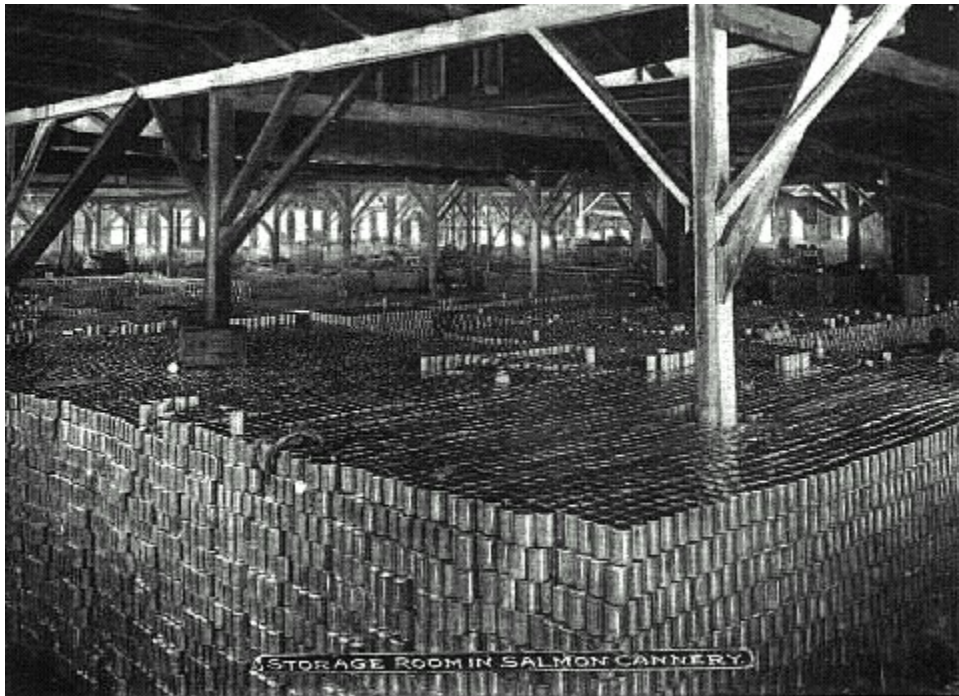


INDEPENDENT SCIENTIFIC REVIEW PANEL

RETROSPECTIVE REPORT 2007

ADAPTIVE MANAGEMENT IN THE
COLUMBIA RIVER BASIN



ISRP 2008-4
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Independent Scientific Review Panel
for the Northwest Power & Conservation Council
851 SW 6th Avenue, Suite 1100
Portland, Oregon 97204
www.nwccouncil.org/fw/ISRP

ISRP Members

J. Richard Alldredge, Ph.D., Professor of Statistics at Washington State University.

Robert Bilby, Ph.D., Ecologist at Weyerhaeuser Company, an expert in riparian ecology (former ISAB member, began ISRP in FY 2008).

Peter A. Bisson, Ph.D., Senior Scientist at the Olympia (Washington) Forestry Sciences Laboratory of the USFS.

John Epifanio, Ph.D., Associate Professional Scientist at the Illinois Natural History Survey.

Linda Hardesty, Ph.D., Associate Professor of Range Management at Washington State University.

Charles Henny, Ph.D., Senior Research Scientist at the U.S. Geological Survey in Corvallis, Oregon.

Colin Levings, Ph.D., Scientist Emeritus and Sessional Researcher, Department of Fisheries and Oceans. Canada.

William Liss, Ph.D., Professor Emeritus of Fisheries at Oregon State University (former ISAB member, ISRP member in FY 2007, now Peer Review Group member).

Eric J. Loudenslager, Ph.D., Hatchery Manager and Adjunct Professor of Fisheries Biology, Humboldt State University, California.

Katherine Myers, Ph.D., Principal Investigator of the High Seas Salmon Research Program at the School of Aquatic and Fishery Sciences, University of Washington.

Thomas P. Poe, M.S., Consulting Fisheries Scientist, an expert in behavioral ecology of fishes, formerly with the U.S. Geological Survey.

Bruce Ward, Fisheries Scientist, Ministry Of Environment, Aquatic Ecosystem Science Section, University of British Columbia, Vancouver, B.C., Canada.

Staff

Erik Merrill, J.D., ISRP and ISAB Coordinator, Northwest Power and Conservation Council.

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Retrospective Report 2007

ADAPTIVE MANAGEMENT IN THE COLUMBIA RIVER BASIN

EXECUTIVE SUMMARY

“However beautiful the strategy, you should occasionally look at the results.”

Winston Churchill

“Failure is the tuition you pay for success.”

Walter Brunell

In 2007 the Independent Scientific Review Panel (ISRP) completed over twenty reports containing reviews of Fish and Wildlife Program projects. This Retrospective Report focuses on how projects are changing their objectives, strategies, and methods based on learning from the results of their actions. We accomplish this by looking at themes that emerged in previous ISRP retrospectives, examining a subset of projects that were reviewed in Fiscal Year 2007, and investigating how sponsors applied the results of their past projects to proposed future actions and monitoring. Some of our findings include:

Effectiveness Monitoring

Habitat restoration projects should include some form of effectiveness monitoring in their plans. This is essential to demonstrating that the project is achieving desired habitat results. Effectiveness monitoring does not have to be costly; in fact, showing some evidence of a beneficial habitat trend is usually sufficient for the ISRP’s needs. We do not in most cases expect individual habitat project sponsors to demonstrate target population benefits. However, demonstrations of population benefits at the watershed scale using approaches such as intensively monitored watersheds are always helpful. We do not wish to place an unfair monitoring burden on individual project sponsors, and we encourage collaboration among habitat restoration participants in documenting physical habitat improvements and population benefits. The ISRP continues to emphasize that each project without an effectiveness monitoring plan represents a lost learning opportunity.

Artificial Production

The ISRP understands that early in 2008 the *Ad Hoc* Supplementation Work Group will submit a final report outlining recommendations for evaluating the demographic and long-term fitness effects of supplementation. We recognize the significant progress made by the regional scientists and look forward to reviewing the report. We specifically anticipate that a plan for a comprehensive evaluation of supplementation is close to implementation. Such monitoring and evaluation should provide information to guide decisions on the efficacy of supplementation and its contribution to the restoration of salmon and steelhead.

Mainstem

In 2007 the ISRP and ISAB completed a review of the Comparative Survival Study's (CSS) Ten-year Retrospective Summary Report¹, one of the largest M&E projects in the Fish and Wildlife Program. The CSS is a field study of the survival of PIT-tagged spring/summer Chinook and PIT-tagged summer steelhead through the Snake and Columbia River hydrosystem from smolts through returning adults, with a focus on relative survival of smolts with different migration routes (e.g., in-river, transported, different routes of dam passage, and different numbers of dams passed). For the most part, the CSS Ten-Year Retrospective was effective in answering the concerns posed by the ISAB's review of the CSS 2005 Annual Report (ISAB 2006-3). It also provided improved clarity in the presentation and explanation of the sophisticated methodologies used in analyses of CSS data.

However, the ISRP, with concurrence of the ISAB, found that one of the major project objectives (Upriver/Downriver Comparisons) did not meet scientific review criteria, because of inevitable confounding from other factors in establishing cause(s) of upriver/downriver differences that may be detected, regardless of sample size and detection power that could be achieved.

Project and Program Reviews

The ISRP's major effort for the year was conducting follow-up reviews to address unresolved issues from the review of 540 FY 2007-09 proposals. In addition, we reviewed proposals seeking to test innovative technologies and methods; completed a retrospective review of results reporting in FY 2007-09 proposals; provided a potential framework for future project reviews; and with the ISAB jointly reviewed a handbook of salmonid field protocols. In this Retrospective Report, we examine a subset of projects that were reviewed in FY07, and assess how the project sponsors learned from their past actions and, based on lessons learned, proposed future actions and monitoring.

Adaptive Management in the Fish and Wildlife Program

Almost without exception, project sponsors state that they use adaptive management to modify the tasks and work elements in proposals. At the same time, however, project proposals almost never provide (1) an experimental design to identify whether biological objectives have been met by employing specific strategies or (2) a decision tree that would be used to modify management based on updated scientific information.

Often project sponsors propose to continue to employ tasks and work elements even when monitoring data indicates that biological objectives are unattainable because of environmental and biotic conditions. Sponsors of these projects are understandably reluctant to abandon these efforts in which they have invested much time and energy. A structured or integrated decision management process, linking the biological requirements needed to sustain fish populations together with the legal and cultural setting, is one approach to create the human dimension required to confront unrealistic biological objectives. Exploration of decisions and alternatives requires clear problem definition, establishing agreed objectives, development of alternatives over several iterations, and evaluation of consequences. The latter requires stakeholder and expert input, aided by simulation modeling.

¹ www.fpc.org/documents/CSS.html

BACKGROUND

THE RETROSPECTIVE CHARGE

In addition to scientific review of individual fish and wildlife projects funded by the Bonneville Power Administration, the 1996 Amendment to the Northwest Power Act charges the Independent Scientific Review Panel (ISRP) to annually review the results achieved from prior year expenditures. The Council's 2000 Fish and Wildlife Program further defines the retrospective review charge, stating that the ISRP's report should focus on the measurable benefits to fish and wildlife made through projects funded by Bonneville and previously reviewed by the ISRP. The ISRP's findings should provide biological information for the Council's ongoing accounting and evaluation of Bonneville's expenditures and effectiveness in meeting the objectives of the program. The Program also states that the ISRP should summarize its province review findings and identify the major basinwide programmatic issues articulated within the province reviews.

The ISRP most recently summarized the majority of its major basinwide programmatic issues and province review findings in the programmatic section of its FY 2007-09 project review report (ISRP 2006-4a²). Those findings were in addition to those identified in the 1997-2005 Retrospective Report (ISRP 2005-14³), which summarized almost a decade of project reviews and attendant programmatic issues. Thus, the ISRP's FY 2007-09 programmatic comments combined with the 1997-2005 Retrospective Report constitute a thorough treatment of scientific issues that have arisen from the project reviews. Because basinwide scientific review issues had been so recently summarized, the ISRP's 2006 Retrospective Report (ISRP 2007-1⁴) focused on the extent that 262 ongoing projects in FY 2007-09 reported physical habitat and biological results, summarized data analyses, and identified adaptive management actions. In the 2006 retrospective and 2007-09 project review, the ISRP identified reporting of project results in proposals as one of the significant deficiencies in the program. This 2007 Retrospective Report logically follows these earlier retrospective reports and focuses on how projects are changing their objectives, strategies, and methods based on the results of their actions -- adaptive management. The ISRP accomplishes this by looking at themes that emerged in previous retrospectives, examining a subset of projects that were reviewed in Fiscal Year 2007, and investigating how they applied the results of their past actions and monitoring to proposed future actions and monitoring.

RECURRENT THEMES FROM PAST ISRP RETROSPECTIVE REPORTS

The ISRP provides this abbreviated summary of recurrent themes from past retrospective reports and programmatic summaries of project and subbasin reviews to identify for readers the major findings of earlier reviews without requiring readers to obtain and read the original documents. For those themes where the ISRP is aware of updates on the status of efforts by the basin co-managers to address these challenges, the ISRP provides here a short statement on progress. For those themes that arose during the 2007 ISRP reviews, an expanded discussion of the themes, including adaptive management considerations, constitutes the body of this 2007 ISRP Retrospective. Themes without a progress statement may be actively being addressed by the basin co-managers, but the ISRP is not knowledgeable about the status.

² www.nwcouncil.org/library/isrp/isrp2006-4a.pdf

³ www.nwcouncil.org/library/isrp/isrp2005-14.htm

⁴ www.nwcouncil.org/library/isrp/isrp2007-1.htm

Monitoring and Evaluation

Perhaps, the most dominant recurrent theme through all the ISRP's past retrospective reports was the lack of adequate monitoring and evaluation in fish and wildlife projects throughout the Fish and Wildlife Program.

In its first retrospective report (ISRP 2005-14), the ISRP noted that development of a systemwide monitoring and evaluation program was in a formative stage with three relatively new initiatives. First was the Collaborative Systemwide Monitoring and Evaluation Project (CSMEP), which was a Fish and Wildlife Program project administered by the Columbia Basin Fish and Wildlife Authority (CBFWA). Second, the Federal Action Agencies proposed a draft Research, Monitoring, and Evaluation Plan. Third, a cooperative monitoring and evaluation program in the Pacific Northwest was established by an ad hoc partnership of biologists from concerned federal, state, and tribal agencies under the name Pacific Northwest Aquatic Monitoring Partnership (PNAMP). The need to develop a coordinated, systemwide monitoring and evaluation program has been recognized by the ISRP from our initial reviews to the present, and the ISRP continues to recommend that the Council support the effort.

