

# Independent Scientific Review Panel



## Retrospective Report 1997 – 2005

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# **ISRP Retrospective Report 1997 - 2005**

## **Executive Summary**

This report satisfies a provision of the 1996 Amendment to the 1980 Northwest Power Act, which charges the Independent Scientific Review Panel (ISRP) to provide a retrospective report of the results of prior-year expenditures to the Northwest Power and Conservation Council. The scope of past ISRP reviews has for the most part been limited to specific projects. With this report the ISRP enlarges the perspective and evaluates the cumulative effect of our reviews on program accountability, project effectiveness, and scientific soundness. The ISRP hopes that this report sets the stage for successive retrospective reviews that examine measurable benefits to fish and wildlife and provide biological information for the Council's evaluation of Fish and Wildlife Program expenditures and effectiveness.

This report has two major sections. The first section discusses the ISRP review process from 1997 through 2005 and its results. The second section covers major programmatic themes including, in order: research, monitoring and evaluation (RM&E); habitat and passage in the mainstem Columbia River (including white sturgeon, lamprey and exotic species); tributary habitat; wildlife; artificial production; and the ocean and estuary. The report also includes an appendix that describes the development of the peer review process in greater detail than the main report.

## **The ISRP Review Process**

The ISRP has two major focus areas of its reviews: the Fish and Wildlife Program projects directly funded by BPA; and the "reimbursable" projects, sponsored by the Corps of Engineers and others, whose costs are reimbursed by BPA. The 1996 amendment to the Northwest Power Act of 1980 directs the ISRP to conduct an independent peer review based on a determination that projects:

1. are based on sound science principles;
2. benefit fish and wildlife;
3. have a clearly defined objective and outcome
4. with provisions for monitoring and evaluation of result; and
5. are consistent with the Council's fish and wildlife program.

The Council must fully consider ISRP reviews before making funding recommendations to Bonneville and explain in writing wherever the Council's recommendations differ from the ISRP's.

## **Fish and Wildlife Program Proposal Review**

Initially, the ISRP found Fish and Wildlife Program proposals to be generally inadequate for scientific review; however, the quality of proposals improved significantly over time

under the stimulus of the review process. The detailed proposal review process that has developed involves the ISRP, Council, CBFWA, the public, and BPA. The respective review roles of the ISRP and the Council, as well as requirements for formal feedback from the Council to the ISRP regarding scientific recommendations, are detailed in the 1996 Amendment. As a result the review process is transparent and effective in providing feedback on decisions about project funding. In fact, the well-documented ISRP reviews combined with the Council's formal feedback requirement have proved to be an excellent approach to instill scientific review in management decisions that could be used as a model in other settings where science and policy interact.

In contrast with the Council's process, the proposal review process within BPA is less transparent. In the absence of specific feedback requirements, the extent to which BPA funding decisions remain consistent with the scientific guidance obtained through the Council and ISRP's peer review process is unclear. The ISRP has recommended that the consistency of BPA funding decisions and contractual Statements of Work with the technical aspects of ISRP-approved proposals be assessed.

It is important to emphasize that the ISRP reviews focus on evaluation of the technical merits of the proposals. Recommendations to the Council may indicate that the proposal is "fundable" or not, based upon its technical adequacy. Budget decisions are made by the policy bodies affected, the Council and BPA as informed by CBFWA. Thus the ultimate direction of the FWP is determined by the policy makers' decisions on funding. The question is whether funding reflects the technical evaluations by the ISRP.

The ISRP has found that proposals were funded for many of the identified needs in the Columbia Basin, but there has been limited funding of targeted, competitive solicitations for new projects that could address significant data gaps, critical uncertainties, or other unfunded needs. The majority of project funding decisions occur in annual solicitations in which new projects compete with established projects for funding. On its face, this approach has significant logical appeal; however in practice, many established projects with ongoing operation and maintenance costs continue to dominate the program often to the extent that funding opportunities for new and potentially important work are foreclosed. The ISRP recommends that alternative review paths be investigated for continuing and new projects. For example, obligatory 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 non-performers recommended for termination), 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.

In 1998, the Panel recommended that the Council permit funding for new artificial production projects only if the proponents can demonstrate they have taken specific measures or requirements of the Fish and Wildlife Program (FWP) to address risk and impacts on native stocks into account. In response, the Council developed the Three-Step

Review process including ISRP review, which was built upon one used by BPA for the design, review, approval, and implementation of new artificial production initiatives.

**Recommendation:** The ISRP believes that the Three-Step review model of focusing on a specific complex program and conducting an iterative review with specific criteria drawn from the FWP has worked well and could be applied to other complex core programs.

Finally, data from past and current projects to support a comprehensive retrospective analysis of biological results has not been available to the ISRP. This lack of data and topical syntheses was also evident in the subbasin plans, the guidelines for which also called for the reporting of project results in the inventory section. This deficiency underscores the need for continued monitoring and evaluation in future FWP projects. BPA's new project tracking database, PISCES, appears to offer significant promise for tracking the status of tasks.

**Recommendation:** The ISRP recommends that future projects and BPA's tracking database be linked to emphasize reporting of data, biological results, and task completion. In addition, projects should be required to report results at specific milestones as a condition for continued funding.

## Reimbursable Program Proposal Review

The ISRP has also conducted proposal reviews for BPA's "reimbursable" program. For the Lower Snake River Compensation Plan, the ISRP project review was successfully incorporated into the provincial reviews. Most recently, the ISRP reviewed proposals submitted to the Army Corps of Engineers (Corps) Anadromous Fish Evaluation Program (AFEP). The ISRP found that the AFEP's current internal process of proposal development did not lend itself to an independent proposal review process. Most of the information available was not well enough developed to be amenable to scientific review, nor did AFEP proposal development process have clear junctures where technical review could be appropriately interwoven.

**Recommendation:** The ISRP recommends that the Council, Corps, and ISRP identify a clear place for ISRP input before another review of AFEP proposals is undertaken.

## Major Programmatic Issues Arising in ISRP Reviews

### Research, Monitoring, and Evaluation

The Council's successive fish and wildlife programs have consistently been organized around the concept that adaptive management be employed to modify the program as new information becomes available. Effective adaptive management requires the existence of monitoring data, evaluation of study results based on mathematical and statistical procedures, and if appropriate, integration of results into development and

adoption of new management actions for the future. The ISRP notes that it is difficult to imagine how one would proceed in adaptive management without consistent, unbiased monitoring of results under present management actions.

The 1996 Amendment to the Northwest Power Act directs the ISRP to review projects in regard to whether they: "...have provisions for monitoring and evaluation of results." The ISRP has been consistent in recommending that all projects have provisions for not only monitoring of task completion, but also low-cost monitoring to indicate benefits to fish and wildlife. Monitoring may be as simple as comparing photographs taken of riparian stream bank habitat at fixed points every five years or documenting that anadromous fish are spawning in an area previously blocked by an irrigation diversion dam. Most project proposals should also document larger scale monitoring provided by another FWP project or other government agency.

The ISRP has struggled with inconsistent terminology concerning research, monitoring, and evaluation among the various fields of science (e.g., fisheries, hydrology, wildlife, genetics) and in particular with the scientific basis for "effectiveness monitoring" of management actions. We present unified terminology in this retrospective report. The goal is to help clarify the research and monitoring that is necessary for establishing the effectiveness of management actions intended to meet objectives of the FWP, the Endangered Species Act, and other legal obligations of fish and wildlife managers in the Columbia Basin.

Development of a systemwide monitoring and evaluation program is presently in a formative stage with three relatively new initiatives. First is the Collaborative Systemwide Monitoring and Evaluation Project (CSMEP), which is a Fish and Wildlife Program project administered by the Columbia Basin Fish and Wildlife Authority (CBFWA). Second, Federal Action Agencies have proposed a draft RME Plan. Finally, a cooperative monitoring and evaluation program in the Pacific Northwest has been 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 we continue to recommend that the Council support the effort. The three new initiatives should be coordinated, and not redundant.

The failure of some projects to report on progress (or the lack of progress) toward project objectives and to provide primary data and metadata to the databases of the region has been a recurring concern of the ISRP. In principle, all data obtained through public funds should be available to the public and recorded in the region's databases. If there are restrictions on data use (e.g., locations of sensitive species or a restricted-use time period for preparation of reports and manuscripts), then the restrictions should be specified and justified. The ISRP supports this principle.

**Recommendation:** The ISRP has recommended that Smolt Monitoring, PIT Tag, Radio Telemetry Technology, Coded Wire Tag, and Sonic Tag projects should be subjected to a

comprehensive programmatic review that gives special consideration to the complex interactions between the projects. This review is critical because regulations requiring mass marking of hatchery fish and selective fisheries has significant impacts on the results of the projects. The Council concurred with the recommendation. Although the ISRP reviewed the set of projects in the Mainstem and Systemwide Reviews in 2002, the ISRP envisions a more focused, comprehensive programmatic review than can be accomplished during a standard proposal review process.

## Mainstem

### Salmon and Steelhead

From the outset of fisheries mitigation research in the basin by the Corps of Engineers in the 1930s and the Northwest Power and Conservation Act's mandated (BPA-funded) Fish and Wildlife Program since 1982, mainstem issues on the Columbia and Snake rivers have held center stage. In the mid-1990s, the National Research Council's (1996) *Upstream: Salmon and Society in the Pacific Northwest* and the Independent Scientific Group's (ISG; 1996) release of the pre-publication copies of *Return to the River* added new dimensions, those of considering the mainstem as a habitat for life functions rather than just a migration corridor functioning to simply move smolts downstream, a fuller consideration of full life-cycle components of salmonid success (and decline), and the need to protect biodiversity among salmonid species and populations.

Early in the review of projects, the ISRP, observing the dominance of mainstem projects devoted to the flow-survival issues and the persistent disagreements between competing smolt passage and survival models, recommended that there be a quantitative evaluation of assumptions upon which structural (e.g., passage facilities) and operational (e.g., flow augmentation) measures in the FWP and Recovery Plan are based. Despite reorientation of modeling efforts toward evaluations of persistence of ESA-listed species, the controversies over passage survival and relationships to river flow persist. There is a continuing need for improving technical information through mainstem experiments and evaluation of technical assumptions for both research and modeling.

Also, in early reviews the ISRP requested a review of the gas bubble disease issues and projects because of potential biological effects and their high cost to the region. Such a specific review was not conducted, but regional negotiations among agencies settled on workable guidelines within acceptable levels of uncertainty. The gas cap and monitoring of gas saturations have become well institutionalized in the basin, and research requests have diminished.

The ISRP reviewed mainstem projects during the Mainstem/Systemwide Province Review in 2002. At that time, projects became much more aligned to the specific actions in the National Marine Fisheries Service's 2000 Biological Opinion than to the Council's FWP. In 2003, the Council adopted a specific Mainstem Amendment to the Fish and Wildlife Program that includes objectives and measures relating to the protection and

enhancement of mainstem habitats, water management, adult and juvenile passage modifications at mainstem dams, adult survival, water quality, and research, monitoring and evaluation. Many of the ISRP (also ISG and ISAB) recommendations are included in this amendment.

The ISRP has not conducted a comprehensive review of projects associated with the Mainstem Amendments; however, the ISRP has participated in a review associated with a particularly contentious provision. This provision involved tradeoffs between upstream effects of water storage and augmented mainstem river flows for salmon. The ecological damages from the operations of Hungry Horse and Libby dams in Montana were to be reevaluated and compared to benefits to downstream salmon in the mainstem. The ISRP has supported these comparisons; however, downstream studies adequate for the comparison have not been conducted. The ISRP concluded that the Council's amendment provision for changed operations was reasonable for reducing upstream effects, but that the ability to demonstrate a benefit for downstream salmon was technically problematic. The Council requested that the operations be approved by NMFS and a study conducted to determine if flows in the lower Columbia River were measurably affected by flow augmentation. Technical analysis is yet to be provided of relative benefits of flow augmentation to survival of downstream migrating juvenile salmon versus associated reduction of production of resident fish in the reservoirs. The issues of comparative upriver and downriver effects of Columbia River flow management therefore, remain unresolved at a technical level.

In the summer of 2004, the ISRP participated in review of draft subbasin plans. Few plans included adequate assessment of habitat in the mainstem Columbia and Snake River reaches, even though the boundaries defined by the Council clearly included them. Mainstem issues were generally treated by the sponsors as "out-of-subbasin" questions that affected stocks within tributary subbasins. The issue is subbasin stock-specific estimates of needed escapement and the impediments to those escapements arising in the mainstem. The subbasin planning exercise, therefore, did not adequately cover mainstem issues related to specific tributary fish stocks. This was a serious oversight, considering the significant mortalities imposed upon juvenile and adult salmonids in their migrations through the mainstem Columbia and Snake Rivers. The joint ISAB and ISRP reported this deficiency to the Council, with no specific Council action taken to date other than the Mainstem Amendment.

The ISRP notes that there are continuing issues of flow management in the mainstem. An ideal flow regime that gives equal consideration to fish and hydropower has not been established, with the possible exception of flow stabilization measures in the Hanford Reach. The operation of upstream storage reservoirs and the role of their limited flow "augmentation" for fish have yet to be agreed upon basinwide. The importance of reservoir hydrodynamics with regard to smolt passage and survival has yet to be fully recognized as equal in importance to passage at the dams themselves. There are long-range predictions of higher average Columbia River flows in winter and less snowmelt in summer in future years. Spring/summer flows could be reduced for all uses (including fish), and winter flows could be high, but undependable (more floods). With water flow

management already a divisive social issue, the need for projects to study the results of flow management alternatives in a changing climate is clear. Large-scale operational experiments have been identified by the ISRP as important for resolving these major flow-survival issues, in spite of the difficulty of conducting them.

At the dams, surface bypass technologies (especially the Removable Spillway Weir – RSW) are emerging as the alternative to massive water spills for fish passage. They offer increased effectiveness in passing juvenile salmonids with less water than standard spillways. Furthermore, experimental research to evaluate these technologies in laboratory facilities are likely to provide answers much faster and at less cost than in-river trial and error with fully implemented prototypes, a procedure which has dominated recent history. One consequence of surface bypass technologies might be a reduced ability to monitor smolts, which now pass through turbine screening and bypass systems where counting stations and PIT-tag detectors are located, though new methods are being developed to monitor smolts passing via these alternate surface routes. There remains a problem of identifying species and stocks that pass in spill.

### **Non-Salmonids in the Mainstem**

Mainstem issues affect species other than Pacific salmon and steelhead. Lamprey passage problems at dams, that are the apparent cause of major population decline, will need to be resolved if these native species are to persist. Sturgeon tend not to use fish ladders, which are not designed for such large fish, so populations are isolated in specific reservoir reaches except for downstream export of larvae and some juveniles. The white sturgeon lacks habitat for reproduction in most of the mainstem and many reservoir sub-populations are in decline, except for the tidal freshwater reach below Bonneville Dam. There appears to be a reproductive bottleneck between egg dispersion and metamorphosis to juveniles that is likely habitat related. For both lamprey and sturgeon, the ISRP and Council sought better integration of planning and research basinwide before major investments in management (especially artificial production). The non-native American shad proliferation in the mainstem, with annual runs past Bonneville Dam of 2- 4 million fish, must be better understood. In spite of ISRP encouragement, little study has been funded. It is unlikely that such a large population of an exotic species could exist without some effect on mainstem migrants or resident fish. Predatory exotic fish species (e.g., walleye, northern pike) provide challenges for smolt survival. As a policy matter, the Council ought to recommend that no new exotic freshwater species of any kind should be deliberately introduced anywhere in the basin, and efforts should be initiated to halt expansion of these populations. The long-standing predator control program focused on northern pikeminnow appears to be well run and effective at controlling this native predator.

### **Conclusions and Recommendations for the Mainstem**

The ISRP is gratified that most of its recommendations regarding projects in the mainstem have 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 have

yielded considerable progress toward developing a mainstem program that is scientifically sound, benefits fish, has defined objectives and intended outcomes. In addition, intensive effort is underway 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 are not completed, and significant technical issues remain, especially if the often competing socioeconomic and fisheries interests are to be wedded as equal objectives. Recent events show that the persistent issues of flow and spill, for example, are not resolved. The mainstem programs of the Corps (AFEP) and the Council require improved interchange and coordination. Species other than salmon need attention. Climate change offers both opportunity and challenge for the mainstem for both fish and other uses. The challenge will be to work with climate researchers to adequately prepare for long-term changes. As subbasin plans formalize expectations for recovery of salmon populations in tributaries, the spotlight will be on the mainstem to preserve the up-river gains.

## Tributary Habitat

*Upstream* (National Research Council 1996) and *Return to the River* (Independent Scientific Group (ISG) 1996; 2000) identified freshwater tributary habitat degradation as a major cause of the demise of both resident and anadromous fishes. Taken as a whole, the various reports and reviews conclude that major long-term intervention will be required to restore habitat diversity and connectivity.

Habitat rehabilitation will require action on both public and private lands. Core or reserve areas that currently contain high quality conditions and maintain strong populations of salmon and trout are of particular ecological importance and should be identified, protected, and reconnected to each other by networks of suitable habitat to form functionally intact migration corridors. Restoration should focus on ecosystem characteristics and processes including watershed features and processes, recruitment of large woody debris, water quality, natural sedimentation rates, floods and other natural disturbance regimes, adequate stream flows, and upland processes. The role of periodic natural disturbances such as wildfires and floods in maintaining healthy watersheds also should be acknowledged and their benefits protected.

### **Subbasin Planning and Habitat**

Although there was a clear programmatic commitment the importance of tributary habitat for restoration of native species and to habitat planning prior to the 2000 FWP, the ISRP consistently found that project proposals suffered from a lack of subbasin-level habitat objectives, watershed assessments, prioritization, and effective monitoring and evaluation – in spite of a commitment from Council since the mid-1990s to develop an approach that would provide guidance for development and selection of tributary habitat projects.

Several issues contributed to this inconsistency. First, watershed assessments and comprehensive planning at the subbasin level required funding, as well a substantial time commitment. Funding specifically earmarked for this activity was not available at that

time. The Council, with a grant from BPA, provided funding in 2003-2004 to develop Subbasin Plans as called for in the 2000 FWP. Second, although the Council repeatedly called for habitat objectives and assessments at the subbasin scale, there were few penalties assessed for proposals that lacked these key elements. The Subbasin Planning Technical Guide was an attempt to identify the detailed elements needed for the comprehensive biological assessments required in the Subbasin Plans.

Unquestionably, the subbasin planning effort represented a major step forward in development of a comprehensive strategy for recovery of salmonid species within the major subbasins of the Columbia River. Watershed assessments were a core component of Subbasin Plans, which also called for an analysis of factors limiting production of focal species. Prioritization of objectives and strategies were key components, as was coordination among actions agencies, tribes, and stakeholders in development of the Plan. The subbasin plans constituted a beginning – an important step toward planning – but many plans had important deficiencies related directly and indirectly to tributary habitat. All plans had a strong tributary habitat component; however many did not reflect some of the more recent scientific knowledge pertaining to ecological restoration. A particular weakness of nearly all plans was inadequate treatment of natural variation in habitat conditions and the landscape processes that caused the variation. The Subbasin Assessments will provide useful resources for future planning; however, habitat objectives and strategies were not prioritized in many plans, which could hamper their effectiveness.

**Recommendation:** It is the ISRP’s understanding and 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 follow on to 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.

## Wildlife

The Wildlife Program has been significantly smaller than the Fisheries Program, and was largely a separate program when the ISRP began its reviews in 1997. The Wildlife Program was also very different in focus from the Fisheries Program, having had a separate history of development based on assessment of habitat losses as an assumed proxy for wildlife losses. Thus, the Wildlife Program had focused on habitat acquisition to replace habitat losses due to development of the federal hydrosystem. Although the Wildlife Program presumably was effective in its emphasis on habitat acquisition and protection, which were assumed to benefit the wildlife species themselves, there was little if any attempt to measure directly the benefits of habitat acquisition (or intended habitat improvement, through management actions) at the level of wildlife populations themselves.

In early reviews, the ISRP was critical of the monitoring and evaluation of results in ongoing wildlife projects and of the lack of clear and well-described plans for future monitoring and evaluation. Many proposals continued to lack clear descriptions of sampling design or of procedures and criteria for assessing the outcomes of management plans, but several proposals had significantly improved monitoring and evaluation sections. The ISRP urged the program away from continuing emphasis on Habitat Evaluation Procedure (HEP) evaluation as a tool for long-term evaluation or management planning and toward more accountability for actual wildlife populations.

Few fisheries projects, if any, related potential benefits of habitat improvement to terrestrial wildlife. The ISRP believes that better integration of fish spawning and rearing habitat protection/restoration projects with protection/restoration of terrestrial habitat will provide long-term benefits. For example, many fisheries projects called for fencing of streambanks to limit access by cattle, while most wildlife projects call for purchase of land or conservation easements. Both of these practices are desirable, but it may be more cost-effective as well as more ecologically effective for the two programs to be coordinated and complementary where possible. Thus, the ISRP 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.”

**Recommendation:** 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 FWP. First, integration of all elements of the FWP 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 FWP is only beginning to be incorporated into actions.

## Artificial Production

In 1996, *Upstream* (National Research Council 1996) and *Return to the River* (Independent Scientific Group (ISG) 1996; 2000) included criticism of artificial production activities in the Columbia River basin, due to their failure to achieve their mitigation goals. In fact both reports specifically identified the scale and ineffectiveness of previous artificial production activities themselves as likely major contributors to the decline of anadromous salmon and steelhead.

Over the near decade period of review (1996 to present), the ISRP examined each BPA-funded artificial production project – often multiple times through various review processes – and extensively reviewed the larger, more complex artificial production programs in the basin, such as those in the Yakima, Hood, Klickitat, Grande Ronde, Clearwater, and Salmon river systems.

**Recommendations:** Four primary themes emerged over the ISRP review history. These include:

- approaching artificial production and supplementation as an experiment that includes defined treatment and appropriate experimental controls, as well as rigorous implementation monitoring and effectiveness evaluation;
- managing artificial production within a subbasin and habitat context, such as matching releases to subbasin and estuary-marine carrying capacities; and,
- integrating and coordinating natural and artificial production at various hierarchical levels including the drainage, subbasin, province, and if possible, entire river basin levels;
- recognizing the Fish and Wildlife Program’s priority on native populations in native habitats, including the need to establishment a system of core natural populations within a framework of healthy habitats.

We acknowledge that initial steps of this reform are currently being undertaken through the Council’s Artificial Production Review and Evaluation (APRE) initiative and its integration with the recent subbasin planning effort. There remain, however, enormous challenges. There is a need, for example, for greatly increased coordination among the major Council and BPA-supported supplementation programs in the Yakima, Hood, Grande Ronde, Imnaha, Salmon, and Clearwater rivers subbasins in order to answer basic questions about the efficacy and potential limitations of supplementation as a rebuilding tool. The need can be met through development of coordinated monitoring protocols and standardized “common currency” data that allow retrospective comparisons between programs, stocks, and geographic locations.

The ISRP believes the subbasin planning effort and the subbasin plans were not adequate with respect to their consideration of artificial production. Almost without exception the subbasin plans failed to adequately describe artificial and natural production elements within a subbasin and to provide a defensible overall production plan that integrated artificial and natural production with programs addressing the subbasin’s limiting factors. The artificial and natural production components were either missing or were not linked to habitat limiting factors and proposed restoration activities.

**Recommendation:** The ISRP recommends 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.

## Ocean and Estuary

The Council's 1994 FWP included the statement that "*Because most of the loss of salmon and steelhead production as a result of hydroelectric development has occurred above Bonneville Dam, the Council will continue to focus its efforts in this area.*" Since 1994, the region has become more aware of the extent that anadromous fish are affected by changes in the estuary, nearshore, and ocean conditions and the potential negative effects of operation of the hydropower system on those areas.

The 1996 Power Act amendment added to these concerns by calling for the Council to consider the impact of ocean conditions on fish and wildlife populations in making funding recommendations. The Council's initial policy response to this charge was adopted in an issue paper entitled "*Consideration of ocean conditions in the Columbia River Basin Fish and Wildlife Program*" (Issue Paper 97-6) on June 3, 1997. In 2000, at the Council's request the ISAB (with significant overlap of membership with the ISRP) released a report examining the impacts of estuarine conditions and management on the Council's mission to "...*protect, mitigate and enhance...*" fish and wildlife in the Columbia River as affected by development and operation of the hydroelectric system (ISAB 2000d, 2000-5).

The ISAB, ISRP, and other advisory groups have recommended funding of projects to understand the impacts of ocean, estuary, and nearshore conditions on anadromous fish populations and the interaction of human management actions with those environments. In general, the Council has supported funding of these projects and recognized the importance of the estuary and Columbia plume to anadromous fish population. In an obvious and important shift from the 1994 FWP, the Council included the strategy in its 2000 FWP to identify the effects of the marine environment (the freshwater plume, the near-shore, and the high seas) on anadromous fish and use this information to evaluate and adjust inland actions. Research efforts since 2000 have made great strides in understanding ocean cycles of variability, and in documenting habitat variability in the estuary, nearshore, and plume environments; however, our understanding of these areas is in its infancy and the ability to manage inland habitat and fisheries programs based on variable climate, environmental, and productivity cycles in the estuary and marine environments is distant and likely to remain so for some time.

Consideration of the impact of ocean conditions on fish and wildlife populations is not exclusive to the Council's Fish and Wildlife Program. A number of multidisciplinary efforts and programs, whether regional, national, or international, continue to devote significant efforts on research, monitoring, and evaluation to understand the forces driving variability in the northeastern Pacific Ocean and how these affect ecosystem productivity. Of particular interest to the Council's Program are the estuary and near-shore studies funded by the Corps of Engineers Anadromous Fish Evaluation Program. However, these studies (funded by BPA's Reimbursable Program) are not fully amendable to scientific review yet and have not been adequately reviewed by the ISRP. The U.S. Environmental Protection Agency is also expanding research on the Columbia River estuary through its National Estuary Program.

**Recommendation:** 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 remains 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 is either a gauntlet common to all up-river and Willamette River salmonids, or could be viewed 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.

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

# ISRP Retrospective Report 1997 - 2005

## I. Introduction

### A. Preamble

Over the past eight years, the Independent Scientific Review Panel (ISRP) has reviewed programs, plans, and projects intended to benefit fish and wildlife in the Columbia River Basin within the United States that are proposed for funding through the Bonneville Power Administration (BPA). These reviews included site visits where the ISRP witnessed renewed vigorous runs of Chinook salmon churning the gravel on spawning grounds, observed the effective installation of fish screens at irrigation withdrawals at many places throughout the basin, saw improvements in fish guidance systems at most of the mainstem and Snake River dams, recommended the application of innovative fish tagging technology to help unravel the uncertainties of downstream migration, and talked with countless individuals dedicated to understanding and enhancing Columbia River Basin fish and wildlife and their ecosystems. The ISRP has informed and participated in a review process that evolved from an annual basinwide review of proposals that were not detailed enough for scientific review to a highly organized, geographic- and watershed-based review that includes detailed proposals, site visits, and reviewer and project sponsor interaction. Some 50 scientists from the United States and Canada have participated as reviewers on ISRP assignments. In total, the ISRP has evaluated and commented on over 1,800 fish and wildlife proposals, received and reviewed over 600 responses to those evaluations, and released over 60 reports. In addition, the ISRP led the review of fish and wildlife assessments, inventories, and management plans for 58 of the Columbia River Basin's 62 subbasins.<sup>1</sup>

In this Retrospective Report, the ISRP looks back on its history and evaluates its contributions to program accountability, project effectiveness, and scientific soundness. The ISRP welcomes this opportunity. Long-term programmatic issues, such as program direction and system-level monitoring and evaluation, were only partially addressed in previous ISRP reports. These issues are important, arguably critically important, in concentrating and coordinating the region's efforts to achieve measurable progress toward the fish and wildlife program's rebuilding goals. With this report, the ISRP further elaborates on these programmatic concerns, identifying both strengths and weaknesses of the program and process.

### B. The Retrospective Review Charge and Approach

When the 1996 Amendment to the Northwest Power Act<sup>2</sup> was enacted, Columbia Basin fish (anadromous and resident) and wildlife populations had been in decline for a century. In fact, the concerns over these declines led to the original enactment of the Northwest Power Act in 1980.

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<sup>1</sup> Plans were not submitted for four subbasins.

<sup>2</sup> Northwest Power Act, 94 Stat. 2710, as amended by Pub.L. 104-206, § 512(4)(h)(10)(D)(i), September 30, 1996, 110 Stat. 3005.

The decline had been broadly recognized as serious for at least five decades and warnings of trouble on the horizon had been issued by well-informed persons as long as 10 decades ago (Hume 1893). Significant efforts were made over that period of time to halt and reverse the decline, even as competing uses for the basin's water and land resources were increasingly being developed. With the first Endangered Species Act (ESA) listing of a Columbia Basin salmon stock in 1991, the awareness and concern intensified, and the annual investments of BPA funds in recovery and mitigation increased from approximately \$150 million in 1991 to over \$258 million in 1996 (Council 2005). In spite of these expenditures, salmon continued to decline and additional listings under the federal Endangered Species Act were proposed.

Against this background of apparent failure, it was logical to ask whether there was some basic flaw in recovery and mitigation efforts, or whether the failure was due to insufficient investment. In this context of uncertainty the Northwest Power Act was amended in 1996, creating the ISRP, and an evaluation of the Council's Fish and Wildlife Program implementation. As mandated by the 1996 amendment, the Council established the eleven-member ISRP and Scientific Peer Review Group (PRG), which consists of a pool of scientists sufficient in size and expertise to assist the ISRP in its review responsibilities. ISRP and Peer Review Group membership includes scientists with expertise in Columbia River anadromous and resident fish ecology, statistics, wildlife ecology, ocean and estuary ecology, fish husbandry, genetics, geomorphology, social and economic sciences, and other relevant disciplines. Members are appointed by the Council from a pool of nominees recommended by the National Research Council (see Appendix).

The amendment directs the ISRP to conduct an independent peer review of projects proposed for funding by the Council through BPA's fish and wildlife budget. In 1998, the U.S. Congress' Senate-House conference report on the fiscal year 1999 Energy and Water Development Appropriations bill directed the ISRP to also review those projects in federal agency budgets that are reimbursed by BPA. These include projects sponsored by the Corps of Engineers' (fish passage at mainstem dams), the U.S. Fish and Wildlife Service (hatcheries in the Snake River Compensation Program), and the Bureau of Reclamation (Leavenworth Hatchery). ISRP project recommendations are specified to be based upon a determination that projects:

1. *are based on sound science principles;*
2. *benefit fish and wildlife;*
3. *have a clearly defined objective and outcome*
4. *with provisions for monitoring and evaluation of results; and*
5. *are consistent with the Council's fish and wildlife program.*

The Council must fully consider ISRP reviews before making funding recommendations to Bonneville and explain in writing wherever the Council's recommendations differ from the ISRP's.

The ISRP's evaluation was informed by several Columbia River Basin scientific advisory groups that preceded the ISRP, the first of which began operating at the inception of the Council's first fish and wildlife program in 1982. Reports of these groups called for refinement of institutional processes to improve scientific rigor across the broad range of projects being funded by BPA under the original Northwest Power Act of 1980. In particular they called for establishment of a

formal scientific peer review process. Details on the evolution of peer review in the Columbia River Basin and on the operation of the ISRP are provided in Appendix A.

