchee	Channel Access	Chumstick(Watkins) Driveway Culvert Replacement.	This project is a continuation of work that has been done cooperatively by NRCS and the Chelan County Conservation District. It involves the replacement of up to 15 culverts in order to improve fish passage on Chumstick Creek near	47 42 39	120 38 24	2/23/2006	9/30/2008			C	P	22.5					

Attachment 3 - Table 5.3. Status of Completed 2007 FCRPS Biological Assessment Table 5a and 5b Replacement and Additional Tributary Habitat Actions Performed with Reclamation Technical Assistance

BiOp ID	Subbasin	Limiting Factor	Project Title	Short Description	Latitude	Longitude	Action Start Date	Action End Date	Streamflow		Type	Access		Entrainment				Comp-lexity (Miles)
									Stream Flow (cfs)	Stream Length (miles)		Extent of Barrier	Access (Miles)	Number of Screens Replaced	Screened Discharge (cfs)	Screened Discharge (A-F/yr)	Stream Miles Affected	
				Leavenworth, Washington.														
4380	Wenatchee	Channel Access	Two Mission Creek Projects-2008	Two projects to improve passage in Mission Creek	47 29 07	120 28 55	6/26/2008	10/15/2008			C	P						
4393	Wenatchee	Channel Access	Chumstick Culverts Replacement 2009 (17)	These projects will address up to 17 passage barrier culverts in the Chumstick Drainage. Reclamation will be providing construction oversight as per the Jeff McLaughlin negotiated construction schedule.	47 41 00	120 38 22	4/16/2009	9/30/2009			C	P	7					
4315	Wenatchee	Channel Complexity	CMZ 12/13	Channel Reconfiguration	47 32 01	120 32 55	2/26/2008	10/15/2008			S							0.4
4316	Wenatchee	Channel Complexity	CMZ 11	Channel Reconfiguration	47 32 04	120 31 25	2/26/2008	10/15/2008			S							0.3
4418	Wenatchee	Channel Complexity	Cashmere Ponds Project	The objectives of the Cashmere Pond Off-Channel Habitat Project are: 1) prevent fish stranding in the pond, and 2) address the primary habitat limiting factor for juvenile steelhead and spring Chinook salmon on the lower Wenatchee River due to the lack of off-channel habitat.	47 31 27	120 28 26	9/9/2008	10/15/2009			S							0.4

Snake River Steelhead and Spring/Summer Chinook Salmon

4327	Grande Ronde	Channel Access	Orodell Diversion Fish Passage Enhancement Project	This project proposes to replace an existing irrigation diversion structure that is currently being used by two ditch companies.	45 20 31	118 06 59	9/24/2007	9/24/2009			D	P	50					
4343	Lemhi	Channel Access	Lemhi River- L-44 Diversion Repair	This project was constructed on the upper Lemhi River in fall 2005. Shortly after completion of the new diversion structure, IDFG raised concerns about the ability of juvenile salmonids to negotiate upstream over the structure.	44 49 46	113 36 37	2/28/2005	9/28/2007			D	P						

Attachment 3 - Table 5.3. Status of Completed 2007 FCRPS Biological Assessment Table 5a and 5b Replacement and Additional Tributary Habitat Actions Performed with Reclamation Technical Assistance

BiOp ID	Subbasin	Limiting Factor	Project Title	Short Description	Latitude	Longitude	Action Start Date	Action End Date	Streamflow		Type	Access		Entrainment				Comp-lexity (Miles)
									Stream Flow (cfs)	Stream Length (miles)		Extent of Barrier	Access (Miles)	Number of Screens Replaced	Screened Discharge (cfs)	Screened Discharge (A-F/yr)	Stream Miles Affected	
4417	Lemhi	Channel Access	Big Timber Flow Enhancement	Water rights from BT-2 diversion were transferred to a new POD in the Lemhi River. Instead, BT-2 water remains in the creek channel to the Lemhi River to a location where the water is diverted out of the river and pumped back up to the historic place of use.	44 42 05	113 22 56	5/30/2003	8/15/2009	2	4.5	D	P	0.75					
4378	Lemhi	Channel Access	Upper Lemhi River Flow Enhancement / Eighteenmile Creek Reconnect	In September 2008, a formerly disconnected Lemhi River tributary was seasonally re-connected to the mainstem Lemhi River by placement of an earthen berm that now blocks diversion of Eighteenmile Creek flow into an irrigation conveyance canal referred to locally as the "Whitefish Ditch." The barrier to fish passage in Canyon Creek also was removed. Eighteenmile Creek stream flow and spring flow water rights that were formerly conveyed to irrigated lands via the Whitefish Ditch were re-directed to now flow into the Lemhi River. Spring flow water rights out of Eighteenmile Creek were transferred by IDWR to a withdrawal location out of the Lemhi River at the L-62 point of diversion. Whitefish Ditch irrigation water is now conveyed via the Lemhi River down to L-62 where the transferred Whitefish Ditch water rights are now diverted/pumped onto agricultural land. This project was funded by the Pacific Coast Salmon Recovery Fund which is provided by the NOAA Fisheries and is administered in Idaho by the Office of Species Conservation. Additional cost share funding was provided by the Natural Resources	44 41 26	113 21 43	10/16/2006	9/15/2009	12	3	D	P	166	1	3.5		3	

Attachment 3 - Table 5.3. Status of Completed 2007 FCRPS Biological Assessment Table 5a and 5b Replacement and Additional Tributary Habitat Actions Performed with Reclamation Technical Assistance

BiOp ID	Subbasin	Limiting Factor	Project Title	Short Description	Latitude	Longitude	Action Start Date	Action End Date	Streamflow		Type	Access		Entrainment				Comp-lexity (Miles)
									Stream Flow (cfs)	Stream Length (miles)		Extent of Barrier	Access (Miles)	Number of Screens Replaced	Screened Discharge (cfs)	Screened Discharge (A-F/yr)	Stream Miles Affected	
				Conservation Service.														
4386	Lemhi	Channel Access	Lemhi River, Little Springs Creek Restoration	Purposed habitat improvements include utilizing a combination of various bioengineering treatments intended to return the stream to a more natural and stable condition. Treatments will include channel/bank reshaping and alignment, placement of engineered log jams, diversion replacement, and planting of riparian vegetation.	44 45 45	113 30 34	2/12/2008	11/16/2009			D	P	2					1.25
4233	Lemhi	Streamflow	Lemhi Basin 06 PHABSIM Studies (TSC)	Objectives of this study are to identify a range of stream flow needed to sustain various life-history stages of salmon, steelhead, and bull trout in Hawley and Eighteenmile Creeks in the upper Lemhi River basin. Results can be used by state and federal regulatory agencies to identify stream flow targets which Reclamation can help meet by implementing other Habitat Program measures.			10/1/2005	7/17/2007										
4237	Little Salmon	Channel Access	Squaw Creek Culvert	A culvert passage barrier is located on the Squaw Creek Road (no. 517). This road is maintained by the Idaho County Road Department. Pre-design should investigate the feasibility of replacing the culvert or modifying it to allow for fish passage. Modification could include backwatering the culvert and installing baffles to reduce velocities in the culvert.	45 25 06	116 21 34	6/1/2005	9/21/2007			C	P	4.5					