Progress: CSMEP has reviewed the strengths and weaknesses of data to provide estimates of the Viable Salmonid Population (VSP) parameters (abundance, productivity, diversity, and geographic distribution) in representative subbasins. Using the information from this review they developed several alternate monitoring and evaluation designs for the Snake River for status and trends of Chinook salmon populations. CSMEP developed status and trends, harvest, hatchery, habitat effectiveness, and monitoring integration workgroups. Each workgroup is developing options for monitoring metrics important to the management of Columbia River salmon. The ISRP recently reviewed the CSMEP 2007 Annual Report and Snake River Pilot Study Reports and found that some elements of the large project are making good progress (e.g., tributary habitat) while others (e.g., hatchery and harvest effectiveness monitoring) will require additional planning.⁵

Beginning with programmatic comments in the first ISRP review of project proposals, the ISRP recommended that smolt-monitoring, PIT-tag, radio telemetry, coded wire tag, and sonic tag projects should be subjected to a comprehensive programmatic review that gives special consideration to the complex interactions between projects. This review was considered critical because regulations requiring mass marking of hatchery fish and selective fisheries have significant implications for the integrity of the data collected by the coded wire tag program and for the analysis and interpretation of management uncertainties addressed by the other tagging programs.

Progress: Some concerns about tagging projects have been addressed by the ISRP data management review (ISRP 2000-3), the ISAB Harvest Report (ISAB 2005-4), and ISAB and ISRP reviews of the Comparative Survival Study (ISAB/ISRP 2007-6, ISAB 2006-3) and reviews of other mainstem uncertainties (i.e. transportation, spill, latent mortality) (ISAB 2007-1, 2006-1, 2). In July of 2007 the Council assigned the ISAB and ISRP to jointly conduct a review of fish tagging projects and objectives in the Columbia River Basin. That review is currently underway.

In the second retrospective report (ISRP 2006-4a), the ISRP recommended that multi-year projects should be required to report both project implementation results and measurable ecological benefits at agreed-upon milestones, or annually, as a condition for continued funding. Future

⁵ www.nwcouncil.org/library/isrp/isrp2008-1.htm

proposals and the BPA database should be linked to enable reporting of biological results in addition to task completion.

The second ISRP report also suggested establishing a statistical support facility to provide assistance to projects that have limited statistical expertise. The facility would answer questions about design and analysis and provide workshops on statistical topics of common interest within the Program. By “facility” the ISRP meant a group, pool, or list of individuals or agency staff with statistical expertise who are available to project sponsors to assist in the development of monitoring designs or analysis of data.

***Progress:** On an ad hoc, informal, basis, CSMEP is providing statistical assistance to project sponsors who have joined the CSMEP network but do not have “in house” statistical and monitoring design expertise. It is too early in this effort to identify whether it can serve a portion, or the entirety, of the statistical support required by project sponsors. In addition, Bonneville funds the University of Washington through the Statistical Support for Salmonid Survival Studies project (198910700⁶) to provide statistical support to Columbia Basin investigators requesting assistance with the design and analysis of tagging studies. The purpose of the project is to ensure that the maximum information can be reliably extracted from tagging studies funded under the Council’s Fish and Wildlife Program. This service has been primarily used by a small group of investigators monitoring salmon passage survival but has recently been used to develop a creel survey and related monitoring for Lake Rufus Woods rainbow trout stocking efforts. Highlighting and further developing and coordinating the support offered by CSMEP, the Statistical Support project, and other potential efforts to cover a wider range of project types and sponsors could help meet this need for a statistical support facility.*

In its FY 2007-09 programmatic recommendations, the ISRP also recommended that the Council and BPA abandon the fixed 5% monitoring and evaluation cap for habitat projects and the implication that M&E funds be limited to compliance and implementation monitoring. The ISRP agreed there should be cost-effective M&E at a sustainable funding level, but the 5% cap in the solicitation is an arbitrary policy decision – that is, it may be too much for some projects and too little for others. Scientifically sound M&E is very project and issue specific, and monitoring budgets should reflect this reality.

Alternative metrics for evaluation may be required for some administrative and educational projects. Fish tagging projects could be measured by the utility of the data to be used to estimate the vital statistics used in harvest and escapement.

***Progress:** The ISRP (ISRP 2007-14) provided additional suggestions for developing performance metrics for administrative, regional coordination projects.*

⁶ Throughout this report, the names of Fish and Wildlife Program projects are followed by the projects’ nine digit BPA project number in parentheses. Generally, the first four digits indicate the year the project began. These numbers are useful because they can help the reader easily access the proposals and reviews of proposals in the Fish and Wildlife Program’s proposal database maintained on the Columbia River Basin Fish and Wildlife Authority’s web site at: www.cbfwa.org/projects/default.asp. For the UW Statistical Support proposal go to: www.cbfwa.org/solicitation/components/forms/Proposal.cfm?PropID=121

TRIBUTARY HABITAT RESTORATION, MONITORING, AND REPORTING OF ACCOMPLISHMENTS

In the first retrospective report (ISRP 2005-14) it was the ISRP's expectation that selection of habitat proposals in the future will be determined in part by their conformity with Subbasin Plans. Such an approach is a logical consequence of the Subbasin Planning effort, and indeed, validates the work and analysis conducted by many hundreds of individuals throughout the Columbia River subbasins. This requisite should make reviews by the ISRP more manageable and transparent, and reward efforts that tie projects to the Plans.

In the programmatic comments for the 2007-09 proposal review (ISRP 2006-4a) the ISRP recommended the Council pay close attention to the implementation of tributary dam removals in the Columbia Basin (e.g., Condit, Marmot, and Hemlock) and ensure, perhaps through targeted RFPs, that dam decommissioning and post-removal effects are properly monitored. The ISRP also suggested that the Council should consider using the Columbia Basin Water Transaction Program's criteria to evaluate proposals for improving irrigation system efficiency to preserve instream flow.

***Progress:** The Council recommended and Bonneville budgeted FY 2007-09 funding for the US Forest Service's Hemlock Dam Removal project (200707700). A companion WDFW project, Adult Steelhead Monitoring in Trout Creek (200721500), to evaluate the effectiveness of the dam removal and to count adults was not recommended for FY 2007-09 Bonneville funding. The ISRP is not aware if this monitoring is funded through other sources (cost share was not shown in the proposal). As recommended earlier by the ISRP, this emphasizes the need of the Underwood Conservation District's Wind River Watershed Restoration project (199801900) to orient its ongoing monitoring and evaluation efforts on detecting potential changes resulting from the Hemlock Dam removal. Although not a Fish and Wildlife Program Project, the Marmot dam was removed in the Sandy River Subbasin, and the USGS and others are monitoring the effects.⁷*

Regarding the ISRP's recommendation to evaluate water conservation projects' contributions to preserving instream flow, the Columbia Basin Water Transaction Program and Council staff evaluated the set of FY 2007-09 proposals that included water conservation actions. However, the ISRP does not know how that information was used by the Council and Bonneville in making project funding decisions. The Water Transaction Program continues to work with Bonneville on developing criteria and an evaluation approach for water conservation projects.

Habitat Restoration Effectiveness Monitoring

Over the last several years the ISRP has used a simplified terminology consisting of *implementation* monitoring (was the project implemented as planned?) and *effectiveness* monitoring (did the project achieve the desired results?). We realize, however, that some practitioners have used several terms to describe the different types of habitat monitoring, in which effectiveness monitoring is divided into two categories – *effectiveness* (did the project achieve the desired habitat benefits?) and *validation* monitoring (did the project result in benefits to the target population?). We want to make it clear that the ISRP's assertion that all habitat projects deserve some level of effectiveness monitoring **does not** mean that population monitoring should accompany every project. Because of the limited geographic scale of most habitat improvement efforts, determining the population benefits of individual projects is usually impossible. The effects of habitat restoration projects on populations are much better addressed using the intensively monitored watershed approach where experiments are applied at a scale appropriate to assess biological responses.

⁷ See http://or.water.usgs.gov/projs_dir/marmot/index.html

When we ask that habitat projects include some form of effectiveness monitoring we mean that post-implementation conditions should be monitored to establish whether the physical characteristics of the restoration site are trending in the desired direction. For example, if the project involves fencing a riparian area to exclude livestock from sensitive streamside vegetation, it is very helpful to know how the vegetation is responding to livestock exclusion. We acknowledge that some forms of passive restoration (such as fencing) take years to produce desired results, and we therefore have recommended some of the monitoring tools that can simply be used to track improvement over time (e.g., photo points). Active habitat restoration actions such as large wood placement in streams or culvert replacement produce much more rapid improvement, and these improvements (e.g., documentation of expanded fish distribution) can be measured over a much shorter time period.

The ISRP's 2006 Retrospective Report (ISRP 2007-1) provides a detailed list of both implementation and effectiveness monitoring metrics for habitat projects (see pages 12-19). The tables for effectiveness monitoring actions include suggestions for both habitat and population level monitoring. To avoid confusion, we emphasize that project sponsors should include some form of habitat improvement monitoring in their plans. This is essential to demonstrating that the project is achieving desired habitat results, and it does not have to be costly – in fact, showing some evidence of a beneficial habitat trend is usually sufficient for the ISRP's needs. We do not, in most cases, expect individual habitat project sponsors to demonstrate population benefits. However, demonstrations of population benefits at the watershed scale (e.g., improved egg to smolt survival) are always helpful, and where individual project sponsors are in a position to contribute to watershed-scale population monitoring those contributions will be most welcome. Additionally, documentation of physical habitat improvement can always be provided by other monitoring efforts as long as there is a clear explanation of the monitoring linkage in the project description. The ISRP does not wish to place an unfair monitoring burden on individual project sponsors, and we encourage collaboration among habitat restoration participants, both with respect to documenting physical habitat improvements and population responses, to increase cost-effective knowledge sharing. However, we continue to note that each project for which there is no effectiveness monitoring represents a lost learning opportunity.

In the 2006 retrospective report (ISRP 2007-1) the ISRP discussed three types of tributary habitat monitoring and provided recommendations for reporting at each level as follows:

Implementation Monitoring

“There are many types of habitat improvement projects currently being funded under the Fish and Wildlife Program. All should be monitored for implementation, and the ISRP supports the need for accurate implementation metrics as a necessary first step in any M&E effort. The ISRP appreciates that each project will not be held to a one-size-fits-all M&E standard.”

Effectiveness Monitoring

“Some form of effectiveness monitoring should accompany any habitat project. The overall level of effectiveness monitoring that have accompanied many projects in the past has not been adequate to address the basic question – are they working? Project sponsors should collect and analyze data that document whether the project is achieving, or is failing to achieve, its stated objectives and is realizing desired habitat and/or target population and/or multi-species benefits.”

Intensively Monitored Watersheds

“The ISRP recommends continuing support of Intensively Monitored Watersheds. To properly address population-level response of fish species to habitat restoration, we support a network of intensively monitored watersheds (IMWs) in which restoration efforts can be coordinated in a way that will facilitate experimental learning by applying enough similar treatments to produce statistically robust results, coupled with thorough inventories of adult, juvenile, and smolt abundance. Many IMWs currently exist in the Columbia River Basin and elsewhere in the Pacific Northwest (some funded outside the Fish and Wildlife Program), but there are still significant geographical gaps in IMW coverage. The ISRP recommends that additional IMWs be added to this regional network over time. Although we realize that the cost of implementing IMWs is high, we note that this approach provides the most scientifically powerful way of addressing the question – Are tributary habitat restoration projects working?”

Progress: *In 2007, and over the past several years, various Pacific Northwest and Columbia River Basin projects and processes have made significant progress on habitat M&E. For implementation monitoring, the Bonneville Power Administration is making some progress on reporting of implementation monitoring (in this case task completion monitoring) through the PISCES database. The Columbia Basin Fish and Wildlife Authority has created the Status of The Resource (SOTR), a web-based report that shows project location and includes reporting of fish and wildlife population status where available.*

The Pacific Northwest Aquatic Partnership (PNAMP) in concert with the American Fisheries Society compiled a set of recommended field protocols for monitoring and collecting fish population data. These protocols are intended to be a reference guide that offers the potential for some standardization of methods and aid to the training of aquatic scientists and technicians. The ISRP and ISAB reviewed the handbook and thought it would be a useful start to standardizing protocols.⁸

As noted above, the Collaborative Systemwide Monitoring and Evaluation Project (CSMEP) has made some progress developing a comprehensive regional M&E program, including development of a habitat monitoring pilot study in the Salmon River, Idaho.⁹ In addition, the Integrated Status and Effectiveness Monitoring Program (ISEMP) has made progress on designing, implementing, testing, and evaluating status and trends, and effectiveness monitoring programs for salmon and steelhead populations and habitat in the Columbia River Basin. Over the past several years, the ISRP has reviewed the study designs for ISEMP pilot studies in the John Day, Snake, and Wenatchee subbasins and found them scientifically sound.¹⁰

Finally, although we have recommended that some form of effectiveness monitoring accompany every habitat project, we emphasize that habitat data collection, analysis, and interpretation need not necessarily be completed within that project. For example, it can be done by a different entity at a larger scale than the individual project.

