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Final Review of 2010 Proposals for the Research, Monitoring, and Evaluation and Artificial Production Category

Part 1: Programmatic Comments

ISRP 2010-44A
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I. Executive Summary

This two-part report provides the final comments and recommendations of the Independent Scientific Review Panel and Peer Review Groups for 99 proposals submitted for the 2010 Research, Monitoring and Evaluation (RM&E) and Artificial Production Categorical Review for the Columbia River Basin Fish and Wildlife Program. Part 1 provides programmatic comments and recommendations that apply broadly to general issues that were identified in multiple proposals during the ISRP reviews. Part 2 includes specific ISRP recommendation and comments on each proposal.

The ISRP found that of the 99 proposals submitted 38 proposals (38%) met scientific review criteria and 50 proposals (50%) met criteria with some qualifications. In addition, the ISRP found that 5 proposals (5%) did not meet criteria and felt that 5 proposals (5%) were not applicable for review at this time. One proposal had yet to address our request for a response. Overall, the projects are demonstrating improved data collection, analysis, and reporting. And the ISRP compliments the Basin's scientists, managers, and technicians for implementing a robust monitoring effort in a large geographic region with a complex legal and administrative structure. The program's RM&E and artificial production projects are providing data that will be useful toward supporting adaptive management of the Fish and Wildlife Program.

In addition to the 99 proposals reviewed for this report, 59 projects recently reviewed by the ISRP were included in this set to provide context for the other 99 RM&E and artificial production projects that had not been reviewed recently. The 59 projects constituted a "contextual" set of proposals and are associated with topical or geographic sub-regions in tables below. This was not an open solicitation. Only project proponents specifically identified by Bonneville and the Council were allowed to submit proposals. However, as a result of this review, gaps might be identified that could be filled by projects submitted through targeted and potentially competitive open solicitations.

In July 2010, a Council letter to the ISRP emphasized that in implementing the 2009 revised Columbia River Basin Fish and Wildlife Program (Program), the Council anticipated maximizing funding of on-the-ground mitigation efforts while conducting an efficient monitoring and research program to meet the priority needs of the region. The ISRP was asked to review RM&E and artificial production project proposals mindful of the Council goal to reduce duplicative and excessive research, monitoring, and evaluation, and of the Council's intent to recommend adjustments to projects as needed and apply savings to on-the-ground work. The ISRP was asked to consider how and to what extent each project supported and was consistent with the following key policies, framed as questions:

- Is the project scale and resource commitment appropriate for the project's objectives?
- For research projects, is a critical uncertainty being addressed? What is the hypothesis being tested, and is it prioritized in the Research Plan?
- Is the monitoring or research conducted by a project proportional to the biological risk or project success risk?
- Does the project contribute valuable data to inform one of the nine program-management questions from the working list proposed by the Council and the associated High Level Indicators?
- What are the major accomplishments of these projects, and are the data derived from the projects useful and relevant?
- Is the project part of a comprehensive monitoring program?
- Does the project fill a priority Program data gap, or is the project required by a biological opinion or a recovery plan for species listed under the Endangered Species Act?
- Does the project's RM&E data have a reasonable certainty or a reasonable confidence level?
- Is the project consistent with the general principles of the Hatchery Scientific Review Group (HSRG)?
- Are data produced by the project fully described, including metadata and methodologies used, easily available for public review, and capable of being used to aggregate data to an appropriate higher scale, such as a broader geographic scale or population scale?
- How should the Council consider the impact of ocean conditions on fish and wildlife populations in making its final recommendations to Bonneville?

To a large extent, the questions posed by Council are embedded in the ISRP's standard scientific review criteria and have been incorporated in individual ISRP proposal evaluations. Those projects with "in part" and "qualified" ISRP assessments may have had components that did not entirely meet the objectives of the guidance questions from Council. Important points of inconsistency are identified in individual proposal reviews.

The ISRP wishes to observe that, overall, we found few projects where RM&E efforts were clearly duplicative or excessive. We do feel there is a need for better coordination and integration among projects, and for a strengthened emphasis on evaluation of field data, but we continue to find that the Fish and Wildlife Program would benefit from more, not less, high quality research, monitoring, and evaluation. The lessons learned from thoughtfully designed RM&E will contribute to the Program's cost effectiveness and will improve the efficacy of future restoration actions.

II. Introduction

This two-part report provides the final comments and recommendations of the Independent Scientific Review Panel and Peer Review Groups (together referred to as ISRP) for 99 proposals submitted for the 2010 Research, Monitoring and Evaluation (RME) and Artificial Production Category Review to implement the Columbia River Basin Fish and Wildlife Program. Part 1 of this report provides programmatic comments and recommendations that apply broadly to program or address issues that were identified in multiple proposals during the ISRP reviews. In addition, Part I of this report provides (1) consideration of the 59 "contextual" proposals (see below); (2) programmatic-level discussion of how well the projects aligned with the questions and policies that the Council provided in its July 15 letter to the ISRP; and (3) follow-up reviews of two proposals reviewed in the Fiscal Year 2010 Fast Track review.[1]

Part 2 of the report includes the specific ISRP recommendation and comments on each proposal. The ISRP does not make funding decisions; that is the responsibility of the Council and Bonneville Power Administration (BPA). In this final review, the ISRP, considered the technical merits and potential benefits of each proposal. The ISRP found that of the 99 proposals submitted 38 proposals meet scientific review criteria and 50 proposals meet criteria with some qualifications. In addition, the ISRP finds 5 proposals do not meet criteria and deems 5 proposals not applicable for review at this time. One proposal has yet to address our request for a response. Overall, the ISRP continues to see a general improvement in the quality of the proposals and the scientific basis of the Fish and Wildlife Program. In addition, this review indicates improving M&E and reporting of results, which can serve as a basis for adaptive management.

This review includes currently-funded Fish and Wildlife Program projects as well as new Columbia River Fish Accord projects and new projects that address gaps in the Program and FCRPS BiOp that were identified in the 2009 collaboration process with regional fish management agencies. This category includes most of the projects referred to in the past as mainstem and systemwide (e.g., the water transaction program and the avian and pikeminnow predator control projects). In addition to the 99 proposals reviewed for this report, 59 recently reviewed projects were included in this categorical review set to provide context for the other 99 RM&E and artificial production projects that had not been reviewed recently. These 59 projects constituted the "contextual" set of proposals and are associated with topical or geographic sub-regions in tables below. This was not an open solicitation. Only projects specifically identified by Bonneville and the Council were allowed to submit proposals. However, as a result of this review, gaps may be identified that could be filled by projects submitted through targeted and potentially competitive open solicitations.

This categorical review is intended to enable the Council, the ISRP, and BPA to review all similar projects (such as fish tagging studies) funded or proposed for funding through the Program. A central purpose of such a broad review is to highlight issues common to similar projects such as relevancy, duplication, coordination, scope, and consistency with the broad basinwide objectives and provisions in the Fish and Wildlife Program. Specifically, with regard

[1] Fast Track Proposals #1989-098-00 Idaho Supplemenation Studies and #1990-055-00 Idaho Steelhead Monitoring and Evaluation Studies.

to the research, monitoring and evaluation components of the projects, the Council and Bonneville are using the categorical review to ensure that RM&E implemented under the Program meets the performance-tracking and adaptive management needs and commitments of the Program and the 2008 Federal Columbia River Power System (FCRPS) Biological Opinion (BiOp).

The Council's 2009 Fish and Wildlife Program focuses on performance and commits to developing a monitoring and evaluation framework to improve reporting of Program progress and to inform Council decisions. From this commitment, the Council developed a draft Monitoring, Evaluation, Research and Reporting (MERR) Plan, which the ISRP and Independent Scientific Advisory Board (ISAB) reviewed (ISAB/ISRP 2010-3). The Council encouraged the ISRP and project proponents to consult with the MERR Plan for this categorical review. In a July 15, 2010 Council letter to the ISRP, the Council also asked the ISRP to review the project proposals mindful of the Council's goal to reduce duplicative or excessive levels of research, monitoring, and evaluation and provided eleven questions/policies to guide the review. The Council hopes that cost savings identified by eliminating redundant or excessive RM&E could be applied to on-the-ground work.

Finally, the ISRP continues to be supportive of this review approach. It incorporates some of the best features of past reviews such as presentations by project proponents and response loops to provide requests for more information. It also adds some positive new features such as an emphasis on topical reviews (e.g., fish tagging) and a recognition of program commitments.

III. The ISRP Review Process

1. Review Criteria

ISRP reviews are based on criteria provided in the 1996 amendment to the Northwest Power Act. The amended Act directs the ISRP to review projects for consistency with the Council's Fish and Wildlife Program and whether they:

1. are based on sound science principles;
2. benefit fish and wildlife;
3. have clearly defined objectives and outcomes; and
4. contain provisions for monitoring and evaluation of results.

Pursuant to the 1996 amendment, the Council must fully consider ISRP recommendations when making its recommendations regarding funding, and provide an explanation in writing where its recommendations diverge from those of the ISRP.

2. Review Steps

In general, ISRP reports provide written recommendations and comments on each proposal that is amenable to scientific review. These reports reflect the ISRP's consensus. To develop final recommendations on 2010 RM&E and artificial production proposals, the ISRP used a multi-step review process:

1. ISRP individual reviews. Three reviewers were assigned to independently review each proposal and provide written evaluations. Individual review comments and records of discussions are confidential and not available outside the ISRP review teams. The ISRP assigned review teams based on expertise and whether members reviewed the project in the past.

2. Project presentations. In the first half of September, for seven meeting days, the project proponents presented their proposals to the ISRP, Council staff, and BPA staff. Time was reserved for questions. These discussions greatly aided the ISRP and project proponents in clarifying specific concerns and better understanding the projects in general.

4. ISRP group evaluation meeting. Individual reviewer comments were compiled, and following the presentations, review teams met to discuss individual reviews, develop a consensus recommendation for each proposal, and ensure consistency across reviews.

5. Preliminary report completion. After the evaluation meeting, reviewer comments were synthesized into a consensus statement on each proposal, which was verified by each of the three reviewers. The ISRP evaluated and edited these draft consensus statements to produce a preliminary report that was released on October 13, 2010. In this preliminary review, the ISRP found that 22 proposals met scientific review criteria, 25 proposals met criteria with some qualifications. ISRP recommendations on those 47 projects were final. In addition, the ISRP found 3 proposals did not meet criteria and deemed 5 proposals not applicable for review. ISRP recommendations on those 8 projects were final. In addition, the ISRP requested responses on 44 proposals, and a month was provided for the project proponents to respond to our comments.

6. Response review and completion of the final report. On November 15, 2010, the ISRP received responses for all but one of the 44 proposals for which a response was requested. We again followed steps 2 and 4 above. Individual reviewers evaluated responses; those evaluations were compiled; review teams met to discuss the evaluations and develop programmatic comments (December 8); and a final draft was circulated to confirm ISRP consensus. Of those proposals providing a response, the ISRP found that 16 proposals met scientific review criteria (37%), 25 proposals met criteria with some qualifications (58%), and 2 proposals did not meet criteria (5%).

Next Review Steps

At the Council's January meeting, the ISRP will present its findings. At the February and March Council meetings, Council staff anticipates presenting recommendations for Council discussion. At the Council's March and/or April Council meetings, the Council will make recommendations.

IV. ISRP Evaluation of the Council's Ancillary Questions

1. Background

In a July 15, 2010 letter to ISRP Chair Eric Loudenslager, Council Chairman Bruce Measure emphasized that in implementing the 2009 revised Columbia River Basin Fish and Wildlife Program (Program), the Council anticipates maximizing funding of on-the-ground mitigation efforts while conducting an efficient monitoring and research program to meet the priority needs of the region. The ISRP was asked to review RM&E and artificial production project proposals mindful of the Council goal to reduce duplicative and excessive research, monitoring, and evaluation, and that the Council intends to recommend adjustments to projects and apply any savings to on-the-ground work. The ISRP was asked to consider how and to what extent each project supports and is consistent with the following key policies framed as questions:

- Is the project scale and resource commitment appropriate for the project's objectives?
- For research projects, is a critical uncertainty being addressed? What is the hypothesis being tested, and is it prioritized in the Research Plan?
- Is the monitoring or research conducted by a project proportional to the biological risk or project success risk?
- Does the project contribute valuable data to inform one of the nine program-management questions from the working list proposed by the Council and the associated High Level Indicators?
- What are the major accomplishments of these projects, and are the data derived from the projects useful and relevant?
- Is the project part of a comprehensive monitoring program?
- Does the project fill a priority Program data gap, or is the project required by a biological opinion or a recovery plan for species listed under the Endangered Species Act?
- Does the project's RM&E data have a reasonable certainty or a reasonable confidence level?
- Is the project consistent with the general principles of the Hatchery Scientific Review Group (HSRG)?
- Are data produced by the project fully described, including metadata and methodologies used, easily available for public review, and capable of being used to aggregate data to an appropriate higher scale, such as a broader geographic scale or population scale?
- How should the Council consider the impact of ocean conditions on fish and wildlife populations in making its final recommendations to Bonneville?

To a large extent the ancillary questions posed by Council are embedded in the ISRP review criteria provided by the 1996 amendment and are reflected in the individual ISRP proposal reviews. Those projects with "in part" and "qualified" ISRP assessments may have had components that did not entirely meet the objectives of the guidance questions from Council. Important points of inconsistency are identified in individual proposal reviews. The important points of inconsistency are identified in the individual proposal reviews.

In several of the Council questions there was explanatory text that addressed coordination and integration of monitoring to provide information for adaptive management, High-Level Indicators, MERR, and the regional Anadromous Salmon Monitoring Strategy (ASMS). Addressing an over-all consideration of gaps, duplication, or excessive monitoring within a geographic region, a salmon ESU or major population group, requires evaluating the objectives and deliverables across all of the projects that contribute data to that region or species. Consequently, the ISRP provides in our programmatic comments a narrative summary of our conclusions on duplication/redundancy, potential gaps, and challenges faced in obtaining reliable monitoring data for groups of projects arranged by the purpose and RME goals identified in the proposal portfolios and by ESU/geographic region. The ISRP believes this will provide Council, BPA, and co-managers with guidance on efforts to enhance coordination and integration.

2. General Observations and Emerging Issues

The ISRP opens this programmatic review section with a compliment to the Basin's scientists, managers, and technicians for implementing a robust monitoring effort in a large geographic region with a complex legal and administrative structure. Overall, the projects are demonstrating improved data collection, analysis, and reporting. The program's RME and artificial production projects are providing data that will be useful toward supporting adaptive management of the Fish and Wildlife Program. For example, major data trends strongly suggest a commonality to the variation in returns that are likely explained by smolt-to-adult survival and ocean conditions. Trends in hatchery- and natural- fall Chinook abundance in the Snake River suggest potential density dependence. There is not evidence of excessive or unnecessary monitoring. Nevertheless, some projects still need improvements, which the ISRP highlights in its individual proposal reviews.

Consideration of Toxic Compounds

Despite the massive use of chemicals in the Columbia River Basin, little attention has been paid to their effects on fish production and survival. This is despite pollutants being a recognized problem in the Columbia River and its tributaries for many decades, especially for species positioned higher in the food web. When fish-eating species experience contaminant-related population declines or reproductive effects, it is obvious that the source of contaminants is the fish they have eaten. In the Basin, top fish-eating predators include the river otter, mink, bald eagle and osprey, with the latter three nearly eliminated from the lower Basin by the mid-1970s. Bald eagle and osprey populations have now recovered following the banning of a number of persistent chemicals (legacy contaminants), and the reduction of those residues in the fish that they eat. However, new chemicals termed "emerging contaminants" (modern pesticides and herbicides, pharmaceuticals, personal care products, flame retardants, etc.) are presenting a new set of problems. Concentrations of many of these emerging contaminants appear to be related to the distribution of agricultural activity, human populations, industrial activity and wastewater treatment plants. Some of the emerging contaminants have been shown to alter salmon swimming behavior, predator avoidance behavior, and foraging behavior. The net effect on salmon appears to be increased mortality and probably reduced somatic growth. These contaminants also may alter the food supply for fish. Contaminants can be considered a "wild

card" when attempting to understand food web and wildlife-habitat relationships, and as such can cause much confusion if not considered. The available evidence strongly suggests that a better understanding of contaminants and their effects on the Basin's salmon populations and food webs are urgently needed. (For more details, see the upcoming Food Web report by the ISAB, Chapter C.7, scheduled for release in January 2011.)