Attachment 3 - Table 5.3. Status of Completed 2007 FCRPS Biological Assessment Table 5a and 5b Replacement and Additional Tributary Habitat Actions Performed with Reclamation Technical Assistance

BiOp ID	Subbasin	Limiting Factor	Project Title	Short Description	Latitude	Longitude	Action Start Date	Action End Date	Streamflow		Type	Access		Entrainment				Comp-lexity (Miles)
									Stream Flow (cfs)	Stream Length (miles)		Extent of Barrier	Access (Miles)	Number of Screens Replaced	Screened Discharge (cfs)	Screened Discharge (A-F/yr)	Stream Miles Affected	
Mid-Columbia River Steelhead																		
4317	John Day Middle Fork	Channel Complexity	Middle Fork Rock Replacement Projects	Channel Reconfiguration	44 35 43	118 31 28	9/17/2007	7/25/2008			R							1.55
4278	John Day Upper Main	Channel Access	GSWCD-North Diversion, Reynolds Creek	Grant SWCD is proposing to build a lay-flat stanchion type dam to replace the current dam. The new structure would incorporate fish passage meeting current criteria.	44 24 40	118 34 04	10/7/2005	8/15/2007			D	F	0.2					
4347	John Day Upper Main	Channel Access	Fry-Ingle Diversion	The Fry-Ingle Diversion is about six miles west of John Day, Oregon, on the John Day River near river mile 241.5. Large boulders appear to stay in place year around with additional gravels pushed up to complete the dam at lower flows. This structure is a full barrier at low flows to all life stages but, at higher flows when the dam is partially washed out, it is a partial barrier.	44 24 54	119 04 05	7/28/2008	8/15/2009			D	F	1					
4271	John Day Upper Main	Channel Complexity	CTWSRO John Day Habitat Improvement Project-Phase 1	The John Day Basin office of the Confederated Tribes of Warm Spring Reservation of Oregon has asked Reclamation for technical assistance to restore instream habitat for anadromous and resident fisheries on the Oxbow and Forest conservation areas on the Middle Fork and Forrest Conservation Area on the upper John Day River.	44 27 31	118 41 31	6/15/2005	7/15/2007			R							5.75
4320	John Day Upper Main	Channel Complexity	Forrest-Emmel Habitat Improvement Program	Channel Reconfiguration	44 27 12	118 40 18	8/27/2007	8/15/2008			R							1.15

Attachment 3 - Table 5.3. Status of Completed 2007 FCRPS Biological Assessment Table 5a and 5b Replacement and Additional Tributary Habitat Actions Performed with Reclamation Technical Assistance

BiOp ID	Subbasin	Limiting Factor	Project Title	Short Description	Latitude	Longitude	Action Start Date	Action End Date	Streamflow		Type	Access		Entrainment				Comp-lexity (Miles)
									Stream Flow (cfs)	Stream Length (miles)		Extent of Barrier	Access (Miles)	Number of Screens Replaced	Screened Discharge (cfs)	Screened Discharge (A-F/yr)	Stream Miles Affected	
4198	John Day Upper Main	Streamflow	Pauls Upper John Day Water Lease	Landowner located East of Dayville, Oregon, has water rights to divert water from the upper John Day River to irrigate a total of 86.9 acres under two separate certificates. He has expressed an interest in no longer farming the majority of his irrigable land and is interested in leasing the water rights to the land currently under sprinkler irrigation, for a period of five to 10 years. This sprinkler-irrigated land amounts to about 54 acres. The result would be a lease of diversions rights of 1.36 cfs with priority dates of 1902, 1906, and 1973.	44 27 18	119 25 28	10/1/2006	9/30/2008	1.36	195									

Attachment 3 - Table 5.4. Status of Ongoing 2007 FCRPS Biological Assessment Table 5a and 5b Replacement and Additional Tributary Habitat Actions Performed with Reclamation Technical Assistance

Table 5.3 contains metric and metric values for ongoing actions initiated in 2007-2009 that will continue into 2010 and later with technical assistance provided by Reclamation in addition to those identified in Tables 5a or 5b of the 2007 FCRPS BA. Some of the actions in table 5.3 may supplement or complement some of the BPA-funded projects listed in Attachment 3, Tables 1 to 4. The following abbreviations apply. Streamflow: streamflow protected under state law. Stream length: stream length affected. Type (channel access): D, diversion; C, culvert. Type (channel complexity): R, restore main channel function; S, side channel reconnection. Extent of barrier: P, partial (upstream access seasonably inaccessible prior to action); F, full (absolutely no passage prior to action). Access: miles made accessible to next upstream full or partial barrier. Stream miles affected by screen: miles between action location and next diversion. Complexity miles: length of instream habitat treated after action completed.

Attachment 3 - Table 5.4. Status of Ongoing 2007 FCRPS Biological Assessment Table 5a and 5b Replacement and Additional Tributary Habitat Actions Performed with Reclamation Technical Assistance

BiOp ID	Subbasin	Limiting Factor	Project Title	Short Description	Latitude	Longitude	Action Start Date	Action End Date	Streamflow		Type	Access		Entrainment				Comp-lexity (Miles)
									Stream Flow (cfs)	Stream Length (miles)		Extent of Barrier	Access (Miles)	Number of Screens Replaced	Screened Discharge (cfs)	Screened Discharge (A-F/yr)	Stream Miles Affected	
Upper Columbia River Steelhead and Spring Chinook Salmon																		
4392	Entiat	Channel Complexity	Bridge to Bridge Phase III	The goal of this project is to meet the needs identified in the subbasin plan and by local biologists for the lower Entiat River: deep, slow-water habitat (pools), localized pockets of depth, velocity, and substrate diversity leading to increased habitat diversity.			4/16/2009				R							0.35
4321	Entiat	Streamflow	Roaring Creek Diversion	Barriers	47 40 53	120 25 17	8/27/2008				C							
4396	Methow	Channel Access	Heath Middle Pond Fish Passage	Replace two impassable culverts with bridges to restore fish access in and out of the middle pond on the Heath property in the Big Valley Reach.	48 30 23	120 15 32	1/23/2009				C	F	0.5					
4401	Methow	Entrainment	Barclay Fish Return Gates	The Barclay fish return is controlled by two headgates that are inoperable. This project would replace the gates, allowing improved diversion intake canal operations. The ability to manage flows throughout the year through the intake canal, upstream of the fish screens, will save hundreds of juvenile spring Chinook, steelhead, and lamprey from stranding. This project is an urgent priority because of the high level of mortality of listed fish in the Barclay intake when the ditch is turned off in the fall. This project is the first phase of future Barclay diversion projects that will benefit habitat and protect fish.			11/2/2009							1			0.5	

Attachment 3 - Table 5.4. Status of Ongoing 2007 FCRPS Biological Assessment Table 5a and 5b Replacement and Additional Tributary Habitat Actions Performed with Reclamation Technical Assistance