The 2008 Program Amendments offer an opportunity to link the various efforts together into a regional RM&E program. The ISRP discusses these issues in greater detail in this report’s “Monitoring and Evaluation -- Next Steps” section below.

⁸ www.nwcouncil.org/library/isab/isabisrp2007-5.htm

⁹ See the ISRP’s March 7, 2008 review of CSMEP: www.nwcouncil.org/library/isrp/isrp2008-1.htm.

¹⁰ For the ISRP’s review of ISEMP’s John Day study plan, see www.nwcouncil.org/library/isrp/isrp2007-8.htm.

WILDLIFE

In the first ISRP retrospective report (ISRP 2005-14) the panel noted that the Management Plans portion of subbasin plans tended to pay far less attention to wildlife than to fish and often did not include much consideration of landscapes, ecosystems, and overall biodiversity. There is a critical need to evaluate (and demonstrate, if possible) where and when habitat restoration efforts increase or sustain fish and wildlife populations and at the same time maintain or increase biodiversity.

Overall, much progress appears to have been made in developing productive scientific review and dialogue about wildlife. Several challenges remain for the wildlife portions of the Fish and Wildlife Program. First, integration of all elements of the Fish and Wildlife Program remains to be realized in the continuing development and implementation of subbasin plans. Second, additional time and thought must be given to criteria and procedures for selecting focal species that will be useful and effective in monitoring and evaluating project effectiveness. Third, the focus on ecosystems and biodiversity that is a central emphasis of the Council's 2000 Fish and Wildlife Program is only beginning to be incorporated into actions.

The ISRP also recommended "that the wildlife and fish habitat protection programs be better integrated and that projects be evaluated on criteria that favor those projects with documented benefits to both terrestrial and aquatic species."

In the second retrospective report (ISRP 2006-4a) the ISRP recommended that the Habitat Evaluation Procedure (HEP) should be used only as an initial scoring system for the mitigation agreements that underlie the Wildlife Program. It should not serve as the sole criterion for judging whether an agreement was worthwhile.

***Progress:** Although some fine examples of wildlife projects exist among the projects listed, wildlife portions of the Fish and Wildlife Program may be considered in a formative stage with little or no connectivity among many of the diversified projects. Some projects have single focal species with quite specific monitoring efforts to understand a single species response to management activities. Other projects are broader in scope with many species targeted for monitoring efforts, i.e., emphasis on biodiversity. Many wildlife species exist and an approach for setting priorities needs to be established for both choosing focal species and targeting critical habitat needs for acquisition. Furthermore, approaches used for monitoring wildlife populations and collecting habitat data are varied. As with PNAMP and the American Fisheries Society's development of salmonid monitoring protocols, perhaps a similar set of protocols, in conjunction with The Wildlife Society, can be developed that offer the potential for some standardization of methods for monitoring various wildlife species and their habitats.*

ARTIFICIAL PRODUCTION

In the first retrospective report (ISRP 2005-14) the ISRP recommended that a defensible overall production plan be developed for each subbasin that integrates natural and artificial production elements and explicitly links them to prioritized habitat limiting factors and proposed habitat actions identified in the Subbasin Plan.

***Progress:** The Fish and Wildlife Program's artificial production effort has improved incrementally through comprehensive basinwide and individual hatchery program reviews. From 1997 through 2004, at Congress' request, the Council undertook an Artificial Production Review Evaluation (APRE), producing principles for artificial production in an Artificial Production Review (APR, NWPCC 99-15), and a review of the purposes of individual programs and Hatchery and Genetic Management Plans (HGMPs) (APRE, NWPCC 2004-17), concluding with a report to Congress (NWPCC 2005-11). Subbasin planning in 2005 revealed a lack of integration of natural and hatchery production in subbasin plans. In response the Council began using the All-H Analyzer (AHA) developed by*

the Puget Sound Hatchery Science Review Group (HSRG) to integrate the biological objectives for natural and artificial production and harvest. More recently Congress has directed that a Hatchery Scientific Review similar to the Puget Sound Hatchery Review be conducted in the Columbia Basin. This review is employing AFLA as a tool to investigate the expected benefits from artificial production and the likely effects from integrating natural and artificial production. The ISRP (and/or ISAB) anticipates reporting to the Council how the final products from this review can be incorporated in the Fish and Wildlife Program to best provide harvest benefits and support restoration of natural spawning populations.

In the second retrospective report (ISRP 2006-4a) the ISRP recommended that the Council issue an RFP to develop methods to evaluate the effects of large-scale artificial production programs designed primarily for harvest on the abundance, productivity, and diversity of naturally spawning salmon populations. Additionally, the ISRP recommended the Council issue an RFP to conduct studies of the effects of supplementation on long-term changes in fitness.

Progress: *See the more detailed summary of supplementation and the ad hoc supplementation workgroup on page 21.*

MAINSTEM

The first ISRP retrospective report (ISRP 2005-14) commented that the ISRP was gratified that most of its recommendations regarding projects in the mainstem over the past eight review years had been adopted by the Council or another agency. The interchanges among the ISRP, the ISAB, the Council and the Council staff have been very positive. They yielded considerable progress toward developing a mainstem program that is scientifically sound, benefits fish, and has defined objectives and intended outcomes. In addition, intensive effort was initiated to provide for continual monitoring and evaluation of results without overwhelming the needs of other parts of the Fish and Wildlife Program.

Nonetheless, research, monitoring, and evaluation on the mainstem have not been completed, and significant technical issues remain, especially if the often competing socioeconomic and fisheries interests are to be wedded as equal objectives. Recent events showed that the persistent issues of flow and spill, for example, have not been resolved. The mainstem programs of the Corps (AFEP) and the Council require improved interchange and coordination.

Progress: *In 2007 the ISRP and ISAB completed a review of the Comparative Survival Study's (CSS) Ten-year Retrospective Summary Report¹¹, one of the largest M&E projects in the Fish and Wildlife Program. The CSS is a field study of the survival of PIT-tagged spring/summer Chinook and PIT-tagged summer steelhead through the Snake and Columbia River(s) hydrosystem from smolts through returning adults, with a focus on relative survival of fish that traveled as smolts by alternative routes (e.g., in river, transported, different routes of dam passage, and different numbers of dams passed). The CSS is important because it is one of the few organized attempts to systematically release PIT-tagged hatchery-reared and wild smolts into the Columbia River for the purpose of comparative monitoring and evaluation. Most aspects of the study, from its design and methods to the analytical results, continue to be strongly debated in the Region because the relative survival rates of salmonids under different hydrosystem operations and environmental constraints is a central concern of water and fish management policies. For the most part, the ISRP and the ISAB found that the CSS Ten-Year Retrospective was effective in answering the concerns posed by the ISAB's review of the CSS 2005 Annual Report (ISAB 2006-3). However, the ISRP, with concurrence of the ISAB, found that one of the major project objectives (Upriver/Downriver Comparisons) did not meet scientific review criteria, because*

¹¹ www.fpc.org/documents/CSS.html

of inevitable confounding from other factors in establishing cause(s) of upriver/downriver differences that may be detected, regardless of sample size and detection power that could be achieved. Nevertheless, the CSS Ten-Year Retrospective provided improved clarity in the presentation and explanation of the sophisticated methodologies used in analyses of CSS data. The scope of CSS investigations resulted in an extensive report, containing many detailed summaries of past and present work, and the report presents key data and data summaries in support of their major conclusions.

The ISAB reviewed models and data to address post Bonneville Dam mortality (latent mortality) (ISAB 2007-1) concluding that the hydrosystem likely causes some latent mortality. However, the ISAB recommended to the region that the components of latent mortality be treated in a single model, and strongly advised against continuing to try to measure latent mortality, and instead focus on estimating total mortality of in-river and transported fish.

OCEAN AND ESTUARY

The first retrospective report (ISRP 2005-14) recommended that the ISRP and Council should encourage innovative ecosystem-based research and monitoring in the estuary, with emphasis on the effects of the hydrosystem (altered flows, primarily) on all components of the ecosystem.

The mainstem Columbia River between Puget Island (upper estuary) and Bonneville Dam remained largely un-assessed even after the subbasin planning process. This limitation has been identified by the ISRP and ISAB numerous times, but it still persists. Approximately 100 miles of river could be viewed as either a gauntlet common to all up-river and Willamette River salmonids or as a hundred miles of restoration opportunities. At this time there is apparently insufficient information to assess the importance of this large and highly modified subbasin.

More thorough assessment and increased attention in regional research, monitoring, and evaluation plans are needed for the mainstem Columbia River between Puget Island (upper estuary) and Bonneville Dam.

Progress: *The ISRP reviewed several innovative proposals for improvement of the information base on ocean and estuary habitats. A project on eelgrass restoration (200751300) was recommended for funding, and a proposal dealing with acoustic tags to examine survival of Chinook in Columbia River plume (200750200) was ranked. The proposals that dealt with ocean and estuary studies were only a small proportion of the total number submitted. The ISRP continues to recognize this shortfall in the project mix, as identified in earlier retrospectives (ISRP 2005-14 and above) and encourages innovative ecosystem-based research and monitoring in the estuary, with emphasis on the effects of the hydrosystem (altered flows, primarily) on all components of the ecosystem. Conditions in the estuary, plume, and ocean are possibly very important in our understanding of key processes such as measuring total mortality that affect Columbia River salmonids.*

PROJECT AND PROGRAM REVIEW PROCESS

The second ISRP retrospective report (ISRP 2006-4a) strongly recommends against further use of an annual solicitation that entails concurrent review of all new proposals and ongoing projects. Annual reviews tax the limits of the ISRP's human and budgetary resources and increase the opportunity for inconsistencies among reviews. Features of the provincial reviews such as site visits and presentations are invaluable in increasing the thoroughness of ISRP reviews through a better understanding of projects (not just proposals) within their geographical and biological contexts. In addition, presentations with question and answer opportunities are a much more efficient way to clarify issues that the ISRP or project sponsors may not make explicit in written documents.

Progress: *The Council has developed alternative paths for proposal and program review. Multiple proposal/project reviews for Lake Roosevelt, Umatilla River, Flathead Lake, and portions of the Clearwater subbasin during 2007 worked well for the ISRP. The ISRP has been briefed on, has reviewed, and supports the Council, Bonneville, and CBFWA staffs' proposed approach to future project reviews. The ISRP looks forward to providing further input on the details of the process. See Future Directions for the Project Review Process on page 32 for more discussion.*

INADEQUATE REPORTING OF RESULTS

In the 2006 retrospective report (ISRP 2007-1) the ISRP's primary observation from our evaluation of the FY 2007-09 proposals for existing projects was that over 40% of the projects needed to improve their reporting of results. A variety of factors helped explain this deficiency in reporting. In the response loop 8% of the projects reported results at a sufficient level. This improved reporting indicated that in some cases the problem was inadequate summarizing, analyzing, and interpreting results in a project proposal rather than lack of data.

Although the current proposal form includes instruction and emphasis on results reporting, the Council and ISRP should develop proposal forms that more explicitly require the reporting of data on physical habitats, biological objectives, summaries of data analysis, and the application of results to fish and wildlife management.

ISRP proposal reviews should explicitly address the level and quality of reporting so the Council can use this information more effectively in developing their recommendations to Bonneville. This ISRP recommendation essentially applies to our internal ISRP review process rather than any potential Council action.

