

Research, Monitoring and Evaluation and Artificial Production Project Review
Final Decision document June 10, 2011 w/ July 2011 addition

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Review of Research, Monitoring and Evaluation and Artificial Production Projects

Recommendations of the Council June 2011 (with July 2011 addition of completed Part 4)

Introduction

Pursuant to Section 4(h)(10)(D) of the Northwest Power Act, the Northwest Power and Conservation Council has been engaged in a review of research, monitoring and evaluation and artificial production projects that implement the Council's *Columbia River Basin Fish and Wildlife Program*. This document contains and explains the Council's recommendations to the Bonneville Power Administration for the funding and implementing of these projects for Fiscal Years 2012 through 2016.

Part 1 below provides the background on the review, including the description of these two categories, the projects reviewed, and the review process.

Part 2 covers programmatic issues. As has been true in the past, the review of the individual projects illuminates a set of broader policy or programmatic issues that affect the Council's review and recommendations for a collective set of the projects. Part 2 describes these programmatic issues and the Council's recommendations for resolving these issues.

Part 3 of this document contains and explains the Council's recommendations for the funding and implementation of the individual projects, along with a description of the form and duration of the recommendations. Associated with this part of the decision document is a set of spreadsheets that list the projects reviewed in this category, with Bonneville's FY 2012 planning budgets and other information, and with comments about each project as developed during this review. The tables include a Council recommendation for each project, as well as conditions or comments to be considered a part of the recommendation, more fully explained in Part 3.

Finally, Part 4 will contain the formal explanations by the Council responsive to the specific requirements of Section 4(h)(10)(D) of the Northwest Power Act. This includes the written explanations required of the Council in those few instances in which the Council's project funding recommendations do not follow the recommendations of the Independent Scientific Review Panel. The Council will also explain how it complied with the requirements in Section 4(h)(10)(D) to "consider the impact of ocean conditions on fish and wildlife populations" and "determine whether

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the projects employ cost-effective measures to achieve program objectives” when making project funding recommendations.

Part 1: Background -- Categories, Projects, and Review Process

Under Section 4h of the Northwest Power Act, the Council develops a program to “protect, mitigate and enhance” fish and wildlife affected by the hydroelectric facilities on the Columbia and its tributaries. Section 4(h)(10)(A) of the Power Act then calls on the Bonneville Power Administration to use its fund and other authorities to protect, mitigate, and enhance these same fish and wildlife “in a manner consistent with” the Council’s Fish and Wildlife Program. Bonneville directly spends hundreds of millions of dollars every year to fund mainstem and off-site mitigation projects that implement measures in the Council’s program, along with associated research, monitoring, evaluation, and coordination projects.

Section 4h(10)(D) of the Northwest Power Act then directs the Council to review projects proposed for funding by Bonneville to implement the Council’s Fish and Wildlife Program. The Council engages in this review with the assistance of its Independent Scientific Review Panel (ISRP). The Council and Bonneville work together to develop the information necessary to make this review process successful.

Past review processes have taken many forms including program-wide solicitations, review of projects by geographical organization (the rolling provincial review), and targeted solicitations. Beginning in 2009, the Council and Bonneville, with advice from the ISRP, decided to review projects in functional categories (wildlife, monitoring, evaluation and research, artificial production, resident fish and blocked areas), to be followed by a review of certain projects, especially habitat actions, organized by subbasin and province. The central purpose of the broad category reviews is to highlight issues apparent only by looking at similar projects collectively, such as duplication and redundancy, relevance and relative priority, coordination, consistency of approach and methods and costs, and collective consistency with the broad basinwide objectives and strategies in the Fish and Wildlife Program. Organizing the reviews by category also recognizes differences in project types, especially highlighting those with longer-term commitments. The category reviews thus focus on existing commitments, as well as clearly identified proposals for similar commitments to fill program gaps. Many of these existing commitments are of many years’ standing and have been the subject of numerous reviews in the past. So an important function of the category reviews is to evaluate project results and how well the projects have adapted proposed future work based on those results, and how well the project sponsors have responded to the scientific and management issues identified in previous reviews. The scientific and administrative review for the category projects should enable the Council and Bonneville to make long-term funding decisions and establish appropriate longer-length review cycles for many of these projects.

In June 2010, the Council and Bonneville together began this review of projects in the categories of research, monitoring and evaluation and artificial production (also known as the RME/AP Review). The Council’s 2009 Fish and Wildlife Program focuses in particular on implementation and performance and commits to developing a better monitoring and evaluation framework for the Fish and Wildlife Program. The goal is improved performance and reporting on progress and effects under the Program and improved decisionmaking on actions in an adaptive management fashion. Reviewing the collective set of research, monitoring and evaluation projects was a logical extension of this commitment. The Council and Bonneville are also using the category review of research, monitoring and evaluation projects to ensure that projects implemented

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under the Program meet the performance tracking and adaptive management needs and commitments of the 2008 Federal Columbia River Power System (FCRPS) Biological Opinion as well as the Fish and Wildlife Program. The Council decided to include the Program's artificial production projects in this review as well, as the monitoring and evaluation elements are a dominant feature of artificial production projects.

The category reviews are designed to include six steps: planning; project sponsors' reports and proposals, ISRP review; public review; staff review and recommendations, and final Council decision. The planning phase for the RME/AP category actually began in January 2009, identifying 99 projects for review. Most of these were existing projects, but the list also included a small set of new projects intended to address gaps in the research, monitoring or evaluation elements of the Fish and Wildlife Program and FCRPS Biological Opinion. These gaps and associated projects were identified in a collaboration process in 2009 with regional fish management agencies (known as the "Skamania workshop"). The "Skamania workshop" sparked the development of the multi-agency Anadromous Salmonid Monitoring Strategy (ASMS), a set of useful principles and guidelines that is itself a work in progress recently reviewed by the ISRP. A broader set of framework principles also useful for review planning are found in the Council's draft Monitoring, Evaluation, Research and Reporting Plan (also known as the MERR Plan). The MERR Plan is an overarching and extensive research, monitoring and evaluation framework the Council has been working on as another facet of the commitment in the 2009 Fish and Wildlife Program. Neither the MERR Plan, nor the Anadromous Salmonid Monitoring Strategy (which may be thought of as an implementing strategy under the MERR Plan), have been formally adopted in a form that allows them to be used directly in this review as a source of decision-making criteria. But the principles and considerations informing the development of the MERR Plan and the monitoring strategy for long-term guidance are also being brought to bear in this review, in a consistent manner.

Part of the planning for this review included a decision to focus the RME/AP category review on activities related to anadromous fish and to resident fish in the portion of the basin below the "blocked areas." Projects or parts of projects related to research, monitoring and evaluation or to artificial production that are not included in this review are as follows:

- Wildlife project monitoring and evaluation (reviewed during the wildlife category review)
- The monitoring work elements in habitat projects, monitoring project implementation (did the habitat action take place?) or project effectiveness (did the habitat actions result in the desired change in local habitat characteristics?) (to be reviewed as part of the geographic review of habitat projects)
- Research, monitoring and evaluation and production projects that relate to resident fish in the blocked areas, such as above Chief Joseph/Grand Coulee dams (next category review)
- Data management and regional coordination projects, even if linked to monitoring and evaluation activities (next category review)
- Artificial production projects implemented under separate, pre-existing legal authorities, even if funding is partly reimbursed or directly funded by Bonneville, including Lower Snake River Compensation Program hatcheries and the Leavenworth Hatchery

For the projects within the current review categories, project sponsors were asked in June 2010 to submit the necessary information for ISRP and Council review by the end of August 2010. The sponsors were asked to include project descriptions, work elements, a report on results, proposed

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work for the next five fiscal years, and proposed budgets. The project sponsors entered the information directly into the Taurus database (cbfish.org) in a set proposal format. The review process also included 59 monitoring and evaluation and artificial production projects so recently reviewed by the ISRP and Council that it did not make sense to ask for project submissions or actually review the specific projects, but which needed to be part of the overall review to provide the necessary context for the full category. The page on the Council's website for the RME/AP Review is at <http://www.nwcouncil.org/fw/budget/2010/rmeap/Default.asp>. The page describes the steps in the review process and includes a link to the list of the projects reviewed or part of the review context.

The ISRP began its review in August 2010. As noted above, under Section 4(h)(10)(D) of the Northwest Power Act, the Council is to conduct its review of projects with the assistance of an Independent Scientific Review Panel appointed by the Council. The ISRP is asked "to adequately ensure that the list of prioritized projects recommended is consistent with the Council's program," and to make project recommendations to the Council "based on a determination that projects: are based on sound scientific principles; benefit fish and wildlife; and have a clearly defined objective and outcome with provisions for monitoring and evaluation of results." Along with the requirements of the Act and the information from the project sponsors, the Council also posed a set of questions based in the Council's Fish and Wildlife Program for the ISRP to consider during the review.

The ISRP issued a preliminary report on the projects in the RME/AP category in October 2010. <http://www.nwcouncil.org/library/report.asp?docid=8>. The statute requires the Council to release the panel's findings for public review and comment. The Council is to "fully consider" the recommendations of the panel. The ISRP concluded in its preliminary review report that 47 of the project proposals met the ISRP's science review criteria either in whole or in part or with certain qualifications. The ISRP noted that for most of the rest of the projects, the ISRP needed further information before it could conclude its review, and asked for a response by the sponsor to a preliminary set of review comments. The ISRP also concluded that a few of the projects did not meet science review criteria or were not amenable to review, and sought further clarification. Project sponsors submitted responses to the Council and the ISRP in mid-November 2010.

The ISRP then issued its final review report on December 17, 2010. <http://www.nwcouncil.org/library/report.asp?docid=27>. To quote from the ISRP's summary of its final report:

This 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 recommendations 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 the ISRP's request for a

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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 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.

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Those projects with “in part” and “qualified” ISRP assessments may have 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 finds few projects where RM&E efforts were clearly duplicative or excessive. The ISRP does feel there is a need for better coordination and integration among projects, and for a strengthened emphasis on evaluation of field data, but the ISRP continues 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.

As required by the Act, the Council invited public to comment on the ISRP’s report and the projects under review. The comment period ended February 1, 2011.

<http://www.nwcouncil.org/fw/budget/2010/rmeap/Default.asp>

The Council staff, working in cooperation and consultation with Bonneville staff and other agency personnel, then began reviewing the project information, comments from the sponsors and other on the projects, the ISRP’s reports, public comment on the ISRP report, and other information. Through the winter and spring of 2011 staff worked with the Fish and Wildlife Committee and with Bonneville and other agency staff to frame programmatic and project-specific issues for resolution on the path to Council’s recommendations. The Council then considered all of this information and made its final decisions on project implementations to Bonneville in April and June 2011.

Under Section 4(h)(10)(D) of the Act, the Council completes the review process by deciding on its project recommendations to Bonneville to implement the Council’s Fish and Wildlife Program. The Act specifies that in making these recommendations, the Council is to “fully consider” the recommendations of the ISRP. If the Council decides not to accept a recommendation of the ISRP, the Council must explain in writing its reasons. The Council is also to “consider the impact of ocean conditions on fish and wildlife populations” and “determine whether the projects employ cost-effective measures to achieve program objectives” when deciding on its project-funding recommendations. “The Council, after consideration of the recommendations of the Panel and other appropriate entities, shall be responsible for making the final recommendations of projects to be funded through BPA’s annual fish and wildlife budget.”

Part 2: Programmatic Issues

Part 2 identifies a set of 11 broader policy and programmatic issues that have arisen out of the review of the projects in the two categories. The ISRP provided a set of programmatic comments, which have been one important source for the identification of these issues. The issues are summarized briefly here, followed by the Council's recommendations for resolving these issues.

The Council's recommendations on the programmatic issues are to be accorded the same weight as the project-specific implementation recommendations. In many cases the Council's programmatic recommendations have become conditions or recommendations that accompany the relevant project recommendations, as explained further in Part 3 below.

1. Reporting and use of project and program results

Issue: One of the salient roles the Council can play in the region is to improve the reporting, explanation, availability, and use of results from all the program's projects, on-the-ground, monitoring and evaluation, and research. "Results" abound in the Fish and Wildlife Program -- whether that term refers to implementation and maintenance reports, monitoring or research data, or analytical or evaluation conclusions. And project and program results of various types are gathered and compiled in many places, including the project proposals and ISRP review reports, the Taurus and Pisces databases for project implementation information, the Status of the Resource website, and various other databases that collect and house monitoring information relevant to the program. Two additional steps we are taking in the review to increase the reporting and analysis of results are (1) placing conditions on individual projects to improve the reporting and evaluation of project results when the ISRP has identified a problem, including limiting the funding recommendation in certain cases until a results report is complete and reviewed by the ISRP; and (2) requiring synthesis reports to be completed and reviewed by the ISRP for a number of the key topic areas in which a number of years of results need to be evaluated, as described in various issues below.