BiOp ID	Subbasin	Limiting Factor	Project Title	Short Description	Latitude	Longitude	Action Start Date	Action End Date	Streamflow		Type	Access		Entrainment				Comp-lexity (Miles)
									Stream Flow (cfs)	Stream Length (miles)		Extent of Barrier	Access (Miles)	Number of Screens Replaced	Screened Discharge (cfs)	Screened Discharge (A-F/yr)	Stream Miles Affected	
4420	Methow	Streamflow	Little Chewuch Streamflow Improvement	The objective of the Little Chewuch Streamflow Improvement Project is to increase flows by 0.5 cfs to enhance critical habitat for T&E Species in the Chewuch River. Scheduled for completion in 2010.	42 25 22	120 07 55	10/15/2009											
4402	Methow	Streamflow	Little Barkley Pipe	Provide design, design support, and construction observation for the conversion of the Little Barkley open canal to an enclosed pipe. Will result in a 0.5 cfs permanent reduction in diversion from the Barkley point of diversion on the Methow River. Scheduled for completion in 2010	48 25 50	120 09 02	11/11/2009											
4394	Wenatchee	Channel Access	Mission Creek Reconfiguration Projects (2)	These projects will address various in-stream habitat elements in Mission Creek.			4/16/2009				D	P	10		1			0.1
4390	Wenatchee	Channel Access	Upper Chumstick Barriers	This project will remove the remaining five-six barriers on Chumstick Creek, allowing passage primarily for ESA-listed steelhead.	47 42 46	120 38 36	12/15/2009				C	F	2					0
4287	Wenatchee	Channel Complexity	Nason Creek MCA Project (Oxbow Reconnection)	This project will reconnect partial flows and full fish access to 4600 linear feet of oxbow habitat to the mainstem Nason Creek.	47 46 20	120 43 17	7/21/2006				S							0.9
4336	Wenatchee	Channel Complexity	Nason 1- Ray Rock Springs	Complexity Projects in Nason Creek.	47 47 13	120 51 03	2/11/2008											
4338	Wenatchee	Entrainment	Icicle ID Screen Replacement and Barrier Removal	This project will replace the currently undersized rotary screen (Schille , WDFW Screen Shop, 2006) with one that meets current criteria.			8/18/2006											
4361	Wenatchee	Streamflow	Peshastin Pipeline	The purpose of this project is to replace two miles of leaking irrigation ditch with 36-inch and 10-inch pipe resulting in 1.2 cfs of water to be returned at the point of diversion. This water will greatly increase the water in the fish bypass at Peshatin Diversion. The water saved will be documented and put in trust for fish passage.	47 31 45	120 37 13	4/2/2007											

Attachment 3 - Table 5.4. Status of Ongoing 2007 FCRPS Biological Assessment Table 5a and 5b Replacement and Additional Tributary Habitat Actions Performed with Reclamation Technical Assistance

BiOp ID	Subbasin	Limiting Factor	Project Title	Short Description	Latitude	Longitude	Action Start Date	Action End Date	Streamflow		Type	Access		Entrainment				Comp-lexity (Miles)
									Stream Flow (cfs)	Stream Length (miles)		Extent of Barrier	Access (Miles)	Number of Screens Replaced	Screened Discharge (cfs)	Screened Discharge (A-F/yr)	Stream Miles Affected	
Snake River Steelhead and Spring/Summer Chinook Salmon																		
4404	Lemhi	Channel Access	L-45 Diversion Replacement	The L-45 Diversion is a typical push-up diversion weir that spans the Lemhi River and requires annual maintenance with heavy equipment in the river. Local IDFG and NMFS biologists have expressed concern that the weir is a fish barrier for migrating anadromous and resident fish. This project would replace the existing rock diversion with another diversion designed to deliver irrigation water and provide improved fish passage in this reach of the river.	44 49 55	113 36 62	2/14/2008				D	P	2					
4403	Lemhi	Channel Access	L-47 Diversion	The Lemhi River, L-47 Diversion consists of a rock irrigation weir that once spanned the Lemhi River. Over time, high river flows have washed portions of the weir away. To divert a sufficient quantity of river water into the irrigation ditch, annual maintenance is required to temporarily repair and lengthen the existing weir.	44 78 11	113 54 88	8/4/2008				D	P	1					
4387	Lemhi	Channel Access	Wimpey Creek-2 Diversion Replacement	The Wimpey Creek No. 2, LWC-02 Diversion check structure has been determined to be a complete barrier to fish passage. IDFG recently installed a fish screen on the ditch and requested design assistance for a replacement irrigation diversion structure.	45 05 56	113 42 55	2/11/2009				D	F	0.5					
4324	Pahsimeroi	Channel Access	Big springs Creek 7-8 Diversion Enhancement	This project proposes to remove the existing wooden check structure and replace it with a structure that would allow fish passage at all times	44 56 28	113 88 87	8/1/2007				D							

Attachment 3 - Table 5.4. Status of Ongoing 2007 FCRPS Biological Assessment Table 5a and 5b Replacement and Additional Tributary Habitat Actions Performed with Reclamation Technical Assistance

BiOp ID	Subbasin	Limiting Factor	Project Title	Short Description	Latitude	Longitude	Action Start Date	Action End Date	Streamflow		Type	Access		Entrainment				Comp-lexity (Miles)
									Stream Flow (cfs)	Stream Length (miles)		Extent of Barrier	Access (Miles)	Number of Screens Replaced	Screened Discharge (cfs)	Screened Discharge (A-F/yr)	Stream Miles Affected	
4400	Pahsimeroi	Channel Access	Big Springs Creek 3 Diversion Enhancement	Salmon and steelhead utilize Big Springs Creek for spawning and rearing habitat, as do bull trout. Big Springs 3 Diversion is a wooden structure that utilizes horizontal boards to check up the water in the creek for diversion into the ditch, which restricts fish passage. This project proposes to remove the existing wooden check structure and replace it with a structure that would allow fish passage at all times, while still allowing the irrigators to continue diverting water.	44 36 69	113 56 24	7/2/2008				D	P	2.5					
4389	Pahsimeroi	Channel Access	Hooper Lane Culverts	Hooper Lane cuts across the Pahsimeroi Valley approximately XX miles upstream from the mouth. There are three culvert crossings on the road that are currently undersized and can restrict fish passage at certain flows. These culverts carry Big Springs Creek, Little Pahsimeroi River, and Pahsimeroi River flows. There is an additional culvert crossing nearby, where Sulfur Creek crosses the Pahsimeroi Back Road, that is also undersized. Replacing these culverts will improve passage to the upstream ends of these drainages. The project will be coordinated through the Custer Soil and Water Conservation District (CSWCD) and the Custer County Road Department. BPA funding will be pursued to construct the new crossings. Construction is planned for July/August of 2011. Completion of the Big Springs culvert will improve access to approximately 0.8 miles of Big Springs Creek, up to the Big Springs XX Diversion. Replacing the Little Pahsimeroi	44 32 55	113 54 57	12/23/2009				D	P	6.6					

Attachment 3 - Table 5.4. Status of Ongoing 2007 FCRPS Biological Assessment Table 5a and 5b Replacement and Additional Tributary Habitat Actions Performed with Reclamation Technical Assistance