Progress: *As described below and a major theme of this report, the ISRP reviewed results reports from a number of projects that the ISRP found deficient in results reporting in the FY 2007-09 review. In addition, the Council and Bonneville have specifically considered how to treat the entire set of projects that the ISRP identified as deficient in the 2006 Retrospective analysis. Related to this, at its March 2008 meeting, the Council requested that the ISRP help identify and prioritize a list of reporting metrics for artificial production, wildlife, and habitat projects. At the time of the release of this report, the ISRP has just begun scoping the metrics review, and this 2007 Retrospective Report should inform our approach to the review.*

2007 ISRP REVIEWS

For fiscal and calendar year 2007, the ISRP continued its role in providing scientific review to assist project sponsors in improving their projects and assist the Council and Bonneville in making project selection and implementation decisions. The ISRP completed a total of 21 reports/memos (see table below). The ISRP's major effort for the year was conducting follow-up reviews addressing unresolved issues from the ISRP's review of 540 FY 2007-09 proposals. In addition, the ISRP reviewed proposals seeking to test innovative technologies and methods; completed a retrospective review of results reporting in FY 2007-09 proposals; provided a potential framework for future project reviews; and with the ISAB jointly reviewed a handbook of salmonid field protocols. The full reports can be accessed via the web links provided in the table below.

Table of Fiscal and Calendar Year 2007 ISRP Reports with Web Links

Number	Title
2007-18	Review of Ecological Restoration Strategies for Lapwai and Big Canyon Creeks
2007-17	Review of Project 2007-405-00 Rufus Woods Supplementation and Creel Project
ISAB/ISRP 2007-6	ISAB and ISRP Review of the CSS Ten-Year Retrospective Summary Report
2007-16	Step Review of Sekokini Springs Isolation Facility
2007-15	Umatilla Initiative Review
2007-14	Input on Evaluation of Regional Coordination Projects
ISAB/ISRP 2007-5	ISAB/RP review of the Salmonid Field Protocols Handbook
2007-13	Preliminary ISRP Review of Project 2007-405-00 Rufus Woods Supplementation and Creel Project
2007-12	Results Report of the Grand Ronde Model Watershed Program Habitat Restoration - Planning, Coordination, and Implementation Project, 1992-026-01
2007-11	Review of Combined Habitat Assessment Protocols (CHAP) work element in Project 200600600, Habitat Evaluation Procedures (HEP)
2007-10	Lake Roosevelt Kokanee Program Review
2007-9	Review of FY 2007-09 Innovative Proposals
2007-8	Review of the ISEMP John Day Study Plan
2007-7	Review of the latest revision of the FY 2007-09 proposal 199101901 (dated 05/25/07), Hungry Horse Mitigation/Flathead Lake
2007-6	FY 2007-09 Follow-up Review of the Shoshone-Bannock Tribes' Southern Idaho Wildlife Mitigation Project 199505702
2007-5	Final Review of Proposal 2003-063-00, Natural Reproductive Success & Demographic Effects of Hatchery-Origin Steelhead in Abernathy Ck, Washington
2007-4	Review of Desert Wildlife Area O&M proposal
ISRP/IEAB 2007-3	SAFE Review 2007
2007-2	Response Loop Review of FY 2007 – 09 Proposal 2007-034-00: Columbia Cascade Pump Screen Correction
2007-1	2006 Retrospective Report
2006-7	Framework for ISRP Review of New and Ongoing Projects for the Columbia River Basin Fish and Wildlife Program

ADAPTIVE MANAGEMENT

USING PROJECT RESULTS IN RESTORATION DECISION-MAKING: COMPLETING THE ADAPTIVE MANAGEMENT LOOP

Past ISRP retrospectives and programmatic comments have emphasized the need for sufficient monitoring and evaluation of Fish and Wildlife Program projects and reporting project results in proposals. One ISRP review question is: Does the project describe the adaptive management implication from past results whether successes or failures?

The reason the ISRP has been focused on monitoring and evaluation and reporting results is that the Council's Fish and Wildlife Program explicitly acknowledges that project work elements are uncertain to achieve their stated biological objectives. The 2000 Fish and Wildlife Program's planning assumptions assert that "Management actions must be taken in an adaptive, experimental manner because ecosystems are inherently variable and highly complex. This includes using experimental designs and techniques as part of management actions, and integrating monitoring and research with those management actions to evaluate their effects on the ecosystem." The program's Scientific Foundation Principle 7. Ecological management is adaptive and experimental, states:

"The dynamic nature, diversity, and complexity of ecological systems routinely disable attempts to command and control the environment. Adaptive management – the use of management experiments to investigate biological problems and to test the efficacy of management programs – provides a model for experimental management of ecosystems. Monitoring and evaluation dovetails with management experiments and so is essential for adaptive management to be successful. Experimental management does not mean passive "learning by doing" but rather a directed program aimed at understanding key ecosystem dynamics and the impacts of human actions using scientific experimentation and inquiry."

Almost without exception, project sponsors state that they use adaptive management to modify the tasks and work elements in proposals. At the same time, however, project proposals almost never provide 1) an experimental design to identify whether biological objectives have been met by employing specific strategies or 2) a decision tree that would be used to modify management based on updated scientific information. Adaptive management components and principles in the Fish and Wildlife Program are largely conceptual and do not provide specific guidance to fish and wildlife managers.

The 2000 Fish and Wildlife Plan's Principle 7 implies the adoption of formal passive or active adaptive management which requires identifying hypotheses to test, establishing common metrics to be monitored, and designing an experimental procedure that will yield a test of the primary hypotheses. Passive adaptive management selects an acceptable initial management strategy based on available information and then proceeds to future decision points where the program is reassessed using the outcome from implementing restoration tasks. In contrast, active adaptive management implements different strategies (e.g., spill or transport of smolts), spatially or temporally, in a hypothesis testing framework. Very few individual projects implement these sophisticated designs to learn how the ecosystem responds from employing alternative management strategies. The ISRP believes it is unrealistic to expect all projects to include such management experiments. Barge transport of smolts, spill and bypass of smolts, habitat restoration projects, and hatchery production would be amendable to active and passive adaptive management.

Formal passive and active adaptive management are not the only processes that can be used for problem solving and decision making concerning Fish and Wildlife Program projects. Much of the adjustment to projects and Fish and Wildlife Program components actually resembles what has been referred to as “evolutionary” problem solving: improvement in practice by using a small number of independent projects that address a specific problem, with regular communication among the projects so the most promising methods are more widely applied.

A transparent methodology to establish unambiguous thresholds for assessing project and program success is absent from many Program projects. Regardless of the decision making structure used, decision trees and mechanisms are needed to guide co-managers to alternative strategies, reassess goals, and reconfigure priorities when repeated efforts do not appear to yield tangible results. There are notable examples where programs have been substantially modified because of apparent failure with the primary strategy and new empirical evidence to explain the lack of success. One example is the decision to halt efforts to reintroduce kokanee in Flathead Lake because the failure of the preliminary efforts was determined to be due to lake trout predation, not a lack of primary production.

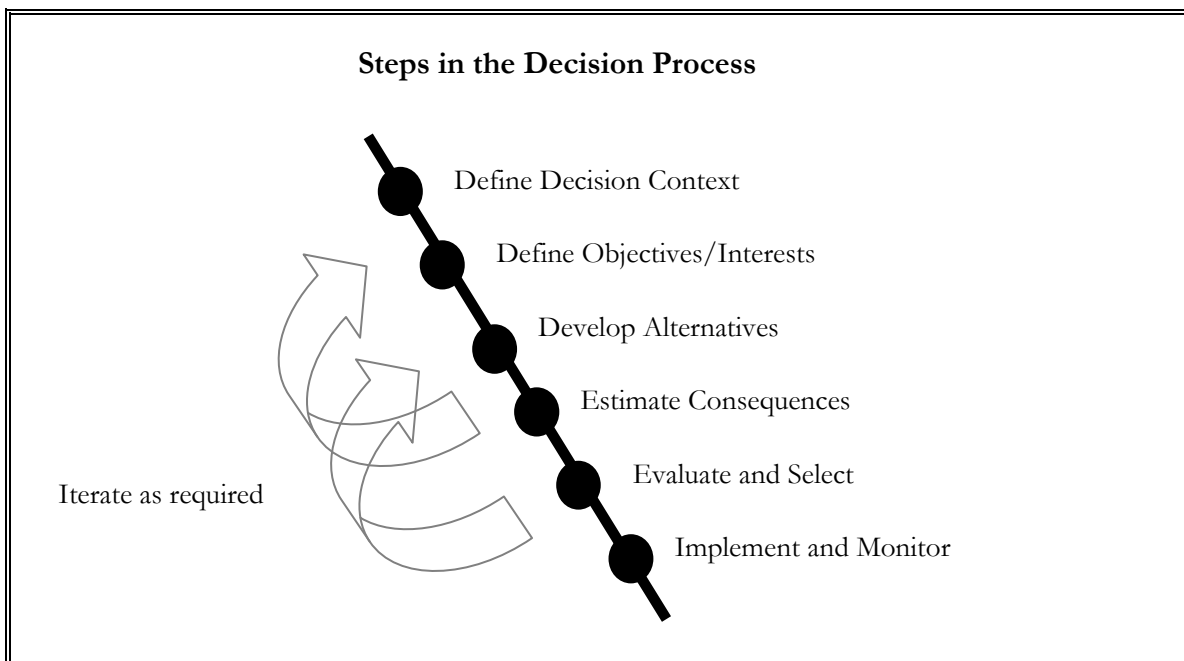
More often however, projects propose to continue to employ tasks and work elements that have not yielded the anticipated biological benefits. In the FY 2007-09 Solicitation Review in 2006 and the follow-up reviews during 2007, there were a number of efforts that adequately reported results including the captive rearing of Snake River sockeye salmon, the artificial production program for kokanee in Lake Roosevelt, harvest programs to manage the abundance of lake trout in Flathead Lake, and the combined natural and artificial production of salmon and steelhead in the Umatilla River. But those results in the ISRP’s view fell short of the projects’ biological objectives. Sponsors of these projects are understandably reluctant to abandon these efforts in which they have invested much time and energy. Often alternative restoration strategies or focal species are not clearly apparent to the project proponents.

Project appraisal based on results requires scientific and technical information. When programs are determined to be unattainable because of environmental and biotic conditions, transformation to alternative strategies or focal species undoubtedly will be more successful when the external social context (conflict among stakeholders, requirements to fulfill legal obligations) is explicitly considered during the process. Although this integration was a primary tenet of subbasin planning, this component of the Fish and Wildlife Program needs development as applied to program implementation and specific projects.

A structured (or integrated) decision making process linking the economic, social, political, and biological requirements needed to sustain fish populations is one approach to evaluate complex multidimensional problems involving imperfect information and often conflicting public values. At the core of structured decision making is the exploration and development of a robust and representative set of objectives, which are used to help create and assess multiple alternatives (and test competing hypotheses) in an iterative, adaptable way. The goal of this exploration is to learn and gain insight into the consequences of the alternatives and make wiser decisions that better balance the competing interests. Exploration of decisions and alternatives can involve expert judgment, statistical models, structuring tools, scenario and multi-attribute analyses, multi-stakeholder input, planning workshops, the explicit treatment of uncertainty, and adaptive management. The process of structured decision making is flexible, but generally follows a six step sequence that is iterative (see the figure below). There is an emerging body of case studies that highlights how structured decision making would be amenable to application in many of the Columbia subbasins. A decision, once reached, requires an adaptive environmental assessment modeling and monitoring procedure, where

management actions can be treated as experiments, with modeled results tested in control and treatment studies. Failing et al. (2004)¹² provide an example of a practical integration of probabilistic policy analysis and multi-stakeholder decision methods at a hydroelectric facility in British Columbia, Canada.

Recent research highlights that carrying out a successful structured decision making process can be greatly facilitated with the assistance of an independent facilitator / decision analyst to assist all parties involved in clearly defining the decision and its context. Several facilitated meetings and discussions may be necessary to reach agreement even at this initial step, but this initial effort is important in setting the stage for subsequent iterative steps providing needed focus and potentially saving considerable time in the longer run, including avoiding expensive litigation. Integrated decision-making considers environmental, social, and economic issues while striving to find ways for all uses to co-exist with less conflict. For example, on the Umatilla River, water use is important for fish, agricultural irrigators, drinking, etc. Decision to alter flows involves several stakeholders in complex fashion, thus consideration of context must include all concerned through the iterative steps in the above figure, whether in this case of water use, or in other examples, such as development of additional hatchery capacity within the Columbia Basin (e.g., Chief Joseph Hatchery). The process has met with success in examples in British Columbia. One example is BC Hydro's water use planning program which resulted in 21 agreements between regulators and community groups for the operation of their hydro-electric facilities (Failing et al. 2004). Another example concerns the Seymour River, where decisions were required on continuation of hatchery operations during periods of low marine survival of wild steelhead, when hatchery fish were suspected to have a negative impact on wild fish. The decision process and related modeling exercises suggested alternatives that led to a compromise, which is now being monitored.