Confidence Levels and other Statistical Considerations

The ongoing discussions and debates in the region concerning identification and implications of standards of evidence, levels of confidence, power of hypothesis tests, and measures of precision and accuracy are signs of progress in the sophistication of using data to inform decision making. Along with efforts to establish region-wide standards for identifying and measuring uncertainty come some challenges and concerns. The variation in project proposals, and in responses to ISRP requests for additional information concerning statistical considerations, suggest a need for continuing the dialog.

Proposed standards of precision, accuracy, and uncertainty should be repeatedly challenged to ensure they are sufficient for the scientific questions being investigated and for decision-making. The consequences of various levels of monitoring must consider the circumstances.

For example:

- Situations with limited coded wire sampling to inform harvest limits need to be more conservative than those with extensive sampling to account for wide margins of error to reduce the chance of overharvesting listed species.
- PIT tag detection and shedding is variable. These factors should be considered in sample size estimation and methods of analysis.
- Under what conditions are redd counts sufficiently precise and accurate for study purposes and under what conditions are the data of no use? Should some current monitoring cease or be conducted in an entirely different manner?
- Hypothesis testing that leads to a conclusion of significant differences is a data exercise. Measuring the magnitude of the effects is necessary, such as, when evaluating supplementation is a 10 percent change, or 20 percent change, sufficient? To evaluate supplementation in the long run deals with both the data collected and the magnitude of the biological response.
- If the difference to be detected is small then a high level of precision is necessary; meaning the monitoring can become very difficult and expensive. The M&E program should consider accuracy and precision from the initial design phases. If the monitoring will only detect a 50% change and the change will likely never be that high, is it worth doing the monitoring?
- The approach of doing high level monitoring in some areas and not in others makes sense. Can investigators roll-up the data for certain areas? Will there be acceptance that a certain study is representative? For example, how many Hood River steelhead relative reproductive type studies are needed before managers make a decision about the efficacy of steelhead supplementation?

- Which projects need an experimental approach and which do not? When can you rely on past studies to show that certain actions have certain benefits in certain situations? What level of evidence is sufficient to make conclusions about culvert removal or fencing or control of non-native species?
- Can a meta-analysis approach be applied more frequently and fruitfully in the region to combine information from multiple studies?
- Can multiple observational studies be used to build a preponderance of evidence, and thus infer cause and effect?
- In studies of the hydrosystem, where the problems of detecting differences, and attributing results to various conditions and operations are so difficult, and assumptions are so many, taking a multiple study approach may be warranted.
- Is fish monitoring data useful if it is not also associated with habitat monitoring data?

3. Ocean and Estuary

Number	Title	Proponent	Purpose and Emphasis	Primary Monitoring
1998-014-00	Ocean Survival Of Salmonids	National Oceanic and Atmospheric Administration (NOAA)	Habitat RM&E	Estuary/plume fish performance
2003-009-00	Canada-USA Shelf Salmon Survival Study	Canada Department of Fisheries and Oceans	Programmatic RM&E	Estuary/ocean uncertainties
2003-114-00	Pacific Ocean Survey Tracking (POST)	Kintama Research	Programmatic RM&E	Estuary/plume fish performance; Estuary/ocean uncertainties
2003-007-00	Lower Columbia River Estuary Ecosystem Monitoring	Lower Columbia River Estuary Partnership (LCREP)	Habitat RM&E	Habitat limiting factors; Estuary/plume fish performance; Habitat action effectiveness

At the project level, answers to the Council's list of questions on ocean RM&E projects were addressed in the ISRP's responses to individual projects. The ISRP finds ocean research, monitoring, and evaluation of the impact of ocean conditions on Columbia River Basin Fish and Wildlife to be needed and informative.

Some of the ocean projects (NOAA and POST), the LCREP project, and the avian predator projects are trying to estimate mortality of juvenile salmon in the estuary. The projects did not present strong evidence of collaboration. A possible exception is the NOAA project inner-estuary purse seining will be done in concert with offshore trawling. There are also several projects in the estuary not being examined in this review, especially estuarine habitat restoration efforts, e.g. Columbia River Estuary Study Taskforce (CREST) Estuary Habitat Restoration

#2010-004-00 and Columbia Land Trust (CLT) Estuarine Restoration #2010-073-00, which should be integrated, given that the overall goal of the restoration is to increase juvenile salmon survival. If survival is being assessed in the main channel (where the above-mentioned three projects are being conducted), and the restoration work is being done inshore, it is difficult to understand how restoration goals in shallow water habitats can be assessed.

At the programmatic level, the ISRP has the following suggestions regarding how the Council can consider/incorporate the impact of ocean conditions (including the freshwater plume, the near-shore ocean, and the high seas) on Columbia River Basin Fish and Wildlife in its final recommendations to BPA:

1. The BPA-funded program needs to be further strengthened to make full use of available RM&E information on ocean conditions to guide management actions in freshwater and to distinguish ocean effects from other effects on survival of anadromous fishes (salmonids, sturgeon, and lamprey).

2. As a first step towards strengthening the Council's ocean strategies, the ISRP suggests an annual BPA-sponsored basinwide forum on the effects of climate and ocean conditions on Columbia River Basin fish and wildlife potentially led by NOAA Fisheries (Project No. 1998-014-00, Ocean Survival of Salmonids). Such a forum or workshop, similar to the estuary workshop, would further encourage collaboration among managers and the research community.

Some BPA-funded projects have recognized the effects of ocean conditions on Columbia River Basin fish and wildlife and are developing new strategies to use information on ocean conditions for inland RM&E and management actions. For example, Project 1983-350-00 (Nez Perce Tribal Hatchery M&E) recognized "out of subbasin factors are primary in limiting adult recruitment in the Clearwater Subbasin," and developed a strategy to "participate in province and basin-wide coordinated studies and water management forums designed to examine mainstem and ocean mortality associated with differential migration timing and life histories of anadromous salmonids and lamprey." Their strategy is to "conduct research within the context of identifying management versus basin-wide environmental effects," to "work with other entities to ameliorate and mitigate limiting factors," and to "determine precise and accurate run predictions of natural and hatchery origin adults," in part using NOAA Fisheries ocean ecosystem indicators of salmon marine survival in the Northern California Current (http://www.nwfsc.noaa.gov/research/divisions/fed/oeip/a-ecinhome.cfm). In addition, proposed releases of coded-wire tagged fish by this project were evaluated with respect to sufficiency for calculation of contribution rates to various ocean fisheries and to determine ocean distribution of salmon. Proponents of this project also recognized that the lack of marine-derived nutrient input into freshwater systems may be limiting restoration of salmon populations despite harvest management and dam passage mitigation, and that recently improved ocean conditions favor increases in salmon abundances.

Some projects, however, still did not recognize or use available scientific information on the effects of ocean conditions on Columbia River Basin fish and wildlife. For example, several other projects from the Clearwater subbasin reported survival and abundance data that seemed to

stop its interpretation at Lower Granite Dam, with little consideration of the subsequent in-river and ocean mortality. While communication among ocean researchers has improved, communications with inland managers need further improvement. A basinwide forum would help to implement the Council's ocean strategies, and contribute to the development of ecosystem approaches to RM&E.

Some potential topics to be considered during this forum include:

(1) Life history diversities — In view of climate change and likely changes in coastal ocean upwelling intensity and timing, it is critical to preserve and enhance all life histories of anadromous fish in the Basin to facilitate resilience. Potentially important aspects of life history diversity include outmigration timing, ocean entry timing, and ocean distribution of wild stocks. In many instances much of this diversity resides in small populations, so it is important that these populations are not over-harvested by fisheries targeting strong runs. The current focus on the effects of ocean conditions on survival of juvenile salmon during their first summer-fall in coastal waters is very important, but a broader perspective that includes salmon at other ocean life stages and in other ocean habitats is needed.

(2) Density dependence — The ocean studies could take a more experimental approach by looking at differences in wild and hatchery fish in the ocean. While initial migration and survival may be similar, based on early studies, survival of hatchery fish from smolt-to-adult is often 2 to 3 times lower than wild fish. Furthermore, the effect of hatchery fish abundance on wild fish survival remains poorly studied.

For decades some scientists have advocated large-scale manipulative experiments to determine the effects of freshwater and ocean conditions on density-dependent growth and survival among salmonids. A recent presentation to the ISAB included a good example, where Lower Columbia River hatchery fall Chinook would only be released on alternate years over a series of years (at least ten years) that included a variety of ocean and freshwater conditions. This type of experiment could reduce or curtail releases at either two-year intervals, for example, or in a randomized manner. For coho salmon in the Lower Columbia River, releases of fish could be manipulated as above, or simultaneously with wild outmigrations and at the different times during the same year, over a series of years, as above. Here it would be important to have life-history monitoring sites like those of the Oregon Department of Fish and Wildlife (ODFW) so smolt to adult survival could be monitored for both wild and hatchery fish. Another strategy would be to reduce releases of hatchery fish in years when ocean conditions are predicted to be poor, such as *El Niños*. This option for exploring density-dependent effects on survival has been suggested in several ISAB reports (ISAB 2007-7 ISAB Climate Report and ISAB 2003-3 Supplementation Report).

Releases of hatchery fish also could be manipulated within a year to occur simultaneously with wild outmigrations or to minimize interactions with wild smolts. All of these designs require life-history monitoring sites like those established by ODFW to measure smolt to adult survival of both wild and hatchery fish.

(3) **Models and Simulations** — Although prediction of salmon run sizes are often inaccurate, they are getting better. Improved models of run sizes and timing based on both freshwater and ocean conditions, growth rates, and jack returns could be developed in order to modify harvest or hatchery releases. The development and improvement of simulation and predictive models (e.g., EcoSim, bioenergetics, migration and growth, plume), would help to focus the work required and the collaborations. Model enhancements could include sub-stock structure in more detail, hatchery release time, area comparisons, in-river migration, associated ocean migration, and other factors. As density-dependent interactions with hatchery releases may occur primarily during in-river migration and early-ocean residency, simulation studies on these life history stages would be of value in exploring the effects of hatchery smolt release timing on wild smolt survival. This work also could help guide ongoing projects involving the estuary, acoustic tagging, and others.

(4) Research — We need a better understanding of *how* ocean conditions affect growth, survival, and ocean distribution of anadromous fish—is this related to feeding and condition and/or predation? Are there critical conditions that effectively regulate survival, and if so when and where do they occur in the ocean? Do different stocks have different migratory paths and feeding grounds? Great progress can be made here with CWTs, acoustic tags, otolith chemistry, stock genetic identification, and distribution of ocean catches (e.g., Project CROOS, Collaborative Research on Oregon Ocean Salmon[2]).

4. Hydrosystem Passage RME and Related Life History Work

Number	Title	Proponent	Purpose and Emphasis	Primary Monitoring
1983-319-00	New Marking and Monitoring Technologies	NOAA	Hydrosystem RM and E	Evaluate Fish Performance FCRPS
2001-003-00	Adult PIT Detector Installation	NOAA, Pacific States Marine Fisheries Commission (PSMFC)	Hydrosystem RM and E	Fish population status
2008-506-00	Smolt Monitoring Video Feasibility Project	Columbia River Inter-Tribal Fish Commission (CRITFC)	Programmatic RM and E	Migration characteristics and river condition
1990-080-00	Columbia Basin Pit-Tag Information	PSMFC	Programmatic RM and E	Fish population status
1994-033-00	Fish Passage Center	PSMFC	Programmatic RM and E	Fish population status; Fish performance in the FCRPS; Migration characteristics and river conditions
1987-127-00	Smolt Monitoring by Non-Federal Entities	PSMFC	Programmatic RM and E	Fish population status; Fish performance in the FCRPS;

[2] http://projectcroos.com/

				Migration characteristics and river condition
2005-002-00	Lower Granite Dam Adult Trap Operations	NOAA	AP RM and E	Fish population status; Fish performance in the FCRPS; Investigate Hydro Critical Uncertainties
1996-020-00	Comparative Survival Study (CSS)	Columbia Basin Fish and Wildlife Authority (CBFWA), PSMFC, US Fish and Wildlife Service (USFWS)	Programmatic RM and E	Fish population status; Fish performance in the FCRPS; Effects of Configuration and Operations Actions Tributary Habitat Conditions and Limiting Factors
1993-029-00	Survival Estimate for Passage through Snake and Columbia River Dams and Reservoirs	NOAA	Hydrosystem RM and E	Fish population status; Fish performance in the FCRPS; Effects of configuration and operation actions
2003-041-00	Evaluate Delayed (Extra) Mortality Associated with Passage of Yearling Chinook Salmon through Snake River Dams	NOAA	Hydrosystem RM and E	Performance in the FCRPS; Migration characteristics and river condition; Effects of configuration and operation actions
2010-076-00	Characterizing migration and survival for juvenile Snake River sockeye salmon between the upper Salmon River basin and Lower Granite Dam	IDFG, NOAA	None identified	None assigned
1996-021-00	Gas Bubble Disease Monitoring	US Geological Survey (USGS)	Hydrosystem RM and E	Migration characteristics and river condition
1991-028-00	Pit Tagging Wild Chinook	NOAA	Hydrosystem RM and E	Fish population status; Performance in the FCRPS; Migration characteristics and river condition; Effects of configuration and operation actions
1989-107-00	Statistical Support For Salmon	University of Washington	Programmatic RM and E	Fish population status
1991-051-00	Modeling and Evaluation Statistical Support for Life-Cycle Studies	University of Washington	Programmatic RM and E	Performance in the FCRPS; Migration characteristics and river conditions
2008-518-00	Upstream Migration Timing	CRITFC	Programmatic RM and E	None assigned for BiOp Strategy or Action
2008-908-00	FCRPS Water Studies & Passage of Adult Salmon & Steelhead	Colville Confederated Tribes	Programmatic RM and E	Harvest
1999-003-01	Evaluate Spawning of Fall Chinook and Chum Salmon Just Below the Four Lowermost Mainstem Dams	ODFW, PNNL, PFMSC	Habitat RM and E	None assigned for BiOp Strategy or Action
1991-	Research, monitoring, and	University of	Programmatic	Migration characteristics

029-00	evaluation of emerging issues and measures to recover the Snake River fall Chinook salmon ESU	Idaho, USFWS, US Geological Survey (USGS)	RM and E	and river condition; Hydro critical uncertainties; Hatchery uncertainties
2002-032-00	Snake River Fall Chinook Salmon Life History Investigations	PNNL, University of Washington, USFWS, USGS	Hydrosystem RM and E	Fish population status; Hydrosystem critical Uncertainties; Tributary habitat conditions and limiting factors

In the review of 20 Hydrosystem RME projects, the ISRP found that as a group, they answered most of the Council's questions regarding major program management questions, associated HLI's. They also were responsive to 2008 BiOp RPAs. In addition, the ISRP did not find excessive overlap of objectives or duplication of data collection among this group of projects.

The ISRP found no priority Fish and Wildlife Program data gaps (such as route specific passage survival) in this set of projects. This is primarily because the US Army Corps of Engineers Anadromous Fish Evaluation Program (AFEP) projects provide detailed study data such as route specific passage survival at individual dams and other significant survival and fish performance data regarding juvenile and adult salmonid hydrosystem passage. That program complements the Fish and Wildlife Program studies such as the CSS Study (1996-020-00) and NOAA Fisheries survival (1993-029-00) and delayed (extra) mortality (2003-041-00) studies, which are broader whole dam and reach survival studies.