In addition to project review, the 1996 amendment directs the ISRP to review, on an annual basis, the results of prior year expenditures. The Council's 2000 Fish and Wildlife Program further defines the retrospective review, stating that the 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. Also, the ISRP should summarize its province review efforts and identify the major basinwide programmatic issues gleaned from the province reviews.

This report focuses on the latter part of the ISRP's charge, summarizing previous reviews and further analyzing programmatic issues identified in those reviews, as the first element in measuring the program's progress. We summarize the evolution of the review process toward both more rigorous technical evaluations and increased interaction with project proponents for the betterment of project quality. This report does not examine the measurable benefits to fish and wildlife made through specific Bonneville-funded projects. Information gathering for an analysis of biological results has been attempted, in part, by requiring all proposals for continuing work to provide results and explain their progress to the satisfaction of the ISRP. However, throughout its reviews of projects and subbasin plans, the ISRP found that most projects were not able to report results at a level sufficient to enable evaluation of the biological results of past expenditures. Instead, most projects reported completion of tasks; e.g., miles of stream fenced. Other groups such as the US Government Accountability Office (previously the General Accounting Office) and the State of Washington's Scientific Review Panel have reached similar conclusions (GAO 2002, ISP 2000). However, progress made in the Council's Fish and Wildlife Program and review process since the ISRP's establishment has increased the likelihood that future retrospective reviews can include an analysis of progress in meeting the biological objectives of the program. A primary aim of this report is to document this progress at the programmatic level and to identify areas needing further attention to enable such a biological assessment.

This report has two major sections. The first section discusses the ISRP review process from 1997 through 2005 and the results of the reviews. The second section covers major programmatic themes including, in order: research, monitoring and evaluation (RM&E); habitat and passage in the mainstem Columbia River (including white sturgeon, lamprey and exotic species); tributary habitat; wildlife; artificial production; and the ocean and estuary. The report also includes an appendix that describes the development of the peer review process.

This report, while it is addressed to the Council, is intended for a variety of audiences including Council members, some of whom are newly appointed, fish and wildlife managers, scientists, the public, and those outside the basin who are interested in this process as a model. Consequently, the report provides more detail on each of the subjects than might otherwise be required. The Executive Summary provides the background needed to effectively use the report.

## II. The ISRP Review Process and Recommendations

### A. Scope of Review

The 1996 Northwest Power Act amendment made a significant change in the Bonneville Power Administration funding process for fish and wildlife projects by requiring scientific peer review. Peer review is an established tradition in research and development enterprises that can help decision-makers determine the quality of scientific information available to inform a decision and can help ensure that environmental decision-making reflects the best available scientific knowledge.

The amendment provided review criteria and charged the ISRP with the task of providing peer review for projects under the Council's Fish and Wildlife Program that are direct funded by BPA. The Program's goals are to protect, mitigate, and enhance fish and wildlife, and related spawning grounds and habitat, of the Columbia River Basin that have been affected by hydroelectric development (Figure P-1). Subsequent Congressional report language also directed the ISRP to review "reimbursable" projects, sponsored by the Corps of Engineers and others, whose costs are reimbursed by BPA.



Figure P-1. Map of the Columbia River Basin showing major hydroelectric

The majority of the ISRP's review efforts and time over its tenure since 1996 have been directed toward projects associated with the Council's direct-funded Fish and Wildlife Program, with a smaller review effort focused on the reimbursable program. Projects supported through the direct program are sponsored by a mixture of state, federal, tribal, and private entities and cover a wide spectrum of activities ranging from culvert replacement, to wildlife habitat acquisition, to artificial production supplementation programs. In contrast, the reimbursable program consists of fisheries mitigation, operations, and maintenance projects conducted by the U.S. Army Corps of Engineers, the U.S. Fish and Wildlife Service's Lower Snake River Compensation Plan, and operation of the Leavenworth Hatchery (Bureau of Reclamation)

## **B. Project Selection and Review Approaches**

ISRP review of these projects and programs has taken many forms and has evolved over time. Much of the content in the ISRP's first two reports was directed toward developing a project review process that would meet the requirements of the 1996 Amendment, namely that proposals include the necessary information to conduct a scientific review. To do this, the Council, BPA, CBFWA, and the ISRP developed a formal peer review process with a uniform proposal format, review procedures, and evaluation criteria. The ISRP was a key contributor to defining the process because ISRP members contributed knowledge from their experiences with other peer review models and funding processes including National Academy of Science programmatic reviews and grants programs, NASA's science program, and the US Department of Energy research and development program. Most of the ISRP's recommendations on establishing an effective and efficient scientific review process have been implemented, but others have not been fully tested and are worth considering as the Council and BPA develop future solicitations.

### **The Role of the ISRP in the Project Selection Process**

The ISRP plays a specific role in the project selection process for the Fish and Wildlife Program, in which ISRP recommendations and comments on the technical merits of proposals directly apply to project selection decisions. Specifically, the Council must fully consider the ISRP's technical recommendations when making its recommendations regarding funding and provide an explanation in writing where its recommendations to BPA diverge from those of the ISRP. In addition to the Council and the ISRP, BPA, CBFWA, and the public also play critical roles.

As a result the review process is transparent and effective in providing feedback on decisions about project funding. In fact, the well-documented ISRP reviews combined with the Council's formal feedback requirement have proved to be an excellent approach to instill scientific review in management decisions. This approach could be used as a model in other settings where science and policy interact.

In contrast with the Council's process, the proposal review process within BPA is less transparent. In the absence of specific feedback requirements, the extent to which BPA funding decisions remain consistent with the scientific guidance obtained through peer review by the ISRP is unclear. The ISRP has recommended that the consistency of BPA funding decisions and contractual Statements of Work with the technical aspects of ISRP-approved proposals be assessed.

This report's appendix provides a more detailed description and analysis of ISRP reviews and the issues raised in those reviews. CBFWA's reports on implementation of provincial review recommendations also provide thorough descriptions of the FWP project selection process and the roles of the various management and decision making entities (see CBFWA 2004).

## ISRP Reviews: Moving towards Efficiency, Competition, and Innovation

Solicitations for the Fish and Wildlife Program can be split into two basic categories, open and targeted solicitations. Open solicitations – the annual basinwide and provincial reviews – are for any type of restoration or enhancement action intended to benefit fish and wildlife resources in the Columbia River Basin by mitigating for impacts of the hydrosystem. The ISRP also participated in myriad other project selection and review processes that were more targeted than the basinwide and provincial reviews, including: 1) Requests for proposals (RFPs) targeted at specific program needs; 2) Innovative proposal reviews; 3) Out-of-cycle emergency project selection processes to meet certain priority needs identified by BPA, including 2001 Action Plan, High Priority, and 2005 Updated Proposed Action proposal reviews; 4) Review of project selection criteria for the Water Transactions and Riparian Easement Programs; and 5) Council Three-Step Reviews of artificial production programs.

Both open and targeted solicitations have been “open” in the sense that any individual or entity can apply to meet the need described in the solicitation. The ISRP’s experiences with both types of solicitations are summarized below. Descriptions of the processes and specific issues that arose in the reviews follow the summaries. Table P-1 summarizes the ISRP’s review efforts.

*Table P-1. Summary of ISRP Review Efforts 1997-2005. The ISRP has also participated in reviews of project selection criteria and regional research, monitoring, and evaluation plans and protocols*

<b>Review</b>	<b>Proposals and Responses</b>	<b>Number of ISRP Review Team Members</b>	<b>ISRP Review Duration</b>
FY 1998 FWP Program Implementation Review	225 project summaries. No proposals for new projects.	11	7 months
FY 1999 FWP Basinwide Annual Review of all ongoing projects and new proposals	403	13	6 months
FY 2000 FWP Basinwide Review	400 100 responses	38	7 months
FY 2001-2003 Provincial Reviews (includes Lower Snake River Compensation Plan review)	704 537 responses	17	2 1/4 years (6 staggered review sets, 5 months each)
FY 2004 Request for Studies and Hatchery/Wild Interactions	15 12 responses	8	2 1/2 months
FY 2001 Innovative	66	10	2 months
FY 2002 Innovative	37	12	1 1/2 months

<b>Review</b>	<b>Proposals and Responses</b>	<b>Number of ISRP Review Team Members</b>	<b>ISRP Review Duration</b>
FY 2001 High Priority Review	96	10	1 1/2 months
FY 2001 Action Plan	40 10 responses	6	10 days
FY 2005 Updated Proposed Action Proposals	9	7	14 days
Three Step Reviews	~20 reports	~5 per review	~2 1/2 months per review
FY 2004 US Army Corps' Anadromous Fish Evaluation Program Review	52 pre-proposals 32 final proposals	11	9 months
2004 Subbasin Plan Reviews	45 plans (30,000+ pages)	26 (ISAB included)	2 1/2 months
Total	1822 proposals 691 responses	50	8 1/2 years

### **Open Solicitations**

The ISRP has conducted what amounts to three comprehensive reviews of all ongoing and proposed projects funded through the Fish and Wildlife Program. The ISRP's first review for Fiscal Year 1998 did not include reviews of individual proposals, but focused on programmatic issues of proposal content and program accountability. The ISRP also made a number of recommendations aimed at developing and improving the review process. These process recommendations were directed at increasing coordination, creating a uniform set of standards and policies for review of new and continuing project proposals, implementing a competitive grants program, and developing a more information-rich accounting and reporting system to facilitate the prioritization and review of ongoing and needed work. Subsequent annual reviews for Fiscal Years 1999 and 2000 and rolling provincial reviews for Fiscal Years 2001 through 2003 included comments and recommendations on each proposal submitted. Substantial improvements in the process were made with each review. A major difference between the FY 2000 review and the ISRP's first two reviews is that the ISRP made extensive use of the Peer Review Groups (PRG), enlisting 27 additional reviewers for a total of 38 reviewers.

For both reviews, the ISRP organized the proposals into geographical grouping - subregions and subbasins - consistent with CBFWA's groupings for their draft annual implementation work plan. The ISRP focused on how the projects fit together to address limiting factors and meet objectives at a geographical scale. This review approach led to ISRP recommendations to create umbrella proposals in FY 2000, subbasin summaries for the provincial reviews, and eventually subbasin plans to provide better assessments and documentation to justify and prioritize projects.

The ISRP based these reviews solely on written documents submitted for review and did not hold briefings with project sponsors. In the FY 2000 review, however, a post hoc "fix it loop"

review was added for project sponsors to respond to the ISRP’s comments. The ISRP then reviewed the responses and revisited its recommendations.

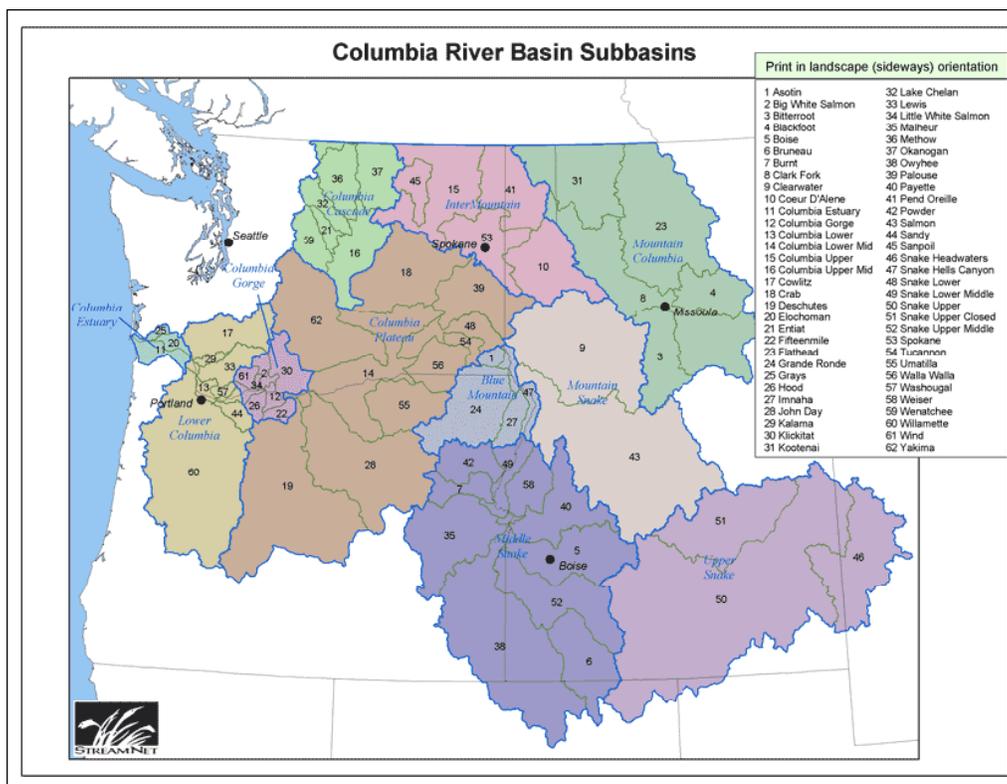


Figure P-2. Map of Columbia River Basin with Provinces shaded and Subbasins numbered.

For Fiscal Years 2001 through 2003, the Council and BPA embarked on a new project selection process that was responsive to past ISRP review recommendations and public feedback on issues such as geographic context, multi-year reviews, site visits, presentations, and response loops. The new process was called the Rolling Provincial Review Process. For the review, the Columbia River Basin was divided into 11 ecological provinces (Figure P-2), plus a mainstem and systemwide category of projects was defined.

Each province was comprised of groups of adjoining subbasins that have similar ecological attributes. Solicitations and reviews for each of these provinces were staggered over 2 1/2 years beginning with the Columbia River Gorge and Inter-Mountain provinces for Fiscal Years 2001-2003 and ending with the mainstem and systemwide set of projects for Fiscal Years 2003-2005. This in-depth review, conducted within a more structured subbasin and province context, enabled the Council to recommend multi-year funding for projects.

In sum for the rolling provincial reviews, the ISRP reviewed 704 proposals and 537 responses to ISRP preliminary reviews of those proposals. These 704 proposals submitted for the provincial solicitation represent an approximately 57% increase from the 400 proposals submitted for each of the basinwide FY 1999 and FY 2000 solicitations. This increase in proposal submittals is evidence that the outreach by the Council and CBFWA was effective in generating local interest.

The large percentage of proposals requiring responses, 76%, was also evidence of the increased role of the ISRP in providing peer advice to project sponsors, intended not only to ensure scientifically sound, accountable proposals, but also to improve project justification, methods, and monitoring and evaluation.

### ***Summary Conclusion for Open Solicitation Process***

**Recommendation:** The ISRP recommends that the Council not go back to a review of all new and ongoing projects in one annual review cycle. That process does not allow time for interaction of the ISRP and project sponsors through site visits, presentations, and response loops. Instead, the ISRP recommends that future processes be modeled after the sequential multi-year provincial reviews, with potential alterations to more efficiently address program needs through topical (e.g., wildlife O&M, systemwide RM&E, lamprey) and targeted reviews.

The benefits of the 2001-2003 provincial review process were manifold and bear repeating: 1) the ISRP gained an unprecedented level of understanding of individual projects and of the Fish and Wildlife Program; and 2) project sponsors were supportive of the process, which they saw as fair and equitable as it gave them opportunities in the site visits and presentations to make certain that the ISRP accurately understood their projects and concerns. A consequence of this systematic and measured review approach was that project sponsors were generally accepting of the ISRP review results, even when proposals did not fare particularly well. Often project sponsors had the opportunity to address ISRP concerns through the “fix-it” loop process. Considerable good will was generated throughout the basin via the provincial review process toward the Council, the ISRP, and the Fish and Wildlife Program.

### **Targeted Solicitations and other Specific Reviews**

Targeted solicitations in our review refers to a variety of review efforts and processes, usually of a more specific nature, smaller size, and shorter review duration than the open solicitation process described above.

#### ***Request for Proposals***

In the ISRP’s first several annual reviews, the ISRP recommended the use of targeted Requests for Proposals (RFPs) as a method of addressing specific critical uncertainties or information gaps not addressed by the majority of ongoing or continuing projects. In FY 1999, the Council and BPA, with assistance from the ISRP, developed two targeted RFPs. These addressed specific critical uncertainties about Chinook salmon intended to further define the roles of mainstem habitat use and needs of Chinook salmon, as well as providing information on their population and genetic structure. The reports and analysis that resulted from these RFPs were extremely informative and well done. Peer reviewed publications also resulted from both efforts. The ISRP found this initial experience with the targeted RFP approach promising and recommended use of the approach again to help resolve critical and controversial uncertainties.

The next specifically focused competitive grants solicitation, which is currently ongoing, was developed by the Action Agencies’ Research, Monitoring, and Evaluation (RME) group in March 2004 to meet three research gaps related to hatchery and wild fish interactions as called

for under the NOAA Fisheries' 2000 Biological Opinion (BiOp) on the operation of the Federal Columbia River Power System (see ISRP 2003-9). The ISRP found that promising proposals were submitted for two of the three RFSs.

**Recommendation:** The ISRP recommends that the Council continue the practice of developing RFPs targeted to specific problems including systemwide information gaps or key limiting factors in a particular watershed. This should become an annual procedure with a specific budget allocation. We further recommend that requests for proposals to conduct the work or research be widely distributed to individuals, companies, and government agencies. The Council might also want to explore the use of pre-proposals to screen qualified proposals to be developed into full proposals.

This approach was employed for the FY 1999 RFPs.

### *Innovative Proposal Solicitations*

In its first several annual reviews, the ISRP noted that the failure to arrest the declines in salmon abundance and bring about recovery suggested that some emphasis should be placed on innovative ideas, which often come from outside the inner circles of salmon management institutions (e.g., the adaptation of transponder identification tags (PIT tags), used for marking racehorses and commodity shipments, to salmonid marking). Many funding organizations and research laboratories maintain specific categories of funds for exploratory, high-risk, potential high-payoff activities as investments in the future. Consequently, the ISRP recommended that the Council and BPA establish a special funding category to encourage innovative projects with the justification that a relatively small investment in a competitive solicitation for innovative projects could provide substantial improvement in the quality of research and recovery actions in the Columbia River Basin.

In response, the Council established a funding mechanism for innovative projects with the goal to improve knowledge, encourage creative thinking, and directly benefit fish and wildlife. Innovative projects were defined as those which rely primarily on a method or technology that : (1) has not previously been used in a fish or wildlife project in the Pacific Northwest, or (2) although used in other projects, has not previously been used in an application of this kind. The ISRP conducted anonymous reviews and ranked the innovative proposals by priority for funding. Pilot projects were funded in FY 1999 and FY 2000. For Fiscal Years 2001 and 2002, BPA and the Council created specific solicitations for innovative fish and wildlife project proposals with a budget of \$2 million. For FY 2001, nine of the 66 proposals reviewed by the ISRP were funded, while in FY 2002, the ISRP reviewed and ranked 37 proposals. The Council recommended eight projects to BPA for funding; however, BPA funded only two of the recommended proposals, citing the BPA fiscal crisis as the reason.

Based on the experience with the innovative projects and review process thus far, the ISRP believes that a major purpose of the innovative funding category is the "proof of concept." Consequently, innovative projects should be pilot-scale, operate on modest to moderate budgets, and be of relatively short duration. While the Innovative Funding Category has been allocated at just over 1% of the Fish and Wildlife Program's annual budget, results from several innovative projects have had important benefits to the region. For example, the retrospective review by ESSA Technologies (Marmorek et al. 2004; Innovative Project 34008) of past habitat

improvement actions and their effect on salmon survival and abundance led directly to many recommendations on data needs and to coordination among projects that are currently being addressed by the developing Research Monitoring and Evaluation plan described above.

**Recommendation:** The ISRP recommends that an annual budget for the innovative proposal solicitation be committed to (especially if advertised in a solicitation) and perhaps increased, and that a separate budget be set aside for targeted Requests For Proposals (RFPs). The ISRP recommends that future solicitations cap budgets of innovative projects at \$250,000 and recommends a range of \$50,000 - \$150,000 for individual projects. The ISRP also recommends that special topic solicitations, such as nutrient supplementation, should be developed as targeted RFPs rather than addressed through the innovative process.

### ***High Priority, Action Plan, and Updated Proposed Action Reviews***

In late 2000 and early 2001, before a majority of the provincial reviews were underway, and again in March 2005, the ISRP responded to requests from the Council for very fast turn-around reviews for proposals for immediate habitat actions to assist Endangered Species Act (ESA) listed anadromous fish in the Basin.

The “High Priority” solicitation (2000) received 96 proposals that offered actions ranging from replacing culverts to acquiring riparian habitat to testing selective fishing gear. The “Action Plan” solicitation (2001) received 38 new proposals, and 12 “High Priority” proposals were resubmitted. Expedited review was requested in order to provide funding rapidly to worthy projects that could offset effects of the power emergency that year. The ISRP conducted expedited reviews for both solicitations and ranked the set of “High Priority” proposals in six weeks and the “Action Plan” proposals in ten days. Almost half the proposals failed the threshold criteria because they did not offer immediate actions that would result in on-the-ground benefits. Although BPA intended for the Action Plan projects to be short-term actions to help fish affected by the power system emergency in 2001, the subsequent contracts were not completed nor work initiated until 2002 (CBFWA 2004).

In March 2005, the ISRP was requested to review a set of nine habitat projects developed by the Bureau of Reclamation in the Columbia Cascade Province intended to help achieve Biological Opinion tributary habitat goals for Upper Columbia Spring Chinook and steelhead. Although some of the projects reviewed might have had significant biological merit, the proposals were not technically justified and received “not fundable” recommendations. The ISRP recommended that any proposals for habitat work in the Upper Columbia River be coordinated with other entities that are active there, such as the Washington Salmon Recovery Board, and the mechanisms established as part of the Habitat Conservation Plans (HCPs) of Chelan and Douglas County PUDs.

The review process for all three reviews differed from the standard ISRP Provincial Review Process in several ways. Subbasin summaries were not provided, the ISRP did not conduct a site visit, project sponsors did not make oral presentations, and a response loop was not included. Consequently, the proposal review was not as interactive or rigorous as the provincial review and did not benefit from the contextual information provided by a provincial review, making the fit of the proposals within a subbasin strategy less apparent.

**Recommendation:** In general, the quality of the High Priority, Action Plan, and UPA proposals fell below those in the provincial and “innovative” reviews. Based on the generally poor quality of these short-timeframe proposals, the ISRP recommends against further short-timeframe (one month from solicitation to submittal), special-circumstance solicitations. Such solicitations, if they occur too frequently and generate proposals of the low quality received in these past reviews, could erode the improvements in accountability, transparency, and fairness that have been gained in the proposal review process over the past eight years.

### ***Review of Project Selection Criteria for Land and Water Transactions***

The ISRP also review has participate in the development of criteria that will be used by another entity to select site-specific projects, without ISRP review (see ISRP 2001-4 for a review of the Confederated Salish and Kootenai Tribes’ Habitat Acquisition and Restoration Plan). This approach has been used for habitat restoration and protection projects and essentially applied by model watersheds as well as irrigation screening projects.

The most recent example of this approach is the ISRP’s review of two sets of draft criteria, one for evaluating proposals for innovative water transactions to increase tributary flows, the other to secure riparian easements to protect tributary habitat. The National Fish and Wildlife Foundation (NFWF) uses these criteria to select projects for implementation through the Columbia Basin Water Transactions Program, funded by the Bonneville Power Administration. The ISRP worked with the Council, BPA, and NFWF to develop criteria that were consistent with the criteria from the 1996 Amendment to the Power Act and that requested the necessary information to scientifically review and prioritize water transaction and riparian protection proposals (see ISRP reports 2005-1, 2004-2, 2003-1, 2002-15).

The project selection process is as follows: NFWF receives, evaluates, and ranks proposals submitted by qualified local entities using the criteria reviewed by the ISRP; obtains BPA approval on selected projects; and facilitates the implementation of those BPA approved projects. Consequently, the ISRP’s role in reviewing the criteria is important because NFWF, not the ISRP, evaluates proposals.

**Recommendation:** The ISRP is aware that the Council may pursue this model of project selection at the subbasin level to enfranchise locals, especially those involved in subbasin plans. This approach could be especially useful in providing an ongoing process for implementing new work between Council and BPA project solicitation, review, and selection cycles. The ISRP has recommended this type of approach for land and water acquisitions. The ISRP is optimistic that such an approach could be successful with: 1) sound criteria agreed upon by the project/program sponsors, BPA, the Council, and the ISRP, 2) participation by knowledgeable and independent evaluators (e.g., NFWF), and 3) periodic ISRP reviews of the programs, which could dictate revision of the criteria and ensure accountability.

### ***Council Three-Step Reviews***

In its FY 1998 report, the ISRP recommended that the Council permit funding for an individual artificial production project only if the project proponents can demonstrate they have taken specific measures or requirements of the FWP into account (e.g., risk analysis and ecosystem

impacts) in the project design, and the Council concurred. To ensure that standard is met, the ISRP recommended that a project should be funded only after a positive recommendation from an independent peer review panel. In response, the Council developed the Three-Step Review process, which was built upon the existing multi-step design and review process recognized in the program and used by Bonneville for the design, review, approval, and implementation of new production initiatives.

The ISRP has produced over 20 Three-Step Reviews at the request of Council, resulting in significant changes for several projects. For example, as a result of the iterative Three-Step review process, the Northeast Oregon Hatchery program's monitoring and evaluation plan improved significantly and has the potential, if implemented, to address some critical uncertainties pertaining to wild and hatchery interactions. It may also serve as a model for other supplementation programs in refining their monitoring and evaluation plans.

**Recommendation:** The ISRP believes the Three-Step Review process has been successful, although its guidance and criteria need to be revised to make the process more effective and efficient. The process is the most in-depth project-specific review conducted by the ISRP and is successful as a means to improve projects or provide scientific rationale for not pursuing a particular approach or strategy under a particular set of ecological conditions. The Three-Step process often involves several interactions between the project sponsor, Council, and the ISRP on the project's technical adequacy and consistency with the FWP. Time constraints during project selection processes do not allow for this level of scrutiny and interaction. The ISRP thinks the Three-Step review model of focusing in on a specific complex program and conducting an iterative review with specific criteria drawn from the FWP could be applied to other complex core programs.

### **Alternative Project Selection Approaches: Evaluating Different Kinds of Projects**

Although a smattering of targeted, competitive solicitations for new work have been undertaken, the Council and BPA have not created a formal two-path project selection process, one path for ongoing operations and a second path for new work. Instead, the majority of project funding decisions occur in annual solicitations in which new and ongoing projects compete for funding. On its face, this approach has significant logical appeal to the ISRP because the competition provides incentives for the Fish and Wildlife Program to fund the most scientifically sound and cost-effective projects. In practice, however, many established projects with ongoing operation and maintenance costs continue to form the foundation of the program. In addition, many potential restoration and mitigation projects are site specific and thus under the jurisdiction of various state, federal, and tribal entities.

**Recommendation:** The ISRP continues to think that a multi-path process has merit and deserves further consideration. The ISRP recommends that alternative review paths be investigated for continuing projects heavy with out-year operating obligations and targeted solicitations for new or continuing work that does not involve routine operations. The ISRP recommends that certain operations projects be separated from other proposals and their review expedited.

## Reimbursable Program Review Processes

The discussion above has focused on the Council's direct-funded Fish and Wildlife Program, where most of the ISRP's review efforts have been focused. Congressional language following the 1996 amendment to the Northwest Power Act also directed the ISRP to review the "reimbursable program" – those project related to fish and wildlife management and mitigation funded by BPA that are reimbursable.

ISRP review of the US Fish and Wildlife's Lower Snake River Compensation Plan was successfully incorporated into the provincial reviews from 2001 - 2003. For the Anadromous Fish Evaluation Program review (US Army corps of Engineers), the ISRP found AFEP's current internal process of proposal development did not lend itself to an independent proposal review process.

**Recommendation:** Before the ISRP conducts another review of AFEP proposals, the ISRP recommends that the Council, Corps, and ISRP identify a clear place for ISRP input into the proposal development process.

## Review Process Conclusions and Recommendations

### Tracking Peer Review Recommendations through BPA Funding

The project selection process generally has functioned successfully. However, if aspects of BPA's funding decisions are inconsistent with the Council's recommendations, there is no formal procedure for documenting those differences. The legal requirement is that BPA make expenditures from its fund in a manner consistent with the Council's Fish and Wildlife Program. Without specific reporting mechanisms in place, it is uncertain whether BPA deviates from the scientific quality obtained through peer review. The ISRP sees the need to compare BPA funding decisions (including their contractual Statements of Work) with the ISRP-approved proposals.

**Recommendation:** To accomplish this comparison, the ISRP recommends that a sample of funded projects be examined to ensure that the scientific quality obtained in peer review is represented through the BPA procurement process. If major discrepancies are found, then a legally binding process should be considered to identify and justify the changes (similar to the Council's obligation to explain in writing if it does not follow the ISRP funding recommendations). The PISCES database has the potential to track post-review changes to a project's work elements (tasks).

## Specific Review Issues

### *Proposal Content*

#### *Justification*

Many project sponsors attempt to justify their projects by citing language in the Fish and Wildlife Program, CBFWA's AIWP, BiOps, or BPA planning documents rather than describing the actual problem or need the proposal would address. While it is important that proposed projects be linked to policy measures or directives in the Council's Fish and Wildlife Program, such linkages, even when directly and explicitly stated, do not constitute scientific or technical justification for the proposed work. The sponsor's proposal needs to clearly describe the scientific or technical background, foundation, and justification for the proposed work.

#### *Objectives*

A common, but critical shortcoming of many proposals was, and continues to be, their failure to articulate objectives in the proper form. Project objectives should be stated in terms of desired outcomes, rather than as statements of methods and tasks. Tasks or strategies should be described in a way that clearly addresses the proposal's objectives. Language explaining this distinction between objectives, tasks, and methods was added to the directions for filling out the narrative section of the proposal form. However, the practice of stating tasks as objectives has persisted and was evident in the subbasin plan review in 2004. The problem is more than a semantic one; objectives give the program a biological benchmark against which to develop a monitoring and evaluation program to gauge the success of strategies.

#### *Results*

A proposal for an ongoing project should include a clear interpretive history of the project's past accomplishments, stated in terms of the benefit to fish and wildlife in the basin and the preservation or restoration of self-sustaining ecosystems that maintain fish and wildlife. Biological goals and evaluation criteria should be clearly given, and data and statistical analyses cited in support of results.

A list of tasks accomplished is one step in meeting the requirement for reporting of past accomplishments, but it does not allow evaluation of how well a project is progressing toward the ultimate goal of benefit to fish and wildlife or to the ecosystems that sustain them. Many tasks that are believed to benefit fish or wildlife do not, in fact, do so everywhere, and so some level of evaluation and reporting of outcomes remains necessary for each project.

To facilitate better reporting of results, the proposal form included a table to capture past accomplishments in the administrative section and directions in the narrative form specifically requested reporting of biological results. Despite these direct calls for reporting of results, most proposals did not report accomplishments beyond completion of tasks. Consequently, data to support a comprehensive retrospective analysis of the biological results of past projects has not been available to the ISRP. This lack of data was also evident in the subbasin plans, the guidelines for which also called for the reporting of project results in the inventory section.

**Recommendations on Reporting Results:** Data to support a comprehensive retrospective analysis of the biological results of past projects has not been available to the ISRP. The ISRP

recommends that future solicitations and BPA's project tracking database be linked, emphasize reporting of both biological results and task completion, and contain mechanisms and protocols that ease reporting and compilation of results. In addition, BPA should explore requiring reporting of results at specific milestones as a condition to continued funding. BPA's new project tracking database, PISCES, appears to offer significant promise for tracking the status of tasks.