¹² Failing, L., G. Horn, and P. Higgins. 2004. Using expert judgment and stakeholder values to evaluate adaptive management options. *Ecology and Society* 9(1): 13. URL: <http://www.ecologyandsociety.org/vol9/iss1/art13/>.

MAJOR 2007 PROGRAMMATIC ISSUES

In this report section, the ISRP examines a subset of projects that were reviewed in Fiscal Year 2007 and investigates how the projects applied the results of their past actions and monitoring to proposed future actions and monitoring. The ISRP first address fish production projects and then habitat related projects including salmon habitat restoration and wildlife habitat strategies.

FISH PRODUCTION

PROGRESS ON RESULTS REPORTING

Select Area Fisheries Enhancement Project (SAFE)

The ISRP and Independent Economic Advisory Board (IEAB) reviewed two SAFE project reports. The ISRP concluded that the SAFE project is consistent with the Northwest Power and Conservation Council's Fish and Wildlife Program and the Bi-State Lower Columbia River and Columbia River Estuary Subbasin Plan (ISRP&IEAB 2007-3¹³). The SAFE fishery has been intensively monitored to assess catch of target and non-target stocks as well as effects on these stocks. The sponsors indicate that agencies specifically adapt management by modifying harvest regulations when deleterious impacts have been observed or anticipated. SAFE appears to meet its overall goals for yielding a relatively stable source and sufficiently high rate of harvest at present levels of production and release. Estimated survival rates for SAFE fish are on par with or exceed those achieved at lower Columbia River production hatcheries, and harvest of SAFE fish makes up a significant component of the lower Columbia River catch of salmon. Importantly, direct impacts to non-target or listed stocks, especially those above Bonneville Dam, appear limited.

While the project sponsors conclude that the program's production could be expanded to increase harvest, the sponsors did not clearly articulate a monitoring design or data analyses to support this conclusion. The ISRP identified several areas for improving the project sponsors' presentation and approach. First, the presentation of monitoring methods and design could have been more comprehensive and complete. Second, a robust statistical analysis of the coded wire tag and other experimental study data was almost entirely absent. As such, the report did not present convincing evidence that an expansion of production to 11,300,000 smolts was needed, would improve harvest, or would have minimal impact on non-target stocks (especially during periods of anticipated or prolonged poor ocean conditions). The sponsors must not assume that because impacts appear minimal with the present scale of production and oceanic conditions, these will continue as the fishery expands or the environment changes. Third, harvest estimates are an important variable in establishing the program's costs and benefits (per unit of catch – see the IEAB section of the SAFE review).

Consequently, within an adaptive management context, the ISRP recommended continuing and enhancing rigorous monitoring, analysis, and results reporting to determine harvest and survival rates, impacts on non-target fish stocks, and stray rates of SAFE fish. If not already involved, a competent statistician should be consulted in project design and analysis of data. Alternative mass marking, such as thermal otolith marking techniques, should be explored to improve survival and catch estimates. The IEAB found the economic analysis of the SAFE project to be generally responsive to past ISRP/IEAB reviews, although some problems remained with documentation,

¹³ See the ISRP report at www.nwcouncil.org/library/isrp/isrpieab2007-3.pdf

detail, and clarity of analysis (see ISRP&IEAB 2007-3 for details). The ISRP and IEAB found the combination of scientific and economic reporting and subsequent review to be a useful model.

Umatilla Initiative Review

The ISRP review of the “Umatilla Initiative” was intended as a comprehensive site and programmatic evaluation of the numerous but interrelated individual projects within the Umatilla River.¹⁴ To facilitate the review, the Confederated Tribes of the Umatilla Indian Reservation (CTUIR) and Oregon Department of Fish and Wildlife (ODFW) prepared, “Umatilla Projects Review: A presentation of the multiple Component Umatilla Basin Fisheries Restoration Program” to address specific questioned raised in the FY2007-09 proposal review.

The ISRP organized projects into three categories reflecting each project’s primary objectives and tasks, providing a logical approach to evaluate project effectiveness: flow enhancement and fish passage; habitat enhancement; and artificial and natural production. Specifically, for flow enhancement and fish passage, Phase I and II of the water exchange program are in place and irrigation diversions have been upgraded to provide passage of both adults and juveniles. For habitat enhancement, numerous stream reaches have received large-wood additions and riparian zone fencing. For production enhancement, a hatchery and satellite facilities for holding and acclimating hatchery fish have been constructed, and spring and fall run Chinook and coho salmon have been re-introduced back into the watershed (after years of extirpation). Some fish are returning to the river, a fishery has developed, and cooperation with landowners is improving. The program, however, has not achieved its proposed salmon and steelhead production, escapement, and harvest goals.

Production activities in the Subbasin are evaluated primarily through the Umatilla Hatchery M&E project (199000500). This Subbasin-wide effort has been essential for providing data and analysis for evaluating the hatchery-related program(s). Since water-exchange and habitat enhancement are intended to increase the abundance of salmon and steelhead, information reported for natural and artificial production is essential for a complete evaluation of the collective projects. The results reported in Grant et al. (2007) – *Comprehensive Assessment of Summer Steelhead and Chinook Salmon Restoration Enhancement Efforts in the Umatilla Subbasin* and summarized in the sponsors’ program review documentation *Umatilla Projects Review: A presentation of the multiple Component Umatilla Basin Fisheries Restoration Program* submitted by CTUIR and ODFW – are sufficient for a preliminary evaluation on the collective success of the subbasin effort. The monitoring effort and data analysis did not evaluate the separate contributions of the individual hatchery, water exchange, fish passage and habitat restoration components. Ultimately, it is not clear whether the updated monitoring plan can separate the effects of these individual actions. The ISRP recommended that additional information on life-stage specific mortality needs to be analyzed and reported for deciding how the project might be modified to close the gap between the goals of the Subbasin Plan and what is actually being achieved.

Lake Roosevelt Kokanee Review

The ISRP concluded that there is no scientific justification to continue artificial production of kokanee for stocking Lake Roosevelt or programs to develop and support naturally produced kokanee. The ISRP came to this conclusion based on the Lake Roosevelt program’s significant lack of success in producing both a tribal and recreational fishery for kokanee salmon. The results reported by the kokanee program’s experimental monitoring and evaluation efforts have documented

¹⁴ See the ISRP report at www.nwcouncil.org/library/isrp/isrp2007-15.htm

that lack of success. Two major factors appear to be limiting this success: entrainment of large numbers kokanee through Grand Coulee Dam (particularly following the initiation of operations of the third powerhouse) and predation by walleye (whose population has increased significantly over the past eight years and now supports the major fishery in Lake Roosevelt). In addition, spring drawdowns have been significant in the past several years and have severely impacted kokanee spawning potential and natural production in the lower reaches of the tributaries.

The ISRP believes, however, if it could be conclusively demonstrated that (1) the entrainment problem was controlled or significantly reduced, (2) the walleye population was significantly reduced and managed, and (3) drawdown levels were reduced or managed, then artificial production and/or support of natural production of kokanee could be re-initiated. In this example, three focused research projects are needed to implement adaptive management principles.

ISRP Review of the Hungry Horse/Flathead Lake Project

The ISRP's final recommendation for this proposal was: *Meets Scientific Review Criteria In Part (qualified)*. In their revised proposal, the project's sponsors partially responded to the ISRP recommendations, but overall did not significantly improve key elements of the proposal. The project sponsors proposed a combination of habitat improvements in Flathead Lake and tributary streams, and lake trout removal in Flathead Lake using angling to decrease predation on bull trout and west-slope cutthroat trout focal species. The sponsors partially responded to the ISRP's request to develop the rationale that the ongoing effort to reduce lake trout numbers via the fishing derbies might overcome the compensatory ability of the surviving lake trout. The sponsors provided a modeling exercise that describes how increased harvest could reduce the lake trout population. Unfortunately, reporting of results to date indicates that the lake trout population has not been reduced by angling and the angling efforts have not yet achieved a sufficient harvest. Further, the sponsor did not provide a rationale that this reduction would in turn provide a quantifiable increase in abundance of westslope cutthroat or bull trout. There is a need for a clear statement of a problem and an outline to resolve that problem that is both quantified and employs technically justifiable strategies and work elements. The ISRP suggested that the lake trout monitoring might be justified if shown to be part of a long-term fisheries plan for Flathead Lake, and funding for the fishing derbies might be justified if linked to a larger lake trout removal effort.

Tributary stream habitat work could be justified if shown to be part of a well developed and prioritized restoration program or that the sites could be specifically linked to habitat restoration objectives in the subbasin plan. Currently, habitat restoration is being monitored almost exclusively with photo-point documentation. Additional metrics that represent trends in ecological conditions are also needed. These can be very simple, based on the Flathead watershed assessment and subbasin plan. What is needed is a more specific set of habitat objectives, a clear rationale that the sites selected for restoration are justifiable in terms of correcting factors that limit fish populations, and a strengthened effectiveness monitoring plan. The effectiveness-monitoring component should be sufficient to detect quantifiable habitat improvements and increases in fish populations or expanded distributions.

RESIDENT FISH SUBSTITUTION: CHALLENGES IN FOCAL SPECIES MANAGEMENT

During the FY 2007-09 project review, the ISRP was concerned that a number of resident fish substitution proposals selected substitution species that did not appear compatible with other species (predators and competitors) in the systems where they were going to be planted/introduced. In some cases the introduced fish posed risks to listed native species and were also possibly inconsistent with the general guidelines of the Council's Fish and Wildlife Program.

The Council's Program provides that anadromous fish losses due to the blocked areas need to be mitigated in part by resident fish species substitutions, provided that (1) populations of resident fish species remain healthy, (2) introduced species may be used if they were compatible with continued persistence of native species, and (3) an artificial production strategy may be used to "*replace lost salmon and steelhead in blocked areas.*" These production programs are to be executed consistent with the Council's Artificial Production Review policies that include (1) maintaining appropriate risk management when using the tool of artificial propagation, and (2) making decisions on the use of artificial production in the context of fish and wildlife goals, objectives, and strategies at the subbasin and province levels.

The ISRP found that these broad Fish and Wildlife Program guidelines/elements do not establish specific limits (i.e., how much risk?) or the methods (i.e., risk management protocols) to evaluate whether a proposed project is reasonably benign and likely to provide benefits without undesired consequences. Clear risk management criteria are needed for sponsors to follow when developing proposals for resident fish substitution projects and for the ISRP to use when reviewing such proposals. These concerns were raised to the ISAB and the Council. Each agreed that this was an important issue, and the Council assigned the ISAB to complete a review report on this issue and on the broader issue of non-native species impacts on the Fish and Wildlife Program. The ISAB report will include suggestions for resident fish substitution criteria and guideline development. This review is currently underway.

CHALLENGES TO ASSESSING COMPETITION AND PREDATION WITH INVASIVE NON-NATIVE SPECIES

Competition and predation are frequently mentioned as the causative agents for decline of native species in Columbia River Basin watersheds where non-native species are present. However, the relative role of these biological interactions is poorly understood in many situations, and further work is required to determine their role relative to habitat factors such as spawning habitat modified by the hydrosystem. The potential for competition for food resources requires data on food supplies as well as spatial and temporal overlap of the potentially interacting species.

Information on effects of competition and predation is required to guide restoration activities, but the essential data are frequently absent from specific lakes and rivers in the Basin where non-natives are dominant. Should effort be placed on harvesting of non-native species to reduce competition and predation, or should emphasis be placed on habitat restoration? In general there is insufficient basic information on feeding habits of fishes in the reservoirs and long-term data sets are especially lacking. The carrying capacity of most reservoirs is not known, so food limitation is difficult to determine. While most jurisdictions require risk assessments for future introductions of non-native fishes, it is not clear how they can be conducted without such information. Clearly, complex ecosystem changes can be caused by introduction of non-native species. While basic information on feeding is required and contemporary methods such as stable isotope analyses can help, a trophic analysis model such as Ecopath (<http://ecopath.org>) might help unravel some of the relationships. The problem is not restricted to reservoirs in the Columbia River Basin but also may be present in tributaries where, for example, brook trout have been established. Thus a basin-wide workshop on the topic might be useful to share information, avoid duplication of efforts, and apply an adaptive management approach to the issue.