Even so, much more could be done to systematically push for, obtain, organize, synthesize, evaluate, and regularly report on the implementation and biological results relevant to the program. In comparison, the Council developed over the last decade a systematic and organized way of reporting annually on program expenditures. *See Ninth Annual Report to the Northwest Governors On Expenditures of the Bonneville Power Administration to Implement the Columbia River Basin Fish and Wildlife Program of the Northwest Power and Conservation Council, 1978-2009, Council Document 2010-06 (May 2010), <http://www.nwcouncil.org/library/2010/2010-06.htm>.* Implementation and biological results are far more complicated than expenditures. Even so, with focused effort we can improve what we do to track, report on and evaluate project and program results, both to educate ourselves and the public and to make more informed decisions. The Council's draft Monitoring, Evaluation, Research and Reporting (MERR) plan includes a proposal for an organized way to report project and program results in a coordinated annual fashion. That includes developing an annual "High-Level Indicators" report to improve how the Council catalogs and reports program results, which the Council is currently working on. Given this, one of the key contributions of this review may be the opportunity it presents for the Council to help develop

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further a more systematic approach toward the reporting and use of the implementation and biological results of these expenditures to the greatest extent possible.

An excellent vehicle for carrying out this work, following the conclusion of the review, is the continuing obligation in Section 4(h)(10)(D)(iv) that “[t]he [Independent Scientific Review] Panel, with assistance from the Peer Review Groups, shall review, on an annual basis, the results of prior year expenditures based upon these criteria [referring to the scientific criteria for evaluating proposed projects] and submit its findings to the Council for review.” The ISRP has been complying with this requirement since 1997 through a number of methods, including:

- The ISRP has produced a number of distinct “retrospective” review reports for the Council. E.g., *Retrospective Report 2007: Adaptive Management in the Columbia River Basin*, ISRP 2008-04 (April 2008); *ISRP 2006 Retrospective Report*, ISRP 2007-1 (March 2007); *Independent Scientific Review Panel’s Retrospective Report 1997-2005*, ISRP 2005-14 (August 2005).
- All project reviews include a review of the results of past activities. Project sponsors are asked to provide information on past project results as well as proposed future activities. The ISRP reviews all this information, and the resulting ISRP review reports to the Council are, in part, findings on past results.
- The ISRP has pushed for project sponsors and managers to produce retrospective reviews of their projects and programs, for subsequent ISRP review. E.g., *ISAB and ISRP Review of the CSS Ten-Year Retrospective Summary Report*, ISRP 2007-6 (Nov 2007). The ISRP intends to press for more retrospective reviews of this type.

The challenge here will be how to tier off this Power Act obligation and these methods so that the ISRP may help the Council produce a systematic, transparent and distinct report each year on project and program results. We know some of the limits of the task: Neither the ISRP nor the Council will report on the results of each project or the entire program annually. That is impossible logistically in any meaningful way. The key will be to review and report results for different critical elements of the program every year, on the basis of a well understood rotation or other selection method. And, the ISRP is not a body that will compile results itself, nor is it a body that collects or analyzes data, with models or in any other way. The ISRP is best set up to review the work of others. Thus we need to develop the mechanisms that feed results to a distinctly identified, annual retrospective review and reporting effort, mining the reporting methods currently in place.

To return to the general principle, the Council is interested in sharing the results of the Fish and Wildlife Program with the region and others. Information collected from research, monitoring and evaluation projects provide important feedback to the Council about the value of the Fish and Wildlife Program. Adaptive management requires that responses from actions are identified and the knowledge shared. And annual reports from the research, monitoring and evaluation projects are necessary for the ISRP to fulfill its retrospective review obligation under the Power Act. Yet at this point we lack a simple reporting system to record and track annually the results of the research, monitoring and evaluation work. The Council will work with Bonneville and the ISRP to design that annual project reporting system.

Council recommendation: Each year the ISRP and then the Council will produce a report that in some way delivers a review snapshot of the implementation and biological results from a subset of the on-the-ground projects, the program's monitoring and evaluation and research elements, or both. The easiest way to do this will be for the ISRP to add a more distinct and visible retrospective/results component to all project reviews, and then mine the reviews each year for information to organize into the retrospective review of results for that year. The ISRP and the Council will also look for frequent opportunities to have the sponsors and managers of the broader programs produce their own retrospective reviews of results over a body of time (such as the CSS review noted above or the synthesis reports in certain topic areas called for below), for subsequent review and report by the ISRP and then the Council, possibly including a workshop. The systematic annual review and reporting of results needs to focus on more than just the results from individual on-the-ground projects. Inherent in the Fish and Wildlife Program is a set of relationships or hypotheses that link the projects to expected changes in the relevant habitat conditions for key species and then in the population characteristics of those species. The on-the-ground projects that we hope or expect will, collectively, produce these changes are not, by and large, tasked with monitoring the status and trends of the targeted habitat and population characteristics. That is the province of distinct program monitoring and evaluation efforts and projects described throughout this document. These efforts need to be included in the revolving annual review and reporting of results by the ISRP and Council. The report on High-Level Indicators could be folded into the Council's part of this effort.

This decision document in this review is not the place to scope out this effort in detail. Those details will come in a separate proposal developed by the Council staff and ISRP together. It is likely the ISRP and staff will propose a test or pilot of this approach in 2011 focused on the results that have or will be gathered for ISRP review this year with regard to artificial production, mainstem monitoring, and the Lower Snake River Compensation Plan activities.

As part of this effort, Bonneville should require all research, monitoring and evaluation projects to report annually, providing an electronic summary of their results and interim findings as well as describing benefits to fish and wildlife. Bonneville should work with the Council to design a concise, useful template for annual reports that can replace other more cumbersome, more costly, and less useful reports for individual projects. The Council will work with Bonneville and the ISRP to identify and assemble the information needed to produce an annual summary of results for Council review, consistent with the principles above.

A separate programmatic issue below (#6) speaks distinctly to reporting requirements for *research* projects in particular.

2. Habitat effectiveness monitoring and evaluation

Issue: The Council's Fish and Wildlife Program is "a habitat-based Program," aiming "to rebuild healthy, naturally producing fish and wildlife populations by protecting, mitigating, and restoring habitats and the biological systems within them." The Fish and Wildlife Program thus depends heavily on actions in the mainstem, tributaries and estuary intended to protect or improve habitat characteristics as the way in which the program will ultimately protect, mitigate and enhance

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fish and wildlife populations adversely affected by the hydrosystem. The FCRPS Biological Opinion is built on the same conceptual foundation. The analysis supporting the conclusions in the Biological Opinion includes quantitative estimates of the improvements in life-stage survival to be gained from habitat actions in all areas.

For this reason, *the* critical programmatic issue in the RM&E/AP review is whether the collective suite of proposed projects is adequate to monitor and evaluate the effectiveness of our habitat actions in ultimately improving the population characteristics of our key fish species, and to be able to use what we learn to adapt the implementation and management of the program. The existing projects and new proposals in this review include dozens of projects that are intended in some way to help to assess whether the habitat work is having the desired impact on fish populations. These assessments are to occur at the watershed or reach scale depending on the effectiveness they are testing, i.e., cause and effect at the population or watershed level (Intensively Monitored Watersheds or IMWs, part of the Integrated Status and Effectiveness Monitoring Program or ISEMP), habitat status and trends that can be correlated to fish status and trends at the watershed scale (e.g., the new Columbia Habitat Monitoring Program or CHaMP), or project-level impacts (project or action effectiveness -- although most of this particular type of monitoring is not part of this review; *see* below). Combined, these projects call for investments of tens of millions of dollars in “habitat effectiveness” monitoring, evaluation and research.

Yet most of the elements of the habitat effectiveness monitoring and evaluation effort are in flux or under development. This includes the precise contours of the status and trend monitoring of habitat characteristics and the relationship of this monitoring to the fish population status and trend monitoring, the distinct but related role of the cause-and-effect “intensively monitored watershed” research effort, and especially the analytical methods and procedures that will be used to evaluate all of this information and report on what is being learned.

In other words, the Council still needs clarity and further definition on the monitoring, evaluation and reporting elements of the habitat effectiveness monitoring and evaluation. The Council will not conclude this review without being comfortable that the monitoring and evaluation protocols and analytical methods are in place to give us a reasonable chance of knowing -- in 5, 10, 20 years -- whether the region’s huge investment in an evolving suite of habitat actions is contributing significantly to the recovery and rebuilding of fish species important to the region.

The review has given the Council reasons to be concerned about, or at least uncertain about, the answers to any of these questions. The ISRP expressed these concerns well in its programmatic report, concerns that others have identified as well:

“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.”

“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.”

“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

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and what positive measurable outcomes can be associated with the habitat status and trend data? With the plethora of data that will be collected 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.”

“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.”

ISRP, “Final Review of 2010 Proposals for the Research, Monitoring, and Evaluation and Artificial Production Category, Part 1: Programmatic Comments,” ISRP 2010-44A (December 2010), pp. 26-27, <http://www.nwcouncil.org/library/isrp/isrp2010-44a.pdf>.

At the same time, as the ISRP recognized, the basic concepts underlying this suite of proposals are sound, and at least most of the projects are technically sound as well. The challenge has been to shape these concepts and the raw material in these proposals into a regional habitat monitoring and evaluation effectiveness framework appropriate to the magnitude and importance of the habitat foundation of the Fish and Wildlife Program.

The ISRP’s concerns in particular led to a one-day workshop hosted by the Council on February 10, 2011, attended by ISRP members and federal and state agency and tribal representatives involved in the habitat effectiveness monitoring and evaluation work. The main focus of the workshop was on the ambitious proposal to implement in dozens of basins a more systematic and coordinated approach to the monitoring of habitat characteristics -- the CHaMP project. The ISRP produced its follow-up report at the end of March, “Review of the Columbia Habitat Monitoring Program (CHaMP) Protocols,” ISRP 2011-10 (March 31, 2011), <http://www.nwcouncil.org/library/report.asp?docid=53>. The ISRP commented usefully both on the specific issues involved in the proposed CHaMP monitoring protocols and on the broader questions of the link of the CHaMP habitat monitoring to the monitoring of fish population status and trends (the “VSP” monitoring, also known as “fish in/fish out” monitoring) and the analytical methods that will be used to evaluate and report on the results of the monitoring over time. The ISRP’s summary conclusions:

CHaMP is an ambitious monitoring project that attempts to provide long-term habitat status and trend data needed to relate changes in fish populations to tributary habitat restoration actions over a large portion of anadromous salmonid habitat in the Columbia River Basin. It is an important companion to the ISEMP project, even though CHaMP and ISEMP sampling locations are not always the same.

The ISRP was impressed by many aspects of the CHaMP sampling protocols. However, we note that consensus among major habitat monitoring organizations with respect to the most effective protocols for tracking habitat attributes and metrics has not yet occurred. We recommend that the CHaMP team continue its dialog with other monitoring groups to resolve differences in approaches and that consideration be given to designing rigorous field tests of various protocols. We also suggest that CHaMP devote additional attention to case-by-case inclusion of “nonstandard” metrics (e.g., agricultural chemicals) and to developing and testing methods of scaling up site-specific habitat conditions to watershed- and subbasin-scale

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indicators of habitat quality. The latter could be evaluated in a few pilot subbasins where both habitat and fish populations are well sampled.

Additionally, simulations could be used to examine the properties and sensitivity of large-scale metrics of habitat change, as well as to compare and contrast the conclusions of CHaMP analytical tools (e.g., the SHIRAZ model) with other widely used habitat models such as EDT. The most pressing need, we feel, is to develop robust, accurate relationships between VSP parameters for target fish species and changes in habitat condition that are related to restoration, or continued habitat degradation, in CHaMP watersheds.

We believe that some CHaMP protocols need additional refinement and testing, and therefore recommend that project partners focus initial activities on a subset of CHaMP watersheds at geographically diverse locations in the Columbia Basin where restoration is occurring and where both habitat and fish population monitoring are sufficiently developed so that CHaMP can build on existing strong RM&E efforts, such as in intensively monitored watersheds. The ISRP would like to review CHaMP after one to two years of data collection to see how field and data management protocols have been modified and how monitoring results are being incorporated into establishing restoration priorities. In addition, we would like to review the ISEMP "lessons learned" report when it is released.