Publication of research results in peer-reviewed literature imposes an additional test of scientific quality that has not been applied to many projects in the Fish and Wildlife Program; consequently, the ISRP has recommended initiating a Columbia River Basin Journal or a Northwest Salmon Recovery Journal that could serve as a regional forum for publication of research and long-term monitoring and evaluation results of particular relevance to the region. While numerous fisheries and ecology journals exist, and many biologists and researchers in the basin publish in them, initiation of a regional-based peer review journal would consolidate regional scientific information on salmon recovery. In its first annual report to BPA (SRG 1990), the Scientific Review Group recommended that development of a suitable regional peer review journal be considered. The ISRP encourages the Council to consider mechanisms for development of such a forum.

### ***Review Criteria***

**Recommendation:** The ISRP recommends that the Council and BPA increase the practice of using targeted solicitations with specific criteria to meet program needs. This allows the ISRP to add value to reviews by ranking or indicating relative priority of proposals at satisfying a specific program need.

### ***Response or "Fix-it" Loop***

**Recommendation:** The response loop is a good mechanism to ensure that the ISRP's peer review advice is considered by project sponsors and, in some cases, used to improve the methods and monitoring employed by a project. The ISRP, however, cautions that the response loop be used equitably and primarily for review of solicitations that include ongoing projects. A response loop should not be necessary for competitive solicitations that are targeted entirely at new proposals, such as for innovative projects.

In the provincial reviews, 17% of the initial proposals were judged as fundable, while 73% were requested to provide a response, generally due to the need for additional technical detail or clarification. Another 10% were judged as technically inadequate and no response was requested. Of those proposals that submitted responses, 78% were judged as fundable.

### ***Site Visits and Proposal Presentations***

**Recommendation:** The ISRP recommends that periodic in-depth site visits be used for targeted reviews of complex ongoing projects, so the ISRP can get a complete understanding of the scope of a project's effort, the ability of the project sponsors, and the quality of the facilities, methods, and other project resources. Site visits provide incomparable review benefits for complex projects, and also are especially helpful for new ISRP (and PRG) members.

### ***Multi-Year Review and Funding***

**Recommendation:** The ISRP will continue to identify projects for which reviews are only warranted every several years, rather than annually.

### ***Review Schedules***

**Recommendation:** The ISRP recommends that in scheduling future reviews, the Council and BPA work collaboratively with the ISRP to organize a review approach and schedule that provide ample time for the ISRP to perform its full range of review functions.

### ***Allocation Issues***

**Recommendation:** The ISRP recommends that a specific budget be committed to and advertised as part of future solicitations. The several instances over the last few years, where expected or advertised budgets have not materialized, have led to disillusionment of project sponsors and erosion of support for the Fish and Wildlife Program and the BPA funding process.

### ***Miscellaneous Issues***

#### ***In Lieu***

Future solicitations would benefit from a clear expression of what constitutes an *in lieu* issue. What is the responsibility of the Fish and Wildlife Program to fund habitat improvements, culvert replacements, irrigation system modifications, intake screening, and other actions for a variety of landowners who face responsibilities under numerous laws? A clear definition, depending on the policy, has the potential to 1) broaden participation, or the opposite 2) limit submittal of proposals to those actually eligible for funding, and/or 3) increase cost-share opportunities and coordination of efforts.

#### ***Confidentiality of Proposal Information***

Some ISRP reviewers raised concerns that proposals for BPA funding are not confidential documents and are made available to the public via the web upon submittal. If the Council thinks this issue is limiting innovation, perhaps it could test the innovative solicitation as a confidential process.

#### ***Rights to Technologies Developed with Public Funds***

The Council may want to articulate a policy regarding the public funding of private developmental research. Some projects are based on tests of developmental technologies that would, if successful, become patented products held by private companies. Joint ventures between private companies and the Fish and Wildlife Program may be a possible funding mechanism.

### **III. Programmatic Results: Ecosystem Principles in Management**

#### **A. Research, Monitoring, and Evaluation**

##### **Introduction**

ISRP reviews and recommendations concerning Research, Monitoring, and Evaluation (RM&E) are justified based on the criteria provided in the 1996 amendment to the Northwest Power Act. The charge to the ISRP includes review of projects in the context of the Council's Fish and Wildlife Program (FWP) and in regard to whether they "have provisions for monitoring and evaluation of results."

The 1996 amendment to the Power Act identified the ISRP as a central technical review group to address adequacy of M&E. The ISRP has conducted annual project proposal reviews (ISRP 1997, 1998, 1999), provincial reviews (e.g., ISRP 2002-11), and subbasin plan reviews (ISRP and ISAB 2004-13). Other related work include the recent reviews of the Draft Research, Monitoring & Evaluation Plan for the NOAA-Fisheries 2000 Federal Columbia River Power System Biological Opinion (ISAB&ISRP 2004-1) and the Pacific Northwest Aquatic Monitoring Partnership's (PNAMP) Draft Recommendations for Monitoring in Subbasin Plans (ISAB&ISRP 2004-2).

The Council's Fish and Wildlife Program of 1996 specified that adaptive management would be employed to modify the program as new information becomes available. Effective adaptive management requires the existence of monitoring data, evaluation of the study results using appropriate mathematical and statistical procedures, and if appropriate, integration of results into development and adoption of new management actions for the future. The ISRP notes that it is difficult to imagine how one would proceed in adaptive management without consistent, unbiased monitoring of results under present management actions.

##### **Classification of Study Designs for RM&E**

During their existence, the ISRP and ISAB have struggled with the inconsistency of terminology concerning RM&E among the various fields of science (e.g., fisheries, hydrology, wildlife, genetics) and with the scientific basis for "effectiveness monitoring" (Action Agencies 2003). For example, the words mensurative, implementation, observational, retrospective, non-experimental, pseudo-experiments, Tier 1 monitoring, Tier 2 monitoring, baseline, trend, or simply "monitoring" have been used for scientific studies in one general category. The words manipulative, true experiment, effectiveness monitoring, Tier 3 monitoring, and response monitoring have been used in a second general category of RM&E. The ISRP has concluded that a review of these concepts and development of common terminology is important in this retrospective report for effective communication among researchers and administrators in the Columbia basin. We elect to classify the RM&E studies conducted in the basin into mensurative experiments and randomized treatment (manipulative) experiments Hurlbert (1984). Hurlbert

(1984) used the words mensurative experiments and manipulative experiments, but we prefer to use the words “randomized treatment” rather than “manipulative” because mensurative experiments often involve some “manipulation” of the environment. All of the studies are referred to as experiments, because scientists have long used “experimental” as a synonym for “empirical” data measured in a study. In the remainder of this section, we first describe these two general categories of RM&E, then review the major issues that have arisen in the ISRP review of projects and subbasin plans submitted to the Council’s Fish and Wildlife Program.

## Mensurative Experiments

Mensurative experiments or observational studies<sup>3</sup> involve the collection of data at one or more points in space or time WITHOUT some type of random assignment of treatments (e.g., management actions, including reference areas with no treatment) to areas (Table RM&E-1). Some or all of the areas under study may have been deliberately or inadvertently “treated” by the researcher or others, e.g., uncoordinated implementation of management actions to improve freshwater tributary habitat or spills of hazardous substances. These studies do not typically allow flexibility on the part of the researcher to determine the location of external influences on the system studied. Other examples are routine monitoring studies, e.g., counts of adult anadromous fish passing Bonneville Dam and meteorological measurements. Routine monitoring typically yields data that are compared over time and space and are correctly classified as mensurative experiments.

Experiment	Basic Definition
Mensurative	Collection of data at one or more study units in space or time WITHOUT random assignment of treatments to units.
Randomized Treatment	Collection of data at two or more study units in space or time WITH random assignment of treatments to units.

*Table RM&E-1. Basic definitions of mensurative and randomized treatment experiments.*

### **Implementation Monitoring in RM&E**

Implementation monitoring is the most simple of the mensurative “experiments,” namely the monitoring of task completion in a specific project (Table 2). For example, the researcher may report miles of stream fenced, number of culverts removed, irrigation diversions maintained, implementation of an experiment, or numbers of fish PIT tagged. In the initial proposal reviews conducted by the ISRP (1997 to 1998), implementation monitoring was often the only monitoring objective stated. Results of implementation monitoring must be presented in proposals for continuing projects, but sound science requires that project results also be measured in terms of benefits to fish and wildlife. In addition to implementation monitoring, the ISRP has recommended that all projects should be monitored or included in an overarching

<sup>3</sup> We prefer to use the word mensurative rather than observational in classification of study designs, because randomized treatment experiments also involve “observation” of data.

monitoring program to establish basic benefit of the project or cumulative benefit of multiple projects for fish and wildlife (see below for additional discussion). Council decisions have supported monitoring of projects beyond implementation.

Type	Class	Objective
Implementation	Mensurative	Monitoring of task completion
Census	Mensurative	Monitoring of one or more areas in space or time, with data collected on all study units to detect changes and trends, compare areas, etc.
Statistical	Mensurative	Monitoring of one or more areas in space or time, with data collected on a probabilistic sample of study units to detect changes and trends, compare areas, etc.
Effectiveness	Mensurative	Establishment of mechanistic or causal links between management actions and population responses with conclusions justified by replicated results and subjective judgment.
Effectiveness	Randomized treatment	Establishment of mechanistic or causal links between management actions and population responses with conclusions justified by the design of the experiment.

*Table RM&E-2. Objectives of four common types of monitoring classified as mensurative or randomized treatment.*

### ***Census Monitoring in RM&E***

Census monitoring involves the collection of data at one or more study areas in space or time, with data collected on ALL units (sites, individuals) within areas (Table RM&E-2), e.g., data are collected on a complete census of units in the project areas or of individuals in the populations. There is no randomization at any level. One cannot make inferences beyond the areas or populations on which measures were taken. Often the objective is to quantify trends or changes over time in a single study area. Observational studies of this type are appropriately called mensurative experiments because data are collected at more than one point in space or time (Hurlbert 1984) with the objective of comparing areas or times and answering particular questions.

The Action Agencies (2003) choose to refer to census monitoring as Tier 1 (Table RM&E-3), because they envision that census monitoring will be most used in tracking status, trend, and changes at the landscape scale (very large study areas, such as the entire Columbia or John Day River basins)<sup>4</sup>. In these applications, census monitoring (Action Agencies' Tier 1) can be a low cost, low level of monitoring on large areas. For example, aerial photography or other remote

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<sup>4</sup> The assumption that census monitoring would be used at this spatial level of monitoring prompted the ISRP to refer to census monitoring as "Tier 1" in earlier reports. However, it is possible to use statistical monitoring on large scale projects, though usually uneconomical. To eliminate the inconsistency, we drop the term "Tier 1" in reference to census monitoring in this retrospective report.

sensing would typically be used to create census data layers in a GIS for long term monitoring of trends or changes in riparian and other terrestrial habitat in subbasins or watersheds. Often, no (or few) changes are expected on decadal time scales (e.g., geology, soils, land surface form), or changes are expected to be relatively slow (e.g., land use; riparian vegetation patterns).

The ISRP and ISAB have used the words “Tier 1, Tier 2, and Tier 3” in a slightly different manner in past reports, referring more to the way data are collected (i.e., census versus sample) than to the scale of the study. The words are not necessary for the purpose of our past reports and this respective report. To eliminate potential confusion, we have dropped the use of the word “Tier” when referring to the way data are collected (Table 3). We apologize for any confusion that our past reports may have introduced.

	Census Monitoring	Statistical Monitoring
Large Scale Tier 1 Monitoring	Usually census monitoring is most appropriate (e.g., remote sensing to create GIS data layers).	Statistical monitoring could be useful in special cases (e.g., in monitoring range condition on BLM land in Oregon)
Small Scale Tier 2 Monitoring	Usually census monitoring is not appropriate because of high costs of large number of experimental units and/or on-the-ground labor intensive methods.	Statistical monitoring with known precision and confidence based on a sample of units is usually most appropriate (e.g., juvenile chinook salmon abundance in a sample of reaches of the John Day River).
Effectiveness Tier 3 Monitoring	Usually census monitoring is not appropriate because of high costs of large number of experimental units and/or on-the-ground labor intensive methods.	Statistical monitoring with known precision and confidence based on a sample of units is usually most appropriate. Rigorous experimental design is required (e.g., evaluation of survival of juvenile salmonids past John Day Dam with different levels of spill).

*Table RM&E-3. Relationship of census and statistical monitoring to Action Agency (2002) Tier 1, 2, and 3 monitoring.*

Census monitoring is appropriate to document direct effects of a project, as long as it allows trends or changes to be distinguished from background noise. For example, the temperature of water entering and leaving a habitat improvement site might be measured in August every year for a 21-year period. Census monitoring in a project to supplement a weak stock of naturally spawning fish with hatchery fish might include complete counts of hatchery and naturally produced adults moving through a weir to the spawning grounds. Census monitoring is not necessarily expensive or time consuming.

The proper role for census monitoring is often to provide long term, daily (yearly), low cost, repeatable data with enough accuracy and precision to detect trend, change, differences, or correlations in the face of background noise. For example, complete counts of adults passing a weir on a study stream to natural spawning grounds over the time period 2005 to 2010 might indicate an increasing trend in the percentage of hatchery fish. The question would arise - Why? When trends or changes are detected, then relatively short-term research projects can be developed to help explain why the trend or changes are occurring.

### ***Statistical Monitoring in RM&E***

Statistical monitoring projects are also mensurative experiments involving collection of data on a probabilistic sample of units from one or more study areas (populations) at one or more points in time (Table RM&E-2). Statistical monitoring differs from census monitoring in that statistical inferences using classical statistical methods must be made on status and trends of parameters for the study areas or populations. Statistical conclusions apply to the areas or populations sampled, not just the units on which data were collected. Inference based on probabilistic sampling is the topic of statistics books with the word “sampling” in the title (e.g., Cochran 1977, Thompson 1992).

When the objectives include study of habitat, vegetation, water quality, fish populations, etc., using on the ground field data collection methods in relatively small study areas (e.g., watersheds compared to entire river basins), the Action Agencies (2003) choose to refer to the studies as Tier 2. They envision that statistical monitoring will be most economical and hence most used in these studies<sup>5</sup>. These data collection methods are often labor intensive and it is not economically feasible to collect data on a census of all units in a study area (e.g., all reaches in a branch of the John Day River).

A good model for statistical monitoring of salmon abundance status and trend is the Oregon Plan for Salmon and Watersheds Monitoring Program (<http://www.nwr.noaa.gov/pcsr/Moore/>) as implemented in Oregon for coho salmon in coastal streams. The Oregon Plan, successfully implemented for estimation of coho distribution and abundance, applied a rigorous design for probabilistic site selection to answer key monitoring questions. The Council’s Fish and Wildlife Program Project #200301700 “Develop and Implement a Pilot Status and Trend Monitoring Program for Salmonids and their Habitat in the Wenatchee and Grande Ronde River Basins” is an example of current development of statistical monitoring (Action Agencies’ Tier 2) for status and trend of salmonids and aquatic habitat over three large subbasins in the Columbia basin (Chris Jordan, NOAA Fisheries, personal communication).

Statistical monitoring reverts to census monitoring if data are collected on all units in the study areas or populations. For example, if upstream and downstream movement of adult spring/summer chinook can be perfectly counted at a weir 24 hours per day for a migration

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<sup>5</sup> The assumption that statistical monitoring would be used at this spatial level of monitoring prompted the ISRP to refer to statistical monitoring as “Tier 2” in earlier ISRP reports. However, it is possible to use census monitoring at this spatial level, though usually uneconomical. To eliminate the inconsistency, we drop the term “Tier 2” in reference to statistical monitoring in this retrospective report.

season, then the total count is census monitoring of escapement above the weir. If counts are made on a random or systematic selection of 24 hour periods, then the total count must be estimated by statistical methods and the result is statistical monitoring.

Individual projects should support larger statistical (Tier 2) monitoring projects by using the same methods to select study sites and the same methods for data collection. For example, a project to monitor habitat in a watershed can most easily provide data for monitoring of habitat in the larger subbasin if the same probabilistic site selection and field data collection methods are used. The more site selection and data collection methods differ, the more difficult it is to aggregate data to larger regions.

Census and statistical monitoring qualify as “research” in the sense that full census data are being provided or probabilistic conclusions are being drawn about entire study areas or populations. For example, statistical estimates of the number of chinook salmon redds in the Wenatchee River basin in 2035 might be based on counts in a probabilistic sample of sites from the basin. However, these approaches limit learning about why trends, changes, or correlations/regression results occurred. The causes of effects detected by census or statistical monitoring usually remain elusive.

Many important census or statistical monitoring projects may not yield results of interest to managers until a significant period of time has passed to establish “baselines” for the study areas, trends/changes are detected, or correlations/regressions results are replicated. The experience of the ISRP is that often 10 to 15 years are required before these status and trend monitoring projects are viewed as successes.

***Treatment-Control (TC), Before-After (BA), and Before-After-Control-Impact (BACI) studies***  
Census or statistical monitoring can be implemented on one or more points in space and time to give rise to Treatment-Control (TC) comparisons between areas, Before-After (BA) comparisons on an area(s), and Before-After-Control-Impact (BACI) designs. We prefer to use the word “reference” rather than “control,” because perfect “controls” are rarely possible in field studies. Measurements are taken with the objective of, for example, asking if there is: 1) a real difference between a “treated” area and a “reference” area, 2) a real difference between years on a site, or 3) a real difference between the effects before and after treatment (i.e., impact) for a treated site and a reference site.

If probabilistic sampling of units from the study areas and time periods is implemented, then these mensurative experiments only lead to “design-based<sup>6</sup>” statistical inferences concerning the specific study areas and time periods. Estimates of parameters with confidence intervals and statistical measures of precision and accuracy apply only to the areas and times studied. Results of testing null hypotheses of “no difference” between sites, statistical power, and regression modeling apply only to the areas and time periods studied. The researcher may conclude that real trends or differences existed between the areas or times, but cause and effect relationships remain elusive.

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<sup>6</sup> Design based inferences are inferences that are justified by the design of the study and do not require additional strong assumptions.

Most statistical inferences in mensurative experiments, including tests of hypotheses, power, and regression modeling, are “model-based<sup>7</sup>”, i.e., statistical inferences are partially based on assumptions or a model. This includes results of statistical tests of hypotheses (e.g., Smith et al. 1993), simple and multiple-regression modeling (e.g., Zar 1999), and the generalized linear modeling (McCullagh and Nelder 1989). Fortunately, the assumptions required are often easy to justify and the methods give good approximate results. However, as above, non-subjective conclusions are basically restricted to changes, differences, and trends, among the specific study areas and time periods involved; causal relationships remain elusive.

Statistical inferences concerning cause and effect relationships beyond the observed “real” differences between specific study areas and time periods are made under assumptions that are difficult to justify and are subject to criticism. For example, hard conclusions concerning cause and effect relationships in a BACI design would seem to require the assumption that the replicate pairs are a random sample from some imaginary universe in space, and that the years are a random sample from time past, present, and future. Conjectured causal mechanisms might be stated as tentative working hypotheses bearing further study.

### ***Other Model-Based Evaluation Methods***

Discussion of evaluation/analysis in the above is from the classical “frequentist” approach to study of probability and statistical inference. There is a large and growing literature on use of Bayesian and other model-based tools (e.g., geostatistical methods) that can be applied in the evaluation/analysis stage of research and monitoring. Such methods have their detractors and cautions, because of the extra assumptions or models required, but can be useful when the conditions are reasonably satisfied.

### **Randomized Treatment Experiments**

Randomized treatment or manipulative experiments incorporate treatments (one or more of which may be designated as a reference(s)) that are randomly assigned to study units (Table RM&E-1, Hurlbert 1984). We prefer to use the term randomized treatment experiment because, in our experience, field biologists often conduct mensurative experiments where the habitat is “manipulated”, but without random assignment of treatments to units. The key difference between mensurative and randomized treatment experiments is that, in the latter, treatments (including references) ARE randomly assigned to study units. These “true” experiments generate the strongest conclusions of research results and require the minimum assumptions or professional judgment. Statistical conclusions concerning causal relationships are “design based” in the sense that they are justified by the randomization and design of the study. Cause and effect conclusions do not require strong assumptions on the part of the researcher. Bootstrapping, permutation methods, and other non-parametric statistical methods are directly applicable and require no strong subjective assumptions on the part of the researcher. Use of many classical statistical test statistics, e.g. Student’s *t*, and Fisher’s *F* give reasonable

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<sup>7</sup> Model based inferences are those that require assumptions (models) on the part of the researcher. For example, confidence intervals around an estimate of a parameter typically require the assumption that the estimator has a normal distribution.

approximations to the results of non-parametric methods even when the data are not normally distributed.

Generally, randomized treatment field experiments are conducted for a relatively short time period, i.e., perhaps for as long as 3 to 5 years. Randomized treatment experiments are relatively more common in laboratory studies than in field studies.

### ***Effectiveness Monitoring in RM&E***

Effectiveness monitoring is often conducted using randomized treatment experiments where objectives include establishing mechanistic or causal links between management actions and fish or wildlife population response (Table RM&E-2). Bisbal (2001) defines this level of effort as effects or response monitoring, the repeated measurement of environmental variables to detect changes caused by external influences. The key phrases here are “establishing mechanistic links” and “detect changes caused by external influences.”

The Action Agencies (2003) choose to refer to this level of monitoring as Tier 3 in their classification of study designs (Table RM&E-3).

Examples of randomized treatment experiments leading to effectiveness monitoring would include: 1) projects to evaluate the effects of different levels of fertilization on growth and survival of juvenile salmonids with streams selected randomly for reference and treatment groups; 2) projects to evaluate the survival rates of juveniles migrating past a dam with different levels of spill systematically assigned to time periods with a random starting point; 3) laboratory experiments to evaluate the swimming ability of lamprey through different types of ladders with lamprey randomly assigned to the different ladders; and 4) projects to evaluate the effectiveness of various watershed habitat treatments on survival of parr with treatments randomly or systematically assigned to watersheds. “Action Effectiveness Monitoring” as defined by the Action Agencies (2003) in their RM&E Plan falls into this category.

A good example of planning for effectiveness monitoring in a randomized treatment experiment in the Columbia basin was the original design of the Idaho Supplementation Study (ISS) on chinook salmon. However, randomized assignment of treatments to streams in this large-scale study was not conducted and the study has reverted to a mensurative experiment. The result is that objective unambiguous conclusions concerning the effects of supplementation (the treatment) are not justified by the study design. Inferences will be based on subjective judgment concerning the validity of assumptions and models. The ISRP cautions that large scale randomized treatment experiments as required to fully meet the effectiveness monitoring objectives of the Action Agencies (2003) will be difficult to accomplish in the Columbia basin.

### ***Effectiveness Monitoring with mensurative experiments***

Mensurative experiments may be conducted where the objective is to establish the effectiveness of various management actions (Table RM&E-2). In these studies the management actions are NOT probabilistically assigned to study units. If census or statistical monitoring are replicated on similar mensurative experiments over time and space, corroborative results of the studies can provide compelling evidence for general conclusions. Such a mensurative study can be quite powerful and quite convincing when many replications of experimental results occur, i.e. there is

establishment of the same relationships over several or many smaller studies. In this inductive sense, census and statistical monitoring in mensurative experiments do support research on cause of effects. The ISRP believes that this is the best study design for establishment of effectiveness of management actions in a large ecosystem such as the Columbia River basin. However, such conclusions require subjective judgment. Hard conclusions as to causal relations are not justified by the design of the study in mensurative experiments because many uncontrolled factors can influence the results.

## The Evaluation Component of RM&E

It is important to separate evaluation based on data collected as part of long-term ecological monitoring (usually, standard, everyday, every-year data collection from large areas and over long time periods) and evaluation of research projects. Research projects are usually relatively short-term, rarely more than three to five years, for investigation of specific hypotheses and must have well defined plans for analysis and evaluation. These plans must be described in the project's proposal for funding and results of the evaluation for ongoing projects must be reported. On the other hand, evaluation is also an important part of all monitoring and there **MUST BE** a perceived need and clear procedure for analysis of data being collected. Real time evaluation is important, as it allows detection of unusual events or changes, in time for them to be subject to additional scrutiny or study. However, evaluation in long-term ecological monitoring should be possible using simple methods with few assumptions, because data should have a long shelf life (in the range of 50 to 100 years minimum). In fact, the methods for evaluation of long-term census or statistical data in the future, say 2055, probably have not been conceived.

The ISRP has been insistent that all project proposals report or reference past achievements and that annual and final reports be issued on time and made available to the region. We have enjoyed good support from the Council in this effort. The ISRP has supported publication of evaluations, perhaps in a Columbia River Basin Journal supported by funds from the FWP (FY00 Council AIWP Vol. I., p. 21), and made the recommendation that "...CBFWA ... include in its Annual Implementation Work Plan a report of past accomplishments at the watershed and subregional/subbasin levels or topical level..." The Council agreed with these last two recommendations and expected subbasin plans to report past accomplishments. However, apparently no action has been taken on creation of a regional Columbia River basin Journal as a vehicle for data presentation and as a forum for advancing regional knowledge on FWP actions.

**Recommendation:** The Council should support publication of a Columbia River Basin Journal

## Systemwide Monitoring and Evaluation

Development of a system-wide monitoring and evaluation program is presently in a formative stage with three relatively new initiatives. First is a Fish and Wildlife Program project, "Collaborative, Systemwide Monitoring and Evaluation Project" (CSMEP) administered by the Columbia Basin Fish and Wildlife Authority (CBFWA). Second, Federal Action Agencies have

proposed a draft RME Plan entitled “Research, Monitoring & Evaluation For the NMFS 2000 FCRPS Biological Opinion” (2000 BiOp, Action Agencies 2003). At the time of this writing, the 2000 BiOp has been modified, but we assume the Action Agencies will continue to be involved in a system-wide M&E program. Finally, a cooperative M&E program in the Pacific Northwest is being proposed by an ad hoc partnership of biologists from concerned federal, state, and tribal agencies under the name Pacific Northwest Aquatic Monitoring Partnership (PNAMP 2004). The ISRP is supportive of current attempts to establish a cooperative system-wide M&E Program in the Columbia basin and the Council has voiced support by supporting the CBFWA project. We hope that these efforts yield improved data in the future on fish and wildlife populations and habitat in the Columbia basin.

**Recommendation:** The need to develop a coordinated, systemwide monitoring and evaluation program has been recognized by the ISRP from its initial reviews to the present, and we continue to recommend that the Council support the effort. The three new initiatives should be coordinated, and not redundant.

## Large Scale RM&E Programs for Tributary Habitat Recovery

We draw heavily from the Independent Scientific Advisory Board (ISAB 2003-2, with significant overlap of membership with ISRP) report entitled “A Review of Strategies for Tributary Habitat Recovery.” That report contains recommendations on design of research and monitoring studies to evaluate the effects of actions intended to recover or improve tributary habitat for fish and wildlife. The material is written primarily in terms of RM&E on fish populations and aquatic habitat; however, the basic principles apply equally well to RM&E of terrestrial wildlife and habitat.

Two general approaches exist to collect empirical data for evaluation of the effectiveness of tributary habitat restoration activities. The first is consistent with that currently promoted by the Action Agencies in their RME Plan (Action Agencies 2003). For example, a large number of pairs of sites (e.g., watersheds) might be located where the primary difference is that one site has a certain habitat improvement (e.g., removal of roads) and the other does not. Future changes in management would be uniformly applied to both members of a pair. As discussed above, this is a mensurative experiment because the treatments (e.g., road removal and reference) are typically not randomly assigned to the pairs of sites. Hard conclusions, e.g., that road removal reduces sedimentation in streams, are not justified by the design of the study. However, if enough pairs of sites are obtained and if the results are corroborative, then evidence is obtained in this inductive sense that a cause and effect relationship has been shown. If strong assumptions are made (e.g., that pairs of sites are well matched on all characteristics except the “treatment”) then model-based statistical methods can be used to quantify the strength of the relationship.

The second approach is to focus intensive evaluations in a few units (e.g., watersheds), a monitoring approach the state of Washington has termed Intensive Watershed Monitoring (IWM). The basic premise of IWM is that cause-effect relationships in complex ecosystems can best be understood by concentrating monitoring and research efforts at a few locations. Closely

spaced measurements in space and time are often required to develop a thorough understanding of the processes causing habitat or fish and wildlife population response to a management action.

In the first approach there are many replications of units or pairs of units, to yield an extensive study design. In the second, there are many replications of measurements within a few (perhaps more controlled) units, giving rise to an intensive study design. Both approaches would generally constitute mensurative studies; however, smaller scale randomized treatment studies are often embedded within the intensive design.

There are obvious advantages and disadvantages to each approach. The first attempts to draw inferences based strictly on the design of the study, but the number of restoration activities or combinations of activities that can be compared is severely limited. The second approach (e.g., IWM) limits inferences to a smaller number of sites with limited geographical coverage, but with intense study of more parameters and their relationships. The number of restoration activities or combinations of activities is again limited, but concentration of effort can focus sufficient resources and research expertise to begin to tease apart some of the complex interactions governing ecosystem response to combinations of restoration activities. Again, randomization of treatment and reference to relatively large watersheds is probably not practical, but perhaps some randomization can take place on streams within the larger units. Inferences concerning applicability of the conclusions to large regions are based on professional judgment in both cases. The primary disadvantages of both approaches are costs, limited inductive inferences to large regions, and logistical difficulties of dealing with relatively large and long-term research projects. However, logistical difficulties with unplanned changes in the study designs should be less with the IWM approach, because fewer sites are required.

Based on the collective judgment of the ISRP and ISAB, we recommend the IWM philosophy for the evaluation of effectiveness of these large scale tributary habitat actions. At the time of this writing, it appears that the region is moving toward probabilistic based status and trend monitoring for fish and wildlife populations and habitat, combined with intensive study of a few watersheds using the approach of the IWM.

## Retrospective Recommendations on Monitoring in Subbasin Plans

It is not easy to condense the advice given by the various government agencies to a simple set of recommendations on research and monitoring in the Columbia basin, e.g., for the effectiveness of habitat restoration actions in a subbasin. Further, the situations in different parts of a subbasin are likely to require different approaches, e.g., evaluation of effectiveness of habitat actions on forest lands might be integrated with the U.S. Forest Service monitoring procedures, while evaluation on private lands may require development of survey procedures. We believe the following four steps contain the essential elements for developing an appropriate RM&E plan in a subbasin of the Columbia basin:

1. Develop a sound census monitoring procedure (Action Agency Tier 1) for trend, based on remote sensing, photography, and data layers in a GIS. Landscape changes in terrestrial and aquatic habitat and land use should be monitored for the smallest units (i.e., pixels or sites)

possible. Future technology may allow low cost remote sensing of important parameters, such as water temperature. Accuracy and precision of data layers in the GIS should be evaluated using “blind” classification of randomly selected units by on-the-ground verification during field visits.

Relatively smaller-scale census monitoring for trend of habitat and fish populations might include data from all stream reaches in a watershed, complete fish counts and condition in bypass systems at dams, adult counts at dams, and adult counts at weirs. However, in practice, statistical monitoring (Action Agency Tier 2) for many field data collection methods is often more cost-effective because measurements can be made on a random or systematic sample of units and/or time periods.