The life history related projects in this group also provide important information on Lower Snake River salmonids including: (1) wild spring-summer Chinook - population status, migration characteristics, and tributary habitat conditions (1991-028-00), (2) wild and hatchery fall Chinook - population status, migration characteristics, hydrosystem critical uncertainties, and hatchery critical uncertainties (1991-029-00 and 2002-032-00), and (3) sockeye – survival, migration characteristics, and tributary/river conditions.

Recommendations

The ISRP believes that addition experimental approaches like NOAA's delayed mortality project (2003-041-00) could help address some of the key uncertainties associated with hydrosystem passage through the four Lower Snake River dams. This type of work should be explored further and expanded by NOAA Fisheries, the CSS Project, and others.

The RME data collected by these projects is primarily from PIT-tagged hatchery and wild salmonids, however, emerging evidence indicates PIT-tagged salmon can shed their tags at very high rates (e.g., 30% among Chinook returning after two years at sea) and that tag loss may vary considerably depending on hatchery and time since tagging (2010 Lower Snake River Compensation Workshop, a presentation by Idaho Fish and Game). Unaccounted tag loss can lead to under-estimation of survival. Variable tag loss can potentially confound experiments that rely on tag recovery rates and minimal measurement error. Effort is needed to identify tagging techniques to minimize PIT-tag loss and to account for variable tag loss, and the ISRP also

recommends that a sensitivity analysis be conducted to assess how tag loss can bias and alter survival estimates related to hydrosystem passage RME.

There is a need for an ecosystem program centered on the reservoirs and estuary. At present there is no program to link the inter-relationships between all the major species (salmonids, sturgeon, lamprey, pike minnows, shad, cyprinids and others) in these relatively well-bounded elements of the system. Such a program could have a food web focus but would need to carefully thought out to make sure it produced results of direct use to managers. Key elements would be invasive species (especially shad), food and space limitation/competition, and predation in the context of depensatory mortality, perhaps all in an umbrella type project examining hydrosystem spill and transport survival estimates through the reservoirs and estuary. Focused research on avian predation in these areas is also needed.

5. Coded Wire Tag, Harvest, and Enforcement

Projects in italics are contextual projects.

Number	**Title**	**Proponent**	**Purpose and Emphasis**	**Primary Monitoring**
1982-013-01	Coded Wire Tag-Pacific States Marine Fisheries Commission	PSMFC	Programmatic RM and E	Fish population status; Harvest
1982-013-02	Coded Wire Tag-Oregon Department of Fish and Wildlife (ODFW)	ODFW	Programmatic RM and E	Fish population status; Harvest
1982-013-03	Coded Wire Tag-US Fish and Wildlife Service (USFWS)	USFWS	Programmatic RM and E	Fish population status; Harvest
1982-013-04	Coded Wire Tag-Washington Department of Fish and Wildlife	WDFW	Programmatic RM and E	Fish population status; Harvest
2010-036-00	*Lower Columbia Coded Wire Tag (CWT) Recovery Project*	*WDFW*	*Programmatic RM and E*	*Fish population status; Selected harvest investigations; Data management*
2008-502-00	*Expanded Tribal Catch Sampling*	*Columbia River Inter-Tribal Fish Commission (CRITFC)*	*Harvest* *RM and E*	*Selected harvest investigations*
2008-508-00	*Power Analysis Catch Sampling Rates*	*Columbia River Inter-Tribal Fish Commission (CRITFC)*	*Harvest RM and E*	*Selected harvest investigations*
2007-390-00	Tribal Conservation Enforcement-Umatilla Tribe	Umatilla Confederated Tribes (CTUIR)	Harvest Law Enforcement	None assigned
2007-391-00	Tribal Conservation Enforcement-Columbia River Inter-tribal Fish Commission (CRITFC)	CRITFC	Harvest Law Enforcement	None assigned
2008-106-00	Tribal Conservation Enforcement-Colville Tribe	Colville Confederated Tribes	Harvest Law Enforcement	None assigned

2002-060-00	Nez Perce Harvest Monitoring on Snake and Clearwater Rivers	Nez Perce Tribe	Harvest RM and E	Selected harvest investigations
2008-105-00	Selective Gear Deployment	Colville Confederated Tribes	Harvest RM and E	Selected harvest investigations

Tagging/Harvest

Tagging of salmon (coded-wire-tags, PIT tags, acoustic tags, and genetic markers) is a key tool for quantifying stock composition in mixed-stock fisheries and on the spawning grounds, estimating survival rates, describing migration patterns, and testing a variety of other hypotheses. After reviewing project proposals, we identified two coded wire tag-related actions requiring further effort in the Basin:

1) develop a comprehensive plan that guides tagging and recovery activities throughout the Basin, especially among CWT operations;

2) evaluate the magnitude of mini-jacks among yearling CWT Chinook salmon releases, and record mini-jack data in the RMIS database.

Tagging projects require coordination among multiple agencies, including management and researcher organizations, in order to be most effective, yet such coordination, planning and justification of tagging and recovery efforts were not apparent among some proposals. For example, although some tagging coordination occurs among agencies, the CWT proposals did not refer to an overall plan to coordinate tagging of salmon throughout the Columbia River Basin, recovering tags in the fisheries, and recovering tags on the spawning grounds. Coordinated tag efforts should justify tagging effort by hatchery location and salmon species, and tag recovery efforts necessary to generate meaningful results for anticipated studies. Furthermore, many juvenile CWT salmon recovered in some research investigations (e.g., NOAA & OSU ocean studies) have not been reported in the RMIS database (2010 Regional Mark Committee minutes). The proposals did not mention how they responded to recommendations by the Pacific Salmon Commission CWT Workgroup (2008).[3]

Mini-jacks can occur at high (up to 50%; B. Beckman, NMFS, pers. communication) and variable rates among yearling male Chinook salmon and steelhead released from hatcheries. High and variable numbers of mini-jacks among CWT releases may bias survival studies because these fish would be counted as mortalities. An effort is needed to document the potential bias caused by mini-jacks and to further evaluate blood assays as a method for estimating the presence of mini-jacks in yearling releases of Chinook and steelhead because some researchers (e.g., R. Carmichael) have not observed the same high mini-jack levels that have been reported by NMFS.

[3] Pacific Salmon Commission CWT Workgroup. 2008. An Action Plan in Response to Coded Wire Tag (CWT) Expert Panel Recommendations, PSC Technical Report #25.
www.rmpc.org/files/psctr25_CWT_Expert_Panel_Report.pdf

Law Enforcement

The Taurus proposal form is new and focuses on individual projects. However, it would be useful for the set of law enforcement to be considered programmatically and to set up a common structure for data reporting and generation of public education tools across these enforcement proposals.

6. Predation and Invasive Species

Projects in italics are contextual.

Number	Title	Proponent	Purpose and Emphasis	Primary Monitoring
1997-024-00	Avian Predation on Juvenile Salmonids	Oregon State University	Predation RM and E	Evaluate effects of configuration and operations; Monitor Caspian tern population, double crested cormorants population; and inland avian predation
1990-077-00	Development of Systemwide Predator Control	Pacific States Marine Fisheries Commission (PSMFC)	Predation Predator removal	Evaluate effects of configuration and operations; Monitor piscivorous fish predation
2007-275-00	Impact of American Shad in the Columbia River	US Geological Survey (USGS)	Programmatic RM and E	Estuary/ocean critical uncertainties
2008-719-00	*Research Non-Indigenous Actions*	*ODFW, USGS*	*Predation* *RM and E*	*Develop strategies to reduce predation;* *Monitoring fish predation*
2008-004-00	*Sea Lion Non-Lethal Hazing*	*Columbia River Inter-Tribal Fish Commission (CRITFC)*	*Predation* *RM and E*	*Marine mammal control measures;* *Monitoring marine mammal predation on fish*

This series of five projects concerns the potential impact of both native (actually several native species of concern) and invasive species on salmonid stocks from the Columbia River Basin. Changes in habitats (creation of dredge-spoil nesting islands in the Columbia Estuary) and other government actions (Marine Mammal Protection Act of 1972) have resulted in attracting the largest nesting Caspian Tern population in the world and also resulted in major population increases of sea lions. Furthermore, Bonneville Dam has created a location where returning adult salmon are especially vulnerable to sea lion predation. Other fish-eating native avian species, such as double-crested cormorants and California brown pelicans that were much reduced by DDT from the 1950s through the 1980s have greatly increased in the Columbia Estuary in recent decades, and have found an abundant food supply, including juvenile salmonids. The salmon taken by the predators include every ESA-listed stock from throughout the Basin, and research is

underway to better assess stock-specific predation rates. Projects are reliably estimating total take for the various bird species (juvenile salmonids) and mammal species (adult salmon, and percent of run), and testing many techniques to move birds (attract to other locations) or to make the adult salmon less vulnerable to predation below the dam. However, similar to other predator control projects, there is a lingering concern of the importance of predation losses of juveniles relative to overarching factors such as ocean survival, i.e., does the predator loss affect the rate of adult returns?

Recently, two issues bring the predator issue into stronger focus: (1) the consumption by double-crested cormorants increased dramatically in 2010 to 19 million young salmon compared to the 2009 estimate of 11.1 million. Apparently, alternative prey were less available to the cormorants in 2010, and (2) the program of lethal removal of certain sea lions at Bonneville Dam was halted by the U.S. Court of Appeals. The Court ruled that NOAA had not adequately explained its finding that sea lions are having a "significant negative impact" on the decline or recovery of listed salmonid populations given earlier factual findings by NOAA that fisheries that cause similar or greater mortality among these populations are not having significant negative impacts and that NOAA had not adequately explained why a California sea lion predation rate of 1 percent would have a significant negative impact on the decline or recovery of these salmonid populations. These two issues indicate that research beyond documenting the number of salmonids taken by predators and the effect of these losses on survival rates is needed, i.e., what is the effect, if any, on the returning adult salmon stocks? Research on predation needs to be better focused and perhaps combined to address the big question regarding effects on returning adult salmon populations after factoring mortality rates in the ocean and estuary. What influence does juvenile salmonid loss to other consumers (bird and fish predators) have on the adult return rate of the various salmon stocks? What are the impacts of hatchery practices on predator abundance; are they taking mostly hatchery fish? Likewise, what does the adult loss due to sea lions have on the adult return of the various stocks? Can the adult fish stocks taken by sea lions be identified (and take estimated) based upon when the various stocks move through the Bonneville ladders? How do ocean conditions and Columbia River flow and temperatures in the estuary influence forage fish availability to sea birds in the estuary?

One of the projects (1990-077-00) is the BPA predator control project focused on the native northern pikeminnow, and the ISRP has frequently reviewed this project and given it favorable reviews as a successful and well-justified project. The only recent qualification has been that the ISRP has recommended that the proponents pursue or continue with development of a model to evaluate the significance of the pikeminnow removals for increasing SARs (basically the same concept as mentioned above for bird and mammal predators). The proponents have indicated that they are pursuing this. The other predation project (2008-719-00) has just started and is studying the impacts of non-native fish predators such as smallmouth bass on salmonid populations, and along with project 2007-275-00, which is focusing on the impacts of American shad competition with juvenile salmonids, has promise to improve our understanding of the impact of non-native fishes in the Columbia River Basin. In general, the impacts of invasive species are poorly understood and more work is needed.

The ISRP recommends that the proponents/investigators of this group of projects increase their coordination to more fully understand the role of predation/competition as a potential

impediment to recovery of listed salmonid stocks in the context of reservoir food webs. Perhaps it should be asked what stocks are taken and to what extent by the various predators, and then evaluate the findings on a stock-by-stock basis in an attempt to sort out population effects (perhaps the confounding effect of ocean conditions could be eliminated/minimized with this type of stock by stock approach). On an individual project basis, some nice work has been accomplished. Some large-scale life cycle population modeling is in order, especially with respect to the role of predators as a group. The importance of various predators (or predators as a group) is going to be asked time after time in the future. A unique point for this group of projects is that most of the predators of greatest concern are native species, which is an indication that the system has been greatly modified and is out of balance. Further work on anticipated effects of climate change and the interaction of invasive species is warranted.

7. Lamprey

Italicized projects are contextual.

Number	Title	Proponent	Purpose and Emphasis	Primary Monitoring
2008-524-00	Implement Tribal Pacific Lamprey Restoration Plan	CRITFC	Hydrosystem RM and E	None assigned
1994-026-00	Pacific Lamprey Research and Restoration Project	NOAA, Umatilla Confederated Tribes (CTUIR)	Programmatic RM and E	None assigned
2002-016-00	Evaluate the Status of Pacific Lamprey in the Lower Deschutes River	Confederated Tribes Of Warm Springs	Programmatic RM and E	None assigned
2007-007-00	*Determine Status and Limiting Factors of Pacific Lamprey in Fifteenmile Creek and Hood River subbasins, Oregon*	*Confederated Tribes of Warm Springs*	*Programmatic RM and E*	*None assigned*
2008-308-00	*Willamette Falls Lamprey Escapement Estimate*	*Confederated Tribes of Warm Springs*	*Programmatic RM and E*	*None assigned*
2008-470-00	*Yakama Nation Ceded Lands Lamprey Evaluation and Restoration*	*Yakama Confederated Tribes*	*Programmatic RM and E*	*None assigned*

The ISRP reviewed two lamprey restoration projects (1994-02600) for the Umatilla River (proponents National Oceanic and Atmospheric Administration (NOAA), Umatilla Confederated Tribes (CTUIR)) and 2002-01600 for the Deschutes River (proponents Confederated Tribes of Warm Springs). There are also projects underway in Fifteenmile Creek and Hood, Willamette, Klickitat and Yakima Rivers. In addition CRITFC is working on a Master Plan for all tribal lamprey research in the Basin and there are major USACE projects in the mainstem Columbia River dealing with lamprey passage issues under the AFEP program.

The ISRP recognizes the significant progress being made by studies on the little-known Pacific lamprey, a key anadromous species from a tribal cultural point of view and also possibly an important species for bringing marine-derived nutrients to tributary ecosystems (ISAB 2009-3).

However, the ISRP is concerned that we were unable to get an overall synthesis of results from all the restoration projects in the Basin. Some of them were started over a decade ago, and a summary of results should be available and is required to guide future lamprey restoration efforts. Justifiably, the proponents in the RM&E review concluded that this was not their task as their mandate was restricted to their particular subbasin. Some of the key questions that need to be addressed in the synthesis are:

- What are the general conclusions of the studies to date? Are lamprey recovering in the Basin?

- What has emerged as primary limiting factors for lamprey basinwide? The ISRP noted that lamprey are declining coastwide, suggesting that ocean factors are affecting survival, but no studies are being conducted in the marine environment. Lamprey are also likely very susceptible to contaminant effects but very limited work is being done on this aspect. Most proponents are focusing on key limiting factors are in tributary habitat but the ISRP, as well as ISAB (2009-3) has pointed out this approach is too restrictive for anadromous lamprey. A comparison of lamprey stocks in various rivers might be useful, including those outside the Columbia River Basin.

- What are the major impediments to implementation of recovery plans? Will mainstem passage problems be resolved to enable sufficient numbers of adults to migrate into tributaries to initiate recovery in synchrony with translocation and habitat improvements such as ramps on low head dams and irrigation screens?

- Is the draft lamprey Master Plan working to guide recovery efforts completed?

- Are study designs and sampling methods coordinated among projects? Some proponents noted that key technical issues, such as sampling efficiency for juvenile lamprey during instream trapping, have yet to be resolved. Others did not, suggesting increased communication among groups is needed. The ISRP is therefore concerned that data may not be comparable between projects.

- What are the escapement goals for lamprey, recognizing that development of these metrics is difficult because of lack of historical information?

- What is the status of lamprey in various subbasins and can a comparison of their status inform an analysis of limiting factors?