BiOp ID	Subbasin	Limiting Factor	Project Title	Short Description	Latitude	Longitude	Action Start Date	Action End Date	Streamflow		Type	Access		Entrainment				Comp-lexity (Miles)
									Stream Flow (cfs)	Stream Length (miles)		Extent of Barrier	Access (Miles)	Number of Screens Replaced	Screened Discharge (cfs)	Screened Discharge (A-F/yr)	Stream Miles Affected	
				culvert will improve access to the upper 2.5 miles of the creek. Replacing the Pahsimeroi River culvert will improve access to 1.7 miles of the river, up to the P-13 Diversion. And replacing the Sulfur Creek culvert will improve access to 2.3 miles of Sulfur Creek. Steelhead, Chinook salmon, and Bull Trout all utilize these streams to spawn and/or for rearing habitat.														
4238	Upper Salmon	Channel Access	East Fork 15 Fish Diversion	Reclamation will design a NOAA Fisheries criteria fish screen for the head of the EF-15 ditch. This design will be constructed by the Idaho Fish & Game screen shop.	44 07 50	114 25 05	3/9/2004											
4240	Upper Salmon	Streamflow	East Fork Salmon River-EF 13 Headgate	A new headgate structure will be installed to allow the irrigator to control the diversion.	44 08 45	114 23 26	3/9/2004				C							
4246	Upper Salmon	Streamflow	East Fork Salmon River-EF 14 Headgate	EF 14 is an irrigation diversion with a gravel push-up dam, located approximately 18 miles from the mouth of the East Fork of the Salmon River. This project would construct a more permanent rock diversion structure. A new headgate may be part of the project, depending on the final design.	44 08 33	114 24 07	2/16/2006				C							
4248	Upper Salmon	Streamflow	East Fork Salmon River-EF 16 Headgate	EF 16 is an irrigation diversion with a gravel push-up dam, located approximately 20 miles from the mouth of the East Fork of the Salmon River. The diversion is unstable and must be re-built several times each year. This project would consolidate three diversions and build a new headgate structure that will allow the irrigator to control the flows into the irrigation ditch.	44 07 31	114 25 39	2/16/2006				C							

Attachment 3 - Table 5.4. Status of Ongoing 2007 FCRPS Biological Assessment Table 5a and 5b Replacement and Additional Tributary Habitat Actions Performed with Reclamation Technical Assistance

BiOp ID	Subbasin	Limiting Factor	Project Title	Short Description	Latitude	Longitude	Action Start Date	Action End Date	Streamflow		Type	Access		Entrainment				Comp-lexity (Miles)
									Stream Flow (cfs)	Stream Length (miles)		Extent of Barrier	Access (Miles)	Number of Screens Replaced	Screened Discharge (cfs)	Screened Discharge (A-F/yr)	Stream Miles Affected	
Mid-Columbia River Steelhead																		
4411	John Day Middle Fork	Channel Access	Austin Ranch Diversion	The Austin Ranch Diversion is about 17 miles northeast of Prairie City, Oregon, and diverts from the Middle Fork John Day. This high quality water is home to spawning and rearing steelhead and Chinook. The diversion is located on the Malheur National Forest, and a letter has been received from the District Ranger specifying that the diversion is a private diversion and the Forest Service has no operation or maintenance responsibilities for the diversion.	44 36 14	118 28 50	10/9/2009				D	F	15					
4412	John Day Middle Fork	Channel Access	Lower Clear Creek Diversion	The Lower Clear Creek Diversion is about 15 miles northeast of Prairie City, Oregon. Clear Creek is a major tributary to the upper part of the Middle Fork John Day. This high quality water is home to spawning and rearing steelhead and Chinook as well as bull trout. Preliminary review of the water rights indicates this diversion has a water right for diversion of 1.59 cfs. This diversion is a partial barrier at lower flows and depends on year-to-year construction of the dam.	44 35 04	118 30 01	10/9/2009				D	P	7					
4348	John Day Upper Main	Channel Access	Cummings Creek Pump	Cummings Creek is a small tributary entering the upper John Day River near river mile 224.This project facilitates the transfer of a point of diversion from Cummings Creek to the John Day River.	44 66 47	119 22 19	6/28/2008				D	P	3.5					
4398	John Day Upper Main	Channel Access	Panama Pipeline Appraisal Study	The Panama Ditch is about 5.7 miles long and diverts from the John Day River mid-way between the towns of John Day and Mt. Vernon, Oregon. Ditch users are interested in piping the ditch, which could	44 25 00	119 03 18	12/18/2008				D	P	0					

BiOp ID	Subbasin	Limiting Factor	Project Title	Short Description	Latitude	Longitude	Action Start Date	Action End Date	Streamflow		Type	Access		Entrainment				Comp-lexity (Miles)
									Stream Flow (cfs)	Stream Length (miles)		Extent of Barrier	Access (Miles)	Number of Screens Replaced	Screened Discharge (cfs)	Screened Discharge (A-F/yr)	Stream Miles Affected	
				improve efficiency and have large fisheries benefits in Beech Creek. This study is considered Phase I and will provide analysis of alternatives and information available for the Ditch Company to seek construction funding sources. If funding is identified and there is strong support for the selected alternative, Phase II would be to further refine and finalize designs and construct the project.														
4405	John Day Upper Main	Channel Access	Lower Deardorf Diversion	The Lower Deardorf Creek Diversion is about 10 miles southeast of Prairie City, Oregon. Deardorf Creek is a large tributary to the upper John Day River near the headwaters. This high-quality water is home to spawning and rearing steelhead, bull trout, and rearing Chinook salmon. In recent years, Chinook spawning has also been documented. The instream part of the structure is composed of large cobble, gravel, and tarps. This diversion is a full-barrier at lower flows and depends on year-to-year construction of the dam.	44 23 47	118 33 44	8/21/2009				D	F	0.1					
4406	John Day Upper Main	Channel Access	Upper Deardorf Diversion	The Upper Deardorf Creek Diversion is about 10 miles southeast of Prairie City, Oregon. Deardorf Creek is a large tributary to the upper John Day River near the headwaters. This high-quality water is home to spawning and rearing steelhead, bull trout, and rearing Chinook salmon. In recent years, Chinook spawning has also been documented. The instream part of the structure is composed of large cobble, gravel, and tarps. This	44 23 48	118 33 43	8/21/2009				D	F	6.5					

Attachment 3 - Table 5.4. Status of Ongoing 2007 FCRPS Biological Assessment Table 5a and 5b Replacement and Additional Tributary Habitat Actions Performed with Reclamation Technical Assistance

BiOp ID	Subbasin	Limiting Factor	Project Title	Short Description	Latitude	Longitude	Action Start Date	Action End Date	Streamflow		Type	Access		Entrainment				Comp-lexity (Miles)
									Stream Flow (cfs)	Stream Length (miles)		Extent of Barrier	Access (Miles)	Number of Screens Replaced	Screened Discharge (cfs)	Screened Discharge (A-F/yr)	Stream Miles Affected	
				diversion is a full barrier at lower flows and depends on year-to-year construction of the dam.														
4407	John Day Upper Main	Channel Access	East Fork Canyon Creek Diversion	The East Fork Canyon Creek Diversion is about 15 miles south of John Day, Oregon. East Fork Canyon Creek is a small tributary to Canyon Creek which is a major tributary to the upper John Day River. This diversion is one of two diversions on the East Fork. The instream part of the structure is composed of large cobble and tarps. Preliminary review of the water rights indicates this diversion has a water right for diversion of .74 cfs. This diversion is a full barrier at lower flows and depends on year-to-year construction of the dam.	44 14 47	118 54 39	8/21/2009				D	P	1.3					
4408	John Day Upper Main	Channel Access	Dovenberg Pump Station	The Dovenberg Pump Station is 10 miles west of Mt. Vernon, Oregon, on the upper John Day River. The existing pump station requires a gravel push-up dam across the river to maintain a pool deep enough for the pump intake fish screens to function correctly. Preliminary review of the water rights indicates this diversion has a water right for diversion of 6.4 cfs. The push-up dam is a partial barrier depending on year-to-year timing and construction of the dam. The Grant SWCD anticipates stabilizing the pool for the pump intakes by installing a permanent weir or modified lay-flat stanchion dam.	44 26 15	119 20 01	8/31/2009				D	P	1					