2. Cooperate with Columbia basin-wide attempts to develop common probabilistic (statistical) site selection procedures for population and habitat status and trend monitoring. Use common protocols for on-the-ground or remotely sensed data collection. In so far as possible, measurement of indicator variables should be collocated on the same sites. Cooperate with status and trend monitoring plans being developed by the Action Agencies for implementation of the EPA EMAP probabilistic selection of aquatic sites in pilot projects in the Wenatchee, John Day, and Upper Salmon subbasins (BPA Draft Report “Research, Monitoring & Evaluation For the NMFS 2000 FCRPS Biological Opinion”). The implementation and refinement of subbasin plans provides the opportunity to promote the collection of research and monitoring data with common methods throughout the entire Columbia basin. Use of probabilistically selected sites should be made as soon as possible to avoid inherent biases in subjectively selected and non-collocated study sites.

3. As data are obtained on status and trends of wildlife or fish populations and habitat, develop empirical (e.g., regression) models for prediction of current abundance or presence-absence of focal species. Potential predictor variables include not only physical habitat variables (flow, temperature, etc.), but also measures of habitat recovery actions that are currently in place or are implemented in the future. Use the empirical models to evaluate the relative importance of physical factors and habitat improvements and to predict abundance or presence-absence throughout major sections of the subbasin. If adequate coverage exists with current study sites, it may be advisable to conduct initial analyses on current data.

4. Make best professional judgment, based on available data, as to whether any new research in the spirit of the Intensive Watershed Monitoring approach should be instigated immediately. Most new intensive research should arise as a result of the interaction of existing inventory data with new data arising in population and habitat status and trend monitoring.

The ISRP judges that the approach in these four steps is the most likely to accomplish successful large-scale, long-term RM&E programs. An extensive long-term status monitoring program identifies important and unexplained trends and changes, i.e., identifies the intensive research that if conducted would explain the “why.” Census monitoring for trend by remote sensing procedures and statistical monitoring provide indications of trend and change in indicator variables, but the “why” of certain trends and changes is usually not well understood. For example, the status monitoring may indicate that a major and unexpected increase in juvenile fish production occurred in a watershed with high summer water temperature and low flow

during the period 2010 to 2020. Why? A population of bull trout is detected in an area in 2035 where current knowledge and logic indicate they should not exist. Why? Thus, census or statistical monitoring lay the ground work for wise choices about when and where more extensive or intensive research-oriented monitoring (Action Agency Tier 3) is needed.

## The Role of RM&E in Proposal Reviews

The 1996 amendment to the Northwest Power Act directs the ISRP to review projects in the context of the Council's program and in regard to whether they: "...4. have provisions for monitoring and evaluation of results". This directive agrees closely with the judgment of the ISRP, and we have insisted that all projects have provisions for not only implementation monitoring but also low cost monitoring to indicate benefits to fish and wildlife. We do not recommend an intensive research project to detect changes and explain why changes occurred on every project. But, we do expect simple cost-effective monitoring to detect benefits to fish and wildlife by the project sponsor. Monitoring may be as simple as comparing photographs taken of riparian stream bank habitat at fixed points every five years, documenting that anadromous fish are spawning in an area previously blocked by an irrigation diversion dam, or documenting that fish from a net pen operation are showing up in a state fish and game department creel survey.

Most project proposals should also document larger scale monitoring provided by another FWP project or other government agency. Relevant data from larger scale monitoring projects should be reported in proposals. Cumulative effects of many small habitat improvement projects in a watershed are probably best monitored by larger scale probabilistic based status and trend monitoring. Ongoing projects should include summaries of monitoring data, figures, and tables, even if the monitoring is conducted by another project.

The 1996 Amendment includes ISRP review criteria specifying that proposals include evidence of benefit to fish and wildlife. ISRP recommendations have focused on this criterion, and Council decisions have in most cases backed the ISRP in these recommendations. For example, "Therefore, the Council calls upon the ISRP to continue to identify those projects that fail to adequately include monitoring of results, and/or methods or provision for evaluation against stated objectives as it conducts its review of projects proposed for Fiscal Year 2001 and future years" (Council decisions on Fiscal Year 2001 proposals). The Council has voiced support for a strong M&E component in their Fish and Wildlife Program. For example, during development of the current program the Council wrote "The program's success cannot be measured and demonstrated without an adequate monitoring and evaluation framework. It is anticipated that a more regimented program framework will facilitate the design of a more robust and effective monitoring and evaluation program. The Council firmly believes that this should be a major objective for the next program. In addition, there is a need to better coordinate with the numerous data collection and management activities and institutions in the basin. There is a need to better coordinate and normalize monitoring and evaluation activities whether they occur as part of the program or otherwise."

## Role of Databases in RM&E

In 1999, the ISRP recommended an independent review of databases and data management efforts. The Council concurred with the recommendation, and an independent review by the ISRP was completed in 2000 (ISRP 2000-3).

There is an obvious need for storage of primary data and metadata collected in RM&E efforts in the Columbia basin. The ISRP's overall impression has been that the various database centers are doing reasonably well with the data they are given. It is not their fault that data gaps exist, that incompatible methods are used by the various agencies in the basin, or that agencies/projects fail to provide public data to the database operators. The Council has generally agreed with our assessment and has recommended corrective actions. However, progress is slow and, at the time of this report, much remains to be done to resolve these problems and make the databases more useful.

### **Failure to Provide RM&E Data to Databases**

The failure of some projects to report on progress (or the lack of progress) toward project objectives and to provide primary data and metadata to the databases of the region has been a recurring concern of the ISRP. Programs should not be permitted to continue without demonstrating that they are making significant progress toward their objectives and providing data to verify any conclusions. If there are restrictions on data use (e.g., locations of sensitive species or a restricted-use time period for preparation of reports and manuscripts), then the restrictions should be specified and justified. In principle, all data obtained through public funds should be available to the public and recorded in the region's databases.

The ISRP has been surprised to find that data from some long-term ongoing projects of high interest for the evaluation of recovery efforts are not readily available to the Council. For example, data and metadata from the "Idaho Natural Production Monitoring and Evaluation Program" (Project no. 199107300) were not available in Streamnet at the time of the ISRP review of the Mountain Snake Province (ISRP 2001-12A) although their following objectives are of high interest:

1. Manage and collect long-term monitoring data for wild/natural steelhead trout and spring/summer chinook salmon populations in Idaho,
2. Measure changes in wild/natural steelhead and spring/summer chinook productions attributable to habitat enhancement projects, and
3. Estimate life cycle survival for wild/native steelhead and spring/summer chinook."

Council decisions have been supportive of the ISRP's recommendations that data of all projects be made available via the program's database projects. For example, in the review of the Hood River Production Program, 2002, the Council requested Bonneville to establish a specific contractual requirement for reporting of the program's monitoring data to Streamnet.

## Need for Metadata in Databases

It is critical that metadata (the methods by which the data were collected) be archived in a database structure that maintains the association between primary data and their pertinent metadata. Monitoring data are intended to have a long shelf life (e.g., 50-100 years) and, if the methods are not available, the usefulness of monitoring data is severely limited.

We have recommended adoption of a policy requiring that the reporting requirements for projects funded by the program include requirements for delivery of primary data, and their associated metadata, in a standard machine-readable format, within a specified period of time. Compliance with this policy should be a condition for continued funding. The Council has been supportive of this policy.

## Overlapping Responsibilities of the Program's Databases

Early in our reviews of the FWP, the ISRP raised the possibility of overlap in responsibilities of the database projects. We have since concluded that the amount of money that could be saved by curbing the small amount of redundancy that exists between data management projects (primarily between Fish Passage Center and DART) is not significant. Cost of the overlap pales in comparison to the problem of meeting significant basinwide data gaps. We have recommended continued support of the database programs, and the Council has agreed.

## Inconsistent Implementation of ISRP and Council Recommendations in the Oregon Portion of the Columbia Plateau

Ongoing Project #199801600 (ODFW, "Monitor Natural Escapement & Productivity of John Day Basin Spring Chinook") was recommended for funding by the ISRP as expanded by the ODFW to include portions from Proposal #25088 (ODFW, "Salmonid Population and Habitat Monitoring in the Oregon Portion of the Columbia Plateau"). In response to ISRP reviews of #199801600 and #25088, ODFW responded that they

*"....expanded this project to create a comprehensive proposal to include all monitoring and evaluation for all anadromous salmonid lifestages and habitats in the Oregon portion of the Columbia River Plateau Province. Specifically, the proposal has been changed to add objective 1 (Oregon Plan approach for steelhead adult, salmonid juvenile abundance, and salmonid habitat) and objective 2 (steelhead smolt production) from project #25088. In our original submission of proposal #199801600, we had already proposed to integrate the EMAP sampling approach into the ongoing adult chinook surveys. Thus, this project (#199801600) includes a coordinated approach using Oregon Plan EMAP design for all chinook salmon and steelhead adult monitoring, juvenile salmonid abundance monitoring, smolt production monitoring, and salmonid habitat monitoring for the Oregon portion of the Columbia River Plateau Province."*

Project #199801600 as amended was recommended by the ISRP, approved by the Council and forwarded to BPA for funding. However, during establishment of the contract with BPA, the use of the Oregon Plan EMAP in the Deschutes, Umatilla, and the Walla Walla subbasins was

removed from the ODFW statement of work by BPA and not funded. This project was approved as a showcase pilot project for M&E. The ISRP objects in the strongest possible terms to the modifications of projects by BPA outside the review process of the Council's Fish and Wildlife Program.

**Recommendation:** The ISRP repeats its recommendation from the process section that the consistency of BPA funding decisions and contractual Statements of Work for projects be compared with the technical aspects of proposals that were recommended by the ISRP and approved by the Council.

### Inconsistent Recommendations by the ISRP in the Grande Ronde

In retrospect, the ISRP regrets that its support for use of the Oregon Plan probabilistic site selection (EMAP) in a pilot project on the John Day had a negative effect on its implementation in the Grande Ronde Project no.199202604 "Investigate the Life History of Spring Chinook Salmon and Summer Steelhead." The ISRP gave the Grande Ronde project a Fund in Part designation supporting all aspects of the project except the EMAP activities, assuming that the EMAP pilot project in the John Day would be fully implemented as the primary demonstration project. The ISRP reasoned that a demonstration of results by the approach in the John Day would be most effective in communicating the benefits of the Oregon Plan. However, the ISRP did not fully understand the objectives of the sponsors and NOAA Fisheries for monitoring results of habitat management actions underway and planned for the Grande Ronde. Bonneville supported funding the project with the exception of the EMAP tasks. In regional discussions, the EMAP tasks were never taken into consideration, since they failed to gain the endorsement of the ISRP and would not be a part of any Council recommendation. In retrospect, the lack of support for the Grande Ronde project was probably a mistake given the support and planning of its sponsors.

### Coordination of Monitoring of Marked Smolt and Adults in the FWP

The ISRP has recommended (ISRP 1998) that Smolt Monitoring, PIT Tag, Radio Telemetry Technology, and Coded Wire Tag projects should be subjected to a comprehensive programmatic review that gives special consideration to the complex interactions between the projects. To this list, we would now add the sonic tag projects. The Council concurred with the recommendation. Although the ISRP reviewed the set of projects in the Mainstem and Systemwide Reviews in 2002, the ISRP envisions a more comprehensive overall programmatic review than can be accomplished during a standard proposal review process. Critical components needing review include the PIT tag projects, mass marking of hatchery fish, and the CWT projects.

**Recommendation:** The ISRP recommends that the Smolt Monitoring, PIT Tag, Radio Telemetry Technology, Coded Wire Tag, and Sonic Tag projects be subjected to a comprehensive programmatic review.

### **Pit-Tags in RM&E**

Much has been learned about survival and return rates of salmonids based on PIT-TAG technology. Unfortunately, there is not a coordinated annual operations and management project for application of PIT-TAGS in support of long-term monitoring and evaluation of out-migration survival of juveniles and return rates of adults. Fortunately, there have been enough special interest research projects in the past, e.g., the Comparative Survival Study, to provide large numbers of PIT-tagged anadromous juveniles for analysis. At the time of this report, it does not appear the ISRP's recommendation for a coordinated effort to ensure adequate PIT-tagging of anadromous juveniles has been fully appreciated by the Council.

### **Coded-Wire Tags and Mass Marking in RM&E**

Several proposals were related to the application of coded-wire tag technology. This technology has been effective for many years as a way of rapidly and indelibly marking juvenile salmonids (often at hatcheries) with tiny bits of metal on which an identifier code is etched. Coded-wire tags are the principal means for identifying origin of fish harvested by commercial fisheries and are also used for other stock-identification purposes. The technology thus serves multiple and important uses for the FWP. The current CWT program represents a complex set of projects, many of which might be incorporated into a single program proposal, experimental design, and administrative oversight.

The use of mass marking and selective fisheries will have far-reaching negative effects on interpretation of current data and treaty requirements with Canada. Complete redesign of the CWT program may be required. The negative effects of mass marking and selective fisheries on the CWT program have been recognized by the scientific community, but have not been broadly addressed by the Council and other responsible agencies at the time of this writing. The need for an overall programmatic review of monitoring of marked smolt and adult fish remains.

### **RM&E of Supplementation and Hatcheries**

Much has been written by the ISRP concerning the need for better monitoring of hatchery fish once they leave the hatchery. In particular, there has been a clear need expressed for monitoring of reproductive success of hatchery fish spawning in the wild and long-term effects of supplementation and straying of other hatchery fish on naturally spawning populations. The issues are complex and are addressed in more detail elsewhere in this retrospective report (see Supplementation Section). The Council has generally agreed with the ISRP's assessments of the need for RM&E of effects of supplementation and straying.

## Resident Fish RM&E

With the exception of bull trout and white sturgeon, RM&E of resident fish populations has tended to receive less attention and lag behind that for anadromous populations in the FWP. Most of what we have written about RM&E for anadromous species applies to resident species.

## Specific Recommendations for Terrestrial RM&E

It is unfortunate that a good model for probabilistic sampling and inventory of terrestrial components of large subbasins does not exist. The National Resources Inventory (NRI) has studied long-term changes in cultivated agricultural lands and has initiated pilot projects to monitor grazing lands on private property in Washington, Oregon, and Colorado. The Forest Service has its Forest Inventory and Analysis program, but it does not extend easily to other land uses and is not really appropriate for many terrestrial wildlife parameters. The Bureau of Land Management apparently has little to mimic. The EPA Environmental Monitoring and Assessment Program (EMAP) is helping some of the states instigate valid probabilistic sampling for certain aquatic parameters. In short, there is not a good existing program like the Oregon Plan for aquatic monitoring on which statistical monitoring of terrestrial habitat and populations might be attached or modeled after.

Implementation of subbasin plans allows the opportunity to help implement a coordinated statistical monitoring program for estimation of key terrestrial parameters over subbasins and to influence the direction of terrestrial monitoring for the entire Columbia basin.

**Recommendation:** The ISRP recommends that a general protocol for probabilistic selection of terrestrial sites be developed and included in a basin-wide plan or appended to the subbasin plans.

**Recommendation:** ISRP reports have often included the recommendation that better attention be given to M&E of extensive active management (including comparison with passive management) to better understand when the high cost of such ongoing actions is actually justified. Unfortunately, not much progress has been made in this area. The ISRP recommends that overarching coordinated monitoring be used to evaluate effectiveness of alternative land management practices.

## Wildlife Monitoring and Evaluation

Habitat Evaluation Procedure (HEP) makes sense as a method for defining losses of land and of habitat. It also makes sense as a conceptual approach to wildlife habitat acquisition and restoration. Indeed, the wildlife portion of the Council's FWP is based on the HEP concept, and land acquisitions are pursued and accounted for using the HEP currency. While the ISRP does not contest this approach or the policy decisions behind it, we continue to have concerns that the monitoring and evaluation of wildlife projects and programs should not rest solely on a HEP-based analysis.

**Recommendation:** The ISRP recommends that HEP-based management projects or programs should include a monitoring and evaluation component that routinely assesses the expected versus actual responses of both target and non-target wildlife species.

## B. Mainstem

### Background

From the outset of fisheries mitigation research in the basin by the Corps of Engineers in the 1930s and the Northwest Power and Conservation Act's mandated (BPA-funded) Fish and Wildlife Program since 1982, mainstem issues on the Columbia and Snake rivers have held center stage. Even the extensive hatchery developments in the Basin are an offshoot of losses of spawning habitat and high mortalities of migrating smolts in the mainstem. It is only recently that comparable attention has been directed beyond the mainstem toward upstream, tributary habitats. The ISRP was formed by mandate from the Congress in 1996, contemporaneously with major declines in salmonids in the Basin (and listing of several under the Endangered Species Act), largely seen as declining numbers of adults returning to mainstem dams and reduced numbers of smolts migrating downstream past dams.

Issues at the forefront of attention at the time the ISRP was formed still largely pertained to the mainstem: smolt survival through the hydrosystem (particularly flow-survival relationships and monitoring of it), purported benefits of drawdown of reservoirs to speed migration rates, gas supersaturation due in part to increased spilling of water at dams to avoid passing smolts through turbines, predator control, excessive harvest, and the support of the multi-agency PATH process (Plan for Analysis and Testing of Hypotheses) aimed at resolving management disputes over mainstem smolt passage by assembling knowledge in computer models. However, at about the same time, the ISG's *Return to the River* report and NRC's *Upstream*, in particular, added new dimensions. They stressed consideration of the mainstem as a habitat for life functions rather than just a migration corridor (including the need for normative flows more like historical flows), a fuller consideration of full life-cycle components of salmonid success (and decline), and the need to protect biodiversity among salmonid species and populations.

Independent scientific review of the mainstem programs has been, in many ways, a blend of the work of three predecessor groups. The independent, peer-review functions of the ISRP were adopted and expanded from the existing functions of the SRG, the ISG, and its successor, the ISAB. This functional blending was workable because there was a large overlap in membership. The 1999 congressional mandate for the ISRP to review the BPA's reimbursable program as well as the direct-funded program shifted some mainstem review functions from the ISAB to the ISRP. The first mandated ISRP review of the reimbursable program, conducted in 1999 (ISRP 99-1), actually relied on the ISAB's recently completed congressionally directed Corps Capital Program review. For that review, the ISAB had completed a series of reviews and reports covering Corps' projects and studies related to adult passage, John Day Dam extended length turbine intake screens, the Bonneville Dam bypass system outfall, and dissolved gas. In addition, the ISAB had provided a broader conceptual view of the Corps' mainstem program (ISAB-99-4). The Council adopted the ISAB's reviews and provided the Congress with a summary report and

recommendations for the Corps' Columbia River Fish Mitigation Program (CRFMP; Council Report 99-5), a program largely concerned with fish passage at the mainstem dams. The second ISRP review of the reimbursable program, conducted independently in 2001, covered the decision-making process on Bonneville Powerhouse I bypass options (ISRP 2001-11). The latest review, of the project selection process of the Corps' FY 2004 Anadromous Fish Evaluation Program (AFEP), a component of the CRFMP, was conducted by the ISRP (ISRP 2003-14; ISRP 2004-8).

The ISRP, in conjunction with the ISAB, influenced the mainstem aspects of the Council's program in several ways. It fostered implementation of the broader dimensions recommended in *Return to the River* and *Upstream*, instilled scientific rigor of peer review for all BPA-funded projects in the Council's Fish and Wildlife Program (including need for context and justification), and initiated (and often carried out) in-depth analyses of topical areas to better focus needed attention. Early in its existence, the ISRP pointed out the uneven level of expenditures among topics, particularly the overwhelming attention to the mainstem (and to artificial production activities) to the detriment of other geographic locations important for salmon recovery that also needed attention.

This section reviews mainstem topics, including the ISRP's annual reviews of proposals for the mainstem (and the Council's treatment of those recommendations), the Council's Mainstem Amendment to the Fish and Wildlife Program, the introduction of the Reimbursable programs to ISRP review, the lack of consideration of the mainstem in Subbasin Plans, other species besides salmonids that are of concern in the mainstem (white sturgeon, Pacific lamprey, American shad, and other exotic fish species), and predator reduction programs. The ISRP's view of the future of the mainstem is offered also, as a guide to what we believe can be expected to be included in subsequent ISRP and Council deliberations about the mainstem. ISRP recommendations that are still not acted upon are highlighted.

## Annual Reviews of Proposals in the Fish and Wildlife Program

In its initial formal review of proposals for BPA's directly funded program and the FWP as a whole in 1997 (for FY 1998 funding), the ISRP noted the laundry-list quality of the measures in the 1994 FWP and the existence of several competing recovery plans (e.g., FWP, *Wy-Kan-Ush-Mi Wa-Kish-Wit*, 1995 Biological Opinion) (See ISAB 1999-3). The ISRP recommended that all migration-related research, monitoring, and management be coordinated and integrated across agencies and tribes. The Council agreed that more coordination was needed and opined that the PATH process was supposed to accomplish it. The Council considered the ISRP's coordination recommendation an issue not for a funding recommendation, but to be accomplished in other ways. There ensued a flurry of attempts in the basin to foster coordination, culminating in the current hierarchical structure of decision-making and consultation. The Council heeded the call for integration in the FWP with a long-term strategy of incorporating an integrated framework into the next FWP amendments. This integrated framework was the basis for the 2000 FWP.

Also in this initial review, the ISRP pressed for implementation of the *Return to the River* recommendations concerning the mainstem as fish habitat and a fuller consideration of the entire life cycle of salmon. As a consequence, the Council set aside funds for two specific analytical

studies, one on mainstem habitat and one on population structure, as a prelude to funding mainstem habitat research. The first study assessed historical and current records to identify the amount of mainstem fish and wildlife habitat and riverine processes that were lost as a result of development and operation of the Columbia River hydroelectric system. It identified the historical “hot spots” for salmon production downstream of the current limits to anadromous fish passage as an indicator of habitats to preserve or restore. The second study assessed population structure of Chinook salmon in the context of current theories of habitat structure and population (metapopulation) variation. It emphasized the importance of water temperature, not just as a physiological stimulus, but as a driver of population segregation. Both studies were published by the Council and have guided further research and mitigation. Both were subsequently published in the peer-reviewed literature (Brannon et al. 2004; Dauble et al. 2003).

The ISRP, somewhat frustrated by the plethora of mainstem projects devoted to the flow-survival issues and the persistent disagreements between competing models from PATH, recommended that there be a quantitative evaluation of assumptions upon which structural (e.g., passage facilities) and operational (e.g., flow augmentation) measures in the FWP and Recovery Plan are based. The Council declined to recommend funding for additional assessment beyond what was being done by PATH. The inability of PATH to self-critique its assumptions eventually led to the discontinuation of PATH in subsequent years, following a recommendation from the ISRP.

In this same vein, the ISRP recommended a “thorough peer-review evaluation of the effectiveness of high-cost actions” in the mainstem, specifically naming the smolt monitoring program, predator control bounties, and biological studies of gas supersaturation. Each appeared to be due for evaluation for attainment of goals and possible redirection of effort. The ISRP believed that the smolt monitoring program, although of high quality, should give more attention to analyses that try to answer critical uncertainties about alternative management practices than to more routine monitoring and “counting” activities. The ISRP wondered whether the predator control program could find more cost-effective ways to reduce predators. The ISRP questioned whether further gas supersaturation research was needed when the physical and biological causes of the gas supersaturation and biological effects are well known and engineering solutions are available. The Council did not recommend new peer-review efforts, but in subsequent years requested in-depth reviews of the smolt monitoring and predator-control programs by the ISAB or ISRP that resulted in major realignments. The predator control program is discussed further below. The Council noted that NMFS had commissioned a Dissolved Gas Team to review that topic, and awaited its results before changing the research agenda. Subsequently, the NMFS team, a CBFWA review and an ISAB review of the dissolved gas issue resulted in scaling back of research to a monitoring level and implementation of engineered control measures, which are now well institutionalized. The Council added the PATH process as another high-cost action in need of review in FY 1999. It recommended that the PATH work be funded on a time-and-task accounting basis and not be considered as non-discretionary funding by BPA outside the normal Council/ISRP review process. The Council recommended a thorough review of all BPA non-discretionary projects for their relevance to the FWP and the ESA-driven recovery program (an issue that was to continue between the Council and BPA for several years).

With the 1997 (FY 1998) review, discussed above, having been oriented largely toward programmatic issues, the ISRP review in 1998 (for FY 1999) focused more on individual

projects, including those in the mainstem. The ISRP recognized that there were several proposals related to smolt monitoring and recommended that they all be incorporated into an umbrella proposal that clearly justified the various elements and defined their relationships. A programmatic review was again recommended, as was establishment of a multi-year funding track. The Council recommended a review of the smolt-monitoring program by the ISAB, which was subsequently carried out. The ISRP also noted a lack of good proposals for protection and enhancement of mainstem habitat and recommended that the Council place more emphasis on ways to enhance habitat of the naturally reproducing salmon populations in the mainstem. With no formal proposals in hand, the Council had no recommendation to make in its response to the ISRP to address this concern other than to remind that the special studies on habitat and population structure recommended the previous year were just getting underway.

The FY 1999 review was the first in which the Council received independent recommendations from the ISRP and CBFWA. The ISRP tallied the respective proposal recommendations and noted agreement and disagreement. Three of the “disagree” proposals (ISRP recommended but CBFWA did not) were for work proposed for the mainstem: Monitoring and Evaluation Statistical Support, Use of Unsteady Flow to Aid Mainstem Passage of Juvenile Salmonids, and Inventory of Resident Fish Populations in the Bonneville, The Dalles, and John Day Reservoirs. The ISRP recommended they be funded, but only the first was included in the regular funding cycle, while the second was eventually funded as a one-year innovative study under a separate solicitation.

For FY 2000, the ISRP had several general comments in addition to comments on specific proposals, some reiterated from previous year’s reports. The ISRP reiterated its recommendation that projects related to smolt monitoring be combined and subjected to a comprehensive programmatic review that gives special consideration to the complex interactions between projects. The Council concurred and commissioned the review by the ISAB. The ISRP also recommended an independent review of the data management efforts that were supported by the direct funded program before funding would be continued beyond FY 2000. This recommendation resulted from the numerous (perhaps overlapping) data-management projects and some expressed discontent with how the data centers were operated and used. The Council concurred and commissioned the ISRP to conduct the review, which was accomplished and published (ISRP 2000-3). (See M&E Section.)

The ISRP identified that work on wild stocks of salmonids was poorly represented among the proposals reviewed for FY 2000. It recommended that monitoring of the remaining wild spawning populations be targeted as a priority for FY 2001 and that a request for proposals be issued. The Council concurred with extending priority to wild stocks, but declined to issue a special request. This was primarily because of an intended shift to a province-based review process in the future, with sub-basin plans that should identify wild stocks in need of attention. The Council further encouraged the ISRP to highlight topics needing attention, under its statutory review criterion of benefiting fish and wildlife. In a related comment, the ISRP reiterated its support for emphasis on protection of mainstem-spawning stocks, which the Council pledged to include in its goals for the new 2000 FWP.

In a particularly auspicious recommendation for FY 2000, the ISRP called for the honorable retirement of the PATH projects, which were largely devoted to mainstem issues. PATH had effectively conducted cooperative modeling and analysis, but had recently become mired in controversy over competing models. A fresh start based on new data and modeling was seen as needed. Primary tasks for a new process would be to address data collection design issues for the basin, identify data needs that are critical to the actual management questions, and ensure that data needs are met in a coordinated and efficient manner. The Council concurred with the recommendation and referred to the ISRP's 1999 *Response Review* in which such a transition was first raised. The Council outlined specific recommendations for the follow-on to PATH, including transition funding with 13 specific tasks, and additional tasks specific to data collection, analysis, and management. The PATH modeling process has now been superceded by other coordinated modeling and analysis efforts largely directed to the ESA issues of population sustainability (principally by NOAA Fisheries). A plan for revision of the region's data system was commissioned by the Council and is currently being acted upon. (See M&E Section.)

With the Council's Provincial Review process in place in 2000, the mainstem projects were not reviewed again until the Mainstem/Systemwide Province rolled around in 2002, near the conclusion of the two-year provincial review cycle. At this time, projects became much more aligned to the specific actions in NMFS's 2000 Biological Opinion than to the Council's FWP. The Council's program, moreover, was in a revision mode, with only a framework and general principles having been adopted (specific actions were to be derived subsequently from sub-basin plans being developed in 2002-2004). Nonetheless, several mainstem issues of concern surfaced in 2002.

The ISRP noted the continuing difficulty in estimating smolt-to-adult survival rates (SARs) through the hydrosystem. The best formulas were complicated, convoluted, and, in general, very unsatisfactory from a statistical point of view. Accordingly, the ISRP saw a high probability that these methods would continue to spawn arguments and counter-arguments over trivial issues that would occupy the human and other resources of the region, because the stakes are high: e.g., high costs of spill, high costs of transportation, unknown long-term effects of the non-normative transportation option, and high costs of flow augmentation. The primary solutions appeared to require detection of sufficient numbers of PIT-tagged juveniles passing Bonneville 2 Dam, sampling of PIT-tagged fish in the new Corner Collector at Bonneville 2, and/or obtaining sufficiently large sample sizes of PIT-tagged fish downstream of Bonneville. The ISRP recommended the Council and the Corps give high priority to PIT-tag detections at the Corner Collector. This recommendation was acted upon by the Corps.

The issue of Hanford Reach stranding was raised anew in review of a proposal to analyze mechanisms of stranding there. The adequacy of the amended Vernita Bar Agreement of February 25, 2002 was questioned for its efficacy in protecting juvenile fall Chinook from stranding. The ISAB had a particular interest in this stranding issue and in 1999 had recommended to the Council that a revision of the Vernita Bar Agreement be adopted to extend protection to emigrating fry (ISAB 99-5). Grant County PUD led numerous parties in development of a new agreement. Subsequently, the new agreement was discovered to have loopholes that led to less than desirable levels of protection (inadequate specification of frequency, duration and rapidity of flow fluctuations, and lack of field monitoring at times when

stranded fish would be observed). The ISRP recommended that the new agreement be modified to correct the problems with flow specifications and inclusion of nighttime fish observations. The Council concurred, and recommended funding of the proposed study to inform possible changes in flow management.

The ISRP once again addressed the gas bubble disease issue, because of its continuing cost to the basin. The ISRP requested a review that would cover the status of the Corps' installation of dissolved gas mitigation at mainstem dams, use of models of gas saturation in the hydrosystem during spill as a substitute for continual monitoring, the actual risk to salmonid populations considering various routes of passage, acceptability of the 120% gas cap for both migrants and resident aquatic organisms (and reexamination of the EPA water quality standard of 110%), and possible development of a gas bubble disease "SWAT team" to monitor dissolved gas and aquatic life primarily during floods and emergency outages that cause dissolved gas to rise unexpectedly and to dangerously high levels, such as above 130%. The latter was suggested as a possible alternative to routine monitoring under conditions that may not pose risk. To our knowledge, there has been no movement by any agency to conduct such a specific review, but regional negotiations among agencies settled on workable guidelines within acceptable levels of uncertainty. The gas cap and monitoring gas saturations have become well institutionalized in the basin, and research requests have diminished.

Delayed (latent) mortality in the estuary and ocean from possible sublethal damages to juveniles incurred in passage through the hydrosystem is an issue addressed in the NMFS's 2000 Biological Opinion that has spawned proposals for study through the FWP. The ISRP believed that these concepts, developed largely from modeling exercises that showed otherwise unexplained fish losses, deserved rigorous biological testing for verification. The Council agreed and recommended funding.

Somewhat surprisingly, the ISRP was not engaged in debates over smolt transportation. Transportation had been thoroughly reviewed by the ISG prior to formation of the ISRP. The ISRP consistently supported the continuing evaluations of the benefit (or not) of transportation in studies of smolt survival and smolt-to-adult returns, largely by NMFS.