INTERSPECIFIC HYBRIDIZATION AS A CONSERVATION CHALLENGE FOR RESIDENT FISHES

Hybridization between native and introduced species of fishes is increasingly proving to be a challenge for conserving or restoring aboriginal populations of salmonids. For example, efforts to recover degraded or “introgressed” populations of westslope cutthroat trout have been impeded by interbreeding with introduced and established populations of rainbow trout. Several issues confront these efforts such as:

1. An understanding of the extent of hybridization having taken place (e.g., low level or recent interbreeding v. long-term or extensive interbreeding);
2. What level (if any) of interbreeding can be reasonably accommodated for conserving or restoring aboriginal populations;
3. The comparative effectiveness of chemical, mechanical, or biological eradication methods;
4. The effectiveness of barriers and “quarantine” for native populations at risk from local upstream or downstream sources of introduced or hybridized trout populations;
5. What constitutes an adequate source for re-establishing a “vacated”, extirpated, or eradicated habitat within the aboriginal range;
6. The effectiveness of re-introducing propagated young v. transplanted adults v. natural recolonization; and,
7. The efficacy of demographically swamping a population with a monophyletic source.

The first two issues deal with detecting and assessing risks from changes to the structural elements of biological diversity, while the remaining five issues deal with approaches and specific methods for addressing threats created by interbreeding of divergent taxa. The ISRP acknowledges that reducing the threat to native trout posed by hybrid or introduced subpopulations is daunting and there are no easy solutions. The ISRP believes there are considerable logistical challenges associated with any undertaking to address the effect and legacy of former trout introductions. Any projects need to establish a logic pathway that links quantifiable outcomes with proposed treatment. It will also be critical to address these issues within a broader context, such as that currently under consideration by the ISAB in its non-native species review. Finally, robust M&E should accompany any program to answer questions of whether renovated lakes or streams support self-sustained populations of native trout (or other species) following eradication and repopulation. The ISRP recommends that M&E plans should include methods, protocols, as well as the kind of data collected, and specific hypotheses to be tested. We do not recommend measuring “everything” but rather those variables that can permit judgment as to whether the treatment(s) have worked or not.

SUPPLEMENTATION

Hatchery production of salmon and steelhead is a component of most subbasin plans implemented as part of the Columbia River Basin Fish and Wildlife Program. Most hatcheries are operated with the intent that the juvenile fish released will be harvested in the ocean or when they return as adults to the Columbia River. These hatcheries are referred to as harvest augmentation programs. The adults returning from juvenile releases from harvest augmentation programs are not intended to spawn naturally.

In contrast, a number of hatchery programs, referred to as conservation or supplementation, are operated with the intent that a significant fraction of the released fish will escape harvest to successfully reproduce in the wild. Juveniles from these supplementation programs are released into habitats to which they are expected to return and spawn, thereby providing a “demographic boost” that eventually leads to increased abundance of natural-origin adults in the salmon or steelhead population.

The Council, when deciding to proceed with supplementation, recognized it as experimental, requiring risk assessment and monitoring (NWPPC 99-15, NWPCC 2000). The uncertainties are whether supplementation actually provides a demographic increase in natural production (the potential benefit) and whether supplementation leads to decreased natural-spawning fitness (the potential harm) in the wild stocks. The ISRP and ISAB have expressed the view that the uncertainty of both the benefits and the risks of supplementation are sufficient enough to put the merit of supplementation into question as a recovery strategy. The ISAB review of supplementation (ISAB 2003-3) found that, in general, the correct parameters were not being evaluated in most supplementation projects. The ISRP and ISAB (ISRP&ISAB 2005-15¹⁵) provided a concise summary of possible approaches to monitoring supplementation and recommended that a uniform approach be established to evaluate the abundance, productivity, and capacity of target populations; to establish more reference locations; and to establish an evaluation of long-term fitness. The panel and board suggested that the Columbia River Inter-Tribal Fish Commission, NOAA-Fisheries, and the Council organize a workshop of the Basin’s fish managers to develop this comprehensive evaluation of supplementation within the Columbia River.

Two workshops have been held: the first April, 6 and 7, 2006, and the second February 14 and 15, 2007. The first workshop brought together the managers and biologists responsible for implementing many of the basin’s supplementation projects with the objectives:

1. To review the status of ongoing supplementation monitoring programs in the Columbia River Basin.
2. To discuss ongoing or proposed monitoring programs with respect to a recent set of recommendations made by the ISRP and ISAB in the report: Monitoring and Evaluation of Supplementation Projects (ISRP&ISAB 2005-15).
3. To identify areas where greater coordination among supplementation (and population) monitoring programs would be beneficial.

The first workshop identified strong support among managers for an effort to coordinate monitoring and evaluation of supplementation across the Columbia River Basin. The effort will concentrate on two approaches: establishing monitoring protocols and analytical methods for long-term trend analysis for abundance and productivity in treated versus reference streams to evaluate demographic “boost” from supplementation; and intensive experimental studies to assess the long-term fitness effects of supplementation.

The second workshop objectives were to outline the design of an evaluation of the demographic effects of supplementation on salmon and steelhead population abundance and productivity; and to further consider the design of a meta-analysis of projects using pedigree analysis that could be used

¹⁵ www.nwcouncil.org/library/isrp/isrpisab2005-15.pdf

to assess the long-term effects of supplementation on natural spawning fitness of salmon and steelhead.

Attendees of the second workshop concluded that with additional monitoring of reference streams the demographic effects of supplementation could be assessed, and an Ad Hoc Supplementation Work Group was created to coordinate with the CSMEP Hatchery Workgroup to establish standardized metrics to evaluate supplementation projects. Attendees also concluded that the objective to develop a design for a meta-analysis of projects using pedigree analysis was premature. There was a need to review and clarify the kinds of information that pedigree analysis can and cannot provide. During 2007 progress was made on both of these objectives, and a report is anticipated early in 2008.

Also in 2007, the Fish and Wildlife Program project *Reproduction of Steelhead in Hood River* (200305400) published a peer-reviewed article in *Science*. Genetic effects of captive breeding cause a rapid, cumulative fitness decline in the wild. *Science* 318:100-103. Michael Blouin and associates at Oregon State University (OSU) used an innovative pedigree analysis of the numbers of adult progeny produced by hatchery-origin adults spawning naturally that had either wild or hatchery parents when produced in the hatchery. This permitted a comparison of genetic effects un-confounded with environmental effects. They reported a 40% reduction in the natural-spawning fitness of hatchery-origin steelhead that had hatchery-origin parents compared to hatchery-origin steelhead that had wild parents.

The preferred contrast to evaluate the long-term fitness effects of supplementation would be to compare the adult progeny produced by natural-origin fish with different histories of supplementation in their pedigrees. The approach used by Dr. Blouin and the Hood River/OSU team is a reasonable surrogate when the preferred method is untenable owing to logistical constraints. If the effect measured in Hood River steelhead is observed in other steelhead and Chinook salmon, it would demonstrate a significant long-term genetic risk from supplementation.

At the Council's December 2007 meeting, Dr. Blouin presented the Hood River study's results. He was followed by members of the Supplementation Work Group who identified other studies in the Columbia River and elsewhere that could provide similar information in the near future.

The ISRP understands that the Supplementation Work Group will submit a final report outlining recommendations for evaluating both the demographic and long-term fitness effects of supplementation early in 2008. The ISRP recognizes the significant progress made by regional scientists, looks forward to reviewing the report, and is hopeful a plan for a comprehensive evaluation of supplementation is close to implementation. The monitoring and evaluation should provide information to guide decisions on the sufficiency of supplementation to contribute to the restoration of salmon and steelhead.

HABITAT

SUBBASIN HABITAT PROGRAMS (JOHN DAY, GRAND RONDE, UMATILLA)

In the 2007-2009 Projects Review and 2006 Retrospective Report, the ISRP identified serious deficiencies in a majority of the projects in reporting results related to the project's effectiveness in achieving the stated objectives. This deficiency was related in part to inadequate programs for monitoring and evaluating project success. The problem was particularly acute for habitat restoration projects. Without adequate monitoring and evaluation, it is difficult to determine whether a project is achieving or failing to achieve its objectives and is providing benefits to fish and wildlife.

Furthermore, without appropriate M&E, implementation of adaptive management is seriously impeded. In the 2006 Retrospective Report, the ISRP recommended to the Council that more emphasis should be placed on reporting results in project proposals and some form of effectiveness monitoring should be required of all habitat projects. As we have noted above, effectiveness monitoring associated with individual projects should most often focus on response of habitat rather than population responses.

Three projects reviewed by the ISRP in 2007 differ in several ways, but all had significant habitat improvement components. In their initial review of these projects during the 2007-2009 Project Review process, the ISRP expressed concern about results reporting and the adequacy of monitoring and evaluation. These concerns were acute because the projects had been implemented for well over a decade and there was a clear need for some assessment of project success. Each of the sponsors of these projects prepared reports that responded in some way to the ISRP's comments on results reporting and M&E. These reports were reviewed by the ISRP in 2007 to determine how well the sponsors had addressed the concerns.

For the *Grand Ronde Model Watershed Program Habitat Restoration - Planning, Coordination and Implementation Project* (199202601) the ISRP called for "a report presenting quantitative and qualitative results to date pertaining to the effectiveness of the projects under their domain, a general summary and conclusions about overall project effectiveness, and the application of the results to management." The watershed program sponsors submitted the report for ISRP review on July 12, 2007.

In 2007 the ISRP also reviewed the sponsor's response to the ISRP project review of the *Mainstem, Middle Fork, John Day Rivers Fish Habitat Enhancement Project* (198402100). The ISRP's major concern was that this project, ongoing since 1984, lacked a comprehensive reporting of results demonstrating the effectiveness of the project.

The ISRP also reviewed in 2007 a set of projects directed at restoration and protection of salmon and other aquatic biota in the Umatilla Basin. There are currently two large BPA-funded habitat enhancement projects in the Umatilla: *Umatilla Subbasin Fish Habitat Improvement Project* (198710002) with ODFW being the lead entity, and *Umatilla Anadromous Fish Habitat - CTUIR* (198710001). In addition, *Umatilla River Basin Stream Temperature Monitoring* (200729300) involves a continuation of stream temperature monitoring at 31 long-term monitoring sites and *Iskuulpa Watershed Project* (199506001) (CTUIR lead entity), which is specific to a single watershed, is designed to enhance habitat for focal wildlife and fish species. A fifth project – *Morrow County Riparian Buffers Umatilla County Riparian Buffers* (200202600) (Morrow County Soil & Water Conservation District lead entity) – involves enrolling farmers in riparian conservation programs to improve riparian zones.

The Umatilla projects were reviewed individually during the 2007-2009 Projects Review. Central issues in the ISRP's original review of the individual projects had to do with results reporting and M&E. The ISRP recommended these proposals be reviewed as a comprehensive package to clarify relationships among the projects, identify measures for effectiveness evaluation, and assess the overall benefits for salmon and other aquatic biota and their habitats.



Iskuulpa Creek and Meacham Creek, Umatilla River Subbasin

After reviewing the responses of the sponsors from each of these three subbasins to ISRP comments made in the 2007-2009 Projects Review, we abstracted general themes or elements common to all the projects in terms of how well they addressed the ISRP concerns about results reporting and M&E.

All three projects maintained some level of monitoring and evaluation, principally implementation monitoring, but also some, usually qualitative, monitoring of project effectiveness. The ISRP remains convinced that M&E should be improved for all projects to enable more comprehensive, quantitative evaluation of project effectiveness. The lack of evaluation of biological effectiveness for all projects was especially striking. Sponsors generally acknowledged that in many cases M&E was inadequate or entirely lacking, but they clearly saw the need for monitoring and evaluation, and they expressed the desire to increase M&E efforts, consistent with available funding. Some are pursuing opportunities for collaboration with other projects and programs to facilitate monitoring activities.

In many instances monitoring was sufficient to demonstrate some benefits derived from the project and assess, to some extent, whether the project was achieving its objectives. Project sponsors were able to identify not only parts of their projects that appeared to be successful but also those that failed to meet expectations. Often, adaptive changes were made to improve the project. Had some level of monitoring not taken place, these failures would not have been identified and appropriate project modifications could not have been implemented. Even so, all three projects could benefit from a more rigorous, systematic program for monitoring project effectiveness.

In the sponsors' responses, reporting of results, including data presentation, analysis, and interpretation was improved over the original proposals but still largely lacked the comprehensiveness needed for rigorous, quantitative assessment of project effectiveness. All projects had potentially important ongoing habitat restoration and protection work, but it was often unclear how well the individual habitat projects were achieving their objectives and were contributing to overall restoration goals. The projects were especially deficient in data related to biological population response. One reason for the insufficient reporting of results was inadequate summarization, analysis, and interpretation of physical habitat and biological data. Another, perhaps more serious problem, appeared to be insufficient physical habitat and biological data collection due to the lack of a rigorous monitoring and evaluation program. The lack of critical data underscores again the need for more comprehensive monitoring and evaluation.