The framework or architecture for the effort to monitor and evaluate the effectiveness of habitat actions has several different elements, defined and summarized in a number of places, including the Council's draft MERR plan. This need is to monitor and evaluate the effectiveness of actions in producing change at each step in the program's assumed relationship between discrete habitat actions and the ultimate goal of improvements in the number and productivity of key fish populations:

Habitat actions >

- Impact of habitat actions over time in changing key habitat characteristics >
 - Impact of changed habitat characteristics over time on key life-stage fish population characteristics >
 - Impact of accumulated life-stage improvements on life-cycle population characteristics (greater adult abundance, productivity, diversity, population structure).

The ISRP's review conclusions neatly cover three of those key elements, distilled as follows:

Monitoring of the status and trends in habitat characteristics. The primary focus in the ISRP's review has been on the CHaMP proposal to transform the way habitat characteristics are monitored. Key issues raised include the validity of the proposed monitoring protocols and sampling methods, and the scale of proposed implementation.

With regard to the monitoring protocols and sampling methods themselves, the ISRP usefully concluded that there is great value in development a consistent, standardized set of monitoring protocols and methods, and that the basic set proposed in CHaMP makes sense. At the same time

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the ISRP raised a set of useful cautions, including that the choices not to monitor certain parameters might in the end mean valuable information is lacking, while some of the parameters chosen may prove to be less useful. The ISRP recommended building flexibility into the protocols by field testing their value while also monitoring a few “non-standard” (in CHaMP terms) habitat parameters at certain places to evaluate their value. The ISRP also recommended that the CHaMP personnel continue the dialogue with the other entities that monitor habitat characteristics -- such as the Forest Service’s PIBO effort (the PACFISH/INFISH Biological Opinion Effectiveness Monitoring Program) -- and be open to the possibilities of flexibility and adaptive management with regard to methods and chosen characteristics to monitor to synch these different efforts as much as possible.

As for the aggressive scale at which the federal agencies propose to begin implementation of the proposed CHaMP habitat monitoring effort, the ISRP had as many concerns as others have had. The Panel illuminated the potential problems, both at the practical scale (e.g., implementing the sampling effort as described is ambitious, and will likely need time, experience and tweaking to get right) and at the broader scale of whether this is precisely the right approach for monitoring and evaluating changes in habitat characteristics in relation to fish population improvements, given the many uncertainties and sheer novelty of the effort. The ISRP also highlighted the need for “a broadly based buy-in” to the CHaMP effort if it is to be successful, including the development of methods for the effective transfer of information, technology and expertise. And as described in the next section, the ISRP in particular saw a need to improve how the habitat monitoring would line up with salmonid population monitoring in the same basins. And for these reasons the ISRP recommended an incremental or pilot approach, to reiterate:

We believe that some CHaMP protocols need additional refinement and testing, and therefore recommend that project partners focus initial activities on a subset of CHaMP watersheds at geographically diverse locations in the Columbia Basin where restoration is occurring and where both habitat and fish population monitoring are sufficiently developed so that CHaMP can build on existing strong RM&E efforts, such as in intensively monitored watersheds. The ISRP would like to review CHaMP after one to two years of data collection to see how field and data management protocols have been modified and how monitoring results are being incorporated into establishing restoration priorities.

If an incremental or phased-in approach makes sense, it will be important to pick the right basins in which to initiate the work, and the right period of time to gather and review information before deciding on the next increment. This will also mean developing a transition plan to phase out of separate habitat monitoring projects in certain basins as the coordinated CHaMP effort phases in.

Monitoring of the status and trends of fish populations characteristics. The ISRP emphasized both the need for and uncertainty about how well the habitat monitoring would be related to the monitoring of the status and trends in fish population characteristics. This is needed ultimately to verify the value of using these habitat metrics and to evaluate the effectiveness of efforts to change habitat characteristics to achieve the desired population response. The ISRP review conclusions on the need for further development of this linkage are:

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We are still not sure how habitat status and trend monitoring data will be related to (integrated with) status and trends of fish population data within CHaMP watersheds to evaluate the effectiveness of specific restoration strategies or general restoration effectiveness in a geographic area (e.g., are the co-managers in a given subbasin successful in restoring stream habitat in their area?). It was unclear which entity or entities will be responsible for conducting fish status and trends monitoring at CHaMP sites, what kinds of fish data would be collected (e.g., site/reach-specific abundance sampling or fish in- fish out), and what kinds of analytical methods will be used to relate fish status and trends to habitat status and trends. CHaMP indicated that fish population surveys are not being carried out simultaneously with the habitat measurements, although it was their hope that ISEMP and other cooperators would be able to provide fish demographic data that could be associated with the habitat surveys. The linkage between fish and habitat monitoring in CHaMP watersheds requires development.

The ISRP understands that a primary objective of CHaMP is to track status and trends in stream habitat condition over large areas using a spatially balanced sampling approach and that this objective does not, by itself, require corresponding fish population data. However, the corollary objective of determining habitat restoration effectiveness *does* require fish demographic data in order to establish a causal link between habitat change and fish performance. Establishing this connection, we believe, is the primary purpose of intensively monitored watersheds. However, in those CHaMP watersheds where restoration actions are taking place, but which do not have experimentally controlled restoration treatments as in the IMWs, the ISRP feels that there is still great value in collecting both habitat and fish data at as many sites as possible in order to verify assumptions about relationships between habitat conditions and fish populations.

ISRP, "Review of the Columbia Habitat Monitoring Program (CHaMP) Protocols," ISRP 2011-10, at 11.

The need to further develop the linkage between the habitat and population monitoring was one of the reasons the ISRP recommended initiating the CHaMP effort on an incremental or phased-in basis, to help develop and test those linkages, and then adapt or tweak the monitoring protocols if needed to make the links detectable, before implementing across the basin. These conclusions also formed the core of the ISRP's concern about the lack of development and selection of the analytical techniques to be used to evaluate the information obtained (the next topic). And because it is not necessarily the responsibility of, or in the control of, the CHaMP project itself to develop the linkages to the VSP monitoring and the overarching analytical methods for evaluating habitat effectiveness, the ISRP recommended a comprehensive review of the entire framework or architecture after it is more fully developed.

Analytical techniques/models/methodologies to be used to evaluate the ultimate effectiveness in improving fish populations. Related, the ISRP noted there is no "consensus" among the habitat monitoring entities as to the correct analytical tools to evaluate the monitoring data and generate conclusions about the effectiveness of our efforts to change key habitat characteristics and obtain resulting improvements in life-cycle and life-stage population characteristics. As the agencies develop and implement the incremental CHaMP effort, they need as well to put much more definition on the analytical or evaluation end of the habitat effectiveness m&e effort, as well as an explicit commitment to reporting results on a regular basis. The ISRP recommended this be part of a subsequent ISRP review of the overarching habitat monitoring and evaluation framework after the further development called for by the ISRP and discussed here.

In the development and use of these analytical techniques, the Panel noted that “simulations could be used to examine the properties and sensitivity of large-scale metrics of habitat change, as well as to compare and contrast the conclusions of CHaMP analytical tools (e.g., the SHIRAZ model) with other widely used habitat models such as EDT. And the Panel emphasized that “[t]he most pressing need, we feel, is to develop robust, accurate relationships between VSP parameters for target fish species and changes in habitat condition that are related to restoration, or continued habitat degradation, in CHaMP watersheds.” The ISRP also emphasized that the agencies need to build into these analytical techniques some way to account for a set of possibly confounding factors that are not directly captured in the habitat and fish population monitoring, including food web factors; exposure to toxic compounds (ditto); out-of-basin effects of habitats downstream in the tributaries and then in the mainstem, estuary and ocean; and the presence of hatchery fish and non-native species.

Project- or site-level action effectiveness. Note that one important element in the overall architecture of habitat effectiveness has not been part of this review, except peripherally. The habitat effectiveness monitoring and evaluation projects included in this review are focused on watershed- and population-scale efforts to monitor how habitat characteristics are changing and to relate those changes in some way to changes in life-stage and life-cycle population characteristics. Except for the research-heavy Intensively Monitored Watershed efforts, the projects reviewed here do not focus on monitoring whether particular actions are effective in changing targeted habitat characteristics or achieving a local population response. That kind of work is often called “project-scale or local-scale action effectiveness” or “project effectiveness.” That is, did a habitat action (e.g., planting trees) result in the desired change in the local habitat characteristic(s) targeted (e.g., water temperature and sedimentation)?

Most of the “project effectiveness” habitat monitoring in the program, when it happens at all, currently takes place as part of the work elements of individual habitat projects. These projects and work elements are not part of this review, but will be reviewed during the follow-on geographic review of habitat projects. Discussions are also taking place about developing an umbrella approach to this particular type of monitoring, with an independent third party overseeing the monitoring and evaluation of project-scale effectiveness in a coordinated, consistent manner. That umbrella proposal is not ready for review or recommendation in this RME/AP review, but the Council’s recommendation below will highlight the role of this type of monitoring in the overall habitat effectiveness framework, and our expectations for how this monitoring might take place in the future through such an umbrella.

Council recommendation: The recommendation is based squarely in the ISRP review conclusions. The Council supports, as did the ISRP, the concept of a coordinated, standardized approach to monitoring habitat characteristics and evaluating the effects of changes in those characteristics. We know the federal agencies are working, in the aftermath of the ISRP review and other comments and developments, to reshape the implementation plan for the CHaMP project (and possibly the related ISEMP research effort) and to make additional progress on the other elements of the habitat effectiveness monitoring and evaluation framework. In the best example, at the Council’s Fish and Wildlife Committee meeting in Hood River, Oregon, on May 10, NOAA Fisheries staff presented at length on the “Implementation of the FCRPS BiOp Tributary Monitoring and Evaluation Framework.” With some obvious differences (especially about the pace

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of the implementation of the CHaMP project), much of what NOAA presented is consistent with the principles recommended below by staff. The Council expects continued benefits from continued cooperation and communication between NOAA and the Council on this issue.

The Council calls for the federal agencies to follow or incorporate the following principles in this effort:

- Revise the CHaMP project and implementation plan and further develop the other elements of the habitat monitoring and evaluation effort consistent with the ISRP's review conclusions *and do so in collaboration with* the ISRP and the Council and its staff, as well as the basin's other participants in habitat monitoring and evaluation. This cannot be simply a federal agency effort imposed on the Fish and Wildlife Program, even as the Council is also sensitive to the federal agencies' need to meet Biological Opinion requirements. An overarching goal should be that what is developed and implemented is a cost-effective, standardized, independent, statistically valid approach for evaluating habitat effectiveness. Decisions regarding the implementation and sequencing of CHaMP should be driven primarily by how well the scientific review issues have been addressed and not by other considerations.
- Implement the CHaMP project through an incremental approach, consistent with the ISRP's review conclusions. This means:
 - Begin by implementing the CHaMP project *only* in "a subset of CHaMP watersheds at geographically diverse locations in the Columbia Basin where restoration is occurring and where both habitat and fish population monitoring are sufficiently developed so that CHaMP can build on existing strong RM&E efforts, such as in intensively monitored watersheds." The federal agencies should consult with the Council and others before deciding in which basins to initiate the incremental effort. The basins chosen should allow for the best opportunities to relate, align and integrate the habitat status and trend monitoring data with the monitoring of the status and trends of fish population characteristics. If possible, the chosen basins should also provide good opportunities for exploring how to coordinate the CHaMP approach with the existing habitat monitoring efforts of other entities.
 - Implement the monitoring protocols in the subset of the basins in such a way as to:
 - flexibly and rigorously field-test the proposed sampling methods and the appropriateness or value of the habitat characteristics chosen for monitoring;
 - include some monitoring of "non-standard" (in CHaMP terms) metrics and methods to evaluate their value;
 - continue the dialog with other monitoring groups to resolve as much as possible the differences in approaches to habitat monitoring, including the use of side-by-side field comparisons of various protocols as part of the pilot effort;
 - develop and assess the relation of the habitat monitoring to the fish status and trend monitoring in the same basin;

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- as part of developing and assessing the pilot basin approach, develop and test methods of scaling up site-specific habitat conditions to watershed- and subbasin-scale indicators of habitat quality;
 - explore whether monitoring more sites less intensively may be more valuable than monitoring fewer sites more intensively;
 - develop to a satisfactory level the methods for the transfer of information, technology and expertise to the people and entities participating in CHaMP; and
 - clearly identify the roles for the various cooperators in the CHaMP effort (e.g., data collection only, responsible for producing analysis of the monitoring effort either separately or as part of a collective effort, etc.)
- The CHaMP project sponsors, working with their agency partners, should develop a “lessons learned” report based on the experience in the pilot subbasins that includes any proposed revisions to the protocols and methods based on what has been learned; a review of how well the habitat and the population monitoring has been linked or integrated; and any proposals to ramp up the implementation of CHaMP. The ISRP and then the Council should review this report and the proposals for future work favorably *before* the federal agencies ramp up the implementation of CHaMP into other basins. Decisions on whether to continue or ramp up implementation of the CHaMP monitoring effort will also depend on progress made in developing and reviewing the other elements of the habitat effectiveness framework (*see* below).
 - As the federal agencies implement the CHaMP project in an incremental fashion, Bonneville should work with the Council, NOAA and other participants on a transition plan as to how to implement and/or phase out separate projects involved in the monitoring and evaluation of habitat characteristics. Projects involved in the monitoring of fish population status and trends should, as a general matter, be implemented for the time being, with the possibility of reshaping those projects as needed upon further experience with the implementation of CHaMP and its relation to fish population monitoring.
 - During the initial pilot phase, Bonneville and NOAA Fisheries will meet at least quarterly with the Council’s Fish and Wildlife Committee to report on progress with field testing monitoring protocols, techniques and methodologies as implementation in the pilot subbasins is carried out.
- Within one year, NOAA and Bonneville, working with other relevant participants, should further develop the analytical, evaluation and reporting elements of the habitat effectiveness monitoring and evaluation effort to accompany the CHaMP monitoring, consistent with the ISRP’s review conclusions. The agencies should then produce a clear statement about those elements for the ISRP and Council to review. The statement should include:
 - A description of the analytical methods and models to be used to evaluate the monitoring data relevant to habitat effectiveness and how these methods and models will be used so as to incorporate or respond to the ISRP’s review conclusions. Include an evaluation of how the different models and methodologies compare, such as SHIRAZ and EDT and

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the use of expert panels, and how the output of these methods and models will be used in further decisions on the implementation of habitat actions.