## Mainstem Amendment

In 2003, the Council adopted a specific Mainstem Amendment to the Fish and Wildlife Program. Many of the ISRP (also ISG and ISAB) recommendations are included in this amendment. A particularly contentious part of the Mainstem Amendment was the provision that the operations of Hungry Horse and Libby dams in Montana be reevaluated and modified to minimize reservoir drawdowns there in the biologically productive summer months and stabilize outflows to reduce ecological damages to the reservoirs and river reaches immediately downstream. The ISAB had previously reviewed biological studies of these Montana reservoirs and rivers and concluded that there was good evidence for ecological damage (ISAB 1997-3). The established dam operations were in place largely because of mandates from the NMFS 2000 Biological Opinion that were intended to provide flow augmentation in August for the lower Columbia River to enhance migration of ESA-listed underyearling fall Chinook salmon from the Snake River. In 2003, the ISRP was asked to conduct a special review of a proposal by Montana biologists to further

document the damages to Montana fish from the current operations. The ISRP noted the general high quality of the proposal, but concluded that the real issue was one of comparing effects on resident fish and their ecosystems with effects on downstream salmon, yet a comparable downstream study was not proposed (ISRP 2004-3; ISRP 2004-6). When Montana formally petitioned NMFS for the changed operations, the Council asked for review by the ISAB in conjunction with a fact-finding workshop (November 9-10, 2004). The ISAB was asked to consider a possible design for a downstream study. It concluded that the Council's amendment provision for changed operations was reasonable and that, because the expected effect on downstream flow and survival was small, the ability to demonstrate an effect on downstream salmon was very problematic (ISAB 2004-2). The Council responded by seeking to have the operations approved by NMFS with a study to determine if flows in the lower Columbia River were actually affected by upstream releases (the operations change was not approved, and the study not completed).

**Recommendation:** Flow changes in the lower Columbia River attributable to water releases from Hungry Horse and Libby dams should be quantified as a first step toward evaluating benefits of this flow augmentation on migrating smolts.

## Reimbursable Program

Because the ISRP initially relied on, and essentially adopted, the ISAB's several reviews of mainstem issues for its early evaluation of the reimbursable program, the Council responded to the recommendations of the ISAB for its 1999 report to the Congress on the Corps' mainstem Columbia River Fish Mitigation Program (Council Report 99-5). The Council recommended that the entities that participate in decisions regarding mainstem modifications revise their processes and criteria to the extent necessary to be consistent with the principles, guidelines, and ecosystem perspective outlined by the ISAB. Key recommendations were to protect biodiversity and to favor passage solutions that best fit natural behavior patterns and river processes.

There were specific issues, as well. The Council concurred with the ISAB/ISRP recommendation that surface bypass technologies be developed and tested at mainstem lower Columbia River dams as well as in the lower Snake River dams. The Council concurred with the recommendation that the Corps should continue implementation of its Gas Abatement Program as a high priority, including coordination with the Transboundary Gas Group to abate high dissolved gas throughout the international basin. The abatement program was to take priority over additional biological studies, as the ISAB had recommended. The Council concurred with the ISAB's recommendation calling for additional research and monitoring of the effect of elevated temperature on the stress and survival of both juvenile and adult salmonids passing through the mainstem. The recommendation included the need to identify and implement all feasible structural and operational measures to reduce water temperatures in fish passage facilities as well as in the eight mainstem reservoirs. The Council concurred with the ISAB's concern about the effectiveness of extended-length screens in general and the John Day Dam screens, in particular. A prototype screen was recommended that would test the ISAB's concern that such screens selectively favor some species over others, and may increase fish injury and debris loads in the bypass systems. Full installation of such screens at John Day would be

deferred until the prototype tests were completed and parallel surface bypass and spill evaluations were farther along (a process still underway).

The Council also concurred with the ISAB recommendation that correction or prevention of adult passage problems be given more attention. The widely held assumption that adult passage problems had been solved was doubted. The accuracy and precision of counting adult salmon passing dams needed improvement. On the issue of relocating the Bonneville Dam bypass outfall, the Council concurred with the ISAB that this should proceed to completion, but that the whole fish-passage strategy for Bonneville Dam should be re-evaluated in light of protecting biodiversity and matching natural fish behavior patterns. The 2001 ISRP review of Bonneville Powerhouse I bypass options and subsequent exchanges of responses was an iterative process in which the value of the Corps' "risk analysis" using the model SIMPAS was evaluated and discussed, although the Council took no further formal action.

As discussed in the section on ISRP process above, the ISRP was asked by Council in 2003 to review the project selection process used by the Corps of Engineers for funding its mainstem fish passage research under the Anadromous Fish Evaluation Program (AFEP). This program had been in effect for several years, and an annual sequence of steps was in place, including solicitations, reviews of preliminary proposals, selection, contracting, and annual presentation of results at a public meeting. The ISRP was asked to evaluate the Corps' process and the proposed work as it might evaluate proposals in the Council's FWP process. The ISRP found that the process did not allow an independent review of proposals comparable to those for the FWP. The preliminary proposals were generally incomplete (ISRP 2003-14), and final proposals were either not provided or came too near the actual fieldwork to allow peer review (ISRP 2004-8). The Corps has very specific needs for fish passage studies in the mainstem, and the proposals were largely work statements from pre-selected contractors. In only a few cases were there competitive proposals for similar work. Although the program was judged to be quite productive, the ISRP noted that the ISAB had earlier said that the Corps could save time and money by conducting selective laboratory studies rather than immediately engaging in expensive, time-consuming, full-dimension tests at the dams. The Council and Corps used the ISRP report to increase coordination on developing a regional research plan.

**Recommendation:** Further integration and coordination of the mainstem projects under the Corps' AFEP with the Council's FWP, including scientific peer review, should be fostered.

## Subbasin Plans

In the summer of 2004, ISRP members participated with members of the ISAB in review of draft subbasin plans commissioned by the Council. The exercise was taken too literally by most of those assigned the responsibility for developing plans whose boundaries encompassed the mainstem. Few plans included the mainstem reaches, even though the boundaries defined by the Council clearly included them. Mainstem issues were generally treated by the sponsors as "out-of-subbasin" questions that affected only stocks that originate within a basin. The issue is subbasin stock-specific estimates of needed escapement and the impediments to those escapements arising in the mainstem. The subbasin planning exercise, therefore, did not adequately cover mainstem issues related to specific tributary fish stocks. This was a serious

oversight, considering the significant mortalities imposed upon juvenile and adult salmonids in their migrations through the mainstem Columbia and Snake Rivers. The joint ISAB and ISRP reported this deficiency to the Council (ISRP 2004-13), with no specific Council action taken to date other than the Mainstem Amendment.

**Recommendation:** Subbasin stock-specific estimates of needed escapement and the impediments to those escapements arising in the mainstem should be developed for subbasins.

## Non-Salmonids in the Mainstem

Although restoration and protection of salmonids has dominated thinking about the mainstem, other species are of concern. White sturgeon and lamprey are of concern for their own sake, whereas northern pikeminnow and introduced species (such as American shad) are of concern because of their influences on sustainability of salmonids.

### White Sturgeon

The ISRP has influenced the Council's basin-wide white sturgeon program primarily by (1) stressing the need for coordination among projects across the basin, (2) emphasizing evaluation of white sturgeon's problems prior to initiating mitigation activities, (3) placing white sturgeon artificial production in the context of the Congressionally mandated Artificial Production Review, and (4) urging that BPA-supported efforts with the ESA-listed Kootenai River white sturgeon be fully consistent with (and contribute to) the Fish and Wildlife Service's Recovery Plan. There has been successful feedback between white sturgeon researchers and the review process that has led to improved projects. Comprehensive syntheses and focused research are still needed, based on ISRP reviews of project proposals and resulting publications. Each of these points is discussed below.

Just prior to formation of the ISRP, the Council had commissioned a white sturgeon review. White sturgeon populations in the basin have been subdivided by dams, most spawning sites have been eliminated by reservoirs, and reproduction has been reduced to levels that no longer support fisheries (or even self-sustaining populations) in most areas. A key concern from that review was whether implementation of artificial production and other mitigation measures were getting ahead of the intent of the 1994 Fish and Wildlife Program to conduct research and evaluation of status and potential for rebuilding (Section 10.4A). This concern has colored the ISRP's continuing reviews of white sturgeon projects, both individually and programmatically.

There are three main white sturgeon activities in the basin, all related to poor reproduction:

- a) several projects and subprojects in the Columbia River and lower Snake River under the umbrella of Oregon Department of Fish and Wildlife, to identify causes of low recruitment and test mitigation methods,
- b) efforts by the Nez Perce Tribe in the Snake River above Lower Granite Dam to rebuild populations and to reinitiate a fishery as off-site mitigation for loss of lower Columbia River white sturgeon fisheries,

- c) research and artificial production, primarily by the Kootenai Tribe of Idaho and Idaho Department of Fish and Game, to restore the endangered Kootenai River white sturgeon.

Balance between integration among basin-wide efforts and identity of individual projects for review has been a continuing concern of the ISRP and the Council. In its earliest reviews (FY 1998), the ISRP found the assemblage of projects in the Columbia and lower Snake River to be difficult to review because the components were not well identified and clearly outlined. On the other hand, there seemed to be poor integration among the Columbia, Snake, and Kootenai efforts, particularly with regard to identifying the root causes of pervasive poor recruitment. In its FY 2000 review, the ISRP called for an umbrella proposal to coordinate all of the basin's white sturgeon research. The Council chose, instead, to initiate the provincial review process, but it asked for a demonstrated coordination of basin-wide white sturgeon projects. Largely because of a negative ISRP review of a proposal to rebuild Snake River white sturgeon, the Columbia Basin Fish and Wildlife Authority developed an approach for integration and coordination among relevant parties, including the Nez Perce Tribe, Idaho Department of Fish and Game, Oregon Department of Fish and Wildlife, Washington Department of Fish and Wildlife, the Council, BPA and Idaho Power Company (which independently conducts research and analysis of white sturgeon in the Middle Snake River). A key component is an annual workshop. The Council subsequently recommended that BPA include the CBFWA integration and coordination points in all white sturgeon contracts in the Columbia and Snake rivers (interpreted to include the Kootenai, as well).

The ISRP and Council have emphasized research and evaluation of white sturgeon's recruitment problems prior to initiating mitigation activities. Proposals in FY 1998 to initiate an intensive supplementation program to expand experimental transplantation of white sturgeon in reservoirs with low populations were not recommended by the ISRP and Council. A proposal by the Kootenai Tribe of Idaho in FY 2000 for capital construction funds for an expanded white sturgeon hatchery was delayed by the Council, with sponsor concurrence, pending comprehensive review of region-wide white sturgeon recovery efforts. Also in FY 2000, the ISRP did not recommend funding a proposal to establish a consumptive white sturgeon fishery in Hells Canyon and Oxbow reservoirs (largely because of technical quality of the proposal). However, the Council approved an evaluation of production and release plans but no implementation until there was a peer-reviewed master plan (the proponents withdrew the proposal until FY 2003, when a revised evaluation proposal was recommended for funding). In the 2003 Mainstem and Systemwide review of the Columbia-Snake River project, the ISRP and Council reiterated the value of on-going white sturgeon research and evaluation projects, but gave artificial production efforts there a low priority. Only in the Kootenai River, where white sturgeon is endangered and has had essentially no reproduction in over 20 years, was artificial production supported, and then at only an experimental level.

The ISRP and the Council have consistently placed white sturgeon artificial production in the context of the Congressionally mandated Artificial Production Review initially recommended by the ISRP, primarily for salmonids. Supplementation in the lower Columbia River, capital construction of a Kootenai River hatchery, and a hatchery to support white sturgeon harvest in

Hells Canyon and Oxbow reservoirs were denied by the Council without a 3-step artificial production review.

The Council has urged that BPA-supported efforts with the ESA-listed Kootenai River white sturgeon be fully consistent with the Fish and Wildlife Service's Recovery Plan. The proposed projects received positive ISRP reviews. The Council then requested that proponents define the scope of requirements of the Kootenai white sturgeon recovery plan for Bonneville. Recovery team members, including staff of the Fish and Wildlife Service assured Council staff that the scope of the proposals for Kootenai white sturgeon are consistent with Bonneville's obligations under the recovery plan and the Biological Opinion for the hydropower system. Bonneville's comments also concur that these projects meet Biological Opinion requirements.

White sturgeon research and mitigation provide a good example of iterative ISRP reviews leading to a technically sound project. In an initial FY 2000 ISRP review, the Nez Perce Tribe's proposal, "Consumptive Sturgeon Fishery – Hells Canyon and Oxbow Reservoirs," was not recommended for funding because of lack of scientific justification and detail in the proposal. The Council approved only planning, and the sponsors withdrew the proposal. In the ISRP's Mid-Snake FY03 provincial review, a rewritten proposal, "White Sturgeon put, grow, and take fishery feasibility assessment, Oxbow/Hells Canyon reservoirs," was recommended by both the ISRP and Council.

Despite improved coordination and information exchange, the white sturgeon researchers in the basin have not, collectively or individually, provided a comprehensive synthesis of knowledge about the causes of the pervasive poor recruitment. Such a synthesis has been called for by the ISRP since its inception, and is implied in the 1994 Fish and Wildlife Program's Section 10.4A. The closest to this goal was identification by Kootenai River researchers of a reproductive bottleneck between spawning and metamorphosis to small adult-like fish (natural spawning occurs and hatchery-produced juveniles survive and grow well, suggesting that the deficit is between these two processes). After numerous reviews of sturgeon research by the ISRP, Coutant (2004) attempted such a synthesis.

In the spirit of the Council's current Program, with its emphasis on natural processes and habitat restoration, automatic implementation of artificial white sturgeon production throughout the basin does not seem to the ISRP to be appropriate. Restoration of natural habitats and reproductive processes, especially as they affect the purported reproductive bottleneck, ought to be the preferred option. However, well-focused, comparative field research is needed on the reproductive stages in this bottleneck (e.g., egg dispersal, egg attachment and incubation, larval habitats and feeding, larval dispersal) in habitats with successful and unsuccessful reproduction. With this information, the mitigation measures most useful for enhancing wild populations can be selected, and artificial production can be implemented only where critical for maintaining the species presence.

**Recommendation:** The FWP should focus on understanding the apparent reproductive bottleneck at the egg and larval stages through well-focused, comparative field research in habitats with both successful and unsuccessful reproduction.

## Lamprey

As with white sturgeon, the ISRP reviews of proposals on Pacific lamprey projects have led to requests for better regional coordination of work on the lamprey species in the basin, principally the Pacific lamprey.

Tribal interest in protecting the Pacific Lamprey was first brought to Council in 1994, prior to formation of the ISRP. In 1994, the Council received and approved the first Pacific lamprey project in the Fish and Wildlife Program (#9402600). The project was proposed by the Confederated Tribes of the Umatilla Indian Reservation, and called for research and restoration of Pacific lamprey throughout Umatilla tribal ceded lands. The Council, in the 1994 Fish and Wildlife Program Section 7.5F, called for a status report and recommendations resulting from this project. The “Status Report of the Pacific Lamprey (*Lampetra tridentata*) in the Columbia River Basin” was provided by the tribe in 1995. The Council took action in 1995 by calling for implementation of portions of the report’s “Recommendations for Research and Data Gathering”, to assess abundance, past and present distribution, and passage and habitat limiting factors for Pacific lamprey. However, the Council deferred funding the report’s “Recommendations for Immediate Management and Enhancement Actions”, and the portion of the Research and Data Gathering recommendations that had to do with transplantation and artificial production. The Council deferred action until such time as a detailed work plan might be prepared and returned to the Council for consideration.

For Fiscal Year 1999, following ISRP review, the Council specifically recommended that new lamprey research and evaluation projects recommended by CBWFA not be funded.<sup>8</sup> Council expressed concern that these new projects did not appear to be connected or coordinated with the continuing project (#9402600), which the Council identified as responsible for developing the necessary coordination. That project had been further developed and funded in response to the lamprey status review conducted in 1995. The Council understood that this project was to be conducted in phases, with Phase I completed with submission of the Status Review and Recommendations, and Phase II to provide restoration plans, prior to funding of Phase III, which would include implementation of measures intended to restore lamprey populations. Since Phase II had not been completed, it made little sense to fund new projects not linked to the existing coordination project. Furthermore, the new proposals included implementation of measures intended to restore lamprey, which the Council said was out of sequence, since Phase II had not been completed. The Council recommended no funds be expended on these lamprey projects until Council reviewed and approved the lamprey restoration plans to be produced during Phase II of the project.

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<sup>8</sup> CBFWA appears to believe that each subbasin probably has its own, unique set of problems that may require solutions, thus their recommendation in 1999 that the Council call for funding of the two new lamprey projects because they covered geographic areas different than the ongoing project(s). On the other hand, the ISRP is of the opinion that the primary limiting factor(s) operate at a basin-wide level, so that a single, unified study approach ought to lead to identifying the factor(s) and a recommendation for a solution. Evidence for this point of view stems from the facts that lamprey populations are universally at low levels and that a serious problem of passage of adult lamprey has been identified at the mainstem fish ladders.

In response to the Council's recommendation, in August 1999, CBFWA submitted a Draft Work Plan that included a draft version of the lamprey work plan. In October 1999, the Council received the final work plan from CBFWA, entitled "Planning of Columbia Basin Pacific Lamprey Projects and Needs", that was prepared by a technical workgroup appointed by CBFWA. In November 1999 the CTUIR submitted a document "Restoration Plan for Pacific Lampreys in the Umatilla River" to the Council. This Plan was developed with the cooperation and review by members of CBFWA's technical workgroup. The Umatilla restoration plan did not attempt to address all of the uncertainties identified in the CBFWA Work Plan, but focuses on the Umatilla River. At its February 22, 2000 meeting the Council approved the restoration plan, but requested an independent scientific review of the overall restoration plan. At the request of the Council, in FY 2000 the ISRP reviewed the "Restoration Plan for Pacific Lampreys (*Lampetra tridentata*) in the Umatilla River, Oregon." The ISRP found that the plan was a useful draft, but that the study plan lacked specificity and technical details. It would require considerable revision if it were to be a clear and persuasive document justifying and guiding the restoration program planned by the tribe and Council. We provided detailed and specific guidance in our comments that were intended to assist the tribe in meeting the Council's requirements.

Tribal interests enlarged to include other Tribes in 2000. As part of the Columbia Plateau review, the ISRP (2000-8) reviewed two ongoing and two new proposals for work on Pacific lamprey. Though they found that the proposals met the established criteria for funding, they raised questions about the need to frame these proposals into a comprehensive study on lamprey in the Columbia Basin (an "umbrella" proposal) to facilitate regional coordination, and recommended that such proposals should be developed in FY 2001 for all lamprey and white sturgeon projects.

The Council responded to the recommendation for development of an "umbrella" proposal by insisting upon development of a restoration plan that would encompass the basin as a whole. The requirement for producing that plan was included as a condition for continued funding of the existing project #9402600. While it decided not to require an umbrella proposal per se, the Council interpreted its program provisions and ISRP reviews that related both to sturgeon and lamprey to require regional coordination of these types of projects. Therefore, in order to demonstrate consistency with the program, the Council required that sponsors of these projects demonstrate to the ISRP and Council that there is regional coordination by some means.

In response, sponsors of Pacific lamprey projects proposed for Fiscal Year 2000 conducted a workshop and developed an appendix to the CBFWA draft work plan that demonstrated the regional coordination of those projects. The Council said this type of report and documentation, at a minimum, will be necessary for these projects in Fiscal Year 2001 and beyond.

Throughout this interplay among the ISRP, the Council, and tribes (and other proponents), there has emerged a consensus on the limiting factor for Pacific lamprey. In 1999 it was found that mainstem dams present a serious obstacle to upstream passage of adult lamprey (Vela et al, 1999a, 1999b), as noted in the "Restoration Plan for Pacific Lampreys in the Umatilla River" (Close, 1999). Only a small percentage of radio tagged adult lamprey were found to successfully pass upstream through fish ladders at mainstem dams in the lower Columbia River. The ISRP was informed by Rock Peters of the COE that the Corps has implemented a project specifically

intended to address and solve the problem of adult lamprey passage at the mainstem dams ( a project included in the ISRP's review of the Corps' AFEP program). The Council took notice of this situation in its language regarding the "Restoration Plan for Pacific Lamprey (*Lampetra tridentata*) in the Umatilla River, Oregon", on February 22, 2000. The Council said "Coordination is especially needed in regards to mainstem dams and passage issues...The historical analysis revealed that the biggest constraint for recovery of Pacific lampreys in the Columbia River Basin are the mainstem hydroelectric dams. Lampreys have trouble negotiating the entrance to fishways and the ladders." The Council called upon the TWG<sup>9</sup> established by CBFWA to continue to ensure that coordination and links are occurring with all federal (e.g. COE) and program projects.

In terms of priority of actions it would seem to be wise to place a large effort on solving the mainstem passage problem. Once that is dealt with there will be a reasonable expectation of an increase in abundance of Pacific lamprey in the tributaries. Should such an increase not occur after the passage problem is solved, then it might be appropriate to consider basic biological studies, such as have been funded. Otherwise, we have a definite cart before the horse situation, such as the Council feared in 1995. Certainly, transplantation and artificial propagation activities are premature. These activities are taking place on a "pilot" basis, under the original project.

**Recommendation:** The ISRP recommends that the Council give priority to improved passage of adult lamprey at mainstem dams before implementing other immediate management and enhancement actions.

### **American Shad**

The American shad is an introduced anadromous species that uses the mainstem for migration, spawning, and juvenile rearing. It is not a predator on other salmonids or other fishes. However, questions have been raised about the potential for competitive interactions of juvenile shad with juvenile salmonids and the potential for shad to augment the year-around food supply of predatory fishes, thus increasing their abundance. Specific information on American shad ecology in the Columbia River mainstem is lacking. In the course of reviewing the few proposals submitted for study of American shad, the ISRP has expressed the opinion that studies of American shad specific to the Columbia River are warranted.

American shad were introduced into the Sacramento River in 1871 and spread to the Columbia River by 1876 (Radovich, 1970). Counts of adult shad at the mainstem dams have shown a dramatic increase in their numbers since counts began at Bonneville Dam in 1938 (Oregon Dept. F&W and Wash. Dept. F&W, 2002). Counts rose from fewer than 10,000 in 1938 to a peak of 5.5 million in 2004. Construction of The Dalles Dam in 1959 opened up the river above Celilo Falls, which had obviously been a barrier prior to that time. Counts prior to 1959 had generally ranged below 50,000 and never reached 500,000 until 1962. Similarly, as the hydroelectric system was developed, fish ladders expedited their spread upstream, producing another increase in counts to above the 1 million mark, corresponding with the construction of John Day Dam in

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<sup>9</sup> Technical Workgroup appointed by CBFWA, consisting of fishery agency and tribal representatives involved in lamprey studies.

1968. In recent years, adult shad have made up between 60-80% of the whole anadromous run. Female shad may bear tens of thousands of eggs, raising the possibility that millions if not tens of millions of fry could inhabit the reservoirs in the lower river during summer months.

There have been complaints by Oregon and Washington fishery managers that there are so many adult shad in the ladders at some times that they (might) impede the progress of salmon. This was the impetus for the Monk et al. (1989) study at John Day, according to Petersen et al. (2002). Another hypothesis suggests that they might spread diseases as a result of crowding with salmon in the ladders. No documentation exists to support these speculations.

A third speculation is that juvenile shad might compete with juvenile salmon that use the same plankton for food (Chapman, et al., 1991). However, the question of competition is difficult to address. In a general ecological context, it would appear to be reasonable to hypothesize that something (animal) had to move over to make room for shad. If so, what was it? This question would have been addressed by an Innovative Proposal that was reviewed and supported by the ISRP, but not funded.

A recent publication reported that, when juvenile American shad are available from August through October, they are a significant element in the diet of northern pikeminnow (Petersen et al. 2003). The authors suggested that the high energy density of shad relative to other prey available in those months probably leads to increased growth rate of northern pikeminnow, hastening the time when they would reach a size at which they would prey on salmonid juveniles. The very presence of juvenile American shad in the system at that time of year provides a food source that would otherwise be lacking, a factor which experience and theory agree probably makes possible the existence of a larger population of northern pikeminnow than would otherwise be present, as Olney, (1975) found with northern pikeminnow in Lake Washington, where seasonally available prickly sculpin provided an alternative food source at times when sockeye salmon juveniles were not present.

Management efforts to date have been hampered by the fact that the adult shad run coincides with runs of some Chinook stocks that require protection, so commercial fisheries have not been possible except in some small backwater areas (Washougal Slough). Beginning in 1994 and continuing for several years the Yakama Tribe undertook an experiment to determine the feasibility of harvesting shad from fish ladders in the mainstem. The project took place at The Dalles Dam, a most suitable location, considering that The Dalles Dam and reservoir inundated Celilo Falls, the former site of a large treaty tribal fishery. This project was continued, at different locations with other methods, until the year 2000. There was also a project undertaken to develop a processing method that would make shad meal acceptable as food for hatchery salmonids. This idea appears to have perished because of a nutritional shortcoming that was discovered. (Personal communication, Frank Young, CBFWA). Petersen et al. (2003) refer to a report by Huppert and Flaherty (done for NMFS) that they say discusses the economics of reduction of shad abundance by various means.

It is well known that shad are reluctant to use submerged orifices in fish ladders. This was the problem at the John Day Dam ladders, according to Monk et al. (1989). The ladders were modified to accommodate them. In fact, shad have been observed to accumulate as they

hesitated under the shadow of a bridge (personal observation). This problem was identified as the basis for low numbers of shad that are observed to pass the east ladder at Priest Rapids Dam. At one time the fishery agencies requested that Grant County P.U.D. modify the ladder to correct what they saw as a problem in passage. However, the P.U.D. was aware of increases in abundance of shad that were associated with the provision of passage at Celilo Falls (The Dalles Dam), was aware of the fishery agencies concern about shad crowding salmon in the ladders, and pointed out that expediting passage of shad might lead to an increase in their abundance, thereby leading to a worse situation rather than addressing the basic problem, which was too many shad. The P.U.D. asked the agencies to prepare an EIS that would consider the issue from a larger perspective than simply passage at one dam. A proposal (#25037) was submitted in 2001 to study the problem. It was given low marks by the ISRP, primarily because it did not appear to be scientifically sound, because it put a focus on an effort to guide shad by means of an unproven method, judged to be unlikely to be successful as it was not based upon known behavior of shad, and it was not funded.

Despite encouragement from the ISRP, shad research has not been supported. Over the years since FY 1997, a number of proposals (7) have been submitted for work on American shad. In addition, one ongoing predator reduction project included activities intended to gain information on American shad. For a variety of reasons, none of these shad proposals was funded. The most promising proposal was submitted as an innovative proposal in 2002 and would have used radioisotopes to identify direct and indirect interactions of American shad with other members of the ecosystem. It received a high mark from the ISRP and was recommended for funding by the Council, but was not funded by BPA. An attachment provided by that proposal was a very useful manuscript, later published by Petersen et al. (2003), that summarized information on American shad in the Columbia River.

The American shad proliferation in the mainstem must be better understood. If shad are benign with respect to salmon, then this should be clearly established. It is unlikely, however, that such a large population could exist without some influence on mainstem migrants or resident fish. Research by the USGS Cook lab, for example, is identifying indirect effects of juvenile shad abundance in the fall on the strength of predator populations, which then feed on young salmon at other times of year (spring and summer). These relationships will need attention.

**Recommendation:** Because so little is known, a broad-based ecological study of American shad in the Columbia River should be conducted, with emphasis on ecological interactions of all life stages with salmonids and salmonid predators throughout the mainstem.

### **Exotic Species as Salmon Predators and Competitors**

Introduced non-native fishes, such as walleye, largemouth and smallmouth bass, and channel catfish, have been shown to be, at times and places, significant predators on salmonids, as are the native northern pikeminnow (Gray et al. 1984). While none of these exotic species were found to be either as abundant or as significant as predators on juvenile salmonids as the native northern pikeminnow (below), nevertheless their combined effect on survival of juvenile salmonids during their outmigration deserves closer scrutiny. Among the AFEP proposals the ISRP has been given for review is one for evaluation of predation by smallmouth bass at The Dalles Dam.

The sponsors reported that large numbers of smallmouth bass have been observed in the tailrace at The Dalles Dam, and they may be on the increase, which might explain low survival rates of juvenile salmonids observed at that project.

Smallmouth bass and channel catfish support significant sport fisheries in the lower Snake and lower Columbia rivers. Walleye are the subject of significant sport fisheries in the mid-Columbia, extending into the lower Columbia River. It seems somewhat contradictory that the Council has continued to support the project aimed at reduction in abundance of the northern pikeminnow, when in the meantime, the state agencies, Washington, Oregon and Idaho, have adopted management policies that in some cases seem aimed at perpetuating or even enhancing populations of these introduced predators. For example, all three states have regulations in place that limit the daily catch of bass by recreational anglers.<sup>10</sup> In particular, Washington's regulations seem to be designed to optimize the spawning capability and thus recruitment of bass, using the same type of regulations as in the sturgeon fishery. Similarly, Washington's regulations for the walleye fishery seem aimed at optimizing recruitment through protecting spawners. Walleye are not abundant in the Snake River, which explains Idaho's lack of regulation of their catch.

Exotic species are a problem outside the mainstem, too. In several lakes located in tributary systems, there have been introductions of *Mysis* shrimp that have been demonstrated to be competitors of kokanee and other salmonids, and the result has been reduction in kokanee abundance. Similarly, there have been introductions of lake trout, known to feed on kokanee and other small salmonids, and the result has been further reduction of kokanee abundance. Reviews of the kokanee measures funded by BPA in Flathead Lake indicated that the majority of hatchery planted kokanee were consumed by lake trout in a matter of weeks. One proposal reviewed by the ISRP in the Gorge and Intermountain Province estimated that 10-20% of hatchery planted kokanee were consumed by walleye within a few days. The Council has continued to receive proposals aimed at counteracting these adverse effects on kokanee, such as increased hatchery stocking of kokanee, and, in one case, elevation of lake level during the kokanee spawning and incubation period with the intent of increasing recruitment of kokanee that might result from lakeshore spawning. The ISRP has continued to be skeptical of the likelihood of success of any of these measures, based on experience documented in the scientific literature, as well as in the progress reports of the projects themselves. It needs to be recognized that the ecosystems of these lakes have been reorganized as a result of these introductions, and there is little or no likelihood of success of measures intended to reverse the shifts in the food web that have occurred.

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<sup>10</sup> Washington – Walleye, 16” to 22” size limit. Daily limit 5. Only 1 over 22”. Bass size limit only fish less than 12” or greater than 17. Daily limit 5. Only 1 over 17”. Channel catfish. Daily limit 5.

Oregon - Walleye. Daily limit 6 fish. Bass, 12” size limit. Daily limit 6. Channel catfish. No size or bag limits.

Idaho - Walleye. No limits. Bass. Daily limit 5 (6 in Snake River). No more than 3 over 15”. (No length limit in Snake River below Hells Canyon Dam). Channel catfish. No size or bag limits.

Policy issues present themselves wherever exotic species are present. For example, the presence of introduced lake trout in Flathead Lake makes unlikely the success of any effort to restore kokanee abundance to levels experienced before their introduction. According to the Council's AIWP for FY00, the sponsors stated that the kokanee program has failed and the focus of the program shifted to rainbow trout and westslope cutthroat trout. In its place, the sponsors submitted a proposal for reduction of lake trout in Lake McDonald in Glacier National Park, the place where lake trout were first introduced and from where they spread to Flathead Lake. The Council decided as a policy matter not to fund the project, as its connection with the concept of mitigating for impacts of the hydroelectric system was missing.