Attachment 3 - Table 5.4. Status of Ongoing 2007 FCRPS Biological Assessment Table 5a and 5b Replacement and Additional Tributary Habitat Actions Performed with Reclamation Technical Assistance

BiOp ID	Subbasin	Limiting Factor	Project Title	Short Description	Latitude	Longitude	Action Start Date	Action End Date	Streamflow		Type	Access		Entrainment				Comp-lexity (Miles)
									Stream Flow (cfs)	Stream Length (miles)		Extent of Barrier	Access (Miles)	Number of Screens Replaced	Screened Discharge (cfs)	Screened Discharge (A-F/yr)	Stream Miles Affected	
4409	John Day Upper Main	Channel Access	Beech Creek Moore Diversion	The Beech Creek Diversion is at the southwest edge of the city of Mt. Vernon, Oregon, and is the lowermost diversion on Beech Creek. The instream part of the structure is composed of large rock and tarps. The Grant SWCD anticipates moving the point of diversion downstream to the John Day River and installing a pump station for this landowner. Along with the pump station, a measurement structure would be constructed in Beech Creek to measure the flow available to the water right.	44 24 49	119 06 52	8/31/2009				D	P	2					
4413	John Day Upper Main	Channel Access	Dad's Creek #1 Siphon	The Dads Creek #1 Siphon project is located about two miles east of Prairie City, Oregon. This small tributary is known to have a remnant population of spawning and rearing steelhead. About a quarter mile from the mouth, the stream is intercepted by two irrigation ditches with no passage or screening provided. The ditch crossings are made by blocking Dads Creek with push-up dams or tarps.	44 27 22	118 40 11	10/7/2009				D	F	0.5				6.5	
4414	John Day Upper Main	Channel Access	Dad's Creek #2 Winegar Diversion	The Dads Creek #2 Diversion project is located about 2.5 miles east of Prairie City, Oregon. This small tributary is known to have a remnant population of spawning and rearing steelhead. This diversion is one of four planned for replacement as part of a full watershed restoration approach.	44 27 44	118 39 57	10/7/2009				D	F	0.1					
4415	John Day Upper Main	Channel Access	Dad's Creek #3 CTWSRO Diversion	The Dads Creek #3 Diversion project is located about 2.5 miles east of Prairie City, Oregon. This small tributary is known to have a remnant population of spawning and rearing steelhead. This	44 27 50	118 39 55	10/7/2009				D	F	1					

BiOp ID	Subbasin	Limiting Factor	Project Title	Short Description	Latitude	Longitude	Action Start Date	Action End Date	Streamflow		Type	Access		Entrainment				Comp-lexity (Miles)
									Stream Flow (cfs)	Stream Length (miles)		Extent of Barrier	Access (Miles)	Number of Screens Replaced	Screened Discharge (cfs)	Screened Discharge (A-F/yr)	Stream Miles Affected	
				diversion is the second of four planned for replacement as part of a full watershed restoration approach.														
4416	John Day Upper Main	Channel Complexity	UJD Forrest Property RM 264.7 Enhancement	The Confederated Tribes of Warm Spring Reservation of Oregon owns the Forrest Conservation Area on the upper John Day River. Past management activities have simplified the river system by blocking off side channels, straightening sections, and hardening bends with rip rap. This project would add complexity back into the system with addition of a few large wood structures, opening access to historic flood plains and side channels, and removing riprap on a .3 mile reach of the river.	44 27 09	118 40 32	5/18/2009				R							0.3
4388	John Day Upper Main	Channel Complexity	Blanchette Habitat Project	The Blanchette property is seven miles west of Mt. Vernon, Oregon, and is bisected by the Upper John Day River. ODFW biologists have indicated that salmonids move to this section of river for overwintering, but there is currently a lack of pool and cover habitat in any season. Also, two sections of river bank on the property are actively eroding causing losses in bank vegetation and fine sediment issues downstream. The Grant SWCD will assist the landowner in using constructed log jam or rootwad structure placements to add pool and cover needed to improve fish habitat conditions and reduce sediment loads associated with bank erosion on the mainstem John Day River. Vegetative plantings and	44 25 39	119 15 10	12/15/2009				R							0.28

Attachment 3 - Table 5.4. Status of Ongoing 2007 FCRPS Biological Assessment Table 5a and 5b Replacement and Additional Tributary Habitat Actions Performed with Reclamation Technical Assistance

BiOp ID	Subbasin	Limiting Factor	Project Title	Short Description	Latitude	Longitude	Action Start Date	Action End Date	Streamflow		Type	Access		Entrainment				Comp-lexity (Miles)
									Stream Flow (cfs)	Stream Length (miles)		Extent of Barrier	Access (Miles)	Number of Screens Replaced	Screened Discharge (cfs)	Screened Discharge (A-F/yr)	Stream Miles Affected	
				fencing will be used along with the woody materials to rehabilitate the banks and improve fish habitat.														

Attachment 3 - Table 6. Actions Identified for 2007-2009 Implementation in FCRPS BA, Attachment B.2.2-2, Table 6: Lower Columbia ESUs/DPSs

ESU/Population	Project #	Project Title & Short Description	2007-09 Action Description	FY07-09 Progress
Lower Columbia River coho/Lower Gorge tributaries Lower Columbia River steelhead (summer & winter)/Hood Lower Columbia River Spring Chinook/Hood	199802100	Hood River Fish Habitat Implement habitat improvement actions in the Hood River subbasin that will support wild fish and supplementation efforts of the Hood River Production Program (HRPP).	Increase Instream Habitat Complexity	Installed pipeline to conserve instream water and improve 7 stream miles, placed large woody debris and improved 1.9 stream miles of complexity; removed existing water intake structure & installed diversion channel to improve access to 3 miles fish habitat; decommissioned 0.27 miles of riparian road; installed flat plate fish screen; replaced culvert in Evans Creek.
			Install Fence	
			Plant Vegetation	
			Install Fish Passage Structure	
			Install Fish Screen	
			Remove/Modify Dam	
			Install Pipeline	
			Plant Vegetation	
			Realign, Connect, and/or Create Channel	
			Remove/Modify Dam	
Lower Columbia River steelhead (summer & winter)/Wind	200707700	Hemlock Dam Removal This project will remove a 26-ft high dam on Trout Creek, a tributary to the Wind River. Trout Creek provides spawning and rearing habitat for LCR steelhead. The project will restore unimpeded fish passage and improve water quality and habitat.	Plant Vegetation	Hemlock Dam removed and restored access to 15 miles fish habitat, recontoured 0.5 miles of Trout Creek through reservoir reach; began site rehabilitation.
			Realign, Connect, and/or Create Channel	
			Remove/Modify Dam	