- Explain how, within these analytical methods and models, the habitat status and trend monitoring data will be related to and integrated with the status and trends of fish population data in order to evaluate the effectiveness of specific restoration strategies or general restoration effectiveness in a geographic area. Explain how the analysis will develop robust, accurate relationships between the VSP parameters for target fish species and changes in habitat condition that are related to restoration, or continued habitat degradation, in the CHaMP watersheds.
- Explain how the results of the ISEMP Intensively Monitored Watershed research efforts will be integrated into this analysis. Consider whether and to what extent it is important to continue the distinct IMW effort and at what scale.
- Explain how the evaluation results will be regularly and publicly reported and used to guide decisions on the implementation of habitat actions in the future.
- During the development phase, Bonneville and NOAA Fisheries will meet at least quarterly with the Council's Fish and Wildlife Committee to report on progress with developing the analytical, evaluation and reporting elements of the CHaMP monitoring protocols.
- All projects involved in this review that are part of the overall habitat effectiveness monitoring and evaluation effort will receive implementation recommendations consistent with these principles, allowing for significant reshaping of the projects as the elements are better developed and reviewed. The Council expects the main focus of any reshaping to be primarily on CHaMP and other habitat monitoring projects.
- With regard to the monitoring and evaluation of how effective specific habitat projects are at obtaining and sustaining targeted changes in habitat characteristics (project effectiveness): Within the year Bonneville and its partners should develop for ISRP review a proposal to transform that effort away from monitoring work elements on individual projects into a cost-effective, independent third-party, standardized, and statistically valid method for evaluating project-level effectiveness. This transformation should be ready in time for the geographic review of habitat actions. Also, the development and review of analytical methods and models called for above should include consideration of how to use information on project or site-level effectiveness in the overall evaluation of the effectiveness of our collective habitat work in realizing improvements in habitat and fish characteristics at the population and watershed level.

3. Monitoring and evaluating the effectiveness of habitat actions in the estuary

Issue: The estuary presents a particular version of the habitat effectiveness issue identified just above. The 2009 Fish and Wildlife Program and the 2008 FCRPS Biological Opinion significantly

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increased attention on the potential for salmon and steelhead survival gains in the lower Columbia River and the estuary. Project implementation and funding levels have correspondingly increased, both for habitat actions and for assessment and monitoring and evaluation elements. But along with the growing attention to the needs in the estuary there appears to be a lack of coordination and communication among different activities, especially a lack of a sufficiently developed framework for linking actions and effectiveness monitoring and evaluation.

The RME review includes two projects devoted to or focused on estuary research, monitoring and evaluation. Meanwhile, the Corps of Engineers is funding and implementing research, monitoring and evaluation activities in the estuary and lower Columbia River as well, and Bonneville staff report that in discussions among the Action Agencies, the Corps of Engineers has been assigned the ultimate responsibility for evaluating action effectiveness in the estuary. In addition, in 2009, Bonneville implemented RPA 37 of the FCRPS BiOp by forming an Expert Regional Technical Group (ERTG) for the estuary. The purpose of the ERTG is to provide technical support to the Action Agencies on *estimated survival benefits* from habitat actions in the estuary, to help inform the selection of habitat restoration activities in the estuary and lower Columbia River. A related initiative is the Integrated Status and Trends Monitoring (ISTM) program. This is a demonstration effort under PNAMP, focusing on developing monitoring processes and tools in the estuary. There are multiple entities involved in this effort including ODFW, WDFW and the US Geological Survey (USGS).

The various activities and participants may each make sense in concept. But better coordination of the work *and* an overarching synthesis of the action effectiveness monitoring and evaluation to the habitat actions are needed if the activities in the estuary are going to be conducted in a scientifically sound, efficient and collaborative manner. One illustration of the problem: Program implementation includes two habitat projects to address the Biological Opinion habitat needs (*CREST Estuary Habitat Restoration* (2010-004-00) and *Columbia Land Trust Estuarine Restoration* (2010-073-00)). Both received unfavorable reviews in 2010 from the ISRP. The Panel recognized the importance of these projects for the BiOp's habitat restoration effort in the estuary. Yet it was completely unclear to the ISRP how these two projects actually fit into an overarching approach to the estuary linking habitat restoration actions to limiting factors and management decisions to monitoring and evaluation activities.

What happened to those two projects is thus symptomatic of the larger issue -- the lack of a clear synthesis or framework in the estuary linking habitat restoration actions to monitoring efforts to action effectiveness evaluations. Part of the issue may lie in the division of responsibility. As noted above, Bonneville informed the Council that the Corps and Bonneville have divided the estuary responsibilities such that Bonneville has assumed responsibility for a significant portion of the habitat restoration actions and status and trend monitoring, while the Corps of Engineers assumed responsibility for action effectiveness monitoring and evaluation. This may work, but only if there is an overarching synthesis of the habitat effectiveness monitoring and evaluation effort in the estuary to connect the elements. Some important elements of a synthesis are being developed (for example, the Corps of Engineers just posted a draft report titled "Evaluation of Cumulative Ecosystem Response to Restoration Projects in the Lower Columbia River and Estuary"). Still further integration of the various elements is necessary to develop a useful comprehensive framework for the estuary. The Council's RME/AP review can be useful in prompting the

responsible entities to develop an estuary-wide synthesis report as described here, for ISAB or ISRP review.

Council recommendation: The Council calls for the responsible entities to complete an estuary-wide synthesis prior to the initiation of the review of habitat actions. Discussions are still occurring with the staff of Bonneville, the Corps of Engineers and others as to the precise contours of this synthesis report. But it should be a synthesis that will summarize the research and monitoring that has occurred or is occurring in the estuary, and how that information will be evaluated, and by what methods and on what reporting schedule, and then used to inform management decisions and priorities for restoration. This is *necessary* if the on-the ground work in the estuary (such as the CREST and CLT projects) is ever to achieve satisfactory scientific reviews and continue with minimal disruption. The synthesis should also assess whether protocols used for the collection of information are standardized or compatible throughout the estuary, and should assess levels of uncertainty and risk in the conclusions drawn. The synthesis report should inform the further development of the research, monitoring and evaluation implementation strategies to accompany the Council's draft Monitoring, Evaluation, Research and Reporting (MERR) Plan.

Among other elements, this synthesis report should also explain more clearly the role of the one estuary monitoring project reviewed as part of this RME/AP review, the Lower Columbia River Estuary Partnership's Ecosystem Monitoring project. The ISRP and staff review of that specific project further highlighted the need for a synthesis of the information collected under the project and how it will be used to evaluate actions. The project should be contracted in such a way that it may be revisited and reshaped if and when needed to reflect the progress made through the development of the estuary-wide synthesis described above. *See* the recommendations and comments for that project for additional information.

4. Monitoring and evaluating the effectiveness and effects of artificial production actions

Issue: The artificial production portion of the category review includes (a) projects that involve the planning, development, operation and maintenance of artificial production activities funded under the Council's Fish and Wildlife Program; (b) separate projects that direct the monitoring and evaluation of these production initiatives; and (c) a set of research, monitoring, evaluation and coordination projects aimed more generally at investigating the effectiveness and effects of artificial production. The Independent Scientific Review Panel favorably reviewed the projects in the category, finding them largely well designed with the ability to report data important to the implementation of regional artificial production goals and objectives. This is due in large part to the number of times many of these projects have been reviewed and improved in the past, upon which significant production commitments have been made under the Fish and Wildlife Program, Columbia Fish Accords, and the *U.S. v. Oregon* agreements and analyses.

Even so, the review by the ISRP and by the Council staff, and the continued stream of information about production that comes the Council's way, continues to highlight critical issues and uncertainties with production. The key question that continues to be asked of the production efforts in the basin, both funded under the Program and otherwise, is whether the production of hatchery-origin fish is or might be having unacceptably adverse effects on the fitness of natural-origin fish, adverse effects that might overwhelm whatever are the benefits of the artificial

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production. There is still uncertainty and contention around this question, as well as a body of hatchery reform recommendations, such as the HSRG report and the work of the Ad Hoc Supplementation Workgroup intended to reduce that risk and uncertainty through recommendations that might be applied more aggressively in certain cases. It is thus not clear whether the production effort under the Fish and Wildlife Program, individually and collectively, is designed and coordinated sufficiently (within the program and with production activities funded outside the program) to be able to evaluate this relationship to the extent we need to and, especially, to then be able to implement hatchery reform measures to improve and protect natural-origin fish when a potential problem is identified.

The lack of a regionally coordinated umbrella for the ongoing collection of monitoring information and the evaluation and reporting of conclusions on hatchery effects and effectiveness thus remains a concern. The multi-agency Anadromous Salmonid Monitoring Strategy (ASMS) helps, but it is not itself the vehicle for the coordinated accumulation and evaluation of the relevant data on production. However, the RME/AP review does contain one newly defined Bonneville/NOAA project aimed precisely at this need, consistent with the ASMS -- the Columbia River Hatchery Effects Evaluation Team (CRHEET). Unfortunately, the CRHEET project is still under development, and not enough is known yet of the details to be able to assess whether and how it will serve the need. The federal agencies sponsoring the project are deferring the beginning of the CRHEET project until the next fiscal year, giving the Council and others time to participate in the effort to work out the project details in the right way.

Council recommendation: The Council, as part of its decisions in this RME/AP review, recommends that the federal agencies incorporate the following principles when designing and implementing an umbrella approach to the monitoring and evaluation of artificial production effectiveness and effects:

- The technical workgroup or team established for this purpose be truly a multi-agency team drawn from the federal, state and tribal agencies and Council staff, with a few unaffiliated members as well.
- Avoid another general review of the problems and benefits of artificial production, nor another separate effort to evaluate all individual production activities and programs. We have many such reviews, guidelines, recommendations, and experiences to draw from over the last 15 years, including most recently the work of the Hatchery Scientific Review Group (HSRG). We also have a plethora of ongoing processes in which to bring this information to bear, including project reviews, step review planning, and hatchery consultations under the Endangered Species Act.
- The Team should build on previous efforts to further the monitoring and evaluation of hatchery effects and effectiveness. This includes the “Recommendations for Broad Scale Monitoring to Evaluate the Effects of Hatchery Supplementation on the Fitness of Natural Salmon and Steelhead Populations - Final Draft Report” from the Ad Hoc Supplementation Monitoring and Evaluation Workgroup (AHSWG 2008); the HSRG’s recommended metrics; the ISRP’s Metrics Review (ISRP 2008-7); and the joint report of the ISRP and

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ISAB on the Monitoring and Evaluation of Supplementation Projects (ISRP/ISAB 2005-15).