Exotic species and their management need to be taken into account in province and subbasin summaries, as well as in individual project proposals. The ISRP encountered this issue in the Gorge, Intermountain, and Mountain Columbia subbasins. Presence of exotic species is a limiting factor in both Flathead Lake and Lake Coeur d'Alene, and is a primary determinant of management options that can realistically be accomplished in those lakes. It no doubt is an issue in other subbasins and locations, though it may not have been brought to the forefront in the texts.

Obviously, the success of resident fish projects can be seriously affected by such predation by exotic species. Introduction of northern pike into the Coeur d'Alene River and Lake system in 1972 has led to expansion of their range downstream into the Spokane River. In time, northern pike will no doubt extend their range into the Columbia River itself and, from there, into other tributaries (Wydoski and Whitney 2003). Note that the northern pikeminnow, the primary predator upon which control measures are focused in the Columbia River derives its name from this fish, the northern pike, one of the most effective predatory fish in freshwater.

**Recommendation:** The Council should do all in its power to limit the introduction of exotic species into the Columbia River basin and to explore ways that exotic species interactions with salmonids and other native species can be minimized. As a policy matter, the Council ought to recommend that no new exotic species of any kind should be introduced anywhere in the Basin.

## Predator Reduction in the Mainstem– Northern Pikeminnow and Several Bird Species

There has been a consensus for many years that predators in the mainstem subject migrating smolts to an unacceptable level of mortality and, therefore, controls are needed. Primary subjects of predator reduction in the FWP are one fish, the native northern pikeminnow, and several bird species, particularly the Caspian tern and the California gull. Sponsors of the Caspian tern project recently enlarged their proposal to include other bird species, the justification being that reduction of abundance of Caspian terns might lead to increases in other predatory bird populations. The Caspian tern, while a native species, moved in substantial numbers into the Columbia Basin after it found favorable habitat created by Corps of Engineers dredge spoils at the mouth of the river. The bird is a significant predator on juvenile salmonids. In 1997, it was estimated that the terns consumed 11 million salmonid smolts. The Council has called for measures to remove the terns from this location. The Corps of Engineers and the U.S. Fish and

Wildlife Service have undertaken some measures intended to discourage the birds there and encourage their movement elsewhere. Recently, increased numbers of other birds have been observed including double-crested cormorants, common mergansers, and pelicans. The ISRP has not been asked to review proposals in this arena.

The northern pikeminnow reduction program has been a part of the FWP since 1982. It has been the subject of reviews by the SRG and its successors, the ISG and the ISRP, as well as the IEAB. Reduction of pikeminnow is accomplished by a reward system that compensates sport fishermen on a per fish basis. Mathematical modeling of the components of pikeminnow life history has been used to demonstrate that specified reduction in levels of abundance of pikeminnow can be expected to result in corresponding reductions in levels of predation experienced by juvenile salmonids. The project seemed vulnerable to criticism, in particular because there seemed to be no firm basis for the decision about what level of reward should be offered. However, the project has stood up well under intense scrutiny. In the 1998 AIWP, the Council concluded that the project had been so successfully monitored and evaluated that it ought to be possible to cut significantly the evaluation part of the project, funding only the basic work of monitoring catch and the pikeminnow populations. In the FY 2000 AIWP, the Council expressed an interest in being sure that ISRP recommendations aimed at reducing expenditures were being followed. A response was provided by project sponsors. Project sponsors have published several papers in national peer reviewed journals. A portion of the project that included net fishing by tribal fishermen was eliminated in response to comments focusing upon the low catch rates experienced in that fishery. Perhaps the only suggestion that has not been addressed is the ISRP suggestion that the per fish reward might be manipulated experimentally to identify an optimum cost, or that other kinds of experimental approaches be tested to observe the effects on catch and the pikeminnow population. The Council followed up in the AIWP for FY00 with a recommendation for a 50% budget reduction. If objections by BPA and the sponsors persist, without alternatives being offered, Council asked that BPA and the sponsors explain in writing why the budget of \$1.5 million/year over the next three years would not yield substantial biological benefits.

**Recommendation:** Although predator control programs appear reasonably successful, the Council is encouraged to focus research and mitigation on ecological changes created by the hydrosystem that foster the proliferation of predators and their impacts on salmonids.

## Conservation Enforcement

The law enforcement program funded under the Council's FWP began in the early 1990s (prior to the ISRP) as a three-year pilot project, developing over time into a permanent law enforcement program with an annual budget of approximately \$4M. It was mainly devoted to illegal catches of migrating adult salmon in the mainstem. The continued funding of the program was controversial, with questions raised about program effectiveness, program cost, the peripheral connection to hydropower impacts, and funding responsibility. The ISRP, in recommending peer review of high-cost mainstem actions, noted that there was "little substantiation that illegal catches are a major problem for salmon survival," and also that the program was "a major drain on funds needed for work to protect juvenile salmonids."

In 1997, the Council recommended the discontinuance of BPA funding for law enforcement as a program, while holding open the possibility of funding specific conservation enforcement tasks that were "tied to the core purposes of the Act, do not present an 'in lieu' issue under the Act, and are associated with activities funded under the Council's program, such as protecting habitat investments." This recommendation reflected a concern that the program, which had been established as a pilot for the purpose of investing in equipment, training, and public outreach, had evolved into a permanent high-cost program. The program was seen to have a tenuous connection to the mitigation of hydropower impacts required by the Power Act and to be replacing what had been traditional functions of state, tribal, and federal law enforcement. Continued support of the program was obligating funding that could go to higher priority mainstem research, tributary habitat action, and natural production activities. The Council emphasized that this recommendation did not reflect a judgment on the effectiveness of the law enforcement program, an evaluation of which was then underway.

Nonetheless, in 1998, CBFWA included in its draft workplan a placeholder for law enforcement activities, tentatively assigned to four tribal law enforcement programs. These proposed activities were directed toward harvest enforcement, education, and deterrence related to habitat regulations, habitat improvements, fish screens, water rights, and water quality laws. However, the managers were unable to agree upon selection criteria to apply to law enforcement projects. Continuing the policy articulated in 1997, the Council recommended against reserving an amount in the Fiscal Year 1999 budget for law enforcement projects, instead reiterating its previous willingness to consider proposals for law enforcement tasks that met the stated criteria, if they were advanced with funding recommendations by CBFWA.

In 1999, the ISRP recommended funding of two law enforcement projects. The Council, facing enforcement project proposals with a favorable ISRP recommendation but without a CBFWA consensus recommendation, considered the ISRP's mid-level ranking of the two conservation enforcement implementation projects as indication that limited research funds would be better directed toward new and innovative research projects. The Council stated its intention to continue to meet with the sponsors and CBFWA representatives, assess remaining available funds, and make a final recommendation on these projects.

Conservation enforcement proposals were included in the 2002 Mainstem/Systemwide Provincial Review. Two were particularly applicable to the mainstem. One was for protection of adult anadromous salmonids from illegal take with emphasis on depleted stocks and protection in the Zone 6 migration corridor (Bonneville to McNary dams). The other was to develop a Columbia Basin web-based data center - within a GIS framework - to facilitate conservation law enforcement data compilation and analysis, as well as information sharing for enforcement programs, resource managers, and public information and education. Hypotheses were presented to test the effectiveness of enforcement activities in reducing illegal take. The feasibility assessment has the potential to lead to value-added to systemwide enforcement. Other conservation enforcement proposals sought assistance for upriver tribes. The ISRP found all of the proposals much improved from earlier proposals on conservation enforcement and technically sound. The conservation enforcement data center offered the potential to enhance the system-wide effectiveness and coordination of enforcement as well as to be a public education

tool. Nonetheless, the policy issue of FWP funds going to support enforcement activities was controversial and the Council did not recommend any of them for funding.

**Recommendation:** Enforcement projects should be considered cautiously on a case-by-case basis for consistency with the FWP.

## The Future

Although this retrospective report mainly looks at what has already happened, it is perhaps useful to look briefly at the ISRP's view of the future for the mainstem, based on its decade of reviews. This view of the future spawns numerous recommendations, which are briefly highlighted.

The ESA and recovery of listed salmon populations will likely continue to dominate mainstem research, monitoring, and evaluation, with the Council and its advisors providing a broader context. Given recent court scrutiny and a revised Biological Opinion, however, we expect activity less driven by specific mandated actions in biological opinions and more directed by evolving scientific, legal, and social perspectives. This re-direction could involve the ISRP in more scrutiny of needs and resulting proposals.

**Recommendation:** The ISRP work with the Council to frame targeted solicitations.

The issues of flow management in the mainstem will certainly continue indefinitely, until such time as the region comes to grips with the need to design and mandate the conduct of a true experiment designed to isolate the many interacting factors that affect survival of juvenile salmonids. The historical flow pattern of the Columbia River, with its spring/summer high flows and low winter flows has been changed to accommodate storage of spring/summer snowmelt for hydropower generation in the winter. This change conflicts with the needs of outmigrating salmon, which use the high flows of spring and summer (now lower than prior to hydroelectric development and operation) to facilitate their travel to the ocean. Channel-forming processes and many fish life cycles depend on periodic flood flows, now nearly eliminated. An ideal flow regime has yet to be identified based upon scientifically valid estimates of countervailing negative effects on biological productivity in the storage reservoirs versus any positive effects on survival of juvenile salmonids downstream.

**Recommendation:** Coordinated experimentation should be conducted to address basin-wide flow management instead of ad-hoc observation.

There is inadequate planning to accommodate well-known relationships between water availability and the cyclic climatic/oceanic features of ENSO (El Niño-Southern Oscillation) and PDO (Pacific Decadal Oscillation). Climatic change information has yet to be incorporated into planning for flow management and fish. Instead, decisions are made on an annual ad hoc basis based upon measurements of snow pack. Current long-range forecasts suggest there will be higher average Columbia River flows in winter and less snowmelt in summer in future years because of warmer temperatures, more precipitation as rain, and less snow storage. Spring/summer flows could be reduced for all uses (including fish), and winter flows high but

undependable (more floods). With water flow management already a divisive social issue, these climate-driven changes must be given attention.

**Recommendation:** Rigorous scientific analysis and management planning should address the relationship of the known climate/ocean cycles and gradual climatic change to the functioning of the hydrosystem and its fish and wildlife inhabitants.

The importance of reservoir hydrodynamics for smolt passage and survival has yet to be fully recognized on a par with passage at the dams themselves. During low flow years and at low-flow times of year (e.g., summer), migrants face unfavorable flow regimes in reservoirs that are more than just increased water transit times. Fish simply get lost when normal behavioral cues such as directional, turbulent flow disappear, as telemetry studies have shown. Pulsing of flows at dams as a result of load following causes seiches (sloshing back and forth) in reservoirs that likely affect migration of both adults and smolts. As of now, we have only hints of the complex hydraulics of the basin's mainstem reservoirs that probably affect migration and survival of both juveniles and adults.

**Recommendation:** The relationships of hydrodynamics of reservoirs to salmon passage should be studied and taken into consideration in hydrosystem flow management.

At the dams, surface bypass technologies (especially the Removable Spillway Weir; RSW) should emerge as the alternative to massive water spills for fish passage. They offer increased effectiveness in passing juvenile salmonids with less water than standard spillways. Given the pressures within the region to limit the amount of spill for fish it seems only reasonable to expect the region to focus high priority on installation of these alternatives, which have been tested and are being prepared for installation at one or more projects. The RSW shows promise, as does the "corner collector" at Bonneville 2 powerhouse. But successful implementation of technologies to move large numbers of smolts in small amounts of water will require much more attention to understanding the interactions between hydraulics and fish behavior. In principle, natural behavioral cues can be simulated to guide fish to surface bypass entrances (e.g., with induced flows). The surface collector in the forebay at Rocky Reach Dam is proving to be quite effective at attracting juvenile salmon with minimal diversion of water from the turbines. We must come to understand what those behavioral cues are and how to manage them for efficient fish passage. Experimental research could provide answers much faster than will in-river trial and error with full-scale prototypes, which has dominated recent history. One consequence of surface bypass technologies might be a reduced ability to monitor smolts, which now pass through turbine screening and bypass systems where counting stations and PIT-tag detectors are located, although new approaches are being developed. Gas bubble disease concerns should diminish and perhaps disappear as a result of less managed spill and fuller installation of spill deflectors, which will be needed for unavoidable, involuntary spill during high runoff.

**Recommendation:** The relative efficacy of spill and engineered systems for smolt passage should be quantified.

Transportation of smolts by barge will likely be refined as mainly an emergency tool for use in especially low flow years and during the years when climatic ENSO and PDO conditions are

especially unfavorable for salmon in the basin. This would replace the concept that barging is needed all the time. Use of trucks will be discontinued because of generally poor smolt survival. Continued collection of lifetime survival data for salmonids based on adult returns of PIT-tagged fish should quantify the value of smolt transportation in different environmental conditions (e.g., flow, temperature).

Transportation depends upon the bypass systems at the dams to collect fish. These bypass systems are constantly being improved. At some point, as the bypass systems reach their full potential, there will no longer be a need to use barges to transport fish around the dams. An element weighing in favor of in-river transit is the fact that the bypass systems operate selectively on the components of the juvenile migration, favoring larger fish, fish further along in the smoltification process, fish migrating later in the season, and other factors. Furthermore, it has been found that some (undetermined) portion of fall Chinook juveniles in the Snake River overwinter in the river, rather than reaching the ocean in their first season as do most of their cohorts. Transportation could have the potential of reducing the portion of fish showing this behavior. The possible negative effects on viability of the population as a whole have not been evaluated. On the other hand, transportation could have a positive benefit by removing fish from the hazardous river environment created between the Snake River dams by the sharp fluctuations in flow created by load following operations of the hydroelectric system.

In most years, under normal spring flows, the region can structure its mainstem facilities and operations so that in-river survival is adequate for sustainable fish populations. That appears to be an attainable goal that would remove salmon from transportation's "life support", except when really needed (and climatic forecasting is close to being able to define in advance when such support is going to be needed).

**Recommendation:** Continue to quantify the lifetime survival of transported and river-run smolts of various species and stocks, with refinement of when transportation is valuable and when the fostering of in-river migration is best for long-term sustainability of a diversity of salmonid stocks.

Subbasin plans and other discussions of tributary habitat restoration will be clouded by uncertainties about out-of-subbasin effects (mainly survival in the mainstem, although including estuary and ocean). Assigning subbasin-specific survival factors for migrants in the mainstem to go with other subbasin planning will constitute a challenge for stock identification. Managers of fisheries conducted offshore and in the mainstem will need to find a way to take into account the spawning escapement and fishing goals specified in the subbasin plans. Management will have to become much more complex and will require increased levels of M&E.

**Recommendation:** Work toward development of subbasin-specific survival and escapement measures in the mainstem.

Improving survival of smolts through turbines and associated facilities (e.g., draft tubes) is being actively investigated as a means to improve overall smolt survival and may be more effective for overall fish survival than the current strategy of bypassing turbines. The current strategies may need re-evaluation as advanced turbine technologies (such as minimum gap runner turbines)

become more available and tested (as at Wanapum Dam in spring 2005). Dams where bypassing smolts remains problematic would be the best candidates for advanced, “fish-friendly” turbines. On the whole, though, based on information evaluated by the ISRP, it appears that advanced turbines would more likely provide measurable benefits to power generation than to fish on the Columbia and Snake river mainstems. On that basis, allocation of development costs to the hydropower system rather than to the fish and wildlife program would be most appropriate.

**Recommendation:** Encourage the development of turbines that are more fish-friendly as well as efficient for generation, but do not allocate all of that effort to the FWP.

Mainstem issues will have to encompass species other than Pacific salmon. Lamprey passage at dams, now inadequate, will have to be addressed and solved if these native species are to persist. American shad will continue to expand their colonization of the Columbia River basin so long as they have access similar to salmonids. We know very little about their impact on the ecosystem as a whole and salmonids in particular, a situation that must change.

**Recommendation:** Continue to broaden the FWP to species other than salmonids.

## Conclusions

In conclusion, the ISRP is gratified that most of its recommendations regarding projects in the mainstem have been adopted by the Council or another agency. Several years may have elapsed before some recommendations were fully acted upon. Nevertheless, the interchanges among the ISRP, the ISAB, the Council, and the Council’s staff have been positive. They have yielded considerable progress toward developing a mainstem program that is scientifically sound, benefits fish, and has defined objectives and intended outcomes, and intensive effort is underway 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 are not completed. Significant technical issues remain, especially if the often competing socioeconomic and fisheries interests are to be wedded as equal objectives. Recent events show that the persistent issues of flow and spill, for example, are not resolved. The mainstem programs of the Corps (AFEP) and the Council require improved interchange and coordination. Species other than salmon need attention. Climate offers both opportunity and challenge for the mainstem, as forecasting of cyclic events such as ENSO and PDO leads to better forecasts of water availability for both fish and other uses. The challenge will be to work with climate researchers to adequately prepare for long-term changes beyond these known cycles. And as subbasin plans formalize expectations for recovery of salmon populations in tributaries, the spotlight will be on the mainstem to preserve the up-river gains. Funding of conservation enforcement through the FWP remains controversial and generally not Council’s favored policy, despite favorable technical reviews of proposals by the ISRP.

## C. Habitat

### Background

*Upstream* (National Research Council 1996) and *Return to the River* [Independent Scientific Group (ISG) 1996], both major reviews of the decline of native fish populations in the Pacific Northwest and the Columbia River Basin, respectively, identified tributary habitat degradation as a major cause of the demise of both resident and anadromous fishes. They further concluded that human activities (e.g., forestry, agriculture, grazing, hydropower, and development) have played a major role in degrading and fragmenting habitat. Subsequently, other reports, such as the Interior Columbia Basin Ecosystem Management Plan (Quigley and Arbelbide 1997) and the Cumulative Risk Initiative (NMFS), used modeling approaches to further define the problems presented by tributary habitat loss. There is general agreement among both scientists and managers that tributary habitat restoration should be an essential component of an overall strategy for recovery of native fish populations in the Columbia Basin.

Responsibilities of BPA in this arena arise from direct or indirect effects of development and operation of the hydroelectric system. Direct effects have arisen due to inundation of tributary habitat by reservoirs behind the dams. Other projects involving resident fish and wildlife in the tributaries have been justified in situations where mainstem effects cannot be directly mitigated “in time and in place.” In other words, to compensate for unavoidable losses of adult and juvenile salmonids at the dams, the Council has adopted a policy that there may be projects “off site” in tributaries to mitigate for these losses. The Council has wrestled with the problem of quantifying the amount of such off-site mitigation that is appropriate. In particular, this has been considered in the context of hatchery programs that have been instituted to provide a portion of this mitigation.

Taken as a whole, the various reports and reviews, including those cited above, conclude that major long-term intervention will be required to restore habitat diversity and connectivity. Habitat rehabilitation will require action on both public and private lands. Core or reserve areas that currently maintain strong populations of salmon and trout are of particular ecological importance and should be protected and reconnected to form functionally intact migration corridors. Restoration should focus on ecosystem characteristics and processes including riparian features and processes, recruitment of large woody debris, water quality, natural sedimentation rates, floods and other natural disturbance regimes, adequate stream flows, and upland (watershed) processes. There is general recognition that restoration of stream habitat requires substantive efforts at the watershed or subbasin scale. In short, a landscape approach to restoration must be taken if native fishes are to recover in the Columbia River Basin.

### Programmatic Habitat Issues

The following recommendations on tributary habitat were a recurring theme of the ISRP’s programmatic and project reviews:

1. Habitat policies and objectives should be established for each major subbasin and coordinated with overall production goals for the subbasin.

2. Development of reliable watershed assessment procedures should be given high priority.
3. Watershed assessments should *precede* implementation of restoration projects so that probable limiting habitat factors are identified and a reasonable expectation of restoration effectiveness exists.
4. Habitat projects should be prioritized in the context of habitat objectives and fish production goals, and rely on information provided by the watershed assessment.
5. Effective habitat restoration will involve both public and private lands and will necessarily require coordination and cooperation among agencies, tribes, and public.

## Habitat Objectives and Watershed Assessments

Two elements that perhaps are most important for planning habitat projects in subbasins are 1) a set of clear habitat objectives and 2) watershed assessments. These elements also are critical for the ISRP's review of habitat projects because, without objectives and an assessment, the ISRP has no framework from which to evaluate the priority and potential benefits of proposed projects.

Habitat objectives should provide direction and coordination of habitat projects throughout a subbasin. These objectives should be landscape-based and should reflect, to the extent possible, the habitat goals set forth in *Return to the River 2000*. Objectives based on the range of conditions characteristic of different subbasins are more likely to protect the genetic, species, and population diversity of locally adapted stocks than will attempts at one-size-fits-all habitat requirements of individual life cycle stages of individual species. The role of periodic natural disturbances such as wildfires and floods in maintaining healthy watersheds also should be acknowledged in the development of subbasin habitat objectives. Habitat objectives should be coordinated with fish production goals. Stock assessments and an identification of factors limiting production in a subbasin are necessary for linking habitat objectives and fish production goals.

Watershed assessment is a procedure that is intended to provide a systematic way to understand and organize ecosystem information and to characterize the human, aquatic, riparian, and terrestrial features, conditions, processes, and interactions within a watershed. Watershed assessment is a process that establishes the context for subsequent project decision steps, as well as project prioritization within the watershed. It simplifies and shortens the preparation of project environmental analyses. It enhances the ability to estimate direct, indirect, and cumulative effects of management activities and guides their general type, location, and sequence within a watershed.

Watershed assessment is intended to address two specific factors:

- 1) The physical and biological characteristics of a watershed reflected in the local geology, terrain, climate, vegetation, history of past use, and natural events.
- 2) The individuality of watersheds as they differ in sensitivity to impacts from human use. Watershed assessment allows development of a local framework and database with which to make land use and land management decisions, conduct analyses of outcomes, and modify practice in response to outcomes.

Watershed assessment offers the benefits of bringing all individuals and groups with legitimate concerns into the decision-making process, and it offers tailored, site-specific, and regionally coordinated management plans as an outcome.

A proposal to conduct or apply results of a watershed assessment must describe several key aspects of the assessment process. These include regional and basin goal-setting, risk assessment to define current problems and predict future problems, and an adaptive management process to modify tools, practices and goals on the basis of experience. These components imply three phases for a watershed assessment: 1) resource assessment (physical, biological, and social inventory); 2) prescription writing and management planning; and 3) monitoring. All should be explicitly addressed. Additionally, methods for each, and the underlying scientific rationale, should be clearly specified. Finally, the group of stakeholders involved in the assessment and their roles in the process should be clearly stated. As a rule of thumb, a completed watershed assessment might be considered current and valid for about five years, after which revisiting or revision would be appropriate.

## The Council's Response to ISRP Recommendations

It is clear that the Council has long endeavored to develop and implement a more coordinated and guided process for determining how to select tributary habitat and watershed improvement projects. Each FWP since 1994 has taken a more comprehensive and systematic approach to habitat project planning than the previous FWP, culminating in the 2000 FWP subbasin planning process.

The Council's 1994 FWP included several individual measures for tributary habitat protection and restoration. In *Return to the River*, the ISG (1996; 2000) found that the specific measures in the 1994 FWP, including those that address habitat, were not based on an explicit scientific framework that would unify habitat actions, were not prioritized, and were not specifically adapted to conditions in individual subbasins. The ISRP agreed with the ISG's assessment.

The 1996 FWP acknowledged that habitat degradation had been a major cause of salmon declines in the Columbia River Basin and that existing habitat is seeded at low levels. Degraded habitat was believed to be limiting to natural production, even when population densities are low due to inadequate seeding, because "reduced habitat quality results in lower survival during critical spawning, incubation, and rearing, and migration periods." The Council strongly endorsed the concept of cooperative restoration planning undertaken by federal, state, private, and tribal organizations. They further stated "if watershed restoration is to be successful, instream restoration should be accompanied by riparian and upslope restoration."

To achieve the restoration objectives laid out in the 1996 FWP, the Council proposed aggressive development of cooperative watershed restoration plans. These plans were to be crafted after a commonly agreed-upon set of goals and objectives and based upon coordinated watershed planning which included four elements: watershed assessment, identification of management alternatives, collaboration, and site-specific watershed management projects. All federal, state, private, and tribal interests were to be included. Default habitat objectives were provided in the

FWP until local, peer-reviewed, habitat objectives were established after a thorough watershed assessment and expedited funding for high priority projects was undertaken. These steps taken by the 1996 FWP represented a significant improvement over past FWP's.

Despite the Council's call for development of watershed restoration plans including watershed assessments, the ISRP, in its 1997 programmatic review, found numerous deficiencies in habitat project proposals. Very few habitat projects actually were based on appropriate subbasin habitat goals, policies, and objectives. The proposed projects were rarely, if ever, preceded by watershed assessments. And, few projects included an evaluation process that monitored long-term project survival or biological effectiveness.

The rationale for selecting those watersheds that received the majority of habitat restoration funds under the FWP was not clear; the ISRP was not aware of an objective process for setting priorities among subbasins. These findings indicated a lack of a basin-wide approach for watershed planning. The ISRP also noted a general lack of coordination of watershed projects within major subbasins of the Columbia and Snake rivers.

In 1997, the ISRP recommended that 1) habitat policies and objectives be established for each major subbasin and coordinated with overall production goals for the subbasin, 2) development of reliable watershed assessment procedures be given high priority, and 3) watershed assessment *precede* implementation of restoration projects so that probable limiting habitat factors be identified and a reasonable expectation of restoration effectiveness exists.

The Council was in broad agreement with the ISRP's recommendations and noted that the ISRP's recommendations were consistent with the Council's goal of developing procedures and criteria for selecting habitat projects. The Council offered a set of guidelines for developing habitat criteria and procedures. Many of these guidelines were based on ISRP recommendations. These guidelines specifically called for watershed assessments and selection of all projects funded under the program according to a set of specific criteria. The Council also put on hold, with some exceptions, the funding of all habitat projects, whether new or ongoing, pending evaluation according to a habitat project selection process that was being developed.

In response to the regional need for a better coordinated and systematic protocol for evaluating and selecting habitat and watershed projects, a report entitled "A Method and Criteria for Prioritizing Fish and Wildlife Populations/Subbasins and Watershed/Habitat projects" was prepared by an *ad hoc* Habitat Work Group and submitted to the Council on June 25, 1997. The purpose of the document was to provide an initial screening process that would be used to determine which habitat projects were technically sound and feasible.

In their review of a draft of the report, the ISRP concluded that the proposed criteria for evaluating the technical merits and feasibility of watershed/habitat projects represented an important and useful method of screening new projects and evaluating ongoing projects for funding. The criteria were an excellent start at defining the approach to selecting watershed/habitat projects for funding. The methods and criteria included many of the

evaluation features recommended by the ISG in *Return to the River* and the ISRP in its programmatic review of the Fish & Wildlife Plan (ISRP Report 97-1), including the very important role of peer review in improving projects through constructive criticism. The ISRP suggested a number of ways that the process outlined in the report could be improved.

Despite the programmatic commitment to habitat project planning reflected in the 1996 FWP and the Council's response to the ISRP's 1997 recommendations, the ISRP, in their 1998 review, expressed concern at the number of habitat restoration proposals that still did not give sufficient evidence of being supported by a watershed plan and preceded by a watershed assessment. The ISRP identified the deficiencies common to many proposals. Specifically, many proposals did not contain information on:

1. The distribution of the species of interest within the watershed, in relation to the location of the proposed restoration activity. That is, was the project sited correctly relative to the behavior and distribution of the organism(s) of interest?
2. How the proposal related to other restoration efforts within the watershed. Were restoration activities complementary or would there be potential conflicts?
3. Whether the proposal would promote the restoration of normative ecological processes within the watershed.
4. Whether the proposal had considered the alternatives of passive restoration (e.g., letting the stream or riparian zone restore itself through successional habitat recovery) vs. active restoration (assisting the recovery process through intervention activities such as riparian plantings or instream structure placement).
5. Whether any steps were being taken within the watershed to correct the source(s) of problem(s).
6. What evidence suggested that the proposed activity would actually correct a significant limiting factor to natural production?

The ISRP recommended that "... the Council set a deadline of 2-3 years after which no habitat projects would be funded unless preceded by and consistent with a watershed assessment..."

The Council's response indicated a strong commitment in principle to the ISRP's findings. The Council recommended that all watershed project contracts for FY 1999 address the six points identified by the ISRP.

The Council also agreed with the ISRP's recommendation not to fund proposals that were not backed by a watershed assessment. The Council gave CBFWA the task of developing regional criteria for watershed assessment and to compile a list of existing watershed assessments. This work was to dovetail with Council staff efforts to apply program elements and prioritization process principles to the watershed project package, watershed coordination, and the concept and use of watershed assessments. Once the work described above was completed, the Council suggested that CBFWA consider allocation of a portion of the FY 2000 and 2001 budgets to completing needed watershed assessments.

In 1999, the ISRP noted a general lack of coordination of watershed projects within major subbasins of the Columbia and Snake rivers. Watershed restoration projects were now to be

preceded by an approved watershed assessment, but again habitat projects often were not shown to be organized or prioritized using the results of such an analysis. Additionally, watershed-level evaluation of project success was largely lacking.

In their 2001 and 2002 reviews, prior to implementation of subbasin planning called for in the 2000 FWP, the ISRP continued to press for watershed assessments in the subbasins. They noted that standard protocols for watershed assessment, prescription, rehabilitation, and evaluation in the Columbia River Basin were lacking. The ISRP recommended several assessment protocols currently in use within the Basin for guidance in developing a basin-wide assessment protocol. They also suggested that projects proposing to do habitat restoration should attempt to estimate the expected contribution to fish runs and to relate these expectations to the historical and current runs in the subbasin.

The ISRP noted significant progress toward an adequate assessment in some provinces (such as in the Yakima, using the Ecosystem Diagnosis and Treatment modeling approach referred to as EDT). The ISRP also found that Confederated Salish and Kootenai Tribes' Habitat Acquisition and Restoration Plan document described a good plan for habitat acquisition and restoration of wildlife habitat in mitigation for lost aquatic and riparian habitat and could serve as a useful model to other habitat and restoration proposals with some minor revision of the monitoring and evaluation (M&E) component of the plan.

## The 2000 FWP and Subbasin Planning

The 2000 FWP was the most comprehensive program to date for dealing with habitat issues. As stated "This program relies heavily on protection of, and improvements to, inland habitat as the most effective means of restoring and maintaining fish and wildlife populations." A unique element of the 2000 FWP was the development of a set of principles that would form a scientific framework for restoration and protection. The science principles in the 2000 FWP are largely ecosystem based and explicitly acknowledged the role of habitat in sustaining biological diversity and productivity. Habitat also is a key component of basin-scale biological objectives and restoration strategies given in the 2000 FWP.

Perhaps most relevant to ISRP habitat recommendations was the FWP's requirement for subbasin planning. The subbasin plans were intended to direct selection of projects to be recommended by the Council to BPA for funding. The plans themselves were developed under the guidance of the Council itself with a grant from BPA. The plans were to be developed locally and in collaboration among agencies, local governments, interest groups, and stakeholders.

A subbasin assessment characterizing the biological and physical attributes of the subbasin was a major component of the subbasin plan. The Council developed a Technical Guide for subbasin planners that provided specific guidelines for development of subbasin plans, including guidelines for subbasin assessments. The Council's Technical Guide for subbasin planners explicitly called for characterization of historical, current, and potential future environmental

conditions, and an assessment of the difference between current and historical conditions. Physical habitat conditions, of course, are major components of environmental conditions. The Technical Guide also called for identification of key environmental correlates that are particularly important for species survival. The assessment also was supposed to identify factors limiting fish production, many of which will be habitat related. The habitat-based modeling system EDT, was suggested as an aid in subbasin planning.