- Comparative data on the non-anadromous brook lamprey might help determine if limiting factors in the ocean are important for the Pacific lamprey.

The ISRP suggests that the Inter-Agency Lamprey Technical Working Group would be a possible group of experts that could write a basinwide synthesis including major conclusions that could be drawn at this point with supporting evidence, status and trends, and a candid evaluation of whether tributary habitat projects are improving lamprey returns. A draft outline could be developed based on comments from this RM&E review, other project reviews, and ISAB suggestions (ISAB 2009-3). The ISAB should review the synthesis.

8. Sturgeon

Italicized projects are contextual.

Number	Title	Proponent	Purpose and Emphasis	Primary Monitoring
1986-050-00	Evaluate Sturgeon Populations in the Lower Columbia River	ODFW	Habitat RM and E	None assigned
2007-155-00	*Develop a Master Plan for a Rearing Facility to Enhance Selected Populations of White Sturgeon in the Columbia River Basin*	*CRITFC*	*Programmatic RM and E*	*None assigned*
2008-504-00	*Sturgeon Genetics*	*CRITFC*	*Programmatic RM and E*	*None assigned*
2008-455-00	*Sturgeon Management*	*Yakama Confederated Tribes*	*Artificial Production Supplementation*	*None assigned*

A review of four Projects (1986-050-00, 2007-155-00, 2008-504-00, and 2008-455-00), the draft White Sturgeon Monitoring Strategy, and related studies resulted in the identification of five data gaps. No duplication of effort was found. This section does not cover the Kootenai River white sturgeon (a defined, isolated and endangered ESU) because that proposal is part of the resident fish categorical review and a Step Review.

The five gaps were:

1. An effective basinwide management plan for white sturgeon is lacking and is the most important need for planning future research and restoration.

   It is not agreed upon whether the best long-term approach is to emphasize recovery of wild sturgeon wherever possible or to turn the Columbia Basin white sturgeon into predominantly, and perhaps almost exclusively, a hatchery-maintained species. Our understanding of factors affecting recruitment of wild fish (partly but incompletely dealt with under 1986-050-00), development of individual projects related primarily to hatchery development (2007-155-00, 2008-455-00), and genetic research (2008-504-00) are being conducted without a well thought out basinwide plan for sturgeon recovery. A unified vision is not embodied in these projects individually or in aggregate. This process of crafting a basinwide plan was begun in earnest with the 2009 Sturgeon Workshop in Boardman, Oregon and will continue this January 26-27, 2011 with a second meeting in Boardman. It is important that agencies develop a unified, consistent basinwide plan from these meetings and not just agree to disagree on how sturgeon will be managed. They must also reconcile how proposed hatchery programs upriver will provide adequate protection for the large wild fish population below Bonneville Dam as well as remaining wild fish above Bonneville Dam. Large numbers of hatchery fish released above Bonneville Dam may negatively affect wild fish through diseases and density-dependent growth and survival. Our understanding of these issues for this species is in its infancy.

2. Specific factors affecting recruitment of white sturgeon are poorly understood.

   Despite more than a quarter century of research (1986-050-00; Beamesderfer and Nigro 1993[4]), it is not clearly understood exactly why sturgeon reproduction and recruitment are much greater below Bonneville Dam than elsewhere in the Basin. Overall, poor recruitment of all wild sturgeon (i.e. attainment of a size large enough to escape predation by most fishes) is a critical concern worldwide and the Columbia River Basin is no exception. Parsley at al. (1993[5]) reported much greater recruitment of sturgeon below Bonneville Dam than in the three reservoirs below McNary Dam. The fish below Bonneville Dam are the critical remaining linchpin of wild sturgeon reproduction and recruitment (past age-1 and older); they provide the last truly viable fishery of any size in the Basin. The rest of the populations are so depleted and recruitment is so poor that harvest fisheries are marginal and perhaps not sustainable in the long term.

   The exact causes of this differential recruitment above and below Bonneville Dam are unclear (Parsley et al. 2002). Parsley et al (1993) suggested that the causes of the differences were low broodstock numbers and loss of good spawning habitat above Bonneville Dam. Project 1986-050-00 has suggested based on several past studies (compiled in Beamesderfer and Nigro 1993) that a combination of flows, turbidity, and other factors affect recruitment success. One difference below Bonneville Dam from above might be the lack of slack water habitat and lack of standing water below; that might make young fish less susceptible to sight-feeding predation by predators well adapted to lakes and reservoirs. Another hypothesis is that accumulation of contaminants in pools above Bonneville Dam has negatively affected the sturgeon and their ability to reproduce. (http://www.spokesman.com/stories/2006/apr/09/pollution-may-be-factor-in-sturgeon-decline). In this scenario, the constant flow of water below Bonneville results in less accumulation of contaminants there. In years when successful year classes result, the importance of food availability at critical early life stages needs to be understood (Parsley et al. 2002).

   It is important that researchers develop, evaluate, and test specific hypotheses about what the limitations are in the pools above Bonneville Dam compared to the river below Bonneville Dam, with the ultimate outcome of providing scientific information on recruitment relevant to dam operations and impacts. Dealing with this data gap is more critical than much of the work outlined in the "White Sturgeon Monitoring Strategy" where efforts are directed at monitoring the lack of recruitment without adequate attention to determining why natural (wild) recruitment is so poor and what can be done

[4] Beamesderfer, R. C. and A. A. Nigro. 1993. Status & Habitat requirements of the white sturgeon populations in the Columbia River downstream from McNary Dam. 2 volumes. Bonneville Power Administration, Division of Fish and Wildlife Project 86-50. Portland, Oregon.

[5] Parsley, M. J., P. J. Anders, A. I. Miller, L. G. Beckman, and G. T. McCabe, Jr. 1993. Factors affecting spawning and recruitment of white sturgeon in the Columbia River downstream from McNary Dam. Pages 61-79 *in* Beamesderfer, R. C. and A. A. Nigro, editors. Status & Habitat requirements of the white sturgeon populations in the Columbia river downstream from McNary Dam. Volume 1. Bonneville Power Administration, Division of Fish and Wildlife Project 86-50. Portland, Oregon.

about it. Lacking natural recruitment, and not knowing why we do not have it and where the natural bottlenecks to recruitment are, the most obvious alternative is hatchery proliferation and the long term prognosis for wild sturgeon is unclear. With recruitment, efforts can be focused on sound harvest management, science-based habitat improvement and determination of beneficial dam operation changes.

3. The importance of the estuary and ocean in sturgeon production below Bonneville Dam is poorly understood.

   Important aspects of estuary and ocean rearing of white sturgeon are poorly understood region-wide (e.g., Levings and Nelson 2003[6]). More needs to be known about the amount of production of sturgeon below Bonneville Dam that results from estuary and ocean rearing. Studies need to be conducted to assess the seasonal, annual, and lifetime movements of sturgeon of various sizes and ages to and from estuary, ocean, and lower river habitats. We also need to know the percentage of sturgeon by size, age, and sex making those movements between areas. These data needs can be met with combinations of acoustic telemetry studies using arrays of detectors in place for other studies. Conventional tagging studies and otolith and possibly fin ray microchemistry will also be useful to identify patterns of movements.

4. The productivity of pools above Bonneville Dam for sturgeon is poorly understood.

   Agencies and tribes proposing and conducting research above Bonneville have established goals to rebuild fish numbers in those pools to levels similar to below Bonneville Dam. It is not known if this goal is achievable; productivity of sturgeon in the reservoir pools compared to historical riverine habitats is poorly documented. The evidence is not clear that these fragmented reservoir habitats can support significant sustainable harvest of sturgeon. Many sturgeon historically harvested upriver may not necessarily have recruited nor reared there.

   The patterns of movements from river–estuary-ocean and resulting growth rates below Bonneville Dam (Data Gap 3) can be combined with feeding studies to compare with growth rates and reproductive periodicity (the latter estimated under 1986-050-00) of fish in pools above Bonneville Dam. Insight will be gained into the actual potential of the pools for sturgeon productivity compared to the area below Bonneville Dam. Well-designed food web studies among sturgeon and other key species may provide insights into factors affecting the current capacity of inter-dam pools for sturgeon. It makes little sense to set a goal resulting in over-stocking sturgeon in upper pools hatchery fish when the actual carrying capacity for the species may be much lower than hoped.

5. Consideration of adaptive management approaches should include a review of harvest regulations with the intent of facilitating the efficient, low cost acquisition of creel data needed for stock assessment.

[6] Levings, C. D. and W. A. Nelson 2003. Review of potential critical habitats for white sturgeon (*Acipenser transmontanus*) in the Fraser River estuary. Canadian Science Advisory Secretariat Research Document 2003/099. Ottawa, Ontario, Canada.

Effectiveness of sampling of the fisheries, especially sport fisheries basinwide could be improved. Information on the fisheries provided under 1986-050-00 indicated that harvest management regulations have been quite static for these fish over the past few decades. The harvest slot approach has had a positive effect protecting broodstock, but prevents the acquisition of important data on large mature fish. Where harvest exists, collecting creel data on these very valuable fish is difficult and expensive to obtain because fishing seasons are long and open areas are expansive. Harvesters have few requirements placed upon them for reporting catches of these very valuable individual fish. The best way to more effectively and less expensively creel fish to effectively monitor these sport-caught fish and meet program objectives may be to develop some meaningful season area restrictions, as has occurred for sturgeon in many other locations. Such outside the box thinking might be pursued in cooperation with other agencies as part of the critically needed sturgeon basinwide plan. In that way, harvest could be concentrated spatially and temporally, the creeled fish concentrated in area and time, and creel data vital to maintaining these fish could be more easily obtained. One aspect of adaptive management is that regulations can be set to provide a successful positive feedback loop for data acquisition needed for research, monitoring and evaluation. For high valued individual fish such as sturgeon, such restrictions are more easily justifiable and defensible than for other species.

We suggest that a clear, unambiguous basinwide plan be developed that addresses these data gaps, and a better understanding of the factors limiting recruitment be developed before instituting widespread, uncoordinated expansion of hatchery programs in the Basin. A review of the projects indicates that some agencies and tribes are proposing and implementing major hatchery recovery efforts (e.g., 2007-155-00, 2008-455-00) without understanding the causes of recruitment failure; they have essentially given up on natural recruitment of wild fish to rebuild populations in pools above Bonneville Dam. This may be the appropriate conclusion, but that conclusion should be an outcome of basinwide plan discussions and some scientific evidence of the factors clearly preventing natural recruitment in various localities. The potential impacts of greatly increased hatchery production on wild fish are not known, and the long generation time for sturgeon makes an assessment much more difficult than for fish such as salmon with short generation times. Without overstating the issues, sturgeon management, research, and restoration in the Basin are at an important crossroad.

In evaluating the status of sturgeon in the Basin, the coordinated basinwide plan will have to interpret genetics data and decide the appropriate level of stock specificity for managing the sturgeon in the Basin. The genetics project (2008-504-00) has the potential to provide adequate knowledge of stock specificity. Once the basinwide plan is completed and preliminary data are available on genetic diversity of sturgeon in the mid-Columbia, more robust experimental designs for both fish collections and data analysis throughout the basin should be developed and peer reviewed. This work should be conducted under a unified proposal to avoid duplication of effort. It is important that the new generation of sturgeon studies address the gaps recognized from the past generation of important studies (i.e., Beamesderfer and Nigro 1993) and not merely repeat the older studies.

9. Habitat Action Effectiveness Monitoring – Basinwide

A. IMWs, CHaMP, ISEMP, and Status and Trends Monitoring

Italicized projects are contextual.

Number	Title	Proponent	Purpose and Emphasis	Primary Monitoring
2003-017-00	Integrated Status and Effectiveness Monitoring Program (ISEMP)	National Oceanic and Atmospheric Administration (NOAA)	Programmatic RM and E	Fish population status; Tributary habitat conditions and limiting factors; Effectiveness of tributary habitat actions
2010-082-00	PNAMP Integrated Status and Trends Monitoring (ISTM) Demonstration Project	ODFW, OSU, USGS, WDFW, BioAnalysts Inc, Lwr Columbia Fish Recovery Brd, WDOE	None assigned	None assigned
1998-019-00	Wind River Watershed	Underwood Conservation District (UCD), USFS, USGS, WDFW	Habitat RM and E	Fish population status; Tributary habitat conditions and limiting factors; Effectiveness of tributary actions
2010-035-00	*Abundance, Productivity and Life History of Fifteenmile Creek Winter Steelhead*	*Oregon Department Of Fish and Wildlife (ODFW)*	*Programmatic RM and E*	*Fish population status*
1996-035-01	Yakama Reservation Watershed Project	Yakama Confederated Tribes	Habitat Restoration and Protection	Fish population status; Evaluate tributary habitat conditions and limiting factors
2010-030-00	*Project to provided VSP Estimates for Yakima Steelhead MPG*	*Yakama Confederated Tribes*	*Programmatic RM and E*	*Fish population status; Tributary habitat conditions and limiting factors; Selective harvest; Hatchery effectiveness*
2010-028-00	*Implement a Rotating Panel Sampling of Small Steelhead Streams to Establish Abundance Indices for the Streams*	*Washington Department of Fish and Wildlife (WDFW)*	*Habitat RM and E*	*Fish population status*
2010-042-00	*Tucannon Expanded Pit Tagging*	*WDFW*	*Habitat RM and E*	*Fish population status; Hatchery effectiveness; Hatchery critical uncertainties*

2002-053-00	Asotin Creek Salmon Population Assessment	WDFW	Habitat RM and E	Fish population status; Selective harvest investigations
2009-004-00	*Monitoring Recovery Trends in Key Spring Chinook Habitat Variables and Validation of Population Viability Indicators*	*CRITFC*	*Habitat* *RM and E*	*None assigned*
2010-032-00	*Imnaha River Steelhead Status Monitoring*	*Nez Perce Tribe*	*Programmatic* *RM and E*	*Fish population status; Tributary habitat conditions and limiting factors; Selective harvest investigations; Monitor hatchery effectiveness; Hatchery critical uncertainties*
2002-068-00	Evaluate Stream Habitat- Nez Perce Tribe Watershed Monitoring and Evaluation (M&E) Plan	Nez Perce Tribe	Programmatic RM and E	Tributary Habitat and Limiting Factors
2003-022-00	Okanogan Basin Monitoring & Evaluation Program (OBMEP)	Colville Confederated Tribes	Programmatic RM and E	Fish population status; Performance within the FCRPS; Coordination
2010-075-00	Upper Columbia Implementation and Action Effectiveness Monitoring	Upper Columbia Salmon Recovery	Programmatic RM and E	Evaluate tributary conditions and limiting factors
2009-002-00	*Status and Trend Annual Reporting*	*Yakama Confederated Tribes*	*Programmatic* *RM and E*	*Fish population status*
2010-034-00	*Upper Columbia Spring Chinook and Steelhead Juvenile and Adult Abundance, Productivity and Spatial Structure Monitoring*	*WDFW*	*Programmatic* *RM and E*	*Fish population status*

The ISRP needs to review the Columbia Habitat Monitoring Program (CHaMP) methods and protocols in detail to ensure they will satisfy the habitat status and trends needs in the Council's Fish and Wildlife Program. The designation of Intensively Monitored Watersheds (IMWs) by project sponsors appears to have greatly expanded in the Basin, but whether these watersheds include the carefully controlled large-scale restoration projects envisioned in the original plan for IMWs is somewhat unclear. Often, an IMW component has been tacked onto an ongoing status and trends project, e.g., in the Grande Ronde and Umatilla projects (this is not to imply that those projects do not qualify for IMW status; rather, that the IMW designation seems to have been added after the fact). A lot of data will be collected, and currently it is uncertain that the analytical methods will be sufficient to produce meaningful results in terms of understanding the effects of habitat restoration actions. This topic should be revisited when the ISRP again reviews the Integrated Status and Effectiveness Monitoring Program (ISEMP) project.