- The Team should develop a standard set of reporting metrics for the monitoring and data collection efforts, necessary for any overall or comparative evaluation of hatchery effectiveness and effects as a main focus of the umbrella effort. These metrics should include:
 - PNI values (proportionate natural influence on a composite hatchery-/natural-origin population)
 - HOB and NOB values (number of hatchery-origin fish and natural-origin fish used as hatchery broodstock) and pNOB values (proportion of hatchery broodstock composed of natural-origin fish)
 - HOS and NOS values (number of hatchery-origin fish and natural-origin fish spawning naturally) and pHOS values (proportion of natural spawners composed of hatchery-origin fish)
 - HORs and NORs values (number of hatchery-origin recruits and natural-origin recruits)
 - stray rates
 - carrying capacity in areas affected by production releases and returns (ultimately information will also need to be developed and integrated on carrying capacity for juveniles in mainstem migration corridors and the estuary)
 - life history characteristics and genetic diversity for naturally spawning populations from both production and non-production reference streams
 - comparative productivity, abundance, diversity and fitness measures for naturally spawning populations from both production and non-production reference streams
 - comparative timing of returns of hatchery-origin and natural-origin fish
- The Team should also establish or identify a readily accessible means by which to share the data reported on these metrics, to facilitate assessments at level above individual production activities.
- The Team should then work with management and policy representatives across the agencies in the Pacific Northwest to make sure these metrics are consistently used, reported on and evaluated in whatever review process is underway. This includes project reviews, “three-step” reviews or similar reviews of proposals for new production, hatchery consultations, decisions on research priorities relating to production, and broad-scale program planning decisions that include issues of production policy. Further, management and policy representatives across the agencies in the Pacific Northwest should make sure that any proposed changes to current hatchery production and associated infrastructure, such as new or upgrades to production or weirs, should be reported to the team so that these changes can be taken into account in the basinwide effort to assess hatchery effects and effectiveness.
- In a second main focus for this effort, the Team should be clear about what analytical techniques it will use or suggest be used to evaluate this information, as well as any large-

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scale experimental designs that the team recommends as necessary to address critical uncertainties. The team should also develop and recommend a clear approach for how the evaluation results should be regularly reported and used to guide production reform and improvement activities.

- In consultation with the Council and others in the region, the Team should develop and recommend a set of criteria to help prioritize research questions, including efforts to assess relative reproductive success.
- The Team should annually report its progress on the tasks it undertakes. This should include progress on the use and reporting of the standardized metrics. As the team develops and implement its approach for evaluating hatchery effects and effectiveness, the report should also include recommendations regarding infrastructure and other needs to assure that data on these metrics can be collected and shared efficiently. The annual report should also assess ongoing production reform activities and the extent to which the team's activities are having a practical effect.
- The Team should also regularly report -- perhaps every three to five years -- on the analytical results of the monitoring, data collection, research, evaluation and production reform activities, including an assessment of the extent to which the results and the way the results are being used are narrowing the uncertainties and reducing risks.

On this basis, the Council also recommends implementation of the projects relating to artificial production as proposed and reviewed as part of the decision on the "A list" of projects. All of the artificial production projects on the "A list" that involve research, monitoring and evaluation should be contracted in such a way that the Council may revisit and recommend revisions to a project if and when needed to reflect the progress made through the umbrella approach as described above. As such, the projects within this group carry the following implementation condition: "Implementation subject to regional hatchery effects evaluation process described in programmatic recommendation no. 4."

5. Research projects relating to the ocean

Issue: The RME review included three research projects totaling \$5 million per year studying the survival of salmon and steelhead in the ocean. Each project has its particular merits and issues, addressed by recommendations and comments associated with the project. But the ISRP report and staff review have raised broader issues about the ocean research, including the lack of any overarching plan for the ocean research and a lack of coordination among the projects, and a lack of coordination with the projects in the estuary also attempting to estimate juvenile salmon mortality. It is also not clear how the projects collectively are addressing the ocean strategies in the 2009 Fish and Wildlife Program and thus how the information to be gained will help us distinguish the effects of ocean conditions from other effects and help us manage in freshwater for variable ocean conditions.

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After noting the lack of coordination and synthesis, the ISRP (in its programmatic comments) suggested the possibility of a Bonneville/NOAA sponsored forum on the effects of ocean and climate conditions on Columbia fish and wildlife. Substantive topics needing more consideration included an inquiry into life history and density dependence matters, the possible development of simulations and predictive models to vary harvest or hatchery releases, and in general a better coordinated effort to understand how ocean conditions affect growth, survival and ocean distribution of anadromous fish. These considerations and the project-specific reviews help inform the Council how best to continue research in the ocean under the program.

Council recommendation: The Council calls for the project sponsors involved to complete jointly a comprehensive synthesis report on the ocean research. The synthesis report should be responsive to the program's strategies, the ISRP's comments, and the points noted here in the description of the programmatic issue. The synthesis should detail what has been learned, what is being investigated, what conclusions can be drawn now, and the expected time frame for the research to yield further conclusions. The synthesis report should include consideration of potential salmon management implications, and if possible recommendations for management based on the information collected and evaluated. The report should also describe how the disparate research projects will be coordinated from here on, and how data collection will be standardized and data made widely accessible. The report should also take into account related ocean research conducted by others not funded under the program, including an assessment of what opportunities we have to draw information and conclusions useful for the program from that other research.

Under this scenario, the Council recommends that the funding for the ocean research projects through FY 2012 are to include the completion of the synthesis report and to allow for subsequent ISRP review and a Council recommendation on future implementation and funding. The project sponsors have already begun working on the synthesis, in the hopes of completing it near the end of 2011. Even if the synthesis report is completed in 2011, it likely will still be necessary to continue the projects into 2012, during which time the ISRP will review the report and the Council will consider future funding for ocean research projects. If the scope of work and budgets for the projects need to be reworked to accommodate the production of the synthesis report, Bonneville should see to that. The Council and Bonneville will decide on additional funding for these projects in out years depending on the production and review of the synthesis report, and then on how the project sponsors propose to re-shape the research projects consistent with the recommendation here and the outcome of the synthesis report review.

6. Research projects in general

Issue: Research projects can help to resolve critical uncertainties concerning regional efforts to protect, mitigate and enhance fish and wildlife populations. The development, evaluation and testing of specific hypotheses can shape the Council's work to be more effective and responsive to gains in scientific understanding. Results from research can drive improvements in planning and implementation and regional dialogue that expands the opportunity to collaborate and learn from each other by improving timely access to information. Related to the first programmatic issue described above about project and program results, the implementation and review of the program by Bonneville and the Council could be improved by a more formal structure for designing, implementing and reporting of the results of research projects.

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The RME review includes a number of research projects (approximately 30) across the spectrum of the Fish and Wildlife Program. Some are pure research; some are projects that mix research elements with other aspects of monitoring, evaluation, assessment, or on-the-ground actions. The ISRP and then the Council have worked in this review to assess whether individual research projects have an appropriate study design that clearly states the hypotheses or premises being investigated, the reason the research should be considered a priority by addressing critical uncertainties important to management decisions under the program, the methods and timelines for the research, and a definite terminus date for the research. Ongoing research must be reporting results and progress. The comments and conditions associated with individual research projects will highlight these factors, include whether these elements are missing and need further definition.

Council recommendation: The Council recommends that all research projects receive no more than three-year funding recommendations. Out-year funding will be dependent on ISRP and Council review of the reports of research results and a proposal for further work.

More generally, the Council recommends that Bonneville, working with the Council and other program participants, identify, organize and track all research projects as part of an overall research effort. When projects include both research and monitoring and evaluation elements, the research components should be tracked as part of these coordinated research efforts. All research projects should initially report basic information, followed by an annual status report that can be used to track the accomplishments of projects. Information to be reported by research projects should include the following:

Initially Report:

- An accounting of past hypotheses tested, conclusions reached, and benefits for fish and wildlife;
- A clearly defined hypothesis to be tested that links to a critical uncertainty; description of scientific methods and statistical analyses; a timeline for producing results including milestones and end dates.

Annually Report (including final report):

- Electronic progress reports including any results, conclusions, benefits for fish and wildlife, and a link to any publications resulting from the work.

How to evaluate from a programmatic perspective what research is a priority under the Program is also becoming an issue. The Council approved a Research Plan in 2006. The RME/AP review indicates that the plan may be out of date in certain particulars, and the plan's statements about research priorities may be too broad in certain cases to provide much guidance in shaping priorities. Other plans and programs are also a source of research priorities, especially the FCRPS Biological Opinion and the Corps of Engineers' research efforts, and the disparate efforts are not sufficiently coordinated. The Council and staff have already been discussing the need for review and possible revision of the Research Plan before the next program amendment process, coordinated with and tiered off of the effort to develop a comprehensive Monitoring, Evaluation, Research and Reporting (MERR) Plan. Consistent with that idea, the Council, in the next two years, plans to undertake a

thorough review and revision of the Research Plan, yielding a much more rigorous set of priorities for research to guide future project reviews. The Council will consult with Bonneville, NOAA, the Corps, the other federal agencies, and the relevant state agencies and tribes in this review.

7. White sturgeon

Issue: White sturgeon were historically highly migratory throughout the Columbia Basin and ranged freely between freshwater and marine environments.¹ Dam construction has fragmented the historical population into a series of subpopulations to which the marine environment is no longer available. Most impounded populations are recruitment-limited due to a lack of suitable spawning habitat or flow conditions suitable to produce significant recruitment in the available habitat. The primary spawning population with annual recruitment occurs below Bonneville where better flow and habitat conditions exist. These populations still have access to the estuary and ocean. Other factors significantly affecting sturgeon populations in the lower river include harvest and increasing sea lion predation.

The RME/AP review included four white sturgeon projects in the lower river (that is, from the mouth of the Columbia upstream to Priest Rapids on the Mainstem and up to Lower Granite Dam in the Snake River). These projects collectively include research, monitoring, evaluation and supplementation elements. Current project funding is focused on periodic population status assessment monitoring, recruitment indexing in relation to flow and hydropower operations, fishery management to optimize production of impounded populations in the reservoirs, and evaluations of the appropriateness and feasibility of hatchery mitigation in the Federal Columbia River Power System portions of the mid-Columbia and lower Snake River reservoirs.

The ISRP's review of the specific projects was favorable, albeit with comments about certain elements and activities. These project-specific matters are addressed in the projects comments (*see* Part 3). Yet the ISRP, looking at the collective effort in light of the current condition of sturgeon and of sturgeon knowledge, had several significant programmatic concerns, which the ISRP summarized as:

1. An effective basinwide management plan for white sturgeon is lacking and is the most important need for planning future research and restoration.
2. Specific factors affecting recruitment of white sturgeon are poorly understood.
3. The importance of the estuary and ocean in sturgeon production below Bonneville Dam is poorly understood.
4. The productivity of pools above Bonneville Dam for sturgeon is poorly understood.
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.

The staff concurs with these comments. We would add concerns about the progress on efforts to address mainstem dam passage issues. The Mainstem Plan in the 2009 Fish and Wildlife Program calls specifically for studies that evaluate effects and mortality with respect to dam

¹ Though sturgeon were historically migratory, they are current treated in the program as "resident fish."

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passage. It also calls for an evaluation of the importance of connectivity among populations; assessment of population isolations and evaluation of the feasibility of mitigation, and that this work should occur prior to investing in additional supplementation efforts.

Council recommendation:

1. *Develop a comprehensive management plan for white sturgeon through a collaborative effort involving currently funded projects.*

Two of the four projects are specifically tasked with leading or assisting with the comprehensive management plan. The focus of these two projects would need to be expanded to also include the area downstream from Bonneville Dam. Complete the comprehensive management plan for review by June 2012.

Columbia River Inter-Tribal Fish Commission, Project 2007-155-00. Include in the project contract in Objective 1 to:

Complete, in conjunction with regional, tribal, state, and federal management entities, a collaborative and comprehensive strategic plan for sturgeon conservation, restoration and management to include specific objectives, strategies, actions, milestones and schedules for habitat protection and restoration, natural production, hatchery production, fishery management, research, monitoring, and evaluation.

Yakama Nation, Project 2008-455-00. Include in the project contract in Objective #1 to:

Assist in the development of a recovery, research and monitoring strategy, and hatchery Master Plan for depleted sturgeon populations in FCRPS portions of the mid-Columbia (below Priest Rapids Hydroelectric Project) and lower Snake rivers.

This management plan effort is outside of the current scope and intent of the third sturgeon project in this review, Project #1986-050-00. However the sponsors of that project recognize the importance of this comprehensive management plan and are in agreement to collaborate on this effort and to work with the Council on the plan. The fourth and final project, the Columbia River Inter-Tribal Fish Commission's sturgeon genetics project (2008-504-00) is linked to Project 2007-115-00 above, and will provide information to be incorporated into the management plan.