The Council also asked that the plans address questions important to the NMFS recovery planning. The questions pertain to how habitat changes have altered the abundance, productivity, diversity, and spatial structure of populations, the causes of habitat degradation, and what habitat conditions are necessary to support viable evolutionary significant units (ESUs).

A second central component of the subbasin plan was a Management Plan. The Management Plan was to include a set of objectives that are consistent with the basin-scale objectives and responsive to the results of the subbasin assessment, and strategies, including habitat strategies, for accomplishing the objectives.

All subbasin plans were completed by May 2004 and reviewed jointly by the ISRP and the ISAB (ISRP/ISAB 2004-13). Unquestionably, the subbasin planning effort represented a major step forward in development of a comprehensive strategy for recovery of salmonid species within the major subbasins of the Columbia River. All plans had a strong tributary habitat component.

Below we assess how well the 2000 FWP and the subbasin plans addressed the ISRP's recommendations that came out of their programmatic and project reviews prior to the initiation of subbasin planning:

**1. *ISRP Recommendation:*** *Habitat policies and objectives should be established for each major subbasin and coordinated with overall production goals for the subbasin.*

The Technical Guide guiding development of subbasin plans called for the development of biological objectives and strategies. Biological objectives “describe physical and biological changes within the subbasin needed to achieve the vision.” The objectives should be measurable. Strategies are the sets of actions needed to accomplish the objectives.

The definitions and required content of objectives and strategies are reasonably clear in the Technical Guide. Even so, in their programmatic review the joint ISRP and ISAB concluded that most plans tended to confuse objectives, strategies and actions. Their criticism was aimed at objectives and strategies addressing all causes for fish decline including tributary habitat. The ISRP noted three difficulties that were apparent from this confusion. First, the strategies of many plans were very general and thus of little value in determining whether the actions comprising the strategy would be sufficient to achieve the objectives. Second, strategies often lacked coherence because the actions comprising the strategy were insufficiently integrated. Finally, objectives and strategies were not prioritized in many plans.

**2. ISRP Recommendation:** *Development of reliable watershed assessment procedures should be given high priority.*

The Subbasin Assessment was one of the major elements called for in the subbasin plans. The Technical Guide was intended to provide specific guidance for development of the assessment. The joint ISRP and ISAB judged the Assessments to be the strongest part of most plans. Many Assessments provided valuable syntheses of the condition of tributary habitat within the subbasins, including identification of areas with high quality habitat and areas where habitat had been degraded and, in some plans, the extent to which it had been degraded. The assessments also discussed habitat alterations that could be attributed to human actions, and the actions that were considered to be most important in altering habitat. The assessments should provide useful resources for future planning.

In their programmatic review, the joint ISRP and ISAB noted that many plans did not reflect some of the more recent scientific knowledge pertaining to ecological restoration. A particular weakness of nearly all plans was inadequate treatment of natural variation in habitat conditions and the landscape processes that caused the variation. Virtually no plan attempted to relate the major watershed processes in a subbasin to the dynamics of riparian and in-stream habitat conditions. This omission may be a consequence of the direction provided by the Technical Guide. While the Scientific Foundation in the 2000 FWP placed a great deal of importance on the dynamic nature of ecosystems, the Technical Guide put little explicit emphasis on description of the natural disturbance regime and how it shaped habitat conditions. This weakness was reflected in objectives and actions that called for restoring habitat to a particular state or condition that was judged to be necessary to accomplish fish production goals. For example, many Management Plans proposed to establish fixed, in-channel conditions such as a specific number of pieces of large wood or a specific stream temperature. The ISAB (2003) cautioned that such fixed states might not be sustainable or even desirable in a dynamic ecosystem.

**3. ISRP Recommendation:** *Watershed assessments should precede implementation of restoration projects so that probable limiting habitat factors should be identified and a reasonable expectation of restoration effectiveness exists.*

The Technical Guide that directed development of Subbasin Plans calls for an analysis of limiting factors in each subbasin. The joint ISRP and ISAB identified several problems with the limiting factors analyses in the subbasin plans. These problems appear to stem from a number of interacting factors involving lack of clarity in the Technical Guide over how the limiting factor analysis was to be used in the management plan, confusion over the definition of a limiting factor, lack of evidence that a particular factor indeed was limiting, and difficulties with the assessment tool.

The Technical Guide is not explicit about how the limiting factor analysis fits into the management plan, although presumably the intent was for the plan to develop objectives and strategies that address the limiting factors. The Technical Guide calls for development of biological objectives that describe physical and biological changes within the subbasin needed to

achieve a basin-wide vision, each objective consisting of a biological performance, describing responses of a species to habitat conditions, and environmental characteristics, which describe the environmental conditions needed to achieve the desired biological performance. Little mention is made of how the limiting factor analysis should be used to develop biological objectives and strategies

The joint ISRP and ISAB expressed concern that planners often did not make clear which definition of a limiting factor they were using in the limiting factor analysis. There is no single, accepted definition of a limiting factor. The joint ISRP and ISAB identified three common characterizations of a limiting factor (a single environmental factor that limits the survival and abundance of a species; an anthropogenic factor that negatively impacts a species; a watershed process that creates adverse conditions for a species). The ISRP noted that not only was the definition of a limiting factor not made clear in the subbasin plans, but planners also appeared to use a mixture of definitions ranging from individual environmental factors to large scale landscape processes. Often, little empirical evidence was provided to support designation of a particular factor as limiting.

Planners used three approaches to perform the limiting factor analysis: an assessment model, usually EDT, its variant form for resident fishes, Qualitative Habitat Assessment (QHA), or expert opinion. EDT and QHA were used to assess impacts of habitat factors on production and capacity by comparing estimated historic conditions with current. EDT was not a required assessment tool; however the Council was heavily invested in EDT and its use was encouraged.

Many planners found EDT or QHA to be a useful tool and indicated that the outputs matched their experience. Others experienced difficulty using the model. The joint ISRP and ISAB concluded that there was apparent misunderstanding of the intended use of the EDT model by many subbasin planners. They state that the outputs of EDT and QHA could provide measures of relative, but not absolute, changes in fish populations and habitat conditions, and should be used to generate hypotheses to be tested rather than absolute values that restoration actions are to achieve. The ISAB/ISRP's also expressed concern that, in nearly all cases, actual data used to populate the models were limited, that levels of uncertainty from models or expert opinion were rarely discussed, and that the influence of uncertainty was rarely considered in the Management Plans. Although the EDT model was the most commonly applied aquatic assessment tool, its application did occur at substantial monetary cost to the planning process.

***4. ISRP Recommendation:*** *Habitat projects should be prioritized in the context of habitat objectives and fish production goals, and relying on information provided by the watershed assessment.*

Prioritization is one of the most important elements of the Management Plan and was called for in the Technical Guide. It is essential for identifying areas in greatest need of protection or restoration, directing restoration actions, and serving as the basis for selection of projects for funding. The joint ISRP and ISAB concluded that lack of prioritization of objectives, strategies, or locations where restoration actions were to take place was a major deficiency of most Management Plans. Lack of time to complete the Plan or the inability of participating

stakeholders to reach a consensus on priorities appeared to be two of the major reasons that most Plans did not have a well-developed set of priorities.

**5. ISRP Recommendation:** *Effective habitat restoration will involve both public and private lands and will necessarily require coordination and cooperation among agencies, tribes, and public.*

The 2000 FWP emphasized that subbasin plans were to be developed locally and in collaboration with action agencies, tribes, local governments, and other stakeholders so that the Plan would have broad support. Many were successful in involving a large and diverse group of stakeholders and agencies in development of the Plan. The joint ISRP and ISAB recognized that the plans improved stakeholder involvement in the planning process. They concluded that the planning effort resulted in increased provincial overview and insights, increased planning organization at both provincial and subbasin levels, and, in most cases, increased coordination among subbasin and provincial fish and wildlife managers. The subbasin planning process also intensified the local and province-wide focus on the decline in fish and wildlife populations.

## Summary

Since 1994 the Council has elevated the importance of tributary habitat for restoration of native species and was continuously engaged in refining an approach that would provide guidance for development and selection of tributary habitat projects. Although there was a clear programmatic commitment to habitat planning prior to the 2000 FWP, the ISRP consistently found that project proposals suffered from a lack of subbasin habitat objectives, watershed assessments, prioritization, and effective monitoring and evaluation. This oversight made ISRP efforts to review habitat proposals particularly frustrating. There were several reasons for this inconsistency. First, watershed assessments and comprehensive planning at the subbasin level required funding as well as a substantial time commitment. Funding specifically earmarked for this activity was not available at that time. The Council, with a grant from BPA, provided funding to develop subbasin plans, thus attempting to overcome a major hurdle for subbasin planning. In spite of the effort to finance the planning effort, many planners found the level of funding to be inadequate. Second, although the Council repeatedly called for habitat objectives and assessments at the subbasin scale, there were few penalties assessed for proposals that lacked these key elements. The Council tended to fund, at least partially, habitat proposals that the ISRP deemed not fundable. Apparently, one of the reasons for the Council's actions in this regard was to protect BPA's investment in ongoing projects. In the Subbasin Planning process, selection of habitat proposals for funding will be determined in part by their conformity with subbasin plans. This requisite should make reviews by the ISRP more manageable and transparent and should reward efforts that tie projects to the Plans. Third, there likely was a lack of understanding and therefore regional agreement on the detailed elements composing an assessment. The Technical Guide was an attempt to address this issue.

All of the recommendations tendered by the ISRP were addressed explicitly in the 2000 FWP and the Technical Guide. The 2000 FWP called for development of subbasin habitat objectives as a central part of the Management Plan. Watershed assessments were a core component of subbasin plans, which also called for an analysis of factors limiting

production of focal species. Prioritization of objectives and strategies were key components, as was coordination among actions agencies, tribes, and stakeholders in development of the Plan.

The joint ISRP and ISAB noted, however, that the draft plans only constituted a beginning, an important step toward planning, but that most plans had important deficiencies, including ones related directly and indirectly to tributary habitat, and required substantial revisions and addition before the plans were adopted. The deficiencies likely resulted from insufficient clarity in the Technical Guide, lack of time and funding which cut short effort, difficulties in establishing coordinated working groups and reaching consensus on priorities, difficulty in working with the assessment tools, and lack of adequate data on which to base a quantitative limiting factors analysis.

## D. Wildlife

The Wildlife Program has been significantly smaller than the Fish Program, and was largely separate from the Fish Program when the ISRP began its reviews in 1997. The Wildlife Program also differed in focus from the Fish Program, deriving from its separate history of development based on assessment of habitat losses as an assumed proxy for wildlife losses. Thus, the Wildlife Program had focused on habitat acquisition to replace habitat losses caused by development of the federal hydrosystem.

In developing its first report in 1997, the ISRP reviewed the FWP, including many documents that described development of the Wildlife program. The ISRP noted that "...coordination with other parts of the FWP (i.e., Resident Fishes, Anadromous Fishes) seems largely lacking." The ISRP also observed that, although the Wildlife Program presumably was effective in its emphasis on habitat acquisition and protection, which were assumed to benefit the wildlife species themselves, there was little if any attempt to measure directly the benefits of habitat acquisition (or intended habitat improvement, through management actions) at the level of wildlife populations.

The section on Wildlife in the ISRP's first report (ISRP 1997-1) included nine procedural recommendations, most notably:

- that a separate Scientific Review Group for the Wildlife Program not be formed, but rather that a single Review Group (currently the ISRP) be charged with review of both Fish and Wildlife issues within the FWP. *This should improve program coordination, which will likely remain difficult in such a large and complicated program as the FWP,*
- and several scientific recommendations:
- that the Wildlife Program include an explicit scientific research component. *This would be likely to increase mitigation success and would make evaluation and adjustment of the Program over time much more feasible,*
  - that additional scientific criteria be added to those currently used to prioritize proposals for mitigation projects. *For instance, the geomorphologic suitability of a site to sustain Habitat Units anticipated to be gained should be considered in prioritizing mitigation projects,*

- that the Program give increased attention and priority to research designed to evaluate effectiveness of habitat measures in terms of direct assessment of wildlife populations and their ecology,
- that Council include a portion of the Wildlife Program funds each year within the competitive grants program for research that could contribute to the benefit of wildlife. *Innovative monitoring and research proposals could be encouraged through this part of the Program,*
- that monitoring, which now is based on the unit of mitigation, habitat (measured as HUs [Habitat Units], determined from HEP [Habitat Evaluation Procedure]), be extended to include a requirement for some degree of direct monitoring of target (and perhaps some non-target) wildlife populations.

The Council was largely supportive of these recommendations, from which they extracted two key issues for immediate attention (FY98 Council AIWP): that monitoring and evaluation be extended to include some population monitoring and that acquisition of land continue to be emphasized in the wildlife program. The Council also essentially implemented the recommendation that a common group review both fish and wildlife proposals, as both of these continued to come to the ISRP for outside peer review.

In its next project review report (ISRP 1998-1), the ISRP reiterated the recommendations from its 1997 report that had not been implemented completely. The ISRP stated concerns about location and management of habitat that was acquired to mitigate wildlife losses. The ISRP noted the important trade-offs between allocation of funds to land acquisition versus to land management, as well as the high costs of the large amount of active management that was included in wildlife projects. Thus, the ISRP recommended that the program include research designed to evaluate effectiveness of alternative active and passive management actions that are intended to benefit wildlife, and, more generally, that more relevant and contemporary research be incorporated into the Wildlife program. The ISRP noted that incorporation of an explicit scientific research component would be likely to both increase mitigation success and make adaptive management more feasible.

Future ISRP reports consistently noted the same set of core concerns, but evolved to address more specific examples of implementation and practice. For instance, the FY2000 ISRP review (ISRP 1999-2) noted that few wildlife proposals presented a clear rationale for acquisition of particular parcels of land. The ISRP noted the need for proposers to justify the value of parcels of land to particular wildlife species and to make clear the cost-effectiveness of parcels to be acquired. Thus, the ISRP recommended that: “no land acquisition be funded without a clear description of the land to be acquired and without demonstration of its priority for the fish and wildlife program.”

The ISRP additionally suggested in this review that an umbrella proposal could provide a natural mechanism for explaining the integration and planning that should underlie land acquisition decisions. Several wildlife umbrella proposals for FY2000 addressed this concern effectively (e.g., Oregon Wildlife Mitigation Umbrella) and presented this background and rationale, but others gave no clear justification for land acquisition or land easements. Use of umbrella

proposals was an additional step toward improved project coordination, which evolved over the next few years into rolling Subbasin reviews and the Subbasin Planning exercise.

The ISRP remained critical of the monitoring and evaluation of results in ongoing wildlife projects and of the lack of clear and well-described plans for future monitoring and evaluation. Many proposals continued to lack clear descriptions of sampling design or of procedures and criteria for assessing outcomes of management plans, but several proposals had significantly improved monitoring and evaluation sections. The ISRP also gave examples of the improvements in ongoing and planned data collection, including quoted examples from a selection of proposals, all of which focused on direct measurement of wildlife species or of specific habitat criteria that are of benefit to fish and wildlife. These were suggested as useful models for future wildlife proposals. The ISRP continued the practice of pointing out useful examples of innovations or high quality approaches in its reviews, drawing examples from within the FWP, from other programs, and from the literature.

The ISRP noted in the FY00 report (ISRP 1999-2) that many of the habitat and wildlife projects allocated substantial funds to control of non-native plant species, but that these projects rarely included monitoring to evaluate effectiveness of control methods or experimental designs that would allow comparison of methods of control or of treated and untreated areas. Reviewers stated concerns with the long-term and large-scale commitment of funds for control of non-native species, as well as with the lack of consideration or evaluation of unwanted effects of the use of herbicides, fire, and hard-engineering methods for non-native plant control (e.g., effects on soil fertility, non-target plant species, or wildlife). Active treatment to remove non-native plants, such as broadcast application of herbicides, provides one example of an expensive form of active habitat management that was routinely done, but for which studies to evaluate effectiveness of alternative approaches were rare or lacking. The ISRP suggested that such problems be addressed by directed project solicitations and by increased emphasis on evaluative research. For instance, from the FY00 report, “The ISRP recommends that the Council solicit innovative proposals for development, testing, and evaluation of cost-effective passive methods for control of non-native species.”

Council noted in the FY99 AIWP that the ISRP had essentially repeated several recommendations for the wildlife program from their past report and stated that efforts already were under way to respond to these comments and recommendations. For example, the Wildlife Working Group had released a request for proposals to develop an improved monitoring, evaluation, and research component for the wildlife program, and the group had revised its project selection criteria to address ISRP concerns. Additionally, Council noted that the wildlife program did now include projects that provide integrated fish and wildlife habitat protection (e.g., the Squaw Creek, Pine Creek, and Coeur d’Alene initiatives). However, Council noted that “More needs to be done to integrate anadromous fish, resident fish and wildlife values and habitat protection; this is in part one of the hopes for the multi-species framework development process.”

The ISRP (1999-4 FY00 Response) continued to call for improved monitoring and evaluation of wildlife land acquisitions, noting specifically the limitations of HEP as a monitoring and evaluation tool. “While the ISRP does not contest [HEP evaluation as a method for defining

losses of land and losses of habitat and as a conceptual approach to wildlife habitat acquisition and restoration] or the policy decisions behind it, we continue to have concerns that the monitoring and evaluation of wildlife projects and programs should not rest solely on a HEP-based analysis. A fundamental premise in the HEP approach is that target wildlife species (and associated non-target species) will respond in a positive fashion (usually abundance) to species-specific habitat improvements. While there are strong theoretical reasons to expect a positive relationship between habitat improvements (usually brought about through acquisition and subsequent land management), biological responses are variable and often complex. Therefore, a necessary complement to a HEP-based management project or program, should be a monitoring and evaluation component that routinely assesses the expected versus actual response of both target and non-target wildlife species.”

In reviewing the Albeni Falls proposal for wildlife monitoring and evaluation, the ISRP noted that it included provision for long-term HEP evaluations and suggested that (1) effort put into long-term repetition of HEP analyses may not be very useful and (2) that use of HEP analyses and their associated Habitat Units (HUs) to guide land management may lead to counterproductive management practices. HEP is based on the assumption that habitat suitability for a species can be described by a Habitat Suitability Index (HSI). However, these indices vary in quality, and many are based on limited information. Measures of uncertainty in the form of confidence bounds on HSIs are rarely given, but have been found to be very broad. Management to produce or maintain habitat that is predicted by an index of untested quality to provide good habitat for a particular species is not warranted when better and more direct information on wildlife is available. Thus, the ISRP urged the program away from continuing emphasis on HEP evaluation as a tool for long-term evaluation or management planning. The development of good-quality direct monitoring programs will make this coarse approximation obsolete as an evaluation tool.

The ISRP also again recommended that specific mechanisms be developed to better coordinate the FWP, both internally and with other programs that have significant impact on fish and wildlife and their habitat in the Columbia River Basin. “In general, our concerns were that many projects tended to deal with protection and enhancement of steppe-shrub upland habitat without relating the potential benefits to fish and wetland species in a more integrated ecosystem approach. On the other hand, few of the fish projects, if any, related potential benefits to terrestrial wildlife. The ISRP believes that better integration of projects for protection of habitat for spawning and rearing for fish with protection of terrestrial habitat will provide long-term benefits. For example, many fisheries projects called for fencing of streambanks to limit access by cattle, while most wildlife projects call for purchase of land or conservation easements. Both of these practices are desirable, but it may be more economical, and more ecologically effective, for the two programs to work in harmony with each other.” Thus, the ISRP 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 FY00 Council AIWP, the Council “declined to accept the recommendation that it solicit specific types of proposals for control of non-native species at this time, instead electing to continue the project solicitation and selection model currently used, where both it and the ISRP

receive and review the proposals that are recommended by CBFWA.” The AIWP further stated that “... Council believes efforts to control non-native species should be articulated in the context of a subbasin plan (and in light of complete assessments). Therefore, these types of proposals, and all others for that matter, should be made and reviewed in the context of activities seeking to implement a subbasin plan rather than in the abstract. The Council does encourage the ISRP to identify and comment upon innovative proposals for development, testing, and evaluation of cost-effective passive methods of control of non-native species in the context of its review of proposed projects in its annual reports. The Council will take those comments into account in making its funding recommendations in Fiscal Year 2001 and future years.”

The trade-offs between allocation of funds to management intended to enhance the fish and wildlife value of lands and the alternative allocation of funds to acquire or protect lands continued to be noted by the ISRP, and the responses of Council have varied. Council seems to have embraced the ISRP’s recommendation that evidence be provided of the value of active land management that is intended to maintain or improve habitat value to fish and wildlife, but funding decisions have not always supported this position. For instance, in FY 2002, Council declined to recommend funding for active habitat management of uplands in Garfield County for which the ISRP had noted a lack of justification of the biological benefits from the project: “The Council concludes that the ISRP’s comments highlight critical concerns about the continuation of this project. The Council recommends continued funding of the base program and selected passive restoration strategies... The Council recommends that the budget not include funding for Section 5 (objective 1a), no-till, direct seeding and changing crop rotation until better justification of the biological benefits is presented” (Columbia Plateau Issue Memo FY 2002, Lower Snake Mainstem Issue 1: Garfield County Sediment Reduction and Riparian Improvement Program, Project 199401807). However, in FY 2003, Council considered a set of proposals for the Lower Columbia Estuary Province and recommended funding for the aspects of the projects that supported habitat enhancement objectives, while recommending against those that would have expanded land acquisition in the Willamette Basin (Lower Columbia Estuary Province FY03 Council Issue Memo).

The ISRP’s recommendation that proposals for active land management should justify the costs and values of the proposed active management techniques was applied also to proposals intended primarily to benefit fish or that involved linkages of wildlife and fish habitat. For instance, in the Umatilla River Basin, Council wrote: “These projects are intended to implement actions that protect and enhance riparian and in-stream habitat in the Umatilla River Basin. The Council concludes that the ISRP’s comments highlight concerns about the continuing watershed restoration, to this degree and intensity, without a subbasin assessment and plan. ... The Council recommends continued funding of the base program and passive restoration strategies (i.e. screening, riparian buffers) for these projects pending subbasin planning. The Council recommends that the budget not include funding for aggressive channel design/implementation techniques” (page 35/56, Columbia Plateau Issue Memo FY02, Umatilla Issue 1: Enhance Umatilla River Basin Anadromous Fish Habitat, Project 198710001, and Umatilla Subbasin Fish Habitat Improvement, Project 198710002). Similarly, regarding a project in the Walla Walla Basin, Council wrote: “The Council concludes that the ISRP’s comments highlight concerns about the continuing watershed restoration, to this degree and intensity, without a better link of an assessment and geomorphic stability. ... The Council recommends continued funding of the

project and passive restoration strategies (e.g., screening, riparian buffers) pending subbasin planning. The Council recommends that the budget not include funding for aggressive channel design/implementation techniques.” (p. 40/56: Col Plat Issue Memo FY 2002, Walla Walla Issue 2: Walla Walla Basin Fish Habitat Enhancement; Project 199604601.” These examples also illustrate the Council’s general support of watershed-level assessment and planning, the demonstration of benefits of active management, and the integration of fish and wildlife benefits, all of which had been recommended consistently by the ISRP.

Ultimately, the ISRP’s recommendations featured prominently in the 2000 FWP, which embraces coordination among elements of the Program, including linkage of the goals, objectives, and strategies for habitat, wildlife, and fish, and more emphasis on monitoring and evaluation and its coordination among projects, groups, and subbasins. The ISRP’s recommendations also feature in the Technical Guide for Subbasin Planners (Council Document 2001-20), which emphasizes coordinated, subbasin-scale planning that integrates habitat, wildlife, and fish goals and that incorporates explicit consideration of ecological relationships, including linkages amongst multiple populations of fish and wildlife and their habitat. Thus, the dialogue of proposal and program review that occurred between the ISRP, the Council, and project proponents seems to have evolved into substantive program changes that reflect more emphasis on research, monitoring and evaluation, and adaptive ecosystem management, all within a more coordinated Fish and Wildlife Program.

Review of the first Subbasin Plans was completed by the ISRP, ISAB, and a large group of peer reviewers in summer 2004. Subbasin Planning was intended to significantly increase the coordination and integration of the fish and wildlife programs, as well as to facilitate coordinated planning and review of fish and wildlife actions among subbasins, and the Subbasin Planning process certainly made significant progress in meeting these goals. However, several concerns of the ISRP from earlier reviews remained prominent in comments from the ISRP and ISAB’s review of subbasin plans (ISRP&ISAB 2004-14):

- “... the Management Plans tend to incorporate far less attention to wildlife than to fish and often do 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 diversity.”

Additionally, concerns about wildlife monitoring and about the integration of habitat, wildlife, and fish actions, similar to those that were voiced by the ISRP in earlier reviews, emerged in slightly different form as concerns about the selection and use of focal species in monitoring and evaluation of FWP actions:

- “... the emphasis on ESA-listed species, especially aquatic species, led some planners to exclude non-listed species, which resulted in some important habitat types being overlooked. The strongest plans were those that used functional analysis in selecting terrestrial focal species. Focal species that had very low abundances present a costly task for monitoring changes in these species and their habitats.”

- “... augmenting focal species information with an assessment of changes in the characteristics of biological communities or ecosystem processes would provide a more complete picture of progress towards improved ‘ecosystem health.’”
- “Discussion of population status and trends ... was almost universally lacking for terrestrial and non-salmonid aquatic species.”
- “The choice of focal species affects not only the selection of objectives and strategies in a plan, but also the ability of plan implementers to monitor the effectiveness of actions towards meeting plan objectives.”
- “Ideally, the focal species selected should exhibit three characteristics: (1) they should represent the diversity of aquatic and terrestrial habitats that are the target of restoration actions in the plan; (2) they should be species that are expected to respond to the actions being implemented; and (3) it should be possible to collect abundance or distribution data for these species – ideally, some of these data will already be available. “
- “The feasibility of collecting data on the current and future status of focal species was ignored in many of the subbasin plans. The tendency to select focal species for which little status and trend information exists (or can be practically collected) compromises the ability to evaluate the success of plan implementation. There are many species, however, for which data can be collected, given sufficient commitment to this effort.”
- “Augmenting focal species information with an assessment of changes in the characteristics of biological communities or ecosystem processes would provide a more complete picture of progress towards “ecosystem health.” In future revisions of the subbasin plans, some thought should be given to the identification of “focal processes” as well as focal habitats and focal species.”

Overall, much progress appears to have been made in developing productive scientific review and dialogue. The concerns that were voiced in the first ISRP reviews have evolved in conjunction with changes that were made to address those concerns. The scientific basis of the FWP has been significantly updated in the Council’s 2000 FWP. The depth and quality of discussion of the issues that have persistently been raised by the ISRP have increased significantly, and there have been many efforts to develop better monitoring and evaluation, strike the best balance between land acquisition and land management, choose wisely (using scientifically sound, evaluative information) between different land management alternatives, improve coordination of wildlife and fish programs, and balance attention to biological populations, whether fish or wildlife, with attention to habitat and ecosystem dynamics.

Several challenges remain for wildlife portions of the FWP.

**Recommendation:** Aquatic and terrestrial elements of the FWP should be fully integrated in continuing development and implementation of Subbasin Plans.

**Recommendation:** Additional time and thought should be given to criteria and procedures for selecting focal species that will be useful and effective in monitoring and evaluation.

**Recommendation:** The focus on ecosystems and biodiversity that is a central emphasis of the Council’s 2000 FWP should continue to be incorporated into actions. Currently, the wildlife program focuses on vertebrates, especially game species and rare and endangered species, and continues to emphasize a narrow definition of habitat. In the future, a broader representation of

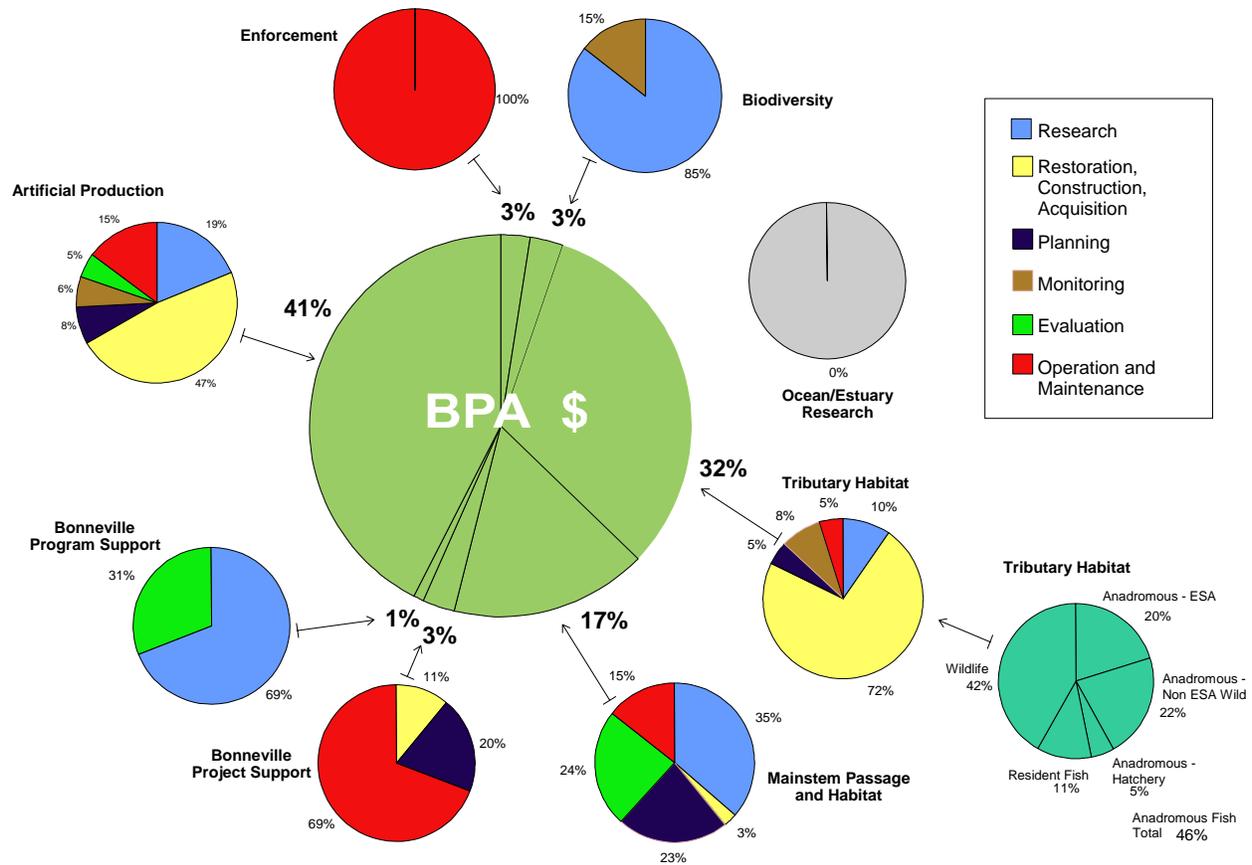
focal wildlife should be included, and landscape structure and ecosystem dynamics should be considered as needed to address the ecosystem and biodiversity-based FWP goals.