Projects added to the ISEMP/IMW/CHaMP network are generally justified, but were difficult to review and understand when linked to existing projects. The ISRP recommends that the 20+ Intensively Monitored Watersheds be reviewed by the ISRP as part of a larger effort that

attempts to identify the signature of habitat improvement actions on target species at the watershed scale. Without a more in-depth and thorough review, it is difficult to ascertain whether or not there is redundant or excessive RME effort within these projects. Here, again, a focused workshop is recommended that utilizes the techniques and protocols of an adaptive environmental assessment approach, where response variables are carefully and selectively chosen, and where simulation models are developed to assess potential outcomes and assist development of the design of field experiments. Some projects seem to try to measure and analyze all factors in a multivariate correlation approach, which may prove too costly and ineffective.

The habitat status and trend data are becoming prolific, as are opportunities for analyses that would inform management actions and test hypotheses. Data quality has improved over the years with the establishment of standardized monitoring protocols. The evaluation component of habitat RME should be emphasized in order to ensure that useful management information is being extracted from the data. What management actions and what positive measurable outcomes can be associated with the habitat status and trend data? With the plethora of data that will be collection from newly planned ISEMP projects, methods of data analysis that can be broadly applied are badly needed. ISEMP has indicated that they are developing these methods.

A conference on the results of habitat monitoring may help spur the dialogue. The ISRP recommends such a conference as a MERR State of the Science workshop. The conference might include summaries of IMW research with regard to habitat action effectiveness. In addition, integration of habitat restoration actions with emerging knowledge of ocean status and trends, and climate change, could be discussed. Previous studies on whole-watershed restoration effectiveness have been confounded by the effects of ocean and adult fish return rates on subsequent fry and juvenile recruitment. The factors must form an integral part of the evaluation of watershed restoration effectiveness. Hatchery monitoring in small tributary systems seems to be moving toward integration with habitat status and trend RM&E so that hatchery and habitat actions are coordinated. This topic would also be appropriate for the workshop.

It is clear that there is still insufficient coordination among practitioners of different habitat restoration actions. Organizations engaged in improving water quality, enhancing physical and/or nutrient instream habitat, protecting and rehabilitating riparian areas, restoring fish passage, or acquiring water rights too often seem to be unaware of what others are doing. There is comparatively little evidence that habitat effectiveness monitoring is being coordinated in such a way that monitoring programs can take advantage of multiple restoration actions occurring in the same area, at least at the subbasin scale. Perhaps the emergence of the new regional "umbrella"-type projects can facilitate better coordination and more cost-effective monitoring actions.

Theoretically, programs and data management and analysis tools being developed through ISEMP and Pacific Northwest Aquatic Monitoring Program (PNAMP) will help to address communication problems. If these efforts help to ensure consistency in data collection techniques and encourage integration and coordination among the many groups collecting habitat data in the basin, the programs will represent a major step forward. Their adequacy could be examined as part of an ISEMP workshop on CHaMP and when the individual programs implementing CHaMP provide more detail on their approach.

B. Miscellaneous Habitat RME

Italicized projects are contextual.

Number	Title	Proponent	Purpose and Emphasis	Primary Monitoring
2010-051-00	Upper Columbia Water Quality and Water Quantity Gauges	Cascadia Conservation District, Washington Department of Ecology	Habitat RM and E	Tributary habitat conditions and limiting factors; Evaluate tributary habitat actions
2007-252-00	Hyporheic Flow Assessment in Columbia River Tributaries	Umatilla Confederated Tribes (CTUIR)	Habitat RM and E	No Assignment
2009-008-00	*Climate Change Impacts*	*CRITFC*	*Programmatic*	*No Assignment*

The ISRP applauds projects that are investigating habitat-related topics that have not received a great deal of attention. These include the CTUIR hyporheic flow assessments and the CRITFC study of climate change impacts. The value of the CTUIR project not only is in understanding hyporheic processes but in using this understanding in evaluating the effectiveness of habitat enhancement actions and in understanding salmonid use of hyporheic influenced areas. We hope that this and future hyporheic studies will evaluate hyporheic influences on reach scale thermal refugia along stream margins and in side channels. Thermal refugia along stream margins and in floodplains can provide important habitats for salmonids even if hyporheic processes have little influence on mainstem temperatures, and these refugia may become increasingly critical for salmon and trout with climate change.

C. Water Transactions

2002-013-01	Water Entity - Water Transaction Program	National Fish and Wildlife Foundation	Habitat Restoration/ Protection	Tributary habitat implementation; Effectiveness of tributary habitat actions

The ISRP feels that some progress is being made in understanding the effects of the extensive water acquisition program. We remain concerned that monitoring may not get the attention it deserves, but the project proponents satisfactorily addressed the majority of our questions. The Water Transaction Program should complete the development of compliance, implementation, and effectiveness monitoring protocols as soon as possible. Given the lead entity is the National Fish and Wildlife Foundation, the proponents should be able to develop their monitoring program fairly quickly.

Cost monitoring and evaluation of water transactions is needed. Thirty six percent of the Program's budget is for program administration through support of Qualified Local Entities

(QLEs). This is a big investment, and CBWTP should systematically evaluate how to keep acquisition and administration costs as low as possible. They could provide some analytical evidence justifying the budget needed to develop and implement water transactions. Costs of different approaches could be summarized at annual meetings so that QLEs can learn from each other how best to conduct acquisitions in a cost-effective manner. The consultant's evaluation report did not address the question of administrative efficiency or cost per acre foot of leased or acquired water under different acquisition strategies. Such an analysis could include a comparison of the annualized costs for a lease (with the accompanying multiple transaction costs) and outright permanent acquisitions (with the one-time accompanying transaction).

D. Nutrient Enhancement

Italicized projects are contextual.

Number	Title	Proponent	Purpose and Emphasis	Primary Monitoring
2008-471-00	*Upper Columbia Nutrient Supple*	*Yakama Confederated Tribes*	*Habitat RM and E*	*Evaluate Tributary habitat conditions and limiting factors*
2008-904-00	*Salmon River Basin Nutrient Enhancement*	*Shoshone-Bannock Tribes*	*Habitat RM and E*	*None assigned*
2007-332-00	*Mitigation of Marine-Derived Nutrient Loss in Central Idaho*	*IDFG*	*Habitat RM and E*	*None assigned*

Nutrient enhancement projects appear to be increasing, but the ISRP cautions that this type of restoration is still largely experimental. The ISRP is pleased that habitat managers are beginning to consider food webs in freshwater restoration projects (also see the pending ISAB Food Web report, scheduled for completion in January 2011). However, there appears to be a perception growing among managers in the Basin that nutrient supplementation has been conclusively shown to be effective, leading to an increasing desire to implement this strategy on an operational basis. The ISRP believes that the effects of nutrient supplementation are not fully understood and any application should be treated as experimental. Careful monitoring of current and future nutrient supplementation projects is essential in order to help us understand whether adding nutrients to streams is having the desired effects. Such studies may be particularly effective if located in an area where Programmatic Habitat projects are being implemented, such as in the Upper Columbia.

Nutrient-related RME projects should address the following questions and topics:

1. What are the cumulative effects over space and time of repeated nutrient additions? How many sites will be needed in a watershed to detect significant nutrient effects? How much nutrient supplementation is too much? How does nutrient supplementation affect downstream nutrient spiraling over time? What physical and chemical forms of nutrient supplementation (e.g., inorganic nitrogen and phosphorus additions, fish carcasses, carcass analogs, etc.) provide the most cost-effective responses? What are the long-term effects of nutrient additions over time (years) and space (multiple tributaries) within a subbasin?

2. What are the specific downstream ecosystem impacts, in terms of biological community changes, of nutrient addition projects?

3. Non-linear responses as nutrients pass through trophic levels from nutrient supplementation should be expected. Some research has suggested that it is easy to move from oligotrophic to mesotrophic and eutrophic states with relatively small nutrient releases, perhaps with undesired results. The range of fish community responses explored thus far has been limited; more work is required to enhance our understanding of these processes in various environments and fish communities.

4. What are the public perceptions of controlled nutrient additions on drinking water, especially if nutrients are sourced from treated wastes?

5. What is the most effective time of year and formulation to introduce nutrients to streams in order to achieve the desired responses?

6. How do nutrient additions intended to benefit salmon and steelhead affect resident fish species?

7. Of the marine-derived nutrients recruited to streams naturally (and through nutrient supplementation), how much is exported from watersheds through smolt emigration?

8. How do nutrient additions affect target populations – density or growth changes, or both?

9. How does the presence of hatchery fish or hatchery effluent affect the nutrient load of a stream?

10. How effective is placement of carcasses by field crews in contrast to carcasses introduced through natural spawning?

The ISRP also believes that there is insufficient communication among the projects evaluating nutrient supplementation. A meeting (annually?) among teams conducting this type of research would help coordinate these projects and ensure efficient exchange of the most current information on this subject.

10. Hatchery effectiveness, Impacts and Reform (HSRG & HGMPs) – Basinwide

There are unrelated genetic and hatchery reform/assessment projects considered in this programmatic section: direct hatchery reform efforts, relative reproductive studies, research investigations of genetic causation of relative reproductive success/natural selection, genetic marker applications in status and trend and harvest management, and implementation of gamete preservation efforts.

A. Genetics

Italicized projects are contextual.

Number	Title	Proponent	Purpose and Emphasis	Primary Monitoring
1989-096-00	Genetic Monitoring and Evaluation (M&E) Program for Salmon and Steelhead	NOAA	AP RM and E	Selected harvest investigations; Hatchery effectiveness; Hatchery critical uncertainties
2002-030-00	Salmonid Progeny Markers	Umatilla Confederated Tribes (CTUIR)	AP RM and E	Selected harvest investigations; Hatchery critical uncertainties
2008-907-00	*Genetic Assessment of Columbia River Stocks*	*CRITFC*	*Programmatic* *RM and E*	*Selected harvest investigations*
2009-005-00	*Influence of Environment and Landscape on Salmonid Genetics*	*CRITFC*	*Programmatic* *RM and E*	*None assigned*
2010-026-00	*Chinook and Steelhead Genotyping for Genetic Stock Identification (GSI) at Lower Granite Dam*	*IDFG*	*Programmatic* *RM and E*	*Fish population status;* *Selected harvest investigations*
2010-031-00	*Snake River Chinook and Steelhead Parental Based Tagging*	*IDFG*	*Programmatic* *RM and E*	*Fish population status;* *Selected harvest investigations*

The region has undertaken an effort to develop single nucleotide polymorphism (SNP) markers for salmon and steelhead population discrimination. Developing this marker type was encouraged by the ISRP and ISAB in their tagging review (ISAB/ISRP 2009-1). This marker development is well justified. The region is also exploring the use of these markers to identify and enumerate Snake River steelhead and Chinook salmon at the population level at Lower Granite Dam – investigations referred to as GSI (genetic stock identification). The final extension of using SNP markers is to develop Parental Based Tagging (PBT) of hatchery salmon and steelhead for use in both harvest and hatchery broodstock management. PBT has the potential to complement or replace CWT management of harvest (see CWT section above). The ISRP believes these methods will yield important efficiencies in managing harvest and hatcheries and are justified. There are no apparent duplications of effort in this area.

B. Relative Reproductive Success Studies

Number	Title	Proponent	Purpose and Emphasis	Primary Monitoring
2003-039-00	Monitor and Evaluate (M&E) Reproductive Success and Survival in Wenatchee River	NOAA, WDFW	AP RM and E	Fish population status; Tributary habitat conditions and limiting factors; Selected harvest investigations; Hatchery critical uncertainties

2003-050-00	Evaluate the Reproductive Success of Wild and Hatchery Steelhead in Natural and Hatchery Environments	University of Washington	AP RM and E	Selected harvest investigations; Hatchery critical uncertainties
2003-054-00	Evaluate the Relative Reproductive Success of Hatchery-Origin and Wild-Origin Steelhead Spawning Naturally in the Hood River	Oregon State University	AP RM and E	Fish population status; Selected harvest investigations; Hatchery critical uncertainties
2003-063-00	Natural Reproductive Success and Demographic Effects of Hatchery-Origin Steelhead in Abernathy Creek, Washington	US Fish and Wildlife Service (USFWS)	AP RM and E	Fish population status; Hatchery critical uncertainties
2007-299-00	Investigation of Relative Reproductive Success of Stray Hatchery & Wild Steelhead & Influence of Hatchery Strays on Natural Productivity in Deschutes	Oregon Department Of Fish and Wildlife (ODFW)	Programmatic RM and E	Investigate hatchery critical uncertainties
2010-033-00	*Study Reproductive Success of Hatchery and Natural Origin Steelhead in the Methow*	*WDFW*	*AP* *RM and E*	*Hatchery critical uncertainties*

Studies of differences in the success of natural spawning by hatchery- and natural-origin salmon and steelhead are important for understanding the potential benefits and costs of using hatchery salmon for conservation and when evaluating the status of natural populations that include a mixture of natural- and hatchery-origin salmon. There are a number of spring Chinook and steelhead projects funded through the Fish and Wildlife Program and others with support from the Lower Snake River Compensation Program, and perhaps other support. There is not, however, a comprehensive summary of the current state of implementation of RRS investigations throughout the Basin. The Columbia River Hatchery Effects Evaluation Team proposal (see below) should be encouraged to develop a current summary of these activities which should continue the progress being made within the basin to develop analyses to inform management decisions.

There are several RRS investigations that have made significant progress, completing the essential reporting for which they were initially implemented. These projects are extending their field and laboratory efforts and expanding the time-frame for the investigations which should provide necessary confirmation of the initial findings and provide important insight into mechanisms for differences in reproductive success between hatchery and natural salmon.

There are also projects that have not been entirely successful in completing the sampling required for a relative reproductive study because of an inability to capture fish or because weirs intended to capture all (or nearly all) adults were inadequate. This finding demonstrates to the ISRP that while the basic strategy of conducting RRS investigations is rigorous and sound, they will not be successful everywhere because of logistical constraints.

There is a large range of relative reproductive success of hatchery-origin salmon and steelhead compared to natural-origin salmon. In most cases, however, hatchery-origin salmon exhibit reduced performance. In many of the investigations the genetic and environmental causes for the reduced performance are confounded in the experimental design. In those circumstances where

genetic and environmental (hatchery domestication) causes of reduced performance can be separately identified, genetic causation has been detected.

C. Hatchery Culture Practices, Evaluation, and Reform

Italicized projects are contextual.

Number	Title	Proponent	Purpose and Emphasis	Primary Monitoring
1993-056-00	*Advance Hatchery Reform Research*	*NOAA*	*AP* *RM and E*	*Monitor hatchery effectiveness*
2009-009-00	*Basinwide Supplementation Evaluation*	*CRITFC*	*AP* *RM and E*	*None assigned*
2010-085-00	Columbia River Hatchery Effects Evaluation Team (CRHEET)	BPA, NOAA	None Identified	None assigned
1997-038-00	Listed Stock Chinook Salmon Gamete Preservation	Nez Perce Tribe	AP RM and E	Implement Safety Net; Selected harvest investigations; Investigate hatchery critical uncertainties
2002-031-00	Growth Modulation in Salmon Supplementation	NOAA, U of W	AP RM and E	Investigate hatchery critical uncertainties

Several projects are currently underway to explore whether modification of growth of fish in a hatchery can be used to generate two-year old steelhead smolts (1993-056-00), and to influence precocious male development in Chinook salmon (2002-031-00). These efforts are important and will likely provide insights into the biology/life-history of propagated salmon that will have implications for understanding natural populations as well. The ISRP continues to caution that these efforts are not a holistic examination of hatchery reform, and that incremental benefits in the hatchery phase of the salmon life-cycle may not yield appreciable improvements in hatchery SARs. Moreover, the effort to make hatchery salmon more like natural salmon might increase ecological interactions and consequently fail to improve total recruitment to fisheries and escapement for natural and hatchery spawning.