Habitat projects collectively could benefit from enhanced biological monitoring. The projects focused monitoring efforts primarily on documenting implementation of habitat projects (e.g., number of stream miles fenced, number of culverts removed, number of habitat structures installed), and to a lesser extent on measuring physical changes in the stream following habitat restoration actions (e.g., stream channel changes resulting from placement of structures). To a far lesser degree, the biological effectiveness of habitat restoration on target populations was evaluated, that is, whether the implemented habitat action was actually improving fish abundance and provided a significant benefit to fish and wildlife (e.g., were fish using newly rehabilitated habitat, whether it is a section of stream previously inaccessible or newly created habitat following placement of instream structures). On larger spatial scales, where feasible, it would be highly desirable to determine adult escapement, smolt production, fry and parr abundance, and other appropriate biological metrics to determine whether habitat restoration actions within a larger area (e.g., watershed) have actually increased fish productivity (the “validation” monitoring described on page 6). Monitoring designs such as comparing a treated stream section with untreated sections upstream or downstream, or comparing treated watersheds with untreated ones, e.g., before-after/control impact (BACI) designs, can be effective ways of determining the efficacy of stream restoration actions. Several of the projects have proposed or are in the process of implementing such designs, and additional opportunities for this sort of work should be explored. The ISRP emphasizes that population-level response monitoring is not a requirement of every project, but the array of tributaries in the Umatilla subbasin with restored and unrestored conditions provides the various stakeholders with an excellent opportunity to design and collaborate on a biological response assessment program that would shed insight on the effectiveness of restoration actions.

MONITORING AND EVALUATION -- NEXT STEPS

Regional Partnerships

The ISRP believes that progress is being made toward improved regional M&E coordination; improved integration of results from focused research efforts and individual monitoring programs; and development of improved indicators of habitat restoration effectiveness. Much of this progress has resulted from work supported by the Council and other organizations through a number of collaborative projects and efforts, the acronyms of which (e.g., PNAMP, CSMEP, ISEMP, IMWs) constitute an alphabet soup that would whet the appetite of even the most jaded bureaucrat. Because monitoring and evaluation is critical to learning lessons from past and ongoing projects, improved coordination among all interested parties will facilitate information transfer throughout the Columbia River Basin.

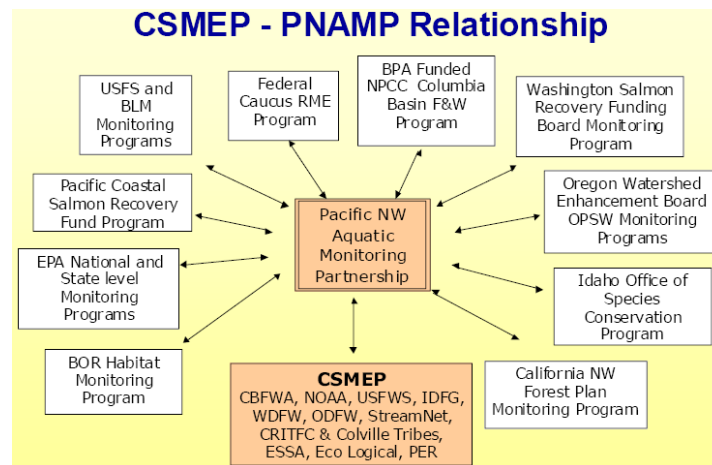
For years the ISAB and ISRP have emphasized the need for adequate monitoring and evaluation of habitat restoration projects. In response to the need for better monitoring and for improved coordination of monitoring programs among federal, state, and tribal organizations, especially in light of tributary habitat improvement goals in the recent BiOps, natural resource stakeholders undertook several initiatives early in the decade to bring together the region’s diverse RM&E programs. Briefly, these include:

The *Pacific Northwest Aquatic Monitoring Partnership (PNAMP)*. This large partnership includes many federal, state, and tribal organizations. PNAMP’s goal is to provide a forum for coordinating aquatic habitat and salmonid monitoring programs.¹⁶ It has the broadest membership of any of the

¹⁶ www.pnamp.org/

regional aquatic M&E partnerships. Most of PNAMP's recent projects have dealt with standardizing and improving habitat inventory methods.

The *Collaborative Systemwide Monitoring and Evaluation Project (CSMEP)*. CSMEP was initiated in 2003 to coordinate efforts to improve the quality, consistency, and focus of fish population and habitat data to answer key monitoring and evaluation questions relevant to major decisions in the Columbia River Basin.¹⁷ CSMEP has a very strong adaptive management emphasis. It is geographically confined to the Columbia River Basin and is administered by the Columbia Basin Fish and Wildlife Authority, and partners include a number of federal, state, tribal, and private natural resource organizations. CSMEP has more of a fish population focus whereas PNAMP has more of a habitat focus. CSMEP's relationship to PNAMP is illustrated in the diagram below.



The *Integrated Status and Effectiveness Monitoring Program (ISEMP)* is noteworthy because the goal is to design, implement, test, and evaluate status and trends, and effectiveness monitoring programs, for salmon and steelhead populations and habitat in the Columbia River Basin.¹⁸ ISEMP is focused on three large “pilot projects” that include the John Day, Snake, and Wenatchee River subbasins, where aquatic habitat and salmon and steelhead populations will be carefully monitored. The program is administered by the Northwest Fisheries Science Center (NOAA Fisheries) and is designed to test the robustness of monitoring protocols, indicator metrics, and sampling designs currently used in monitoring programs. It is perhaps best characterized as an M&E methods development and assessment project, with the products being available for use in both PNAMP and CSMEP.

Also noteworthy is the network of *Intensively Monitored Watersheds (IMW's)* that have been implemented throughout the Pacific Northwest. These long-term studies have the greatest likelihood of providing crucial information about the causal mechanisms that underpin our assumptions about restoration effectiveness. These watersheds typically range in size from relatively small (HUC-7) to mid-size (HUC-5) catchments in which habitat improvement treatments are applied in an experimental manner, i.e., with treatment and control sites, and where fish population responses will be monitored for several generations to determine the changes attributable to restoration. IMW studies are primarily long-term research, and restoration treatments are supposed to follow pre-

¹⁷ www.cbfwa.org/csmeep/

¹⁸ www.nwfsc.noaa.gov/research/divisions/cbd/mathbio/iseemp/index.cfm

planned implementation schedules that are carefully monitored over many years. Funding for IMWs varies widely, and many sites are located out of the Columbia River Basin. Thus, there is no central clearinghouse or web site for IMW data. Nevertheless, results from IMWs will be used directly in PNAMP, CSMEP and ISEMP. Some long-term intensively monitored watershed studies also exist in British Columbia, although they are not formally tied to their U.S. counterparts.

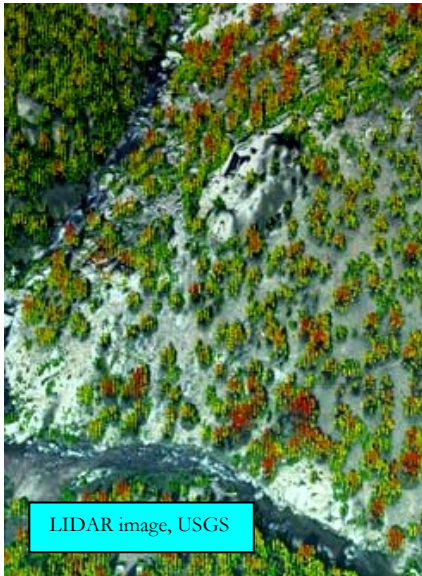
Most of these efforts began about five years ago and involved multi-year planning processes in which RM&E work plans were drawn up and reviewed – many by the ISRP. Only in the last two years or so have these programs begun to implement their proposed activities. It is premature at this point to judge whether those efforts constitute successes or failures. However, the ISRP has consistently supported the goals of these programs in the past, and, in general, we are optimistic that they will lead to improved feedback on the effectiveness of tributary habitat restoration actions to improve the success of future restoration projects.

Virtually all of the collaborative efforts described above involve partnerships between multiple organizations and there are many instances where a scientist or agency is an active participant in several of these programs. As a result, the boundaries between these large-scale M&E programs are intentionally blurred, with information frequently being exchanged among the projects. However, at present there is no central repository for all the habitat M&E data being collected in the Columbia River Basin. This remains an issue worthy of attention, as many of the organizations collecting monitoring information are rapidly becoming swamped with data. This is especially true for the newer generation of remotely sensed environmental data, which often constitute extremely large data sets. The risk is that individual organizations may lose important habitat monitoring information or be unable to effectively share data without a regional clearinghouse for electronic storage and retrieval. The ISRP recognizes that such a repository will never be fully complete or up-to-date, but the development of new monitoring technologies deserves a parallel effort to properly archive the information that will be generated by the collaborative M&E programs mentioned above, as well as from the monitoring of individual restoration projects carried out as action items in subbasin plans (also see ISRP 2000-3¹⁹).

The ISRP therefore supports the goals and objectives of the regional M&E partnerships. Because we are in the early years of implementation for projects such as ISEMP and the IMWs, it is unrealistic to expect that answers for many of the very large, difficult habitat questions will soon be forthcoming, e.g., can tributary habitat restoration offset losses to operation of the hydrosystem? However, the Council embarked on a productive course of action in supporting the development of these M&E partnerships, and staying the course will give them an opportunity to generate information of broad use to policy makers.

¹⁹ <http://www.nwcouncil.org/library/isrp/isrp2000-3.htm>

Emerging M&E Technology



translate the discrete-return point clouds produced by LIDAR flights into usable habitat information. Nevertheless, we anticipate that the cost of LIDAR and other remotely-sensed coverage will gradually decline in the coming years and the analytical tools associated with them will mature, becoming easier to apply. The ISRP believes investments in new remote sensing technology can eventually pay off in the form of cost-effective monitoring techniques that provide rapid feedback on habitat restoration actions

The ISRP also feels the time is right for focusing more attention on the “E” in M&E. Properly evaluating the benefits of habitat restoration requires, among other things, separating the effects of the project from natural environmental noise and determining whether the status and trend of the target habitats and species are responding to the restoration action as anticipated. This will likely include novel statistical approaches and new performance metrics. Interesting work on developing integrated response metrics is being done as part of the ISEMP project, and we strongly support this effort. Development of novel approaches to analyzing habitat and population monitoring data is needed, particularly as conditions in tributaries shift in response to climate change. Novel approaches are also needed to include changes in ocean survival as a factor influencing population changes. Having better evaluation tools will become an important part of the criteria for project selection.

On a related issue, the ISRP suggests that habitat models deserve another review. It has been seven years since the ISAB reviewed the models being used for habitat improvement decisions in the Columbia River Basin (ISAB 2001-1). Since then, models such as Ecosystem Diagnosis and Treatment (EDT) have been widely used in developing subbasin plans and have continued to play a role in identifying restoration priorities. Little has been done to peer review or validate these models and to determine whether their predictions were accurate. Are there new models and decision support tools that can provide additional information for project selection and prioritization? A review of habitat models could also help inform the efforts of the regional M&E partnerships. The review could be a joint ISAB-ISRP effort.

²⁰ See <http://lidar.cr.usgs.gov/>

BENEFITTING WILDLIFE: RETHINKING CREDITING AND MONITORING IN THE WILDLIFE PROGRAM

Throughout the Fish and Wildlife Program's history, land acquisition (by fee simple or easement) has been the major component of wildlife mitigation. As land is acquired with Program funds, it has become customary for the Program to continue to support operation and maintenance (O&M) of the acquisition in perpetuity. Thus, over time, an ever-increasing proportion of funds will be allocated to maintaining the status quo. This might appear to be an economic, rather than scientific issue, except that maintaining status quo does not improve the situation for wildlife. Most project objectives are quite general (improve habitat for mule deer), and many lack focal species or a full complement of focal species that represent the diversity of the species that were initially impacted by the hydrosystem development. Reporting has relied on *activities* (built X miles of fence) rather than the activities' *effects on habitat quality* (control of trespass grazing increased winter forage for mule deer by 40%) or *on populations of target species* (additional winter forage, increased doe survival 15% and fawn production now exceeds the replacement level for this herd).