Subject to revision as discussions continue before the conclusion of this review, the comprehensive management plan should include:

- A description of what we know and do not know about sturgeon life history, status, limiting factors, and current and past programs and activities. The plan should also describe results and conclusions from past work and the extent to which both previous and future work has or will benefit sturgeon and other fish and wildlife. Within the planning area from the mouth of the Columbia upstream to Priest Rapids on the mainstem and up to Lower Granite Dam on the Snake River, this comprehensive management plan should describe for sturgeon a comprehensive and integrated vision, goals, critical uncertainties and risks related to uncertainties, research needs, strategies, and related provisions. The plan should also include summary information for sturgeon areas above Priest Rapids and Lower Granite.

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- Area-specific sections or chapters that identify conservation, mitigation, management and research objectives, strategies, actions and schedules for different portions of the basin.
- Guidance for subsequent implementation work plans, schedules and agreements must be incorporated into the comprehensive management plan.

All of the sturgeon projects should then receive a project-specific recommendation as follows: The Council would recommend implementation for each sturgeon project with relevant conditions through FY 2012. Funding in FY 2013 would be dependent on outcome and review of the plan to reflect the need to implement the highest-priority actions.

2. Conduct a regional workshop on sturgeon passage.

In programmatic comments on the white sturgeon projects, the ISRP called for an evaluation of mainstem passage. The Council will work with Bonneville, the Corps of Engineers, and the fish and wildlife managers to conduct a sturgeon passage workshop. The workshop should explore and describe the current state of knowledge for passage of sturgeon with a focus on the Columbia River Basin. The purpose of the workshop would be to:

- Review sturgeon passage projects in other areas -- regionally, nationally and internationally;
- Define and characterize or quantify anticipated risks and benefits of passage among reservoirs;
- Identify opportunities and constraints to implementing white sturgeon passage improvements among lower mainstem dams;
- Identify critical unknowns and potential assessments to address them;
- Consider experimental and adaptive approaches for implementing changes; and
- Identify monitoring needed to assess passage effectiveness.

The workshop should solicit broad participation from individuals with expertise in Columbia River salmonid passage as well as those with expertise in passage of other sturgeon species. (Note that the 4th Annual North American Sturgeon and Paddlefish Conference will take place July 11-14, 2011, at Vancouver Island University, in Nanaimo British Columbia, a potentially good venue for encouraging participation by sturgeon experts from outside the Columbia Basin. This topic might also be included in the next of the Boardman series of sturgeon planning workshops in Winter 2011-12.)

8. Lamprey

Issue: The RME/AP review included a set of six projects targeted at lamprey that total nearly \$2 million per year. The Corps of Engineers is also funding and implementing five lamprey dam passage-related projects at up to \$5 million annually as a commitment under the Columbia Fish Accords (not reviewed here). The goals and objectives associated with this group of projects focus on determining the status of lamprey populations in different locations and on identifying and addressing the factors that are limiting lamprey survival and productivity.

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The ISRP recognized the progress being made through these projects at learning more about 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. However, the ISRP is also concerned about the lack of an overall synthesis of results from all the lamprey restoration projects in the basin. Given that some of assessment work began more than a decade ago, the ISRP believes that a summary of results should be available and is required to guide future lamprey restoration efforts. The ISRP identified a set of questions that should be addressed in such a synthesis report (ISRP 2010-44A, at 20). On the other hand the sponsors of these projects are largely focused on particular subbasins, and a Columbia or Pacific coast-wide synthesis is not within the scope of their work.

Thus, the key programmatic issue regarding lamprey is whether these efforts are or can be sufficiently coordinated in a way to allow for the information generated by the individual projects to be gathered, analyzed and synthesized in a more comprehensive basinwide approach. The goal would be to have a comprehensive implementation and monitoring program that reports and analyzes results, addresses the critical data gaps for lamprey, and makes sure that information and results and analyses are being shared among sponsors to support coordinated adaptive management of the lamprey restoration effort.

Council recommendation: The Council call for the development of a synthesis report on the lamprey efforts under the program as described above, addressing the issues and questions raised by the ISRP in its December 2010 programmatic comments. The Council concurs with the ISRP suggestion that the inter-agency Columbia River Basin Lamprey Technical Working Group is the likely gathering of experts to produce a basinwide synthesis. The synthesis should summarize results and develop conclusions on the data gathered so far about the status and trends of lamprey populations, limiting factors, and critical uncertainties and risks. The report should also prioritize actions based on these conclusions. Critical questions to analyze include the value of tributary habitat projects in helping to improve lamprey returns, whether mainstem dam passage is the key limiting factor, and the relative role of other factors such as ocean conditions and toxic contaminants.

Staff understands that the Lamprey Technical Working Group believes that they have much of what the ISRP is looking for in a synthesis report. The Working Group is exploring with their members when and how to complete the report, potentially aiming for completion before the end of 2011. None of the projects thus far needs to be modified to complete this report, and all members seem committed to developing the synthesis. The Working Group includes most of the lamprey experts in the region, even beyond those involved in projects funded through the program.

The ISRP should review the synthesis once it is complete. The staff has drafted project-specific recommendations that would call for implementation of the lamprey projects beyond FY 2012 to be subject to the conclusions that arise out of a review of the synthesis report by the ISRP and the Council and any proposed reshaping of the work based on that report. Staff met with the Working Group on May 3 and confirmed this path forward.

9. Coded-wire tags

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Issue: The Council's has had concerns over Bonneville funding of coded-wire tags for more than a decade. In 1997 the Council expressed concerns about a proposal for Bonneville to spend nearly \$3 million per year on coded-wire tags, concluding that *"Tagging throughout the basin and coastwide has primarily benefited the states' harvest regulation activities. This is not an area of Power Act/Council concern or authority... .. The issue is whether the level of Bonneville funding for coded wire tagging is out of proportion with what could be considered Bonneville's "fair share" of the coded wire tagging program, whether that share is based on the proportional number of fish from direct program-funded hatcheries that must be tagged or on the amount of information gleaned from the tags that is relevant to the Council's program."*

At that time the Council called on Bonneville to consult with the coded-wire tag participants and other agencies to realign program funding. This happened to some extent, and Bonneville investments in coded-wire tags dropped to some extent (e.g., even below \$2 million in 2008 actuals). But the issue has never been evaluated and resolved to the Council's satisfaction. And the project proposals for coded-wire tag funding by Bonneville now seem nearly as extensive as ever, with a FY2012 proposal for nearly \$3 million, climbing to \$3.5 million and higher later in the decade.

At the same time, the ISRP and others have raised issues about the continued use of coded-wire tags, most recently in an exhaustive report out of the Pacific Salmon Commission: (*Pacific Salmon Commission Coded Wire Tag Workgroup. 2008. An action plan in response to Coded Wire Tag (CWT) Expert Panel Recommendations. Pacific Salmon Comm. Tech. Rep. No. 25: 170 p.*) These concerns include a lack of coordination, concerns about whether tag recovery efforts are sufficient to generate meaningful evaluation or study results, questions about whether coded-wire tag information is being effectively used to assess modern management issues, concerns over whether certain factors (e.g., mini-jacks) bias results using coded-wire tags, and questions about whether coded-wire tagging should give way to newer tagging technologies. The ISRP concluded that there is a definite need for the development of a comprehensive plan that guides tagging and recovery activities throughout the basin, especially among coded-wire tag operations.

Council recommendation: The Council recommends funding for the coded-wire tag projects for two years only, at the requested FY2012 level. The funding recommendation would be conditioned on the project sponsors, within that time, working with the Council staff to develop an overarching plan for ISRP review to coordinate the tagging of salmon throughout the Columbia River Basin, including the recovery of coded-wire tags in the fisheries, on the spawning grounds and elsewhere. In that plan, the sponsors should:

- address the ISRP's concerns and comments, including evaluating the magnitude of mini-jacks among yearling coded-wire tagged Chinook salmon releases, and recording mini-jack data in the RMIS database);
- address the recommendations of the Pacific Salmon Commission's Coded-Wire Tag Workgroup;
- provide information identified in RPA 62 of the 2008 FCRPS Biological Opinion explaining how coded-wire tag data helps:
 - inform our understanding of survival;
 - inform our understanding of straying;

- inform harvest rates of hatchery fish by stock, rearing facility, release treatment, and location;
- evaluate the viability of replacing coded-wire tags with newer more efficient tagging techniques, including a transition plan to make these changes;
- consider the issues around the use of coded-wire tags in the context of all the tagging of all types of salmon and steelhead in the basin, including the continued review of the use of PIT and related tags described in the next issue below; and
- in collaboration with the Council staff and Bonneville, review the appropriate level of Fish and Wildlife Program participation and Bonneville funding of coded-wire tagging.

Based on the plan and the ISRP review, the Council will then work with Bonneville and the tagging agencies to revise the coded-wire tag projects for the appropriate level of future funding. The Council may charter a formal facilitated workgroup consisting of coded-wire tag project sponsors and Council and Bonneville staff and others to address the need within the Fish and Wildlife Program for coded-wire tag information, a transition plan to alternative, more reliable tagging technologies, and the appropriate level of Bonneville funding for this work.

10. PIT tags and related tags

Issue: The ability to mark and tag fish is one of the most important and useful techniques available to fishery managers and researchers. Tagging of salmon, steelhead and other fish species using Passive Integrated Transponder (PIT) tags, as well as use of active tags such as acoustic and radio telemetry, is a key tool for monitoring and evaluating both juvenile and adult salmon passage from headwater rearing areas through the mainstem hydropower projects, into the ocean, and back to the spawning grounds. Both passive and active tags are used in a wide array of research, monitoring and evaluation (RM&E) projects throughout the Columbia Basin. Fish tagging projects utilizing both passive and active tags are funded under the Council's Fish and Wildlife Program, the 2008 FCRPS Biological Opinion, the Fish Accords, various Habitat Conservation Plans, the Corps-sponsored Anadromous Fish Evaluation Program (AFEP), and state salmon and steelhead recovery efforts. Collectively, these programs utilize either active or passive tags (or both) to monitor the status of fish populations, evaluate the effectiveness of various management actions, and resolve critical uncertainties in recovery strategies.

There are 12 projects in the review involving PIT tagging (11 projects) or the use of otolith marking (1 project) in monitoring, evaluation and research. Estimated total three-year average funding proposed for all tagging projects in this programmatic topic area for FY2012-2014 is approximately \$15 million. All of these projects are important to implementation of the FCRPS Biological Opinion and the projects themselves received largely favorable reviews by the ISRP.

Even so, the ISRP and other reviews have raised issues about the suite of tagging projects. One is whether all these tagging efforts are sufficiently well coordinated so that we have a comprehensive monitoring and evaluation program addressing the critical data gaps or uncertainties, and so that tags, data and results are being shared among sponsors in such a way to adaptively manage future work. A related issue pertains to the status of the data collected to date

and what it is telling us. A third concerns uncertainties about the extent of the physical effects of the PIT tag itself on fish, an issue currently under evaluation.

At the same time, the federal Action Agencies and NOAA Fisheries are working on developing a draft regional PIT Tag Plan. The intent of the plan is to foster better coordination and optimization of future tagging efforts, as well as efficient strategic placement of PIT detection systems throughout the Columbia River Basin. The PIT Tag Plan will be a major component of a broader Regional Tagging and Marking Plan that has been recommended by the ISRP/ISAB (2009), consistent with FCRPS Biological Opinion (RPA 52.6.) The scope of the PIT Tag Plan will also include non-ESA listed fish species. However, the current draft plan focuses on anadromous salmonid management issues. The purpose of the regional PIT Tag Plan under development is to evaluate, coordinate, and recommend the most efficient and effective tagging and detection systems needed to meet the monitoring and research needs of population status and trends, hydropower system passage and operations, habitat, hatchery, harvest management, and estuary and ocean conditions, to the extent feasible for anadromous salmonids in the Columbia River Basin. An important part of the plan will be to recommend required detector locations and capabilities, along with PIT-tagging efforts and analytical methods, with supporting rationale discussing how the precision of critical monitoring estimates may be improved, and how these improved estimates are expected to lead to better management decisions. Once a draft regional PIT Tag Plan is developed, it will be regionally reviewed and vetted, with input provided by the region's fishery agencies, tribes and other interested parties.