Attachment 4: Tributary Habitat Reports by the Bureau of Reclamation

Report Name	Internet address	Date
Washington		
Entiat		
Entiat Tributary Assessment	http://www.usbr.gov/pn/programs/fcrps/thp/ucao/entiat/tribassmt/index.html	Jan-09
Preston Reach Assessment	http://www.usbr.gov/pn/programs/fcrps/thp/ucao/entiat/prestonreach/index.html	Jul-09
Stormy Reach Assessment	http://www.usbr.gov/pn/programs/fcrps/thp/ucao/entiat/stormyreach/stormy-assmt.pdf	Nov-09
Methow		
Completion Report: Wolf Creek Diversion Dam	http://www.usbr.gov/pn/programs/fcrps/thp/ucao/methow/completion/wolfcreekdiversion.pdf	Mar-09
Methow Subbasin Geomorphic Assessment	http://www.usbr.gov/pn/programs/fcrps/thp/ucao/methow/geomorphicassessment/index.html	May-08
Memorandum: Fulton Diversion Dam Investigations	http://www.usbr.gov/pn/programs/fcrps/thp/ucao/methow/fulton/geo-investigation-091807.pdf	Jul-06
Wenatchee		
Kahler Reach Assessment	http://www.usbr.gov/pn/programs/fcrps/thp/ucao/wenatchee/kahler/index.html	Mar-09
Upper White Pine Reach Assessment	http://www.usbr.gov/pn/programs/fcrps/thp/ucao/wenatchee/upperwhitepine/index.html	Mar-09
Lower White Pine Reach Assessment	http://www.usbr.gov/pn/programs/fcrps/thp/ucao/wenatchee/lowerwhitepine/index.html	Feb-09
Nason Creek Tributary Assessment . Technical Appendices	http://www.usbr.gov/pn/programs/fcrps/thp/ucao/wenatchee/nasoncreek/tributary-assmt.pdf http://www.usbr.gov/pn/programs/fcrps/thp/ucao/wenatchee/nasoncreek/app.pdf	Jul-08
Oregon		
General Documents		
Middle Fork and Upper Fork John Day River Tributary Assessments	http://www.usbr.gov/pn/programs/fcrps/thp/lcao/tributary-assmt/index.html	May-08
Middle Fork John Day		

Report Name	Internet address	Date
Rock Removal and Large Woody Debris Installation –Beaver to Ragged Specifications and Drawings	http://www.usbr.gov/pn/programs/fcrps/thp/lcao/middlefork/drawings/index.html	Jun-08
Geomorphology and Hydraulic Model Analysis of the Oxbow Conservation Area	http://www.usbr.gov/pn/programs/fcrps/thp/lcao/oxbow/index.html	Jun-09
Idaho		
Lemhi		
Completion Report: Lemhi River L-3 Wasteway Diversion Fish Barrier	http://www.usbr.gov/pn/programs/fcrps/thp/srao/lemhi/completion/L-3.pdf	Feb-08
Completion Report: Lemhi River L-9 Diversion Replacement	http://www.usbr.gov/pn/programs/fcrps/thp/srao/lemhi/completion/L9.pdf	Dec-07
Completion Report: Lemhi River L-13 Irrigation Fish Screen Replacement	http://www.usbr.gov/pn/programs/fcrps/thp/srao/lemhi/completion/L-13.pdf	Oct-07
Completion Report: Lemhi River L-44 Irrigation Diversion Replacement	http://www.usbr.gov/pn/programs/fcrps/thp/srao/lemhi/completion/L44.pdf	Oct-07
Completion Report: Lemhi River L-35A Fish Screen and Headgate Replacement	http://www.usbr.gov/pn/programs/fcrps/thp/srao/lemhi/completion/L35A.pdf	Oct-07
Flow Characterization Study: Instream Flow Assessment, Hawley Creek and Eighteenmile Creek, Idaho	http://www.usbr.gov/pn/programs/fcrps/thp/srao/lemhi/phabsim/2006/hawley-flowassessment.pdf	Jun-07
Completion Report: L-3 and L-3A Irrigation Diversion Replacement	http://www.usbr.gov/pn/programs/fcrps/thp/srao/lemhi/completion/L3-L3A.pdf	May-07
Memorandum: L3AO River Control Structure Survey, April 13, 2007, Columbia/Upper Salmon Recovery Project, Lemhi River Subbasin, Idaho	http://www.usbr.gov/pn/programs/fcrps/thp/srao/lemhi/L3A0/L3AO-inspection.pdf	Apr-07
Little Salmon		
Completion Report: Squaw Creek Culvert Fish Passage Improvement	http://www.usbr.gov/pn/programs/fcrps/thp/srao/littlesalmon/completion/sqawcrk-	Feb-08

Report Name	Internet address	Date
Project	culvert.pdf	
Upper Salmon		
Completion Report: East Fork Salmon River EF/10 and EF/11 Irrigation Diversion Consolidation Project	http://www.usbr.gov/pn/programs/fcrps/thp/srao/uppersalmon/completion/ef1011/ef10-11.pdf	Jul-07
Completion Report: Garden Creek and Gini Canal Crossing Project	http://www.usbr.gov/pn/programs/fcrps/thp/srao/uppersalmon/completion/ginicanal/gini-garden.pdf	Jul-07
Memorandum: S11-12 Canal Consolidation, Diversion Berm Underwater Inspection, 04/13/2007, Upper Salmon River Water Optimization Project, Idaho	http://www.usbr.gov/pn/programs/fcrps/thp/srao/uppersalmon/completion/s1314/inspection/S11-12-inspection.pdf	Jun-07

Attachment 5: Action Agency 2009 Estuary Habitat Projects

Project	Description	Stream-Type* or Ocean-Type**	River Reach	Status
Perkins Creek (BPA)	This project 1) restored and enhanced passage at the mouth of Perkins Creek; 2) improved passage .27 mile upstream of the outlet by properly siting, sizing and replacing an under-sized culvert; and 3) enhanced off-channel rearing areas for juvenile salmonids at the project site.	Stream-Type and Ocean-Type	Reach A	Completed
Columbia Slough (BPA)	This project improved in-stream, riparian and floodplain wetland habitat with an emphasis on rearing and refuge habitat for juvenile salmonids by installing large woody debris, planting native vegetation and erosion control.	Ocean-Type	Reach F	Completed
Gray's River Restoration (BPA)	Five instream structures, engineered log jams, were placed to help restore hydraulic complexity, restore balance of sediment transport and storage, improve width-to-depth ratio and pool/riffle sequences, increase localized hydraulic connectivity between main and side channels, and increase opportunities for large woody debris recruitment to improve channel roughness and cover for migrating adult and juvenile salmonids.	Stream-Type and Ocean-Type	Reach B	Completed
Sandy River (BPA)	The Sandy River Project is part of a larger 1,500-acre long-term restoration project. The focus of this phase of the overall project is to plant native vegetation on 5 acres of riparian areas and on 1.2 riparian stream miles; plant 35 acres of riparian shrubs; and maintain native vegetation on 45 acres. Sandy River Delta historically was a wooded, riparian wetland with components of ponds, sloughs, bottomland woodland, oak woodland, prairie, and low- and high-elevation floodplain. Restoration of historical landscape components is a primary goal for this land, with current focus on restoration of riparian forest and wetlands.	Stream-Type and Ocean-Type	Reach G	2009 phase completed (multi-phase project).