This acquisition and reporting pattern has evolved based upon the assumption that habitat is an acceptable surrogate for populations. This assumption underlies procedures like Habitat Evaluation Procedures (HEP; <http://www.fort.usgs.gov/Products/Software/HEP/>) and a more complex, but conceptually similar procedure, Combined Habitat Assessment Protocols (CHAP). While HEP may have represented the state of the science underlying wildlife management when it was formulated, HEP is now seldom used by wildlife habitat researchers. Implementation of the Endangered Species Act in recent decades has spurred evaluation of the "habitat as surrogate" concept and found it lacking, both biologically and legally. This assumption has not been tested within the scope of Program activity, but such tests would be impossible in most cases due to a *lack of target species or measurable habitat objectives based upon documented needs of the population* in question. Given Bonneville's commitment to HEP and Habitat Units (HUs) for crediting against losses, there can still be better strategies for using Program resources to evaluate responses to wildlife habitat management activities and to mitigate wildlife losses. Habitat is necessary, but not sufficient for restoring populations. Thus, we find ourselves in a quandary over choosing lands for acquisition as well as determining if the lands obtained and the wildlife program are meeting biological objectives.

Prioritization

The first of these strategies is prioritization. Subbasin plans were intended to provide a basis for prioritizing Program investments within each watershed based upon scientific assessments of resource and population conditions and opportunities related to focal species. Not all of the plans were able to develop priorities. Only a small number of the FY2007-09 proposals substantively used the plans, most just referenced pages in the plan that supported their proposal. There was little evidence that the plans actually influenced thinking about what must be done and how best to do it. To date most acquisitions have been opportunistic – the land was available and it supported some kind of wildlife, usually generalist rather than specialist species. There could be a rubric for evaluating, even guiding acquisitions based on priorities among focal species. For example, a great deal more deer habitat has been acquired than neo-tropical migrant bird habitat. By considering all species equally, as now appears to be the case, the Program is unlikely to mitigate for lost species diversity. Land acquisitions could also be ranked on the relative importance of a parcel to a particular population of focal species. Factors like relative scarcity of particular habitats, contiguity to other protected habitat, role of the parcel in the lifecycle of a species and degree of restoration (if any) needed could be used to compare acquisition opportunities, or even to predetermine an acquisition strategy. Such a structure of species and parcel priorities would also allow determination of priorities among subbasins, which is currently difficult. This model of decision making is being used

successfully by organizations such as The Nature Conservancy that rigorously seek the greatest impact of expending scarce resources. The Willamette proposal (20072600: *Acquisition of a Conservation Easement over 1084 acres of Upland Prairie and Oak Habitat, Willamette Subbasin*) is a fine example of this strategy at work and addresses both rare habitats and rare or unique species. This approach might even lead to RFPs directed at species or habitats currently neglected within the Program.

Monitoring Approaches

Several wildlife projects have shown tremendous wildlife responses to management activities, especially single focal species projects where specific research procedures were used for monitoring the response to habitat improvement, e.g., sharp-tailed grouse in eastern Washington. However, when habitat management is aimed at multiple species or wildlife in general, can a standard approach be used, or must the “monitoring” approach decision be made on a case by case basis? And, who makes the decision, or who decides after the fact that the monitoring approach used was appropriate? Perhaps wildlife habitat experts should be invited to make presentations to the ISRP/ISAB. Presentations to the panel on this subject matter have not been made in recent years. The approach for general “crediting” seems set (and not subject to change), but the approach or series of approaches for “monitoring” different focal species of interest needs to be addressed.

Greater emphasis on focal species would allow development of measurable objectives, and monitoring approaches that actually document the effectiveness of management practices relative to the focal species. Under the present system, there has been minimal monitoring of the benefits of acquisitions or O&M to actual wildlife populations. Even with no change in the criteria for evaluating proposals for acquisitions and O&M, there is room for significant improvement in writing specific, measurable objectives that would lead to credible monitoring, evaluation, and adaptive management.

A common example of this opportunity is invasive species (weed) management. Many O&M proposals that dealt with this issue included budget items for personnel, 4-wheelers, and other resources to spray weeds. Then they reported how many acres were sprayed, rarely identifying what species were targeted, or to what effect. Many private landowners and agencies are finding it more economical and more effective to contract out what spraying must be done to professionals, often with County Weed Boards. Further, herbicide use is only one aspect of an integrated pest management (IPM) plan that involves adjacent landowners, local government, and others in managing invasive species in a holistic manner that includes limiting opportunities for new species to arrive in the area, surveillance to quickly control new populations before they become established, and using a suite of complementary methods to control or eliminate established populations. This might include targeted grazing, use of bio-control insects, establishing more desirable species that can out-compete invasives, and *maybe* the use of herbicides. This state-of-the-art IPM approach is not being used within O&M programs that emphasize the status quo.

More specific management objectives would lead to this more comprehensive approach. For example one objective might be to develop a GIS map of all invasive species on a parcel and then keep it up to date. This would be followed by goals such as eliminating certain species on specific acreages and halting spread of other species. Recording each treatment on the GIS system leads to very specific monitoring regimes to follow the results of each treatment. Such an approach may be more cost-effective and would undoubtedly be more ecologically effective than current practice. It would be very useful for the ISRP to review a subset of early acquisitions, supported by regular O&M funds, to see what has actually been accomplished towards program goals. This could lead to criteria for identifying the most promising acquisitions and perhaps to operations standards that must be maintained to receive O&M funds. Another option might be linking further O&M funding to

successful M&E. Proper management should lead to the need for fewer inputs over time as ecological function is restored and the system becomes more self regulating. Funding should shift over time from O&M to more M&E if management is successful. The current system rewards a lack of success with continuing funds to do the same thing over and over again, as in the weed management example. Most grant programs have a cost-sharing component that the Fish and Wildlife Program does not, because it is a mitigation program for which logically and legally cost-share is not required unless *in lieu* provisions of the NW Power Act apply. However, consideration of benefits from cost-share and other funding mechanisms used by other land acquisition programs may be instructive to increase the efficiency and reduce the long-term costs of the wildlife program. A few of the 2007-09 proposals included provisions for future management funding (e.g., the Willamette endowment idea). A provision for a limited period of O&M funding might lead to more cost-share type commitment for long-term operation, or creativity such as demonstrated by the proposed endowment. The above are just a few ideas of how more benefits to wildlife might be generated by the Program.

FUTURE DIRECTIONS FOR THE PROJECT REVIEW PROCESS

With the experience gained from all its reviews over the past decade and particularly the review of 540 FY 2007-09 proposals, the ISRP's first FY 2007 report provided suggestions on future review processes (ISRP 2006-7²¹). The ISRP recommended in its 2005 Retrospective Report (ISRP 2005-14) and again in its Programmatic Comments to the 2007-09 Solicitation Report (ISRP 2006-4a), that future processes be modeled after the sequential multi-year provincial reviews, with potential alterations to more efficiently address program needs through targeted and topical (wildlife O&M, systemwide RM&E, lamprey, and such) solicitations. A staggered review process that provides for site visits, presentations, and response loops between sponsors and the ISRP improve the Fish and Wildlife Program because the ISRP gains a more thorough understanding of projects and projects are improved by incorporating the ISRP's constructive suggestions.

In the 2005 Retrospective Report, the ISRP also recommended that alternative review paths be investigated for continuing and new projects. For example, long-term operations and maintenance projects could receive administrative review or programmatic review of common methods, other continuing projects could receive periodic scientific review for progress attained (with funding of non-performers discontinued), and new projects could be reviewed both technically and administratively for responsiveness to targeted solicitations. The annual review process might thus concentrate on new proposals and a subset of the continuing projects.

The ISRP's experience in the FY 2007-09 review process further validated these earlier observations and recommendations. The ISRP specified the following elements to consider for future Fish and Wildlife Program project reviews.

1. Establish separate solicitations (RFPs) and review tracks for new projects targeted to specific problems including systemwide information gaps or key limiting factors in a particular subbasin.

²¹ www.nwcouncil.org/library/isrp/isrp2006-7.htm

2. For ongoing projects with large out-year obligations, return to multi-year, sequential reviews making use of the assessments, objectives, strategies, and prioritizations (if done) in subbasin plans.
3. The sequenced review of ongoing projects is intended to provide for a thorough review by the ISRP of programs that are multi-faceted in their activities and potentially involve sponsors from different institutions.
4. The ISRP review process would include (1) preliminary examination of a proposal, past reports, monitoring and evaluation data, and evidence of adaptive management; (2) a tour of past and proposed project sites; (3) presentation of the proposal (preceding or following the site visit depending on the review type and logistics) with an opportunity for questions from the ISRP; and (4) a preliminary ISRP review with a response loop to provide sponsors with the opportunity to incorporate ISRP suggestions. A three-day site visit schedule for an ongoing program might include: Day 1 – program overview and proposal presentation, Day 2 - site tour, and Day 3 – discussion and question and answer session. A written report by the ISRP would complete the review.
5. In addition to the elements requested in the proposal form for the FY 2007-09 solicitation, the proposal form for ongoing projects should be revised to add sections requesting explicit presentation of the objectives proposed in the preceding solicitation cycles, what has and has not been accomplished, and how benefits to the focal species are being evaluated.
6. A first step in initiating such a review is examining projects funded through the FY 2007-09 solicitation and aggregating projects and topics with Council staff to sort projects to be reviewed by topic and by subbasin/province (geography).

This review approach was successfully initiated in FY 2007 with the in-depth review of the set of projects that constitute the Umatilla Initiative and the RFP approach used to solicit innovative proposals. These two reviews are described in more detail below.

The Solicitation for Innovative Projects and a Role for Research Funding

As the ISRP had recommended, funds were allocated in FY 2007 for a solicitation for short-term innovative proposals aimed at testing new protocols and ideas on the ground. From the response, it is apparent that potential sponsors saw value in this opportunity: Fifty nine proposals were submitted, and of these, the ISRP found that nine fit the terms of the solicitation and met scientific criteria. The Council recommended six for funding. It is too early to know the ultimate contribution of these projects. We recommend that such a solicitation be repeated at regular intervals, every one to three years, to maintain consistent participation and interest in the solicitation. The value of this program element might be greater if a slightly longer time period could be funded, particularly where projects are tied to seasonal phenomena.

It was apparent that there was a perceived need by sponsors for some mechanism to fund research prior to the on-the-ground, proof-of-concept stage favored in this year's solicitation. In general, pure research proposals have not fared well in the general solicitations for some very good reasons related to likely benefits to fish and wildlife. If we knew it were a benefit, it would not be research, but there is the risk that unsuccessful ideas would not generate direct benefits to fish and wildlife. The converse risk is that for lack of specific knowledge, we squander opportunities to benefit fish and wildlife. Thus research should be a calculated risk.

There are some recognized research questions that, if answered, could add enormously to the Program's success. One approach to this is targeted RFPs designed to generate the needed information through credible research for direct application to the Program. It may also be valuable to have a limited open research RFP with criteria that link proposals tightly to Program goals. There are undoubtedly talented scientists that see research opportunities we do not, but which would greatly enhance the Program's effectiveness. Because research is a high risk enterprise, cost-sharing and other stringent requirements could be justified. Limiting the duration of funding would be appropriate. Successful research, after some initial Program-funded work, should merit funding from more research oriented programs, in which case Program funding would be leveraged into future work with benefits to the Program, but no further expense to the Program.

Together, innovative, targeted, and research solicitations would be a limited component of the overall Program investment that should generate disproportionately positive benefits to fish and wildlife.

The Umatilla Initiative Review Process as a Model Approach

In the 2007-09 proposal review the ISRP ranked many proposals from the Umatilla subbasin as *Not Fundable (qualified)*. The individual proposals often did not have clear biological objectives, did not provide results, and the relationship between the various projects in the subbasin were not obvious. Consequently the Council instructed the subbasin co-managers/project sponsors to respond to the ISRP concerns. The sponsors, the CTUIR and ODFW responded by producing a summary review document and hosting an ISRP site visit in May 2007. The process of "packaging" the set of closely related project proposals under a unified programmatic-type presentation in which the interrelationships can be clearly specified proved to be effective and efficient. It eliminated the need for each separate project proposal to meet standards set for ISRP review by Congress in the 1996 Power Act Amendment. The ISRP has often found in individual proposals a failure to include sufficient provisions for monitoring and effectiveness evaluation. Often this could be corrected by improved coordination among the projects to ensure that within the set there will be metrics designed to develop some measure of effectiveness in benefiting fish and evidence that monitoring and evaluation will actually be carried out. This serves as an example where program/subbasin level M&E meets the needs of "provisions for M&E" required for an individual project.



Site Visit with Umatilla program, Council, and ISRP participants

The ISRP recommends that the procedure be adopted for similar watershed-scale efforts, for example the Yakima-Klickitat Fisheries Program.

Further, the ISRP recommends that, once it has reviewed and the Council approved a set of proposals at the watershed scale, future reviews of those subbasins might be conducted on a multi-year cycle, or abbreviated to include only review of project proposals that represent some significant change in direction, as might occur as a result of adaptive management.

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