Council recommendation: On this basis, the Council recommends implementation of the PIT and the otolith tagging projects in the review with the following conditions: There should be a *presumptive path* to continue funding for these projects unless substantive issues related to PIT or otolith tagging are identified for any of these projects in the 2013 NMFS Biological Opinion check-in report, in the completed Regional PIT Tag Plan, in the broader Regional Tagging and Marking Plan recommended by the ISRP/ISAB (which the Council encourages the agencies to develop), and/or the completed review of LSRCP hatcheries. If necessary, make any adjusted funding recommendations.

11. Coordination issues

Issue: What are known as “regional coordination” projects will be reviewed as a category after the RME/AP review. But this review has highlighted a set of coordination issues under the Fish and Wildlife Program that could use focused attention. For one thing, the ISRP often noted a significant lack of necessary coordination among projects aimed at the same end, often compounded by a lack of a strategic plan tying together the work. This includes projects involving ocean research, the projects aimed at estuary habitat improvements and the monitoring and evaluation of effectiveness in the estuary, the projects making up the program's effort at assessing and improving conditions for lamprey, the various predation projects, and the monitoring and evaluation of conservation enforcement activities. Other areas within the monitoring and evaluation and artificial production activities exhibit extensive and necessary efforts at coordination (e.g., the habitat effectiveness work), involving personnel from federal, state, tribal and other entities. And yet little or none of this coordination takes place under the umbrella of or involves the coordination elements of the entities funded under the “regional coordination” projects. These factors illustrate in high

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relief the Fish and Wildlife Program's recognition that coordination efforts and funding should be focused through a set of functional activities that need coordination, and not necessarily on the basis of entities desiring coordination funding.

As noted in many of the programmatic issues above, the ISRP identified a range of topic areas that suffered from a lack of coordination in a number of ways, and the Panel often recommended a similar set of solutions intended to increase coordinated efficiencies and effectiveness. This includes developing coordinated synthesis reports; sharing data and information through scientific papers and science/policy forums; holding regular workshops focused on specific species, methods, or geographic areas, and on several topics; and the drafting of basin-wide management plans.

Council recommendation: The Council concurs with many of the recommendations the ISRP made for increased coordination. As a result, the Council's recommendations address these needs on (1) a project-specific basis; (2) through programmatic recommendations; (3) as a follow-up item to consider in the future (e.g. holding a technical forum on a particular topic in the next year or two).

In addition, during the upcoming category review of regional coordination, the staff will extract the coordination components from the research, monitoring and evaluation and artificial production projects (and other functional projects, such as habitat activities) to help bring about a consistent review of all coordination activities under the Fish and Wildlife Program. The Council will be closely guided in this review by the provision on Program Coordination in the 2009 Fish and Wildlife Program, Section VIII(F). The Council will also take a careful look at the regional coordination projects, to see how well they line up with the coordination needs of the program. As the Council and Bonneville review the regional coordination projects, we may find it appropriate to contract with the recipients of regional coordination funding to take on specific tasks identified in this review to increase basin wide understanding of our collective work and accomplishments for fish and wildlife.

Part 3: Projects and Project-Funding and Implementation Recommendations

Part 3 of this document contains the Council's recommendations for the projects themselves. Associated with this part of the decision document, and officially incorporated herein, will be one or more spreadsheets that list the projects reviewed during the RME/AP category review. The right-hand column in the spreadsheet(s) is the vehicle for the Council's recommendation for each project, including any conditions or comments or guidance associated with the project recommendation. Many of the projects have been affected by the resolution of one or more programmatic issues. How a programmatic recommendation affects an individual project is noted in the project recommendation in the spreadsheet.

The Council made its decisions on the project recommendation in two groups, as follows:

“A list” project recommendations (April 2011)

At its regular monthly meeting, in Wenatchee, Washington, on April 13, 2011 the Council decided on a set of implementation recommendations for a subset of the projects under review -- the so-called “A list” of projects. The Council's recommendations for the 100 projects on the “A list” were captured (and transmitted to Bonneville) in the spreadsheet that is attached to and incorporated into this document. The Council's recommendation for each project on the “A list” will be found in the final right-hand column of the spreadsheet, along with any conditions or guidance associated with that recommendation. These project-specific recommendations, conditions and guidance are based in the Council's consideration of the project reviews by the Independent Scientific Review Panel, in the project history and proposal, and in information developed in a series of coordinated Council staff and Council/Bonneville staff reviews of the projects and related materials.

A number of the projects on the “A list” were also associated with the Council's resolution of two programmatic or overarching issues that arose during the review. One involved the monitoring and evaluation of artificial production activities, and the other concerned the use of PIT and associated tags. These programmatic issues, and the Council's recommendations to Bonneville to resolve these issues, described in Part 2 above, were also reflected in the project-specific recommendations on the spreadsheet and were transmitted to Bonneville with the “A list” project recommendations. The Council's recommendations on the programmatic issues are to be accorded the same weight as the project-specific implementation recommendations.

The Council's recommendations on the “A list” projects also included a set of general expectations regarding the duration and implementation of specific project recommendations. These expectations are set forth later in this part. These apply to all projects with the Council's final recommendations.

The reason the Council bifurcated the review in this way is that following the ISRP review report and public comment period, a staff review identified a significant number of the projects and issues in the RME/AP review as ripe for relatively early resolution by the Fish and Wildlife Committee and then the full Council. Projects on this “A list” either were not tied to an overarching programmatic resolution or were subject to a programmatic issue amenable to early resolution, and

most did not present project-specific concerns. Note that the fact that a project was on the “A list” did *not* mean it is more important, or of higher priority, than the remaining projects. The bifurcation was merely a device for managing the issues in the review

Most of the Council’s recommendations for the projects on the “A list” are consistent with the recommendations of the ISRP in their review reports. One exception concerned the kelt reconditioning projects, which the ISRP has not recommended for implementation. In this review and in past reviews the Council has responded to the ISRP’s concerns in large part by treating these kelt projects as speculative research projects to be limited in duration and requiring submission of findings and results reports before any further commitment is made to the concept. There are a few other projects for which the ISRP’s qualifications have been addressed in project-specific comments in ways somewhat different than precisely as the ISRP recommended, although not necessarily with fundamental conflict. In Part 4 of this document the Council will adopt the necessary written explanations for any discrepancies, as required by Section 4(h)(10)(D) of the Northwest Power Act as part of the completion of this review.

Remaining (“B list”) project recommendations (June 2011)

At its regular monthly meeting, in Whitefish, Montana, on June 8, 2011, the Council decided on its recommendations for the remaining projects (the so-called “B list”) and associated programmatic issues in the category review, with the exception of a decision to defer final project recommendations for three ocean research projects until July 2011 (*see* footnote 1 to the programmatic issue #5). Most of these remaining projects are also subject to a programmatic issue. Thus this decision document now contains recommendations for resolving each programmatic issue as well as recommendations for all remaining projects (with the exception noted above). *All* of the Council’s project and programmatic recommendations for the entire review are bundled together in this decision document, with the one spreadsheet containing all of the Council’s project recommendations.

Form and duration of the multi-year project recommendations

One overarching issue with regard to the individual projects has been the form and duration of the recommendations. The Council’s recommendations include the following set of general expectations regarding the duration and implementation of specific project recommendations:

Duration and conditions

The Council’s multi-year funding recommendations for projects extend from FY2012 through FY 2016. The duration of any particular project recommendation is specified in the project-specific recommendation on the attached spreadsheet. These vary from one to five years depending on the type of project, the project conditions, when the project is due to be completed, and if there is delivery of a product to review prior to a recommendation for additional years of funding. For example, the RME review includes a number of research projects (approximately 30) across the spectrum of the Fish and Wildlife Program. Some are pure research; some are projects that mix

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research elements with other aspects of monitoring, evaluation, assessment, or on-the-ground actions. Most research projects are recommended for no more than three years of funding. Out-year funding will be dependent on ISRP and Council review of the reports of research results and a proposal for further work.

Review considerations

The Council's recommendations are based on sound scientific principles, the reviews of the projects by the Independent Scientific Review Panel, review of the projects in the context of the Fish and Wildlife Program, and other considerations and information developed during the review process. Collectively, the body of work recommended is intended to support and address the Council's Fish and Wildlife Program, as also integrated with the requirements of the FCRPS Biological Opinion and the commitments made by Bonneville with the parties to the Columbia Fish Accords.

Funding considerations and expectations

The Council's project recommendations do not include individual project budgets or annual budgets. A multi-year funding recommendation that does not set a particular budget allows Bonneville and the sponsors' flexibility in contracting and spending over the life of the project recommendation. Bonneville may also identify areas for cost savings within the work elements and the funding conditions identified by staff. In each case, Bonneville will have the flexibility to negotiate with sponsors through contracting to finalize work and budgets. Actual spending by Bonneville for each project should be sufficient to maintain project integrity as the ISRP reviewed it. The Council's multi-year implementation recommendation does include the following general expectations:

1. The ISRP's science review of the projects is sufficient for the duration recommended for the project. Additional review generally will not be needed for the duration of the recommendation, with two exceptions: (1) when the project recommendation is conditioned upon the ISRP reviewing a deliverable (such as a comprehensive management plan) within or at the end of the funding period, or (2) when new components outside of the scope or intent of the project at the time of this review are proposed by the project sponsor or Bonneville during the funding period. In these cases, the delivered product or the new project components will be reviewed by the ISRP and a recommendation made by the Council prior to further funding.
2. Bonneville will provide start-of-year budgets for each project in this portfolio prior to the beginning of the next fiscal year, which should also include: (1) trend information to show how and why the overall budget will change from the previous year, and (2) how inflation and cost-of-living adjustments are to be applied, if any; and (3) any modifications to scope negotiated with the project sponsor. The Council also recommends that Bonneville develop accurate budget information about the amount Bonneville spends annually on research, monitoring, and evaluation, and report at least annually on progress in this area.
3. Bonneville will work with the Council to track and follow-up on items or project conditions that require the sponsor to deliver products as part of the funding recommendations.

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4. Bonneville will work with sponsors to address ISRP qualifications and other conditions during contracting when and as recommended by the Council.
5. Bonneville will provide adequate funding to maintain the integrity of the project as reviewed by the ISRP and recommended by the Council.

Project funding package

While the recommendation does not include individual project budgets, the Council recognizes the general starting budget for projects within this initial set. For FY 2012, Bonneville's projected budget for the 100 A-list projects is \$81.2 million. This set of projects includes ongoing, new and modified or expanded projects, in addition to projects that are winding down or are not recommended for funding in FY 2012 and beyond. Bonneville's projected budget for FY 2012 for the remaining projects is approximately \$34.4 million.

Part 4: Council explanations addressing the formal requirements of Section 4h(10)(D) of the Northwest Power Act (approved July 2011)

Part 4 contains the formal explanations by the Council responsive to the specific requirements of Section 4(h)(10)(D) of the Northwest Power Act. This includes the written explanations required of the Council in those few instances in which the Council's project funding recommendations do not follow the recommendations of the Independent Scientific Review Panel. The Council also explains how it complied with the requirements in Section 4(h)(10)(D) to "consider the impact of ocean conditions on fish and wildlife populations" and "determine whether the projects employ cost-effective measures to achieve program objectives" when making project funding recommendations.

Explanations as to how the Council responded to the recommendations of the Independent Scientific Review Panel

Section 4(h)(10)(D) requires the Council to "fully consider the recommendations of the Panel when making its final recommendations of projects to be funded through BPA's annual fish and wildlife budget." If the Council "does not incorporate a recommendation of the Panel, the Council shall explain in writing its reasons for not accepting Panel recommendations." Finally, "[t]he Council, after consideration of the recommendations of the Panel and other appropriate entities, shall be responsible for making the final recommendations of projects to be funded through BPA's annual fish and wildlife budget." The Council has carefully and fully considered the project review reports of the ISRP, and with the few exceptions explained here, the Council has followed the panel's recommendations in formulating the Council's project funding recommendations.

Kelt Reconditioning and Reproductive Success Evaluation Research, Project #200740100, Columbia River Inter-Tribal Fish Commission

Steelhead Kelt Reconditioning, Project #200845800, Yakama Nation

The ISRP remains skeptical of the promise of the kelt reconditioning effort, recommending again against implementing these projects. This is not the first time the Council has faced this issue. These projects began just in 2007 and 2008, and each time the ISRP reviewed them unfavorably. The Panel understands the potential attractiveness of the kelt reconditioning concept. But the Panel has been concerned that the concept has not developed sufficiently to be able to project benefits to the fish populations and is concerned about the ecological and life history diversity issues raised by reconditioning. At the time the projects began, the Council reviewed all of the information, including the ISRP's conclusions and comments after a lengthy period of review, and decided that the concept had sufficient promise to recommend careful implementation of the research study design for a defined period of time, through 2014. *See, e.g.*, the Council decision on the review of the Yakama Nation kelt project (#2008-458-00), letter dated January 13, 2010, explaining why the Council chose to recommend implementation of the research despite the ISRP's negative review.