Project	Description	Stream-Type* or Ocean-Type**	River Reach	Status
Elochoman Acquisition (BPA)	Permanently protect 200 acres of important intertidal wetland habitat located in the floodplain of the Columbia and Elochoman Rivers. The property is off of Highway 4 on the mouth of Elochoman River and the Elochoman Slough, ¾ mile north of Cathlamet in Wahkiakum County, Washington. It is adjacent to the 5,600-acre Julia Butler Hansen Refuge for Columbia White-tail Deer on the Columbia River.	Stream-Type and Ocean-Type	Reach B	Acquisition completed. Under the Corps 536 program a Feasibility Study will be undertaken.
Sandy River Riparian Plantings (Corps)	Final riparian planting of 205 acres on the Sandy River Delta, Sundial Island.	Stream-Type and Ocean-Type	Reach G	Completed
Julia Butler Hanson (COE, USF&WS)	First year of construction, this project replaced 1 old top hinged tide gate with more hydraulically efficient side hinged tide gates (providing improved juvenile fish passage) and installed 2 new side hinged tide gates on blind sloughs restoring a muted tidal signal and juvenile salmon passage for shallow water habitat. Project restores 87 acres of slough/wetland habitat and 210 acres of riparian forest habitat.	Stream-Type and Ocean-Type	Reach D	Phase 1 completed in 2009 (Phase 2 will be completed in 2010)
Pile Structure Program (BPA and Corps)	In 2009, the Action Agencies continued to collaborate with LCREP and others toward planning a pilot pile removal project. Several piles were identified and planning efforts underway for possible removal under the pilot pile removal project. NOAA Fisheries' Northwest Region reviewed and provided comments on the final draft Pile Program Plan.	Stream-Type and Ocean-Type	NA	Ongoing (multi-year process)

Project	Description	Stream-Type* or Ocean-Type**	River Reach	Status
Project Assessment: Deer Island (BPA)	Habitat restoration assessment on Deer Island for future restoration actions for up to 4,500 acres. This project will be implemented in multiple phases. Topographic data collection, juvenile salmonid use and passage through this area, project inventory, and site prep for planting. The overall long-term restoration project on Deer Island seeks to partially restore historical estuarine habitat on the 4,500-acre Deer Island complex. The slough historically was a natural backwater of the Columbia River that provided salmonid rearing and foraging opportunities. Loss of connectivity has reduced access opportunities by salmonids and led to degraded water quality conditions in the form of high temperatures, low dissolved oxygen, and excessive channel aggradation.	NA	Reach E	Assessment in progress (multi-year process)
Project Design: Tryon Creek (BPA)	This project provided final designs for a restoration project on Tryon Creek. The project will enhance critical fish habitat at Tryon Creek confluence, with channel improvements, invasive plant removal and native plantings. The project area is 4.5 acres of publicly-owned land.	Stream-Type and Ocean-Type	Reach F	Design Completed
Project Design: Fort Columbia Design (BPA)	Quality Assurance/Quality Control (QA/QC) and final modeling and design for a culvert replacement project. The QA/QC will reviewed the assumptions, data collection methods, and modeling to determine if any crucial information was missed or any further investigation were warranted. Final design and modeling are necessary to proceed with construction and to finalize a construction timeline. This tidal connection project will be implemented in 2010 and will replace a small culvert in very poor condition with a large box culvert under Hwy 101 which will initially open up 12 acres of wetlands to salt water intrusion. Over time the fresh water wetland will revert back to a salt water wetland which will benefit salmon.	Stream-Type and Ocean-Type	Reach A	Design Completed

Project	Description	Stream-Type* or Ocean-Type**	River Reach	Status
Design: Oaks Bottom (BPA)	Design included development of final project design drawings and design report, design review by civil, structural and geotechnical engineers, and collection of additional data (if needed).	Stream-Type and Ocean-Type	Reach F	Design Completed
Sandy River Dam Removal (COE, USFS)	Began Feasibility Study for Section 536 ecosystem restoration of the east distributary and dam removal.	Stream-Type and Ocean-Type	Reach G	Continue work on Feasibility Study
Abernathy Creek (COE, BPA, WDF&W)	Initiated Feasibility Study for Section 536 ecosystem restoration to add complexity to the lower creek and reconnect with local wet lands.	Stream-Type and Ocean-Type	Reach C	Feasibility Study initiated
WREC (COE)	Completed Design Documents to construct a channel to provide tidal reconnection of approximately 50 acres of wetland to the Columbia River. Implementation in 2010.	Stream-Type and Ocean-Type	Reach G	Design completed

* Stream-type life histories include Snake River sockeye salmon, Lower Columbia River coho salmon, Upper Columbia River steelhead, Snake River steelhead, Lower Columbia River steelhead, Middle Columbia River steelhead, Upper Willamette River steelhead, Upper Columbia River spring Chinook salmon and Snake River spring/summer Chinook salmon.

****** Ocean-type life histories include Columbia River chum, Snake River Fall Chinook, Upper Willamette Chinook, and Lower Columbia fall Chinook.

November 2010

FCRPS BiOp Tributary Habitat Accomplishments From the Action Agencies' 2009 Progress Report

