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.

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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 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.

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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.

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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

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		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.

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	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.

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		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.)

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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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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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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.

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 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.

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		
	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.

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		
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.

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 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.

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 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.

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 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.

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		
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

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		
	▪ *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.

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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.

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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.*	

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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

<table>
<tr><th>RPA No.</th><th>Action Description</th><th>2009 Actions / Accomplishments</th></tr>
<tr><td colspan="3">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</td></tr>
<tr><td>45</td><td>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.
<table>
<tr><th>Site</th><th>Acres</th><th>Proposed Year of Creation</th><th>Proposed Year in which Target Acreage Is Achieved</th></tr>
<tr><td>Fern Ridge Lake</td><td>1</td><td>2007/2008</td><td>2007/2008</td></tr>
<tr><td>Summer Lake</td><td>1.5</td><td>2008</td><td>2008</td></tr>
<tr><td>Crump Lake</td><td>1</td><td>2009</td><td>2009</td></tr>
<tr><td>Brooks Island (San Francisco Bay)</td><td>2</td><td>2008/2009</td><td>2008/2009</td></tr>
<tr><td>Hayward Regional Shoreline (San Francisco Bay)</td><td>0.5</td><td>2008/2009</td><td>2008/2009</td></tr>
<tr><td>Don Edwards NWR (San Francisco Bay)</td><td>0.5-1</td><td>2009</td><td>2009</td></tr>
</table></td><td>▪ 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.</td></tr>
</table>

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.

Research, Monitoring, and Evaluation Actions

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.

Research, Monitoring, and Evaluation Actions

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.

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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.