Because the review of these projects had been so recent, the projects were included in the category review only for reasons of context, that is, so as to be able to look at all the production and

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research projects together. The issues identified by the ISRP in this review are the same as before, and the Council considered and addressed those in its earlier recommendation. And the Council's project recommendations remain the same: Implement the research effort through 2014. Implementation beyond 2014 will be based only on ISRP and Council review of the results report and recommendation of future work.

Mid-Columbia Reintroduction Feasibility Study, Project #199604000, Yakama Nation

The situation with this project is similar to the kelt reconditioning project above. The mid-Columbia coho production initiative has been part of the Council's "Step Review" process for more than a decade. The latest decision by the Council in March 2010 asked the sponsor to move to the design phase even while addressing issues the ISRP still has with the conceptual master plan. The project was included in the category review for context only, to bring all production programs together at one time, and so the ISRP noted the issues to which it is still awaiting responses. That said, the development path the project is on was settled in the March 2010 decision, not in this review. See the Council decision on the review of this project, letter to Bonneville dated March 10, 2010.

Listed Stock Chinook Salmon Gamete Preservation, Project #199703800, Nez Perce Tribe

The project sponsor proposed two work objectives for this project -- to maintain secure storage facilities for cryopreserved gametes and to assist hatcheries with the use of cryopreserved gametes for broodstock management or population recovery. The ISRP concluded that the project met scientific criteria, albeit with technical qualifications that would need to be addressed before implementation, especially with regard to the second objective. The Council decided to recommend only the first objective for implementation. As the ISRP noted, the "most support is to keep the samples frozen in good shape in two local universities and now to also include the federal cryopreservation facility in Colorado." The technical concerns raised by the ISRP about the proposal to use the gametes added to the Council's inclination that implementing the second objective was too low a priority for Program funds at this time.

Assess Reintroduction of Anadromous Fish in Burnt, Powder & Malheur Rivers, Project #200820400, Confederated Tribes of the Umatilla Indian Reservation

The ISRP found this project to be qualified in part on technical grounds. The Council recommends not implementing the project given that reintroduction studies for these basins have already been performed as part of the Hells Canyon relicensing process, and so the proposed work here appears redundant and certainly not a priority for Program implementation at this time.

Impact of American Shad in the Columbia River, Project #200727500, U.S. Geological Survey

The project sponsor proposed to continue this research project into the future. The ISRP concluded that the project met scientific criteria, albeit a conclusion was "qualified" in certain ways. The Council decided instead to recommend not implementing this project further. The technical merits of the research may be adequate, but this is really a question of priorities. The Council approved this project originally for a defined study of a set number of years. The research as

designed concludes in FY2011. More of the same research is unnecessary; the question now would be to review the project's final report and consider what has been learned and whether any particular management decisions are implicated justifying a further Program focus on shad.

Mitigation of Marine-Derived Nutrient Loss in Central Idaho, Project #200733200, Idaho Department of Fish and Game

Similar to the last project, the project sponsor here proposed to continue this research project into the future. The IRSP concluded that the project met scientific criteria. The Council decided instead to recommend against further implementation. This research project completed its original objectives, and the Council deemed it a low priority to evolve the study design further.

Coastal Ocean Acoustic Salmon Tracking (COAST), Project #200311400, Kintama Research

The project sponsor proposed to continue this ocean research project for another three years. The ISRP review yielded a Panel conclusion that the project meets scientific criteria, although that conclusion was "qualified" and the ISRP raised a number of technical issues with the project. The Council ultimately recommended that the project be funded in FY2012 only to participate with other ocean research projects in preparing a synthesis report on the state of the ocean research, and that no further research be conducted. The Council concluded that this has been an expensive research project that has already had six years of funding and research, and was intended to be a demonstration project only but it remains in the "proof of concept" stage after several years of funding. Moreover, the project is largely focused on what is now a lower priority issue of the delayed mortality effects of transportation vs. in-river migration. And those concerns are combined with the significant technical issues noted by the ISRP, technical issues that seem unnecessary to address unless and until a priority for the work is identified. Thus the Council concluded that it was best for the Program to recommend that "[i]n FY2012 implement only to participate in the completion of the coordinated synthesis report per programmatic issue #5. ISRP and Council review of synthesis report to determine if there is a critical need for new work beyond FY 2012."

Consideration of ocean conditions

Section 4(h)(10)(D) provides that "in making its recommendations" to Bonneville, the Council is to "consider the impact of ocean conditions on fish and wildlife populations." Congress provided no other guidance as to the meaning of this consideration. The Council's initial policy response to this charge came in an issue paper titled *Consideration of ocean conditions in the Columbia River Basin Fish and Wildlife Program* (Council Document No. 97-6; <http://www.nwppc.org/library/1997/97-6.htm>). This paper continues to guide how the Council responds to the direction to consider ocean conditions in its project funding recommendations.

Our regional understanding as to how ocean conditions affect Columbia River salmon populations in both the short- and the long-term continues to increase and yet is still quite uncertain. Our increasing knowledge does include greater appreciation for the impact of the ocean on salmon abundance and the degree of variation in the marine environment. As species and as groups of populations (meta-populations), salmon are sufficiently productive under natural conditions to cope

with the mortality, and the variations in mortality, they experience during that portion of the life-cycle that takes place in the ocean. The key scientific principle guiding the Council's consideration is that salmon handle environmental variation throughout their life cycle and over time, including within the ocean portion of their lives, by having a broad array of biological characteristics within and between populations. This biological variation provides different options for salmon to survive environmental variability.

In addition, while the fish and wildlife program and projects cannot influence the ocean environment, actions can be taken to improve water quality and habitat in the estuary and near-shore environments. These transition zones are critical to the survival of young salmon.

Consequently, the Council's 2009 Fish and Wildlife Program describes the ocean environment as an integral component of the Columbia River ecosystem. The primary strategy called for in the program is to "identify the effects of ocean conditions on anadromous fish survival and use this information to evaluate and adjust inland actions." The Fish and Wildlife Program then included set forth two strategies to guide the program's activities with regard to the freshwater plume, the near-shore ocean, and the high seas:

1. Manage for Variability

Management actions should strive to help anadromous fish and other species accommodate a variety of ocean conditions by providing a wide range of life history strategies. Continue monitoring and evaluation of the Columbia River plume and ocean conditions for impacts on salmonid survival. Monitor salmon returns and climate-change impacts on ocean conditions in order to identify factors affecting survival in the ocean and plume.

2. Distinguish Ocean Effects from Other Effects

Monitoring and evaluation actions should recognize and take into account the effect of varying ocean conditions and, to the extent feasible, separate the effects of ocean related mortality from that caused in the freshwater part of the life cycle.

The Fish and Wildlife Program's biological objectives for population and environmental characteristics and its strategies for the mainstem, estuary, habitat, and artificial production add further consideration of relevance. Taken together, the three primary ways the Council acting under the program can take into account ocean conditions in general and influence salmon survival in the ocean are to evaluate proposals and recommending funding for projects that: (1) further improve our understanding of the effects of ocean conditions on salmon populations; (2) improve productivity and preserve and extend life-history diversity in salmon populations; and (3) improve estuarine and near-shore conditions.

Turning to this particular review, only the first two paths are at all relevant. With regard to the artificial production projects under review, we do not yet have enough information to synchronize artificial production activities neatly to ocean conditions for optimum management. But the Program sanctions the use of artificial production for salmon and steelhead only as part of a coordinated production and habitat effort aimed ultimately at improving the abundance, productivity and diversity of natural spawning populations. There are obvious challenges in

meeting that goal. But the Council's recommendations to continue implementation of the production projects are based in part on a judgment that a rational hypothesis remains viable linking these production activities to ultimate improvements in productivity and diversity.

Most relevant, one central element of this review has been to evaluate the research and monitoring and evaluation projects (and other information) to evaluate whether we are making progress in "improv[ing] our understanding of the effects of ocean conditions on salmon populations." See the programmatic issues on the estuary (#3) and ocean research (#5). In both cases, the Council concluded that it is time for a synthesis of the monitoring and evaluation and research information on the ocean, near-shore plume, and estuary to uncover just what we are learning about the ocean and its effects on salmonid populations.

Cost-effectiveness measures

Section 4(h)(10)(D) further provides that in making the project funding recommendations, the Council is to "determine whether the projects employ cost-effective measures to achieve program objectives." As with the command to "consider ocean conditions," Congress did not provide any further explanation or guidance as to the meaning of this provision. The legislation did not specify any particular approach to cost-effectiveness analysis or define in any particular what is meant by a "cost-effective measure." The provision does not require, for example, the use of a single measure of biological effectiveness as a basis for comparison among projects, nor the use of strictly quantitative analysis. And while the logic of the Council's program might focus most of the cost effectiveness analysis among and between project proposals, the literal wording calls for a cost-effectiveness analysis only *within* projects, that is, whether any particular project employs the best of possible alternative methods to meet its objectives.

Given this context, the Council has worked over the years to understand the state of the art in natural resource economics and cost-effectiveness analyses to help guide the Council in making the determination required. Soon after Congress adopted this amendment to the Power Act in 1997, the Council, with the help of its staff economists and its newly-formed Independent Economic Analysis Board (IEAB), developed an approach to the cost-effectiveness analysis in a document titled *Methods of Economic Analysis for Salmon Recovery Programs*, Council Document No. 97-12 (July 1997) ("methods analysis"). The Council first used this methods analysis to initiate the cost-effectiveness determination in the project review process for Fiscal Year 1998. It remains the basis today for the analysis and determination.

The methods analysis concluded that several problems make it difficult for the Council to undertake a quantitative cost-effectiveness comparison between Columbia River fish and wildlife projects using a single, quantified measure of benefits to determine which projects produce the greatest benefits per dollar. The problems include the lack of agreement on measures of biological effectiveness; the fact that the complex life-cycle of anadromous and resident fish makes it difficult to isolate the biological effects of particular activities or to compare different biological effects of different kinds of projects; and the fact that in the project review process, different project sponsors propose vastly different types of activities, and thus different kinds of cost and economic information, which makes cost comparisons difficult.

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These observations remain valid. Based on the methods analysis and the IEAB's concurring advice, and on the intervening years of experience, the Council continues to conclude that it is not able to undertake a classic, quantitative cost-effectiveness comparison of the projects, let alone of alternative measures available to an individual project. This is primarily due to the fact that we cannot directly quantify improvements (and especially direct projected improvements) to fish and wildlife populations in a single biological objective measure resulting from the physical effects of particular projects. There are sound reasons to believe projects produce benefits to fish and wildlife, as explained below, but not in a directly predictable single quantity. A quantitative cost-effectiveness comparison would require a far greater understanding of the direct biological effectiveness of individual actions than we have now.

The methods analysis noted, however, that there is much more to cost effectiveness than a quantitative comparison of the costs of alternative ways to achieve a single biological objective. Much can be done to review the efficiency of projects, to improve the likelihood that the projects selected will be the most cost effective, and to improve project management. Cost-effectiveness review drives toward procedures for project review, selection, and management that emphasize efficiency and accountability.

Based on these considerations, the methods analysis recommended four strategies to improve the likelihood that the projects recommended for funding are those that employ cost-effective measures to the greatest degree:

- Strategy 1: The best assessment of the effectiveness of fish and wildlife projects comes from the review by the Independent Scientific Review Panel (ISRP).
- Strategy 2: Improve the amount, quality, and comparability of project cost information.
- Strategy 3: Evaluate the record of existing projects over time. Projects that have been ongoing for some time should have yielded some measurable effects or have contributed some concrete addition to the region's knowledge about fish and wildlife problems.
- Strategy 4: Introduce selective audits on projects, oriented toward determining whether the contracting process contains the procedures necessary to manage the project's cost and effectiveness.

The Council's experience over the years has added to or elaborated on this set with three further strategies: (1) clarify, specify, and quantify program objectives as much as possible; (2) develop other elements of project review besides ISRP review that also provide accountability benefits; and (3) flag certain projects and programs for more in-depth review of benefits and costs.

The Council acted consistent with these strategies in the just-completed review of the research, monitoring and evaluation and artificial production projects. In particular, the Council relied heavily on the views of the independent science panel in shaping its recommendations, selected certain program areas for further synthesis and review in order to evaluate just how effective key program areas are, and used this review both to evaluate projects over time and also to call for improvements in reporting in order to have a better basis for evaluating projects over time.