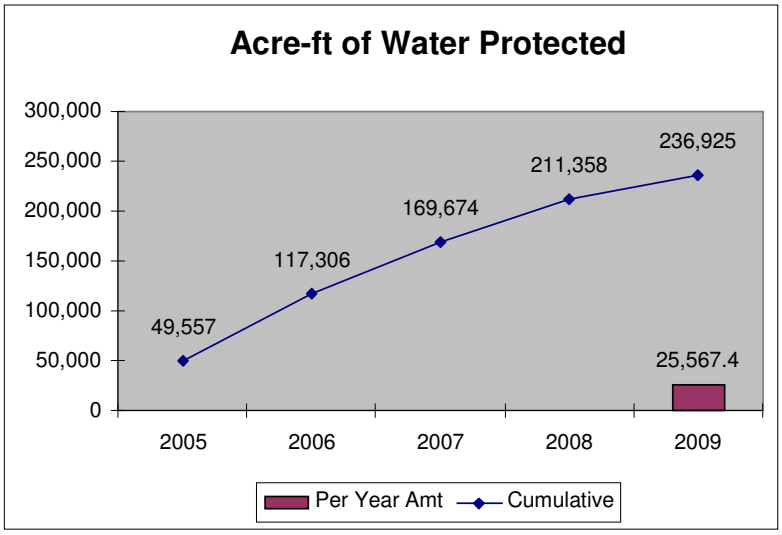

Figure 1

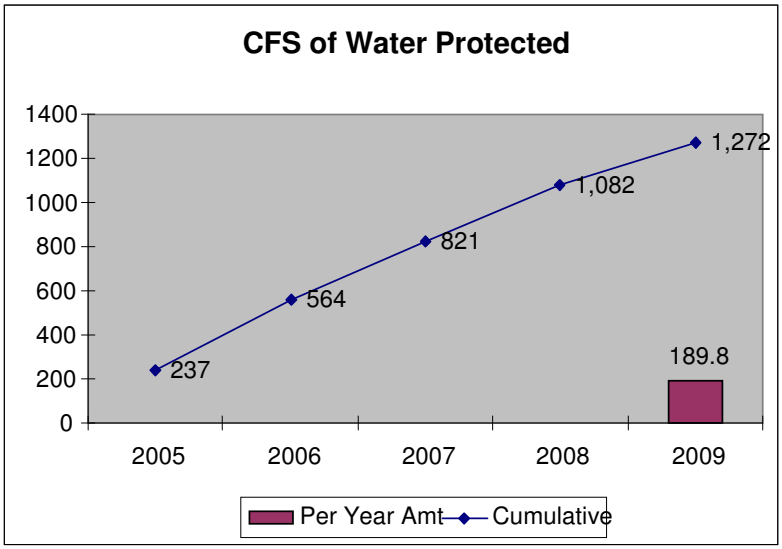

Figure 2

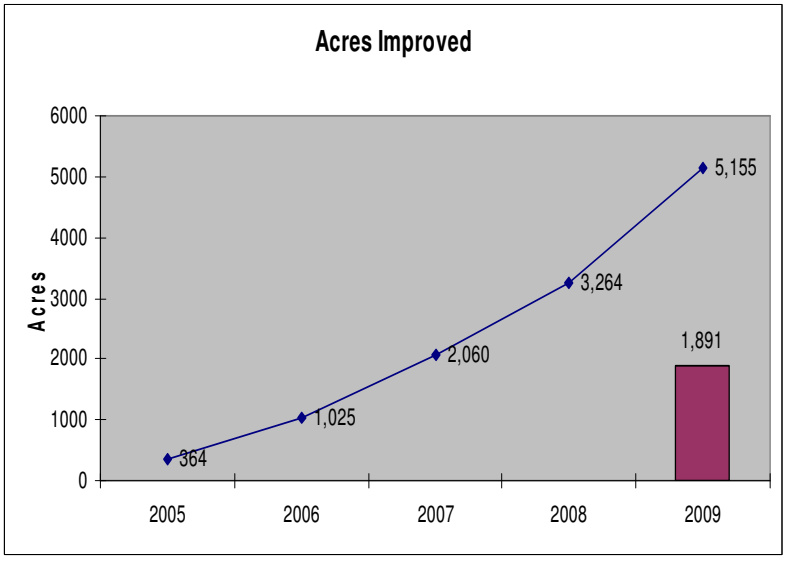

Figure 3

Water Added to Streams

(Fig. 1 and Fig. 2)

Irrigation and other water withdrawals during the peak growing season can cause stretches of many streams and rivers run low – and sometimes dry.

One of the most effective and immediate steps the Action Agencies may take to improve fish habitat is to lease or purchase water rights or install water efficiency improvements to increase the amount of water in streams.

Since 2005, the Action Agencies acquired instream water to conserve or protect close to 240,000 acre-feet and more 1,200 cubic feet per second (cfs) of water in the Columbia River Basin.

Riparian Habitat Improved

(Fig. 3)

Riparian habitat—the streamside environment—makes a major contribution to water quality and long-term salmon survival. Riparian habitat can be protected through land purchases or conservation easements. Plantings or natural revegetation can reestablish a viable riparian zone by providing shade and other benefits for the stream.

Because they can help keep water cool and clean, these projects are an important hedge against the longer term effects of climate change.

More than 5,000 acres of riparian habitat have been improved since 2005.

November 2010

FCRPS BiOp Tributary Habitat Accomplishments From the Action Agencies' 2009 Progress Report

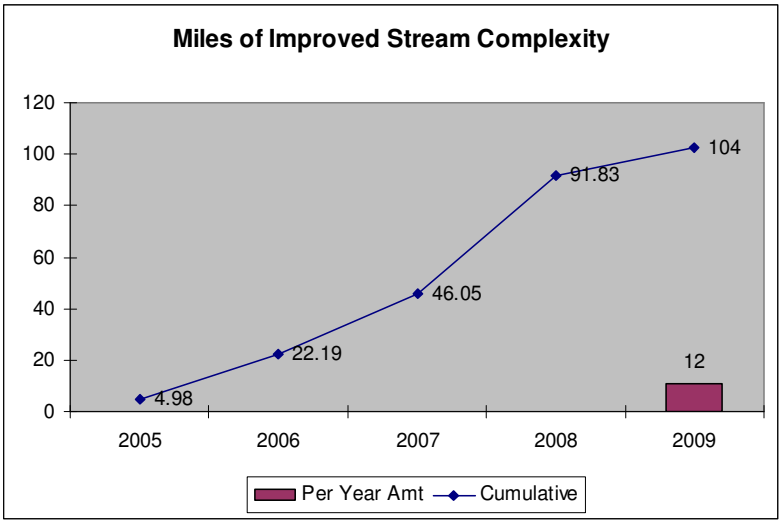

Figure 4

Stream Complexity Improved

(Fig. 4)

Salmon evolved in streams that meandered, created multiple channels, and flooded seasonally. The complex habitats these processes created provided important rearing areas for juvenile salmon and steelhead, as well as cool-water refuges during the heat of summer. Human development has changed the nature of most of the Columbia River basin's river systems, depriving salmon of some of these habitat attributes.

Action Agency habitat projects help improve channel complexity by reconnecting side channels and, where feasible, increasing floodplain function.

Since 2005, the Action Agencies have improved more than 100 miles of spawning and rearing stream habitat, with more than 10 miles completed in 2009.

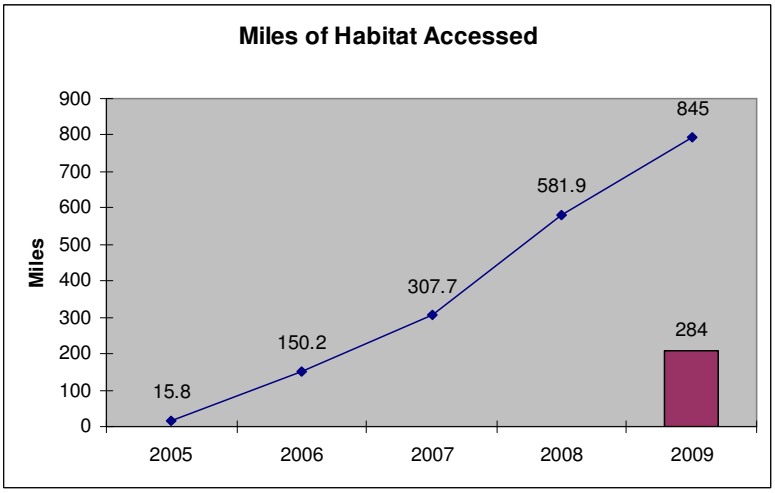

Figure 5

Habitat Opened to Fish

(Fig. 5)

In many Columbia River tributaries, human development has restricted access to significant portions of the historical range of Columbia River basin salmon and steelhead. Many of these blockages can be fixed with negligible economic impact, providing a big biological boost to fish.

In 2009, the Action Agencies funded projects that opened more than 210 miles of salmon and steelhead spawning and rearing habitat.

The federal agencies that manage the system of dams in the basin include the U.S. Army Corps of Engineers, Bureau of Reclamation, and Bonneville Power Administration, collectively known as the Action Agencies. Together, they are implementing actions to improve the survival of salmon and steelhead listed under the Endangered Species Act, as called for in NOAA Fisheries' Biological Opinion for operation of the federal hydrosystem.

More information in the action agencies' 2009 Progress Report at
http://www.salmonrecovery.gov/BiologicalOpinions/FCRPS/BiopImplementation/2009FCRPSBiOpProgressReport.aspx