Supplementation monitoring and evaluation is improving, a number of reference locations have been compared with treated streams. There are locations, for example winter steelhead in the Umatilla River, where analysis suggests some benefit to natural-origin steelhead abundance from supplementation. Broad-scale analysis of spring Chinook in the Snake River basin does not find that natural-origin salmon abundance is increased in supplemented streams.

11. VSP, Hatchery Effectiveness, and Habitat Effectiveness Monitoring – Gaps and Duplications by Species and Geographic Domain

The geographic sets below are organized by the categories in the Anadromous Salmonid Monitoring Strategy (ASMS), watershed and sub-regions, which is different than the Council's Fish and Wildlife Program provinces.

A. Chum

2008-710-00	*Development of an Integrated strategy for Chum Salmon Restoration in the tributaries below Bonneville Dam*	*WDFW*	*AP Supplementation*	*Implement conservation programs; Monitor hatchery effectiveness*

Chum salmon historically constituted an estimated 6% of the total Columbia River salmon run. Their present numbers constitute less than 1% of their historical levels. Chum counts above Bonneville were never high and have dropped to near zero. Columbia River chum salmon crashed in the 1950s, evidently as a result of a combination of directed and incidental harvest and habitat issues. Abundance has not rebounded and remains at critically low levels.

Based on a review of 2008-710-00 and other relevant documents, we identified three data gaps and needs for progress in chum salmon restoration. No duplications of effort were found with other projects.

Specific ecological causes of chum declines in the Columbia River are unknown. No agency in the region has much specific information on causes of the decline. In a recent review of viability status of Columbia River chum salmon in Oregon by McElhany et al. (2007[7]), no mention was made on factors leading to the observed, documented declines. In 1966, Oakley[8] (p. 16) mentioned "Deleterious watershed activities such as logging, gravel removal, stream diversion, improper road building and construction of impassable barriers such as dams and culverts" as well as "intensified land use" and "decreasing freshwater spawn and rearing area" as possible contributors to Tillamook Bay chum declines. He concluded, though, that "the coast wide decline [in chum stocks] has extended to localities which have not suffered pronounced environmental changes. It thus appears most likely that some climatological or oceanic factor is responsible for the widespread decline in chum stocks." A decade later, Berry (1975[9]) made no mention of factors affecting abundance of chum on Oregon streams. Although increased knowledge of the importance of estuaries has ensued, our knowledge of factors affecting chum declines has lagged. Lacking solid reasons for the declines, traditional culprits are implicated (the 4 Hs, with a clear statement that one H, hatchery effects, were in general minimal) with little insight into

[7] McElhany, P., M. Chilcote, J. Myers, and R. Beamesderfer. 2007. Viability status of Oregon salmon and steelhead populations in the Willamette and Lower Columbia Basins. Part 3: Columbia River Chum. Prepared for ODFW and NMFS.

[8] Oakley, A. L. 1966. A summary of information concerning chum salmon in Tillamook Bay. Fish Commission of Oregon Research Briefs 12(1): 1-17.

[9] Berry, R. L. 1975. Status of chum salmon in selected coastal streams of Oregon Fish commission of Oregon.

specific ecological mechanisms. No limiting factors have been identified. Lack of knowledge of declines makes it difficult for agencies to effectively plan and evaluate mitigation and restoration measures, as well as for the ISRP to evaluate proposed measures. We are not sure exactly what habitat conditions or other mitigation measures should be targeted.

In developing a rationale for chum salmon recovery and restoration more effective reviews of the global chum salmon literature and other supplementation experiences are needed. There is an acute need for those proposing Columbia River chum salmon restoration, supplementation and habitat improvement to review the global literature, evaluate the research evidence and supplementation results from elsewhere, hypothesize why Columbia River stocks have declined, and articulate how specific supplementation and habitat enhancements will be successful in rebuilding Columbia chum stocks.

Meaningful review and field research efforts to identify causes of declines of natural populations of chum salmon are needed before more supplementation activities are planned. What do the "successes" with chum hatcheries, especially in other places such as Puget Sound and Asia where stocks have done much better, tell us about what might happen with supplementation, and why? Other possible factors of importance are size of chum fry (i.e., growth) at a given time (wild fish) or time of release (hatchery fish). Available literature should be used to build arguments for factors leading to declines and for the need for supplementation as the best way to mitigate for the losses. More recent literature, especially from Asia, might prove especially useful.

It is important to identify what bottlenecks and limiting factors proposed actions are intended to correct and which life stages (e.g., egg survival, fry survival, etc.) the supplementation is expected to overcome. None of three in-basin documents[10] discussing the usefulness of supplementation for chums discuss the ecological mechanisms or specific limiting factors that supplementation is intended to circumvent.

State management agencies and other interested agencies and groups in the lower Columbia River should closely coordinate their efforts. Efforts by Washington and Oregon state agencies (WDFW, ODFW) should develop concurrently. Cooperation should include the development of joint research and restoration proposals for chum salmon.

[10] HSRG (Hatchery Scientific Review Group). 2008. Summary of HSRG findings for chum populations in the Lower Columbia River and Gorge. Seattle, Washington. Appendix 7; ODFW Native Fish Status Report (www.dfw.state.or.us/fish/ONFSR/report.asp#chum); LCFRB (www.lcfrb.gen.wa.us/Recovery%20Plans/June%202010%20RP/Vol%201/FINAL_Vol%20I%20Ch%202%20ListedSp%202010%20May.pdf)

B. Sockeye

Italicized projects are contextual.

Number	Title	Proponent	Purpose and Emphasis	Primary Monitoring
2007-402-00	Snake River Sockeye Captive Propagation	IDFG	AP Supplementation	Implement Safety Net Program; Evaluate Tributary habitat conditions and limiting factors; Hatchery effectiveness; Investigate hatchery critical uncertainties;
2008-307-00	*Deschutes River Sockeye Development*	*Confederated Tribes Of Warm Springs*	*Programmatic RM and E*	*None assigned*
2008-503-00	*Studies into Factors Limiting the Abundance of Okanagan and Wenatchee Sockeye Salmon*	*CRITFC*	*Programmatic RM and E*	*None assigned*

Snake River sockeye salmon ESU

The ASMS recommends that for the Snake River sockeye salmon ESU, genetic analysis needs to transition from microsatellite loci to SNPs; PIT tagging needs to be increased to provide accurate and precise juvenile survival, SAR, and dam collection efficiencies; and that limnological characteristics of Sawtooth Valley lakes needs to be monitored to assess lake carrying capacity in association with supplementation efforts.

The primary effort on sockeye salmon in the Columbia River Basin involves conservation of ESA-listed Snake River sockeye salmon using captive brood stock technology to slow the loss of critical population genetic diversity and heterozygosity, and to prevent the populations from going extinct. This effort to maintain genetic diversity seems to be successful to date, and the program has collected important population data. The program appears to be in transition in that a hatchery supplementation program is being added to the ongoing captive brood program. At this stage of "recovery" it would be very useful if the program produced a comprehensive synthesis of available information, including comparisons with characteristics of viable sockeye populations in other regions. The synthesis should evaluate factors affecting survival during each life stage in order to identify key "bottlenecks" where additional focus may be needed to enhance population viability. Additionally, the SARs outlook for Snake River sockeye salmon should be explored while considering reasonable survival scenarios during smolt migration and ocean rearing. This analysis should evaluate what is needed in order to produce a viable, self-sustained population of Snake River sockeye salmon.

Upper Columbia River sockeye salmon ESU

The ASMS recommends that for the Upper Columbia River sockeye salmon ESU, coordination is needed between Canada and the US for the evaluation of hydroacoustic enumeration of Okanogan juvenile sockeye; smolt trap efficiency at Lake Wenatchee needs to be refined;

productivity of Lake Wenatchee needs to be determined for sockeye production; pre-spawning mortality needs to be determined for Okanogan sockeye; and predator-prey interactions need to be investigated for both Okanogan and Wenatchee sockeye populations.

C. Kelt

Number	Title	Proponent	Purpose and Emphasis	Primary Monitoring
2008-458-00	*Steelhead Kelt Reconditioning*	*Yakama Confederated Tribes*	*AP RM and E*	*Implement Conservation Program; Investigate hatchery critical uncertainties*
2007-401-00	Kelt Reconditioning and Reproductive Success Evaluation Research	Columbia River Inter-Tribal Fish Commission (CRITFC)	AP RM and E	Implement Conservation Program; Selected harvest investigations; Investigate hatchery critical uncertainties

In an effort to increase the abundance and productivity of steelhead in the Columbia River Basin the 2008 Biological Opinion for the Federal Columbia River Power System called for actions to increase survival of kelts (repeat spawning steelhead) through improved in-river survival, collection and transport of kelts, long-term reconditioning to increase female kelt abundance, and feasibility research to address uncertainties associated with these approaches.

Projects 2007-401-00 and 2008-458-00 are conducting research to investigate the feasibility and survival associated with steelhead kelt transport, short-term, and long-term reconditioning. Results from 2007-401-00 provided much of the information to develop the 2009-2010 Kelt Management Plan (dated February 1, 2010).

The ISRP concludes that project 2007-401-00 has made significant progress in providing data that is essential for understanding iteroparity in steelhead and estimating potential benefits to the recovery of steelhead ESUs, MPGs, and independent populations from the implementation of actions to improve kelt abundance through short- and long-term reconditioning.

The ISRP recommends that before proceeding with additional kelt reconditioning feasibility and physiology research the Basin co-managers need to establish a well defined kelt management research plan. The key question is whether there is an increase in the natural spawning population abundance in succeeding generations following spawning by reconditioned kelts. This research plan needs to use modeling to estimate the benefit of kelt reconditioning to VSP status of steelhead at the independent population, MPG, ESU, and basin levels at various rates of survival for each of the kelt management alternatives – passage improvements, transport, short-term reconditioning, and long-term reconditioning. With this guidance on the expected benefit from kelt management strategies the co-managers can first determine whether even under the best of outcomes kelt management yields a meaningful improvement in steelhead status. If the conclusion is affirmative subsequent steps should include development of an effective adaptive management experiment to determine whether the benchmark survival thresholds can be

achieved. A decision framework also should be created to outline the success required to justify expanding feasibility experiments to the pilot stage and to determine when levels of performance indicate the program should be discontinued.

The ISRP recommends that a thorough quantitative analysis of anticipated benefits to steelhead VSP parameters is needed as a foundation for pursuing steelhead kelt reconditioning as part of a kelt management effort. The ISRP appreciates that this modeling effort is a basinwide requirement probably beyond the scope of the two kelt projects. But it is required as a foundation before considering the expansion and implementation of kelt reconditioning as an element of steelhead conservation and recovery.

D. Lower Columbia/Estuary Sub-Region

Lower Columbia, Hood River, Wind River, Hamilton Creek

Italicized projects are contextual

Number	Title	Proponent	Purpose and Emphasis	Primary Monitoring
1993-060-00	Select Area Fisheries Enhancement	Clatsop County Fisheries, ODFW, WDFW	AP Harvest Augmentation	Selected harvest investigations
1988-053-03	*Hood River Production Monitoring and Evaluation (M&E)-Warm Springs*	*Confederated Tribes Of Warm Springs*	*AP RM and E*	*Fish population status; Evaluate Tributary habitat conditions and limiting factors; Selected harvest investigations; Hatchery critical uncertainties*
1988-053-07	*Hood River Production Operations and Maintenance (O&M)-Warm Springs*	*Confederated Tribes Of Warm Springs*	*AP Supplementation*	*Fish population status; Selected harvest investigations; Investigate hatchery critical uncertainties*
1988-053-15	*Hood River Artificial Production-Parkdale*	*CTWS, ODFW*	*AP Supplementation*	*None assigned*
1988-053-04	*Hood River Production Monitor and Evaluation (M&E)-Oregon Department of Fish and Wildlife (ODFW)*	*ODFW*	*AP RM and E*	*Fish population status; Evaluate tributary habitat conditions and limiting factors; Selected harvest investigations; Investigate hatchery critical uncertainties*
1988-053-08	*Hood River Production Operations and Maintenance (O&M) and Powerdale*	*ODFW*	*AP Supplementation*	*Fish population status; Investigate hatchery critical uncertainties*

The ISRP has no additional comments on this SAFE project other than those provided in the proposal review or on these "contextual" Hood River subbasin projects beyond those provided in the Step Review for the Hood River Production Program (ISRP 2008-10). See the habitat effectiveness programmatic comments above for comments regarding the Wind River Watershed project #1998-019-00.

E. Middle Columbia River Basin Sub-Region

Cascades Eastern Slope Tributaries – Deschutes River eastside, Deschutes River Westside, Fifteen Mile Creek, Klickitat River, Rock Creek

i. Deschutes

All the projects in this set are contextual.

Number	Title	Proponent	Purpose and Emphasis	Primary Monitoring
2008-306-00	*Deschutes River Fall Chinook Research and Monitoring*	*Confederated Tribes Of Warm Springs*	*Programmatic RM and E*	*Fish population status Monitoring;*
2008-311-00	*Natural Production Management and Monitoring*	*Confederated Tribes Of Warm Springs*	*Programmatic RM and E*	*Fish population status monitoring; Selected harvest investigations;* *Hatchery critical uncertainties*
1998-016-00	*Escapement and Productivity of Spring Chinook and Steelhead*	*Oregon Department Of Fish and Wildlife (ODFW)*	*Habitat* *RM and E*	*Fish population status;* *Selected harvest investigations;* *Monitor hatchery effectiveness*

The fisheries enhancement projects listed above for the Deschutes subbasin were not reviewed as part of this specific review; however, each project has benefited from recent (2008-2010) ISRP review. The three projects are in various stages of planning and implementation and currently do not appear to be well integrated with one another. The long-standing ODFW project 1998-160-00 received a detailed and positive ISRP review. The CTWS project on Deschutes River fall Chinook Research and Monitoring (2008-306-00) appears to be in early stages of development and implementation and will benefit from the ISRP review, while proposal 2008-311-00 was not sufficiently developed to allow review. The proposal materials do not provide sufficient information to determine whether integration of salmon and lamprey work in the subbasin makes efficient use of field resources like traps and weirs.

It appears that projects in the Deschutes subbasin directed toward fall and spring Chinook are in various stages of development and implementation. It might be helpful both for the purposes of review and integration for co-managers to develop a comprehensive fish and habitat monitoring plan to be submitted as part of the upcoming geographic review of habitat restoration projects.

ii. Klickitat

Number	Title	Proponent	Purpose and Emphasis	Primary Monitoring
1988-120-35	*Klickitat River Management, Data and Habitat-Yakima/Klickitat Fisheries Project (YKFP)*	*Yakama Confederated Tribes*	*Artificial Production Local Coordination*	*Tributary Habitat Implementation*
1995-063-35	*Klickitat River Monitoring and Evaluation-Yakima/Klickitat Fisheries Project (YKFP)*	*Yakama Confederated Tribes*	*Artificial Production RM and E*	*Fish population status; Tributary habitat conditions and limiting factors; Selected harvest investigations*
1988-115-35	*Klickitat River Design and Construction-Yakima/Klickitat Fisheries Project (YKFP)*	*Yakama Confederated Tribes*	*Artificial Production Supplementation*	*None assigned*
1997-013-35	*Klickitat River Operations and Maintenance (O&M) for Hatcheries and Acclimation Sites-Yakima/Klickitat Fisheries Project (YKFP)*	*Yakama Confederated Tribes*	*Artificial Production Supplementation*	*None assigned*

The fisheries enhancement projects listed above for the Klickitat subbasin were not reviewed as part of this RM&E and Artificial Production review; however, artificial production related projects in the Klickitat subbasin have been reviewed several times by the ISRP. The projects were reviewed extensively in 2000 as part of the Provincial Review and again in the 2006 Annual Review. In both instances, the ISRP recommended further review of the suite of artificial production projects as part of a single comprehensive Master Plan through the Council's Three-Step Review process.

The Step-1 Review process for the Yakama Nation's Klickitat Anadromous Fisheries Master Plan began in 2004. In 2008, the ISRP found the Master Plan to be well-balanced, relatively thorough plan that met ISRP scientific review criteria and Three-Step Review criteria with a qualification that elements of the steelhead and spring Chinook natural and artificial production plans needed additional detailed explanation. These details, which are needed for both the spring Chinook and steelhead components, are to be developed in the Step-Two submittal.

The 2008 Klickitat Anadromous Fisheries Master Plan reflected some important advances (compared to the previous drafts reviewed by the ISRP) in thinking from traditional enhancement projects. Goals and targets were presented, but require further elaboration and

justification in the Step 2 submittal. Decision management tools would aid that process, along with Consequence Tables to guide management actions and deal with variability and uncertainties in measured and monitored results and actions, including regime shifts and climate change.

iii. Fifteen Mile Creek, Rock Creek, and John Day Dam - Mainstem

2007-156-00	Rock Creek Fish and Habitat Assessment	Yakama Confederated Tribes	Habitat RM and E	Tributary habitat implementation; Evaluate tributary habitat conditions and limiting factors
2008-527-00	John Day Reprogramming & Construction	CRITFC	AP Harvest Augmentation	None assigned

For Fifteenmile Creek, see project 2010-035-00 in the habitat effectiveness section.
For the John Day see project 200301700 (ISEMP) in the habitat effectiveness section and summaries in the ASMS.

iv. Umatilla

Number	Title	Proponent	Purpose and Emphasis	Primary Monitoring
1983-435-00	Umatilla Hatchery Satellite Facilities Operations and Maintenance (O&M)	Umatilla Confederated Tribes (CTUIR)	AP Supplementation	Investigate hatchery critical uncertainties
1989-035-00	Umatilla Hatchery Operations and Maintenance (O&M)	ODFW	AP Supplementation	None assigned
1990-005-00	Umatilla Hatchery Monitoring and Evaluation (M&E)	Oregon Department Of Fish and Wildlife (ODFW)	AP RM and E	Fish population status; Selected harvest investigations; Investigate hatchery critical uncertainties
1990-005-01	Umatilla Basin Natural Production Monitoring and Evaluation (M&E)	Umatilla Confederated Tribes (CTUIR)	AP RM and E	Investigate hatchery critical uncertainties
1989-024-01	Evaluate Umatilla Juvenile Salmonid Outmigration	Oregon Department Of Fish and Wildlife (ODFW)	AP RM and E	Fish population status; Tributary habitat conditions and limiting factors
2008-203-00	Assess Reintroduction of Steelhead in Butte, McKay & Willow Creeks	Umatilla Confederated Tribes (CTUIR)	Programmatic RM and E	Tributary habitat implementation
2008-204-00	Assess Reintroduction of Anadromous Fish in Burnt, Powder & Malheur Rivers	Umatilla Confederated Tribes (CTUIR)	None assigned	None assigned
2009-014-00	Biomonitoring of Fish Habitat Enhancement	Umatilla Confederated Tribes (CTUIR)	Habitat RM and E	Evaluate Effectiveness of tributary habitat actions

The set of proposals describes a highly integrated program to collect critical data on production and survival of steelhead and spring and fall Chinook salmon. This program could provide significant data to assess fish population status and trends and the effectiveness of habitat restoration projects in the Umatilla River. The Chinook artificial production program was recently modified by establishing a "Conservation" group of natural origin broodstock and a "Harvest" group derived from hatchery origin fish. The goal of this program is to develop sustainable natural fall and spring Chinook salmon populations while maintaining harvest benefits.

Most of the gaps in data needs identified in the Anadromous Salmonid Monitoring Strategy (ASMS) for the Umatilla Subbasin are either being addressed or are included in current proposals. The ASMS emphasized a need for habitat status and trend and habitat effectiveness monitoring for the Umatilla, a recommendation also made by the ISRP in their review of the Umatilla Initiative (ISRP 2007-15). A comprehensive, large scale Monitoring and Evaluation program is ongoing in the Umatilla Basin. It currently encompasses and proposes to expand ongoing status and trends monitoring and also proposes to embark on a project to evaluate the effectiveness of habitat restoration actions for steelhead under the auspices of the Columbia Habitat Monitoring Program (CHaMP) following Intensively Monitored Watershed (IMW) protocols (but see programmatic comments on this program in the Habitat Action Effectiveness Monitoring – Basinwide section above).

The M&E program satisfies VSP criteria. Fish in/fish out monitoring will be conducted and will include estimates of abundance, distribution, life history and genetic diversity, and spatial structure for juveniles, outmigrants, and adults, including redd counts. Productivity estimates are proposed including egg-smolt and smolt-adult survival. Expanded marking of juvenile fish and outmigrants in tributaries is planned as part of the IMW habitat effectiveness project, addressing another data gap.

In regard to ongoing steelhead supplementation, the ASMS noted that "Analysis of comparisons of natural and hatchery fish in Umatilla and John Day is lagging and unfunded." Comprehensive evaluation of steelhead supplementation is needed, although some data analysis was presented in a proponent's response to ISRP comments (1990-005-00, Umatilla Hatchery Monitoring and Evaluation). Several of the ongoing projects in the Umatilla are collecting data relevant to steelhead supplementation but it is unclear how these data will be integrated and which entity or project will hold major responsibility for its analysis. A plan or design for assessment of supplementation could have been made clearer in the proposals.

A concern with the new artificial production program is that if not enough fish from the new segregated program return by 2013, the program will be mining wild spawners for broodstock instead of allowing more to spawn naturally and develop a self-sustaining locally-adapted stock. As with supplementation, a plan or design for assessment of the new artificial production program could have been made clearer in the proposals.

There was some duplication of effort in two project proposals (1990-005-01, Natural Production M&E and 1989—024-01, Juvenile Outmigration) related to the IMW habitat effectiveness

evaluation. However, the role of both projects in the IMW effort was clarified in the proponents' responses. Both projects had objectives and deliverables related to assessment of salmonid diversity and habitat effectiveness. The Juvenile Outmigration project will assume the major role in the IMW effort and undertake the diversity and habitat assessment work. The response from the proponents of the Natural Production project suggested that they do not intend to assess salmonid diversity and habitat effectiveness, even though they included objectives and a deliverable for them in their proposal (the proponents referred the ISRP to the Outmigration project for details on these objectives). For this reason the ISRP found that these objectives did not meet scientific criteria for the Natural Production proposal.

v. Walla Walla

Italicized projects are contextual.

Number	Title	Proponent	Purpose and Emphasis	Primary Monitoring
2000-038-00	*Walla Walla River Hatchery Program*	*Umatilla Confederated Tribes (CTUIR)*	*Artificial Production* *Supplementation*	*None assigned*
2000-038-01	*Walla Walla Hatchery - Expense*	*Umatilla Confederated Tribes (CTUIR)*	*Artificial Production* *Supplementation*	*None assigned*
2000-038-02	*Walla Walla River Hatchery Operations and Maintenance (O&M)*	*Umatilla Confederated Tribes (CTUIR)*	*Artificial Production* *Supplementation*	*None assigned*
2000-039-00	Walla Walla River Basin Monitoring and Evaluation (M&E)	Umatilla Confederated Tribes (CTUIR)	Programmatic RM and E	Fish population status; Investigate hydro critical uncertainties; Evaluate tributary habitat conditions and limiting factors

The ongoing and proposed work in the Walla Walla Basin is important and is well justified. The fisheries management program in the Walla Walla Basin can boast substantial accomplishments in the last 15 years, leading to vastly improved understanding of steelhead, Chinook salmon, and bull trout abundance, productivity, and distribution. Steelhead and Chinook (mostly hatchery fish) returns above a tributary dam have trended upward in the past several years, suggesting improved returns of adult fish.

Data gaps identified in the Anadromous Salmonid Monitoring Strategy (ASMS) pertain primarily to improving sampling of adult returns, smolt outmigration, productivity and passage. Managers are actively trying to address these gaps, in part through funds requested from BPA in this solicitation. The project has made significant progress in evaluating adult and juvenile salmonid abundance, distribution, and productivity and is continuing to find ways to improve reliability of adult return and outmigrant abundance and timing.

The M&E program satisfies VSP criteria and addresses, to a substantial degree, the Council's High Level Indicator "Abundance of Fish and Wildlife" (abundance of salmon and steelhead and resident fish). Fish in/fish out monitoring will be conducted and will include estimates of abundance, distribution, life history and genetic diversity, and spatial structure for outmigrants, adults, redd counts, spawning fish, and carcasses. Productivity estimates are proposed including smolts/spawner and smolt-adult survival. No mention was made of juvenile sampling, although this work should be considered.

The proposed work does not include status and trends or effectiveness monitoring of habitat and hatcheries, with the exception of stream flow, water temperature, and passage barrier evaluations. Habitat effectiveness and hatchery monitoring apparently is being carried out by other CTUIR projects not reviewed by the ISRP. The project reviewed by the ISRP provides data to the other CTUIR projects. Hopefully juvenile abundance, distribution, and productivity are being measured by these projects. The only Walla Walla project reviewed by the ISRP in this round was 2000-039-00, Walla Walla River Basin Monitoring and Evaluation (M&E). It is unknown whether there is duplication of effort between this project and the other projects in the basin.

vi. Yakima River

Number	Title	Proponent	Purpose and Emphasis	Primary Monitoring
1995-063-25	Yakima River Monitoring and Evaluation-Yakima/Klickitat Fisheries Project (YKFP)	Yakama Confederated Tribes	Artificial Production; RM and E	Fish population status monitoring; Selected harvest investigations; Investigate hatchery critical uncertainties
1995-064-25	Policy, Plan and Technical Support of Washington Department of Fish and Wildlife (WDFW)-Yakima/Klickitat Fisheries Project (YKFP)	WDFW	Artificial Production; Local Coordination	None assigned
1997-013-25	Yakima River Operations and Maintenance (O&M) for Hatcheries and Acclimation Sites-Yakima/Klickitat Fisheries Project (YKFP)	Yakama Confederated Tribes	Artificial Production; Supplementation	None assigned

The size and complexity of the fisheries projects make it difficult to effectively review efforts in the Yakima Subbasin. Clearly the ongoing and proposed work is important and thus requires a more comprehensive review, preferably in conjunction with the annual Yakama Nation Fisheries Program Symposium. Much data is being gathered, in fact so much that it is difficult to interpret and critique the effort without a summary and synthesis focused on whether the program is meeting its objectives.

There are gaps in understanding regarding factors that impact survival of natural and post-release hatchery origin pre-smolts. A better assessment of the wild population response to supplementation is essential. Future investigations need to include a method of estimating proportions of wild to hatchery fish in reference and treatment streams.

It is unknown at this time whether there is duplication of effort among projects in the subbasin.

F. Snake River Basin Sub-Region

i. Lower Snake MPG Tucannon, Asotin Creek

2010-050-00	Evaluation of the Tucannon endemic program	WDFW	Artificial Production; RM and E	Monitor hatchery effectiveness

A set of proposals (2002-053-00, 2010-028-00, 2010-042-00, and 2010-050-00) are designed to contribute to essential anadromous salmon monitoring in the Lower Snake River. Additional monitoring is conducted through the Lower Snake River Compensation Program, which funds and coordinates spring Chinook and steelhead hatchery production for mitigation and conservation in the Tucannon River.

In the lower Snake River sub-region, the Tucannon River has been designated for fish-in/fish-out intensive monitoring for spring Chinook salmon, and Asotin Creek has been designated for fish-in/fish-out intensive monitoring for steelhead. The data collected will provide VSP monitoring, hatchery-effectiveness monitoring (Asotin Creek will serve as a reference location), and habitat-effectiveness monitoring (Asotin Creek is designated as an IMW, and coordinated with ISEMP and CHaMP). The data collections and evaluations are essential for BiOp monitoring, Fish and Wildlife Program evaluation, and integration with Council high-level indicators.

The Anadromous Salmonid Monitoring Strategy (ASMS) identified a number of challenges for monitoring in this region: steelhead adult escapement is estimated using index spawning ground surveys; expanded monitoring will be necessary to implement an endemic stock supplementation program; and additional monitoring is needed to understand the extent of steelhead and Chinook salmon by-passing the Tucannon River and continuing upstream. The BiOp, Fast-track, and RME and Artificial Production proposals all appear necessary to cover gaps and deficiencies in past monitoring. Coordination with Snake River basin genetic stock identification (GSI) at Lower Granite Dam, and parental-based tagging (PBT) is in place and should provide information necessary to evaluate these methods for improved efficiency and cost effectiveness.

Also see projects 2010-028-00, 2010-42-00, 2002-053-00, in the habitat effectiveness section.

ii. Grande Ronde, Imnaha MPG

Italicized projects are contextual.

Number	Title	Proponent	Purpose and Emphasis	Primary Monitoring
1998-007-02	*Grande Ronde Supplementation Operations and Maintenance (O&M) and Monitoring and Evaluation (M&E) on Lostine River*	*Nez Perce Tribe*	*Artificial Production Supplementation*	*Fish population status; Selected harvest investigations; Monitor hatchery effectiveness; Hatchery critical uncertainties*
1988-053-01	Northeast Oregon Hatchery Master Plan	Nez Perce Tribe	Artificial Production; Supplementation	Implement conservation program; Investigate hatchery critical uncertainties
2007-132-00	NEOH Monitoring & Evaluation Implementation (Formerly a component of 198805301)	Nez Perce Tribe	Artificial Production; RM and E	Monitor hatchery effectiveness
1988-053-05	Northeast Oregon Outplanting Facilities	ODFW	Artificial Production; Supplementation	None assigned
1998-007-04	Grande Ronde Spring Chinook on Lostine/Catherine Creek/ Upper Grande Ronde Rivers	ODFW	Artificial Production Supplementation	Fish population status monitoring; Selected harvest investigations; Monitor hatchery effectiveness; Investigate hatchery critical uncertainties
1998-007-03	Grande Ronde Supplementation O&M on Catherine Creek/Upper Grande Ronde River	Umatilla Confederated Tribes (CTUIR)	Artificial Production; Supplementation	Fish population status monitoring; Monitor hatchery effectiveness; Investigate hatchery critical uncertainties
2007-083-00	Grande Ronde Supplementation Monitoring and Evaluation (M&E) on Catherine Creek/Upper Grande Ronde River	Umatilla Confederated Tribes (CTUIR)	Artificial Production; RM and E	Fish population status monitoring; Evaluate tributary habitat conditions and limiting factors; Evaluate Effectiveness of tributary habitat actions; Selected harvest investigations; Monitor hatchery effectiveness; Investigate hatchery critical uncertainties

1992-026-04	Grand Ronde Early Life History of Spring Chinook and Steelhead	ODFW	Artificial Production; RM and E	Fish population status monitoring; Evaluate tributary habitat conditions and limiting factors; Monitor hatchery effectiveness; Investigate hatchery critical uncertainties
2007-404-00	Spring Chinook Captive Propagation-Oregon	ODFW	Artificial Production; Supplementation	Implement safety-net; Fish population status; Selected harvest investigations; Monitor hatchery effectiveness; Investigate hatchery critical uncertainties
1997-015-01	Imnaha River Smolt Monitoring	Nez Perce Tribe	Artificial Production; RM and E	Fish population status; Evaluate tributary habitat conditions and limiting factors; Selected harvest investigations; Investigate hatchery critical uncertainties

Also see projects 2010-032-00 in the habitat effectiveness section.

Within the Grande Ronde and Imnaha rivers, monitoring for viable salmonid population parameters (VSP), habitat action effectiveness and hatchery action effectiveness is necessary for steelhead, spring-summer Chinook, and fall Chinook. Accomplishing this monitoring involves co-management by the Nez Perce Tribe, Oregon Department of Fish and Wildlife, and Confederated Tribes of the Umatilla Indian Reservation and implementation of projects by the co-managers, CRITFC, USFWS, and others. In addition to the Fish and Wildlife Program, funding is provided through Lower Snake River Compensation Plan. The projects to complete the monitoring involve integration with actions outside of the watershed boundaries.

Candidate rivers for high intensity steelhead life cycle monitoring are Catherine Creek and the Imnaha River. Candidate rivers for high intensity Chinook salmon life cycle monitoring are Catherine Creek, Minam River, upper Grande Ronde River, and the Imnaha River.

The monitoring in this sub-region generally follows the Northeast Oregon Hatchery monitoring plan reviewed by the ISRP. Fish trapping, tagging, and counting are completed by ODFW, NPT, and CTUIR. Most of the analysis is being completed by ODFW funded through the Lower Snake River Compensation Plan. Spring Chinook evaluations conducted under the LSRCP appear reasonable.

The co-managers appear adequately coordinated. For this sub-region, the ISRP does not have concerns beyond those expressed in individual proposal reviews. Nonetheless, because there are

activities funded beyond the Fish and Wildlife Program and because so many projects contribute to the monitoring, the ISRP recommends that a succinct summary of the project relationships, linkages to VSP, and habitat and hatchery action effectiveness monitoring accompany the habitat restoration proposals in the anticipated geographic review. The ISRP viewed a power point slide with project relationships at a recent LSRCP spring Chinook symposium. A brief explanatory narrative accompanying such a diagram is needed to understand the interrelations of the co-managers and projects.

iii. Upper Salmon, South Fork Salmon, Middle Fork Salmon, and Clearwater MPGs

Italicized projects are contextual.

Number	Title	Proponent	Purpose and Emphasis	Primary Monitoring
2010-038-00	*Lolo Creek Permanent Weir Construction*	*Nez Perce Tribe*	*Artificial Production; RM and E*	*Fish population status*
1998-010-04	Monitor and Evaluate (M&E) Performance of Juvenile Snake River Fall Chinook Salmon from Fall Chinook Acclimation Project	Nez Perce Tribe	Artificial Production; RM and E	Investigate hatchery critical uncertainties
1998-010-05	Fall Chinook Acclimation Facilities on Snake/Clearwater Rivers	Nez Perce Tribe	Artificial Production; Supplementation	None assigned
1983-350-00	Nez Perce Tribal Hatchery Operations and Maintenance (O&M)	Nez Perce Tribe	Artificial Production; Supplementation	Fish population status monitoring; Selected harvest investigations; Investigate hatchery critical uncertainties
1983-350-03	Nez Perce Tribal Hatchery Monitoring and Evaluation (M&E)	Nez Perce Tribe	Artificial Production; RM and E	Fish population status monitoring; Evaluate tributary habitat conditions and limiting factors; Selected harvest investigations; Monitor hatchery effectiveness Investigate hatchery critical uncertainties
2007-233-00	Distribution and Abundance Monitoring of Oncorhynchus mykiss within the Lower Clearwater Subbasin	Nez Perce Tribe	Programmatic RM and E	Fish population status monitoring; Evaluate tributary habitat conditions and limiting factors
1990-055-00	*Idaho Steelhead Monitoring and Evaluation (M&E) Studies*	*Idaho Department of Fish and Game (IDFG)*	*Artificial Production; RM and E*	*Fish population status; Evaluate Migration characteristics and river conditions; Evaluate effects of system configuration; Hydrosystem critical uncertainties; Evaluate tributary habitat conditions and limiting factors; Selected harvest investigations*

1989-098-00	*Salmon Studies in Idaho Rivers-Idaho Department of Fish and Game (IDFG)*	*IDFG, Nez Perce Tribe, Shoshone-Bannock Tribes, USFWS)*	*Artificial Production; RM and E*	*Fish population status; Collaboration of Monitoring Status; Fish performance within the FCRPS; Evaluate mitigation characteristics and river conditions; Evaluate effects of configuration and operations; Investigate hydrosystem critical uncertainties; Evaluate Tributary habitat conditions and limiting factors; Selected harvest investigations; Hatchery effectiveness; Hatchery critical uncertainties*
1991-073-00	*Idaho Natural Production Monitoring and Evaluation (M&E)*	*IDFG)*	*Artificial Production; RM and E*	*Fish population status*
1997-030-00	*Chinook Salmon Adult Abundance Monitoring*	*Nez Perce Tribe*	*Artificial Production; RM and E*	*Fish population status; Status monitoring collaboration; Selected harvest investigations; Hatchery effectiveness; Hatchery critical uncertainties*
1996-043-00	Johnson Creek Artificial Propagation Enhancement	Nez Perce Tribe	Artificial Production; Supplementation	Implement safety net; Fish population status; Fish status monitoring collaboration; Selected harvest investigations; Monitor hatchery effectiveness; Investigate hatchery critical uncertainties
2007-403-00	Spring Chinook Captive Propagation-Idaho	IDFG	Artificial Production Supplementation	Implement safety-net; Fish population status; Monitor hatchery effectiveness; Investigate hatchery critical uncertainties
2008-905-00	Supplementation Projects	Shoshone-Bannock Tribes	Artificial Production; Supplementation	None assigned
2008-906-00	Crystal Springs Planning and Operations/Maintenance	Shoshone-Bannock Tribes	Artificial Production; Supplementation	None assigned
2010-057-00	B-run steelhead supplementation effectiveness research	IDFG, Nez Perce Tribe	Artificial Production; RM and E	Monitor hatchery effectiveness
1999-020-00	Analyze Persistence and Dynamics in Chinook Redds	USFS	Programmatic RM and E	None assigned

Within the Salmon and Clearwater rivers monitoring for viable salmonid population parameters (VSP), habitat action effectiveness and hatchery action effectiveness is required for steelhead, spring-summer Chinook, fall Chinook, and sockeye (see the sockeye section above). Accomplishing this monitoring involves co-management by Idaho Department of Fish and Game, the Nez Perce Tribe, the Shoshone-Bannock Tribe and implementation of projects by the

co-managers, CRITFC, USFWS, and others. In addition to the Fish and Wildlife Program, funding is provided through Lower Snake River Compensation Plan, and apparently Idaho Power. The projects to complete the monitoring also involve integration with actions outside of the watershed boundaries.

The ASMS Prioritization Criteria for the Salmon and Clearwater rivers are to focus assessment of habitat action effectiveness where intensive VSP parameter assessments are in place, conduct high intensity life cycle monitoring (adults in, juveniles/smolts out, Smolt-to-Adult Return Ratio) in at least one population per MPG, implement hatchery effectiveness monitoring, complete the Idaho Salmon Supplementation Study, and conduct implementation and compliance monitoring on every habitat restoration project.

Candidate rivers for high intensity steelhead life cycle monitoring are Lolo Creek, South Fork Salmon River, Secesh River, and Lemhi River. Candidate rivers for high intensity Chinook salmon life cycle monitoring are Secesh River, Big Creek, Bear Valley Creek, Marsh Creek Complex, Chamberlain Creek, Pahsimeroi River, Upper Salmon River mainstem, and Lolo Creek.

Candidate rivers for steelhead response to habitat actions are Potlatch River, South Fork Salmon River, and Lemhi River. Candidate rivers for Chinook salmon response to habitat actions are South Fork Salmon River and Lemhi River.

Hatchery effectiveness monitoring on supplementation programs would occur for steelhead in the South Fork Clearwater and Lolo Creek and for Chinook salmon on select supplementation programs including LSRCP and Johnson Creek.

The approach is to assess population status and trends using VSP metrics and TRT viability criteria of all populations in every MPG. For steelhead a two-tiered approach is planned: adult abundance will be estimated at Lower Granite Dam using GSI. Results from this method will be compared with abundance estimates obtained from PIT-tagging adults at Lower Granite Dam and subsequent detections at in-stream PIT-arrays in at least two MPG's. For Chinook salmon, adult abundance will be estimated at Lower Granite Dam using GSI (MPG level), selected populations using in-stream PIT-arrays, and in all populations using redd surveys.

There are several recognized challenges to monitor steelhead and salmon in the Salmon and Clearwater rivers: ISS (1989-098-00) will be completing the final production assessments in 2014, and monitoring data from this project needs to be continued in at least some of the streams. Weirs and traps at a number of locations are not adequate. Examples include the need for a permanent weir and PIT tag array in Lolo Creek; the need for adult trapping facilities to operate and maintain, or monitor and evaluate, supplementation programs in the Yankee Fork Salmon River, Panther Creek, or Indian Creek; and the absence of rotary screw traps to monitor juvenile production in Panther or Indian creeks. The weir in the East Fork Salmon River is not in the correct location to manage and monitor the supplementation program using Hatchery Scientific Review Group criteria. Many of these challenges were addressed in the Fast Track proposals and others are under discussion.

In the presentation to the ISRP by the Nez Perce Tribe (NPT) a series of five handouts were provided that summarize NPT Fish and Wildlife Program projects, hatchery production, project linkages to Fish and Wildlife Program management questions, linkages to ASMS monitoring recommendations, and a sixth handout that summarized Snake River fall Chinook monitoring by project, watershed, and co-manager. The ISRP was told this final fall Chinook summary has been agreed upon by the co-managers and that summary agreement for steelhead and spring-summer Chinook is under discussion.

It is clear to the ISRP that coordination and integration among co-managers to accomplish the necessary tasks to efficiently monitoring salmon and steelhead in this large geographic region has made good progress. The co-managers should be encouraged to produce comprehensive monitoring plans for the Salmon and Clearwater rivers and include them in the geographical review of habitat restoration projects.

In the Fast Track Review, the ISRP recommended that the ISS (1989-098-00) and ISMES (1990-055-00) evaluate their monitoring data for compliance with the NOAA standards for accuracy and precision adopted in the regional monitoring forum. The ISRP assessment of the Fast Track addenda is that they complied with the assignment, and provided a sufficient summary.

The steelhead monitoring project had one more standard than the ISS project: "For productivity assessment, a power analysis for each juvenile migrant population being monitored with an ESU should be conducted to determine the power of the data to detect a significant change." The project authors concluded that the power analysis for juvenile productivity was not described with enough detail to know specifically what parameter to estimate – a point or a slope.

Neither report provided an explanation of how the CVs, and their components, were calculated for adult and juvenile abundance estimates. For completeness, this should be provided in future proposals and statements of work.

For the ISMES, adult estimates for CV were above the 15% criterion in 2 of 3 years, for juvenile population estimates three monitored streams were below the 30% CV in the three years evaluated. The analyses of detectable difference in juvenile population size (across three years) were 12%, 39%, and 34% for decreases in Fish Creek, Rapid River, and Big Creek, and were 13%, 64%, and 51% for increases in each of the respective locations. The evaluation of spatial presence revealed that the number of sites sampled within watersheds was too few given the original occupancy rates.

For the ISS, many streams use multiple pass redd counts to enumerate adults and they are unable to assess accuracy or precision. They treat the estimates as census counts. For other locations weirs are present and mark-recapture escapement estimates are made. For these a CV can be estimated. Overall, CV estimates in the Clearwater subbasin do not achieve the 15% standard and estimates with the Salmon River subbasin are well under the standard. For juvenile spring Chinook outmigrant estimates four of seventeen populations have CVs greater than the 15% standard for Chinook salmon. For one of these locations, modification of trapping is likely to bring the CV estimate within the standard. The other three locations may not be able to duplicate the improvement. The ISS selected adult spawning locations to evaluate spatial distribution, but

did not conduct an analysis.

It is clear from the analysis that all projects need to provide this type of information, and then the management implications for meeting BiOp standards for the adaptive management plan need to be clarified. A key question is, are the BiOp standards appropriate to allow informed management decisions in all situations?

G. Upper Columbia Sub-Region (Wenatchee, Entiat, Methow, Okanogan)

All the projects in the set below are contextual.

Number	Title	Proponent	Purpose and Emphasis	Primary Monitoring
1996-040-00	*Mid-Columbia Reintroduction Feasibility Study*	*Yakama Confederated Tribes*	*Artificial Production; Supplementation*	*Evaluate tributary habitat actions*
2009-001-00	*Expanded Multi-Species Acclimation in the Wenatchee/Methow Basins*	*Yakama Confederated Tribes*	*Artificial Production; Supplementation*	*Investigation Hatchery critical uncertainties*
2003-023-00	*Chief Joseph Hatchery Program*	*Colville Confederated Tribes*	*Artificial Production; Supplementation*	*Implement conservation program to build genetic resources and assist promoting recovery*
2007-212-00	*Okanogan Basin Locally Adapted Steelhead Broodstock Step 1 and 2 (Cassimer Bar)*	*Colville Confederated Tribes*	*Artificial Production; Supplementation*	*Implement conservation program to build genetic resources and assist promoting recovery*

See the ISRP comments on projects 2003-022-00, 2009-002-00, 2010-075-00, and 2010-034-00 in the habitat effectiveness section. The ISRP has no additional comments on the artificial production projects than provided recently in the relevant Step Reviews.

V. Proposal Form and Content

Taurus
The new form worked well for some purposes but less well for others. The ISRP intends to work with Council, BPA, and Taurus staff to improve the next forms, likely for the resident fish category review.

Strengths
- Easy to access former reviews
- Easy to access annual reports and some other project related documents
- Budget information was relatively easy to follow

Weaknesses
- Did not work with all internet browsers
- Redundancy of sections, etc. (deliverables were identified under several objectives)
- Methods were selected from a menu of acceptable protocols. As a point of entry for a proposal this is fine. However, there needs to be additional information on how standard methods are applied for a specific project or objective. For example if smolts are being trapped to enumerate a population, information is needed on trap efficiency and other variables that influence the precision of the estimate. In other cases, non-standard methods were employed without adequate description of the methods or their applications, but rather just referred to a reference paper. The proposal form structure does not elicit information from proponents on the difficulties and shortcomings of their methods. Finally, the form changes truncated some of the areas in previous proposals, particularly in the methods section.

Proposal Content

Benefit to fish and wildlife is a criterion by which the ISRP is supposed to evaluate projects. For research and M&E projects, the primary accomplishments will take the form of findings that benefit fish and wildlife management. The proponents should succinctly explain how research will guide management. Research or M&E projects that have existed for a significant period should, besides showing the accumulated data, also present statistical analyses of those data. They should provide a narrative of the project's findings about effects on the target or focal fish or wildlife population (or habitat) and state the management implications with respect to mitigation or other human activities that affect the resource.

For proposals that have been funded in the past for two or more funding cycles, information provided by proponents should focus on progress since the last funding cycle, any new approaches or hypotheses, and changes and improvements to the proposed activities, including the new scientific methods. It should be made clear that sufficient detail be provided for the ISRP to evaluate scientific merits of the proposal, or at least the scientific merits of the proposed changes in the work. Similarly, activities deleted should also be stated, and the scientific justification for deleting these activities listed. If this is done, both the new proposals and the long-term proposals will have enough scientific detail for a science-based review. It may be

worthwhile to consider a subsection on “future directions” as a conclusion to the accomplishments section. Similarly, in the Project description section where they outline methods, for long term projects, it would be very useful to have a section called: *New Approaches, New Methods, and Improvements* where it is requested that they describe how the previous hypotheses and methods are changing in this updated proposal compared to past activities. Specifically, how do the new proposal methodologies improve on those of the past proposal? Are there any new hypotheses to test? For research projects, it might be useful to have a subheading called *Testable Hypotheses***.**

In many proposals, the proposed work is outlined, and the personnel listed at the end of the proposal, but it is not clear exactly who is doing the work by objective or if or how the personnel listed are qualified to do the work. Whenever possible, names should be listed for the objectives, and it should be made clear how the person's resume makes him/her qualified to conduct this work. In cases where staff or consultants need to be recruited, that should also be specified.

Proponents should be asked to avoid making pasted, boiler-plate responses to questions, even those of a general nature such as linkages with other projects. The proposal process through Taurus is not so long that they cannot craft clear, meaningful text to respond to the questions listed. Similarly, maps should clearly show locations of activities.

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