**Recommendation:** To facilitate better decisions about allocation of limited funds to actions intended to benefit fish and wildlife, the biological and economic costs and benefits of active and passive management practices should be evaluated, and these should be compared with the costs and benefits of land acquisition or protection.

Finally, it remains to be resolved what will be the best balance between research and direct actions to accomplish the restoration and conservation of fish and wildlife.

### E. Artificial Production

Support for artificial production constitutes a substantial proportion of the Columbia Basin’s Fish and Wildlife Program (Figure AP-1). As such, artificial production has received considerable focus and attention as the basin’s native salmonid communities have continued to decline or been significantly altered.



**Figure AP-1** shows the distribution of funds in the Council’s Fish and Wildlife Program based on the FY1998 recommendations from CBFWA, including artificial production activities, which accounted for 41% of the proposed funding (from ISRP 97-1).

Large scale reviews, such as the 1996, *Upstream* (National Research Council 1996) and *Return to the River* (Independent Scientific Group (ISG) 1996; 2000; Williams et al. 2003; Williams *in press*), each attributed the decline of native fish populations in the Pacific Northwest and the Columbia River Basin in part to large-scale, disintegrated, and ineffective artificial production activities within the basin. These reports further concluded that a constellation of human activities (e.g., forestry, agriculture, grazing, hydropower, and development) played a major role in degrading and fragmenting viable habitat, which in turn diminished the potential

for and success of artificial production and supplementation to reverse declines of critically depressed salmon and steelhead populations in particular. In addition, a suite of ecological and evolutionary risks increasingly has been recognized as needing consideration, assessment, and amelioration alongside the potential benefits of the Columbia Basin's large-scale artificial production program (see Myers et al. 2004, Nickum et al. 2004 and references therein [including Currens and Busack 2004], and RSRP 2005). Consequently, the region and basin are currently struggling to balance the potential immediate demographic recovery and rebuilding benefits from artificial production programs against the longer-term and deleterious impacts to genetic structure and fitness of native fish populations. The struggle is presently playing itself out in a series of legal challenges and court decisions surrounding various new policies from NOAA-Fisheries that attempt to define the role of hatcheries and hatchery fish in ESUs and in salmon recovery planning and implementation.

Over the past 10-years (covering the period of this Retrospective Review; 1996 to present), the ISRP examined each BPA-funded artificial production project – often multiple times through various review processes – and extensively reviewed the larger, more complex artificial production programs in the basin, such as those in the Yakima, Hood, Klickitat, Grande Ronde, Clearwater, and Salmon river systems. Throughout these reviews, and consistent with *Upstream* and *Return to the River*, the ISRP repeatedly concluded that the general approach to using artificial production in the Columbia River Basin is in need of major reform. Such a call for reform was again raised through the Council's Artificial Production Review and Evaluation (APRE; NPCC 2004-17, NPCC 2005-11).

Several themes repeatedly emerged over ISRP's review history. These include the need to:

- Approach artificial production and supplementation as *experiments* that include
  - a) defined treatments and appropriate experimental controls;
  - b) rigorous monitoring and evaluation;
  - c) technical peer review of design and analyses;
  - d) a documented basis in defensible ecosystem management principles; and
  - e) use of appropriate performance metrics;
- Design the program for integrating or segregating artificial and natural production *a priori* along with
  - a) broader coordination of projects across drainage, subbasin, province, and, if possible, (eco-)system levels; and
  - b) *a priori* risk analyses;
- Manage artificial production within a subbasin and habitat context, such as matching releases to subbasin (and estuary-marine) carrying capacities and periodic evaluation of programs progress toward achieving goals,
- Recognize the Fish and Wildlife Program's priority on native populations in native habitats, including the establishment of core reserve natural populations within a framework of healthy habitats.

**Recommendations:** In order to address these recurring themes and the uncertainties that underlie them, we recommend the following to Council:

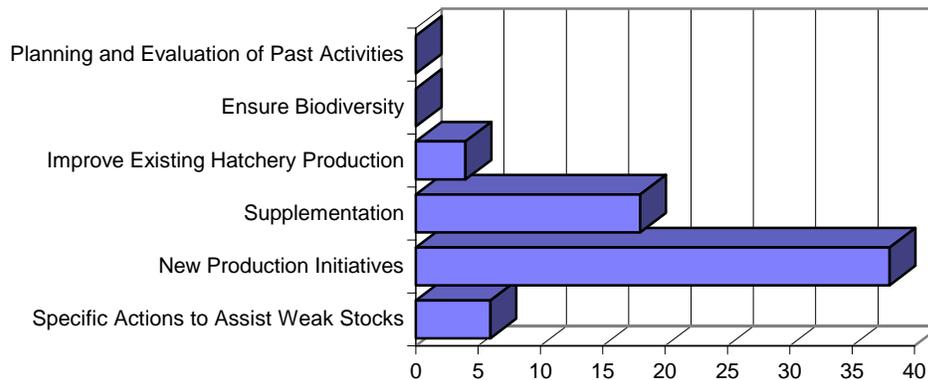
- A. Require that all submissions for new or ongoing artificial production and supplementation projects be approved only when designed and treated as experiments within an adaptive management framework;
- B. Require appropriate ecological, disease, and genetic risk assessments be addressed as part of the design phase, before new projects are approved. Moreover, for ongoing projects, require retrospective risk assessments prior to additional funding.
- C. Require robust periodic evaluation of benefits and contributions of artificial production toward natural reproduction. Such evaluations should occur at multiple levels (i.e., specific drainage, subbasin, province, and even basin).
- D. While the recent subbasin planning effort provided an entree into integration and coordination among programs and projects, require proposed projects to continue to enhance their tie-in with the FWP with other AP projects basinwide.

The ISRP also acknowledges that initial steps of these reforms are currently being undertaken through the Council's Artificial Production Review and Evaluation initiative (APRE; NPCC 2004-17; NPCC 2005-11, June 16, 2005) and its integration with the recent subbasin planning effort (NPCC 2004-13); however, there remain enormous challenges. Specifically, in the opinion of the ISRP, programmatic-level evaluation and reform will require the region and the Council's program to undergo a paradigm shift in the uses of and expectations from artificial production. Our retrospective review will also address the evolution of views of artificial production in the basin over the past decade.

## Artificial Production and the Fish and Wildlife Program

The Council's 1994 and 1997 Fish and Wildlife Programs contained measures intended to increase production from both natural and artificial sources by ensuring that natural and artificial production systems were successfully integrated – in particular, that artificial propagation did not adversely affect natural production or biodiversity and that harvest of artificially propagated salmon did not lead to coincident overharvest of naturally produced stocks. The programs emphasized the need for planning, risk assessment, inventories of natural stocks, and estimates of biodiversity and carrying capacity prior to the development of policies and plans and the implementation of artificial production programs. The ISRP was strongly supportive of this cautious and logical approach to artificial production in the basin (ISRP 1997; 1998); however, ISRP review of the programs and project proposals for FY98 and FY99 revealed a pattern of project implementation without the requisite planning described in the FWP to define direction or to enhance effectiveness (Figure AP-2). The ISRP noted in our review of the FY98 project proposals that new artificial production programs were proposed for implementation without

adequate planning, as described in the FWP (ISRP 1997). Additionally, the ISRP concluded that there had not been adequate evaluation of the effectiveness of existing artificial production programs.



**Figure AP-2.** Distribution of funding projects among the major artificial production measures in the 1994 Fish and Wildlife Program (from ISRP 97-1).

Consequently, the ISRP concluded that proceeding with a high level of investment in *new* artificial production programs without fully examining potential lessons learned from *ongoing* programs was inconsistent with the 1994 and 1997 FWPs. Therefore, the ISRP urged a moratorium on construction and operation of new artificial propagation pending a more formal comprehensive examination of existing hatchery programs designed to evaluate biological planning and wild fish inventory concerns related to carrying capacity, wild stock status, and the potential risks associated with the proposed production initiative.

Interactions between the ISRP, project sponsors, and the Council during the ISRP review process from 1997 to present has had a profound effect on the direction and scientific rigor of artificial production programs and projects within the Columbia Basin. Since 1997, the Council has responded to the ISRP's recommendations on artificial production by initiating a number of specific measures or processes to address the ISRP's programmatic concerns listed above. These include a comprehensive review of artificial production throughout the basin and the 3-Step review process for new artificial production initiatives. These and other responses are described in more detail below. The Council has also worked collaboratively with NOAA Fisheries, BPA, and various state and Tribal fisheries resource managers under the Biological Opinion and the RME (research, monitoring, and evaluation) effort led by NOAA Fisheries and PNAMP (Pacific Northwest Aquatic Monitoring Protocol) to systematically coordinate natural production inventories and to assess the integration of artificial and natural production.

Starting in 2000, the Council's Fish and Wildlife Program (2000 and 2004 FWPs) focused more on guiding principles, both institutional and ecological, and less on the specific implementation measures seen in the 1994 and 1997 programs. This shift coincided with attempts to coordinate fish and wildlife projects at the local and subbasin level, building hierarchically up through the basin's ecological provinces toward a single coordinated Columbia Basin fish and wildlife program.

### **The Council's Response to ISRP Recommendations**

The Council has responded positively in most instances to the ISRP programmatic recommendations on artificial production. The Council's responses have initiated a number of processes or review initiatives in direct response to the ISRP's recommendations (including a recommended moratorium on the construction and operation of new artificial propagation *until* a more formal comprehensive review of existing hatchery programs occurred). First was the completion of a formal and comprehensive review of the basin's artificial production programs<sup>11</sup> by an independent panel of experts (SRT 1999; NPPC 1999). As a result, the Council recommended six specific policies that evolved into the 2004 Subbasin Planning effort. Moreover, the Council adopted a menu of ten principles "to guide use of artificial production," by which the ISRP presently reviews specific proposed projects.

The Council and the ISRP also recognized that some facilities had been in the planning stage for years and were considered high priority by the fish management agencies and tribes. To prevent a complete moratorium on new production, the ISRP recommended to the Council that funding for individual projects be permitted only if the project sponsors could demonstrate they considered a project's effect on carrying capacity, wild stock status, risks of interactions with adjacent or contemporary wild stock, and others (see ISRP Report 97-1 for more detail on these issues). The ISRP recommended that individual projects be funded only after a positive review from an independent body of peer reviewers<sup>12</sup>.

This ISRP recommendation led to the Council establishing the *Three-Step Review Process* aimed at assessing the consistency of proposed artificial production facilities and programs with Fish and Wildlife Program. For individual projects already under consideration in 1997, as well as any programs proposed subsequently, the ISRP and Peer Review Group members examine Master Plans for consistency with the FWP requirements and basic scientific underpinnings. The approach employed focuses on a written iterative dialog (i.e., with a structured feedback loop) between project sponsors and the ISRP or reviewers to achieve a design and approach that is consistent with the FWP. Specifically, a proposed artificial production program (or facility) is

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<sup>11</sup> ISRP Report 97-1 (1997), Section III.B.10. The ISRP recommends the Council implement a comprehensive review of artificial propagation in the basin. *That review should be initiated as soon as possible and cover all propagation activities including hatcheries funded by sources outside the FWP.*

<sup>12</sup> ISRP Report 97-1 (1997), Section III.B.9. To prevent a complete moratorium on new production, ISRP recommends that the Council permit funding for an individual project only if the project proponents can demonstrate they have taken measures 7.0D, 7.1A, 7.1C, and 7.1F into account in the program design and the Council concurs. To ensure that standard is met, the individual projects should be funded only after a positive recommendation from an independent peer review panel.

reviewed at three different points in its planning (hence the “Three-Step” name): Step 1 – the Master Planning phase; Step 2 – the NEPA review phase; and Step 3 – the final engineering design phase.

Finally, the Council has responded to a number of potentially controversial elements and uncertainties about artificial production within the ISRP reviews by tasking out specific programmatic reviews to the ISAB. For example, as supplementation grew as a strategic direction for agencies within the basin, the ISRP consistently challenged the scientific underpinnings of the approach. Rather than permitting the controversies to languish, the Council directed the ISAB to conduct a review of the efficacy and scientific underpinnings of supplementation. The details of this review (ISAB 2003) are discussed in more detail below.

### Specific Review Themes for the ISRP in Artificial Production

ISRP reviews of artificial production activities from 1996 to present described a number of major recurring programmatic concerns. These can be summarized by the following list:

1. Concern over the lower smolt-to-adult survival rates (SARs) in general for hatchery-origin fish relative to natural-origin fish;
2. The lack of demonstrated effectiveness of supplementation;
3. Uncertainty about the effectiveness of captive breeding;
4. Uncertainty about the effectiveness of conservation hatcheries and NATURES rearing approaches;
5. Uncertainty about the effectiveness of reintroductions;
6. Recognition of the FWP’s priority for actions for native fishes;
7. The need for increased focus on resident fishes;
8. The need to integrate proposed projects within a subbasin or watershed context.

### **Hatchery Production and Smolt-to-Adult Survival Rates**

Hatchery production is effective at producing large numbers of smolts, but the smolt-to-adult survival rates (SARs) of the hatchery product have been disappointingly low and considerably lower than the smolt-to-adult survival rates of wild salmon. Because of the low smolt-to-adult survival rates of hatchery fish, hatchery production has not succeeded quantitatively in compensating for lost production, nor has it produced fish cost-effectively.

Three critical uncertainties remain regarding the low smolt-to-adult survival rates. First, it is not known why smolt-to-adult survival rates of both the wild and hatchery fish in the Columbia system are generally low. Second, it is not known why the hatchery fish generally have lower smolt-to-adult survival rates than the wild fish (PATH Scientific Review Panel 1998), although hatchery effects such as artificial selection and domestication are speculated to be the cause. Third, it is unclear whether hatchery fish have negative effects on the wild stocks with which they interact and interbreed. A great deal of scientific theory predicts these effects to be negative,

but such theory does not predict sufficiently their magnitude or frequency of occurrence. Protection of the wild stocks has risen in priority, yet this uncertainty remains unresolved.

## Supplementation

Supplementation, the use of artificially-reared fish to attempt to enhance numbers of outmigrating juveniles, and thereby the returning adults, to increase the numbers of naturally spawning adults in a target population, has been a controversial option for rebuilding depressed salmon populations for over two decades. In spite of this, supplementation has played, and continues to play, a central and critical role in achieving the Council's Fish and Wildlife Program's goals.

Starting with the Fish and Wildlife Program in the early 1990s, the Council expressly approved the use of supplementation as a management tool to protect threatened endemic gene pools and to increase run-strengths – the latter often undertaken without much regard for the former. This neglect became evident in project design and in monitoring and evaluation components during the ISRP annual review of projects (1997-99), the later provincial reviews and subbasin plan reviews (1999-2004), and the ongoing three-step reviews (1997 to present). Also evident are the potential inherent conflicts between supplementation and preservation of genetic biodiversity due to movements and interactions of propagated versus wild fish, competition, and other ecosystem effects.

The ISRP and the ISAB, as well as their predecessor groups, the Scientific Review Group (SRG) and Independent Scientific Group (ISG), have consistently recommended caution to the Council in relying on supplementation programs to achieve Fish and Wildlife Program rebuilding goals and described the need for rigorous evaluation of experimental design and results-to-date for existing supplementation programs. Other reviews of artificial production programs in the Columbia Basin and Pacific Northwest have been equally cautious and critical of supplementation (NRC 1996; Myers et al. 2004; RSRP 2005).

The ISRP reviews of supplementation projects across the basin from 1997 through the provincial review process in 2002 noted that projects differed in their degree of coordination with other supplementation projects. These differences, and the continued important role and controversial nature of supplementation, indicated to the ISRP that supplementation efforts in the basin would benefit greatly from a coordinated overall review. Such a review did not appear to be underway through any of the review processes identified above; however, a programmatic review of supplementation and its projects would complement the Council's ongoing comprehensive review of artificial production. As a result, the ISRP recommended all supplementation projects in the basin undergo a coordinated programmatic level review by an independent scientific review panel. The panel needed to address scientific and technical *uncertainties*, as well as differences, among supplementation projects with respect to *monitoring and evaluation* (M&E) protocols, including project-specific goals, as well as *program goals*, and an assessment of the *effectiveness* of supplementation as a rebuilding tool.

In response to the ISRP's concerns and recommendations about supplementation, the Council and NMFS (presently known as NOAA Fisheries) requested the Independent Scientific Advisory Board to review supplementation, resulting in ISAB's 2003 *Review of Salmon and Steelhead Supplementation* (ISAB Report 2003-3).

The supplementation review's primary conclusions challenged the pervasive perspective that the supplementation approach was contributing to recovery or maintenance of salmon and steelhead populations. The ISAB's conclusions included:

- 1) While supplementation is ongoing, it can often be expected to increase the number of salmon and steelhead spawning naturally in the target population, and this may provide additional harvest opportunities, compared to the situation with no artificial production.
- 2) The increased population size and productivity attributable to supplementation will likely not persist once supplementation ceases.
- 3) Supplementation can reduce the natural spawning fitness component in the integrated (mixed natural- and hatchery-origin) population, and this reduction in natural spawning fitness will persist in the natural spawning population for some number of generations after the termination of supplementation.
- 4) Data to calculate the correct performance indicators are not being collected regularly in supplementation projects. Because of the widespread lack of reference populations, neither benefits to abundance, nor risks to natural spawning fitness, can be effectively quantified at present.
- 5) Except for critical cases where a natural spawning population is literally on the verge of extinction with no credible options for rescue by habitat improvements or harvest management, a technically valid risk-benefit assessment of supplementation to decide upon whether supplementation should be undertaken in any particular stream will be dominated by uncertainty because the data needed for the assessments are largely unavailable.

**Recommendations:** As a result of their findings, the ISAB offered the following recommendations, with which the ISRP concurs:

- A. *Sparing use of supplementation* - only in a subset of the locations where unharvested natural populations are not replacing themselves, where habitat capacity is believed to be able to accommodate additional production, and where landscape conditions and institutional considerations are suited to maintaining the integrity of the experimental design.
- B. Supplementation, where used, should follow *a protocol that uses natural-origin adults* from the target population as parents in hatchery spawning.
- C. Establish and *monitor performance standards* for each project for natural-origin and hatchery-origin adult abundance and per capita production rates.

- D. Conduct all supplementation projects *with explicit experimental designs* to reduce uncertainty and contain supplementation risks. Establish reference populations, adequate monitoring, and objective means to assess when supplementation should be terminated (due to either success or failure).
- E. *Coordinate the multiple supplementation projects across the Columbia River Basin* so that in aggregate they constitute a basinwide adaptive management experiment. The Fish and Wildlife Program, through BPA funding, supports a number of large-scale supplementation projects in the Hood, Yakima, Grande Ronde, Imnaha, Clearwater and Salmon river basins. The FWP should include mechanisms to ensure that individual projects are collecting the data necessary to test their effectiveness and ensure regional coordination of the multiple experiments.

### **Captive Breeding**

Beginning in 1998, captive breeding and captive broodstock development for critically imperiled stocks became areas of increasing interest by fisheries managers throughout the region and by the Council. In fact, many FY 2000 proposals were aimed at developing captive broodstock and several umbrella proposals indicated that many more captive broodstock efforts would be planned. Given the increasing vulnerability of many basin stocks, particularly upper river stocks, to stochastic demographic extinction, captive brood technology offered a tool with some promise for maintaining populations and genetic diversity as an interim measure while threats to survival were relaxed or removed.

However, the use of captive broodstock raised many specific concerns common to this approach with other vertebrates, including domestication, poor breeding success or survival, and increased disease sensitivity. As these concerns generally were not well addressed in proposals, the efficacy of captive breeding might be overstated and its risks understated. The chance for success of this approach is uncertain in the face of the factors that are causing fish stocks to be at very low densities in the first place. The ISRP recommended that proposals should develop a better rationale and plan for how captive broodstock programs fit into overall current recovery efforts, dam configurations, ecosystem health, and other factors. The reliance on captive broodstock can be regarded only as a short-term and temporary solution to the threat of extinction of these anadromous stocks.

Moreover, there are issues associated with long- and short-term costs, tractability, and comparability relative to other alternatives that would greatly benefit from some basic examination and presentation. Some recent studies and reviews are recommending that captive broodstock be a last-resort strategy and be preceded by careful field studies, a determination that other preferable alternatives are not available, and clear demonstration that captive breeding is necessary for short-term survival. The ISRP recommended that the Council terminate funds for captive brood projects not providing solid justification and evidence that the problems causing depletion have been identified (as part of a watershed assessment and limitations analysis, for example) and that reasonable plans and effort are being applied to their resolution. The primary large-scale research proposal for the assessment of captive breeding in the basin is NMFS'

Proposal #199305600 (Assessment of Captive Broodstock Technologies). The ISRP had previously reviewed this proposal and recommended a more integrated approach. Project sponsors heeded these recommendations to address issues associated with physiology, behavior, genetics, ecology, microbiology, and nutrition; nevertheless, the ISRP raised concerns over adequacy of their own review of such a large and complex project and recommended a more in-depth scientific review of this one project, alone (not as one of 104 projects within the context of a provincial review) or in the context of basinwide captive breeding efforts.

**Recommendation:** In the 2000 FWP, the Council approved the use of captive breeding as a management tool to protect threatened endemic genotypes and (coupled with supplementation) to increase run-strengths. At the same time, the ISRP recommended that all captive brood projects in the basin undergo a coordinated programmatic-level review by an independent scientific review panel to address scientific and technical *uncertainties*, analyze differences among captive brood projects in *monitoring and evaluation* (M&E) protocols and project-specific as well as *program goals*, and provide an assessment of the *effectiveness* of captive brood technology as a rebuilding tool.

An overall review of captive propagation would fit in with the program-level coordination recommended above for supplementation projects (see Supplementation Recommendations A, B, D, and E above); however, this recommendation has been partially addressed through the ISRP's 2004 review, at the request of the Council, of the captive propagation programs for sockeye salmon in Redfish Lake and for spring Chinook salmon in the Salmon and Grande Ronde rivers (ISRP 2004-14). Performance measures for juvenile and adult salmon in the Redfish and Salmon River programs showed the programs were rarely meeting their own performance objectives. The Grande Ronde program, which was more clearly designed and described, has the potential to provide meaningful insight into whether or not captive propagation can provide anything more than hatchery-origin adults returning from the ocean. Nevertheless, the ISRP concluded that, based on the larger scientific literature on captive propagation and on experiences within the Basin thus far, the outlook for using this technology to achieve recovery of populations near extirpation or to reintroduce extirpated lineages is not at all encouraging.

### **Conservation Hatcheries and NATUREs Rearing**

Significant resources have been invested into testing and implementing new protocols and reformed approaches in artificial production, such as the evaluation of NATUREs rearing on salmonid behavior, morphology, physiology, and post release survival of hatchery fish as well as their ecological interactions with wild fish. NATUREs attempts to substitute more natural rearing conditions and avoid concrete raceway conditions as a way to better acclimate young to post-release river conditions. The appeal of such an approach has warranted answering some basic questions.

The primary research proposal for the NATUREs rearing effort has been NMFS' Project #199105500 (Natural Rearing Enhancement Systems [NATUREs]). The project had two major foci: to test NATUREs rearing-habitat components at production hatchery scale and determine interaction effects between rearing-habitat variables assessed based on smolt-to-adult survival,

and to investigate benefits of predator conditioning to juvenile migratory and adult survival. This research program, which was designed to provide answers to uncertainties about NATUREs effects, will require 8-10 years for meaningful results. The approach, unfortunately, has been implemented in the basin at production scales without a suitable hypothesis-driven and statistically rigorous monitoring program in several places (e.g., supplementation in the Yakima and Clearwater systems).

**Recommendation:** In response to these concerns, the ISRP recommended to the Council that the NMFS design for evaluation was appropriate and needed, but that NATUREs alone would not address the constellation of risk issues associated with artificial production in the basin. The ISRP asserts that this remains an uncertainty that needs to be addressed before widespread application of the approach.

### **Reintroduction into Vacated Habitats**

The issue of “reintroduction” has become a concern with an increase in project proposals that seek to release salmonids back into stream systems where they have been extirpated. In the Columbia Cascade Province, for example, these include Project #199604000 (Evaluate the Feasibility and Risks of Coho Reintroduction in the mid-Columbia), Project #200001300 (Evaluate an Experimental Re-introduction of Sockeye Salmon into Skaha Lake), and Project #29016 (Return of Sockeye Salmon to their Historic Range).

**Recommendation:** The ISRP highlighted two important issues for these project proposals. First is the importance of not confusing or lumping such reintroduction projects with supplementation projects – the goals, basic strategies (such as short versus long-term time horizons for releases), and potential risks to recipient populations are distinct. Second is the importance of rigorous, hypothesis-driven monitoring associated with these actions, for example, testing whether such introductions have the greatest chance for success where proximal stressors or causes of extirpation have been removed.

### **Resident Fish**

The Council’s Fish and Wildlife Program is designed in broad brush to direct about 70% of its funding and focus toward anadromous fish projects, with the remainder being split approximately equally between resident fish projects and wildlife projects.

An important advancement in perspective for the basin in recent years was the recognition of the role of resident fishes in the ecosystem. When considering resident fish propagation and supplementation of wild stocks, many of the same questions arise as occurred for anadromous fish production projects. For example, funding recommendations in hatchery-related proposals for resident fish are premised on acceptance of the high value of artificial propagation. This premise needs evaluation from the perspective of the fish species or stock being propagated, as well as from the perspective of the wild, native stocks with which the hatchery-produced fish will mingle and the ecosystems the fish will inhabit. Similarly, in instances where resident fish

declines are related to decreases in the carrying and productive capacity of local habitats, use of artificial production to augment or rebuild resident fish populations needs to be explicitly linked to actions that improve habitat and address factors limiting production wherever possible. The ISRP recommended that the ongoing basin-wide review of hatchery effectiveness be continued, including consideration of resident fish concerns, and that the results of such a review be used to form the basis for future hatchery funding decisions.

The 1994 Fish and Wildlife Program established a policy giving priority to management activities that focus on native resident fish in native habitats where possible, before considering management alternatives such as substitution and use of non-native fish stocks. Thus, the FWP places an emphasis and priority on rebuilding native stocks in native habitats, wherever possible. There are many ecological and conservation biological reasons why this emphasis is warranted. Consequently, this issue has received continued attention from the ISRP and the Council.

Introductions of non-native species have had a devastating effect on native resident salmonids in the Columbia River Basin and elsewhere in western North America (Billington and Hebert 1991; Lee et al. 1996; Behnke 2002). Therefore, great concern and caution should be exercised when reviewing projects that propose using non-native species for substitution. As a point of clarity, non-native species also include resident fish species native to the Columbia River Basin when they are introduced to locations outside of their native range. For example, most hatchery strains of rainbow trout were derived from coastal rainbow trout stocks; however, planting these stocks in the interior Columbia Basin (east of the Cascade Mountains) results in a non-native introduction, because a different form of rainbow trout, interior rainbow trout (e.g., redband trout), exists there.

**Recommendation:** Specifically, the ISRP recommended that sponsors focus on native stock recovery and mitigation wherever possible. Proposed supplementation with non-native stocks remains common. This is in sharp contrast to the terrestrial habitat and wildlife programs, which tend to focus on non-native plant eradication. Although an outright prohibition on the use of non-native stocks is probably unrealistic, further justification for their use over a local or native stock is warranted as a path to stimulate more efforts to use native stocks.

As an example, Projects #8815600 (*Implement Fishery Stocking Program Consistent with Native Fish Conservation*) and #20094 (*Assess Resident Fish Stocks of The Owyhee Basin*) should be integrated with one another. The first project, by its title, appears to focus on conservation of native interior rainbow trout (i.e., redband trout) stocks, yet proposes development of a new reservoir to be stocked with non-native strains of hatchery-reared rainbow trout. Remnant native redband trout populations exist immediately adjacent to the proposed reservoir site and could be examined through Project #20094 for use in Project #8815600. It should be possible to use these native populations either as a stocking source or as a broodstock source for planting the new reservoir. Such actions would be consistent with the Council's mitigation responsibilities and with the FWP's priority emphasis on native species in native habitats. Additionally, they would avoid the well-recognized negative impacts that can arise from introductions (and eventual escapement or spread) of non-native fish as a mitigative substitute for native fisheries enhancement. The ISRP recommended, therefore, that resident fish mitigation actions focus on

actions that directly benefited native resident fish stocks, rather than substituting non-native stocks, wherever practicable, reflecting the priority assigned to native stocks by the FWP.

### **Artificial Production and Subbasin Planning**

In contrast to habitat and wildlife issues, where the Subbasin Plans often presented substantial analysis and planning, the ISRP believes the subbasin planning effort and the subbasin plans were not adequate with respect to their consideration of artificial production. Almost without exception the subbasin plans failed to adequately describe artificial and natural production elements within a subbasin and to provide a defensible overall production plan that integrated artificial and natural production with programs addressing the subbasin's limiting factors. The artificial and natural production components were either missing or were not linked to habitat limiting factors and proposed restoration activities.

**Recommendation:** The ISRP recommends 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.

### **Integrating Natural and Hatchery Production**

The review of subbasin plans by the ISRP in the summer of 2004 concluded that, almost without exception, the plans did not adequately integrate a comprehensive vision of artificial and natural salmon production based on the habitat capacity and limiting factors identified in the subbasin. The Council recognized this deficiency, as well as the challenge of developing measurable goals for natural and artificial production that are intended to contribute to conservation and harvest from each subbasin, such recognition evidenced in tasks the Council identified in their Artificial Production Review and Evaluation Report (APRE) (Council document 2004-17):

- Consistent with basinwide goals and priorities, establish long-term management objectives for hatchery and wild stocks that describe measurable contributions to harvest and conservation
- Identify hatchery programs as either being integrated with wild stocks or segregated from wild stocks and articulate how each program will contribute to long-term management objectives.

To achieve these objectives, methods are needed to assess the natural and artificial production in each subbasin and to evaluate the potential contributions of each to conservation and harvest. One such tool – the All H Analyzer (AHA) – came to the attention of the Council, and they requested a review of that tool by the ISRP and ISAB. In their review of AHA, the ISRP and ISAB (ISRP 2005) recommended that the tool should not be used to generate specific objectives or to propose recovery goals for anadromous fish, because the model outputs are driven by input

parameters whose true values are unknown. At this juncture, the need is to encourage research and monitoring to obtain the empirical values for the missing parameters.

### *A Priori* Risk Assessments for Hatchery Programs

The Council's Artificial Production Review (NPPC 99-15) established Artificial Production Policy 8, which states that appropriate risk management needs to be maintained in using the tool of artificial production. The ISAB (ISAB 2000a, 2000b, 2000c) elaborated on the need to develop risk assessment and risk management guidelines for hatchery production. The Mainstem and Systemwide solicitation in 2003 included projects to address reasonable and prudent alternative(s) 182 and 184 in the 2000 FCRPS Biological Opinion, which addressed concerns with hatchery programs. One of the projects the ISRP reviewed and BPA subsequently funded was a Risk Assessment Modeling Project (RAMP, BPA Project No. 2003-058-00, Contract No. BPA00016399). A final report from this project was released in April 2005 (Busack et al. 2005), describing tools for evaluating ecological and genetic risks in hatchery programs. The "tools" are intended to be used by hatchery managers and scientists to evaluate how different hatchery management regimes influence the risk hatchery production poses to natural populations of anadromous salmon and steelhead. Tools for quantifying the risks from selection regimes in the hatchery, loss of diversity from reductions in the genetic effective size of composite hatchery-natural populations, and loss of natural production from competition and predation have been developed.

**Recommendation:** At this time the RAMP tools have not yet been peer reviewed, and to our knowledge have not yet been applied to assess risk or recommend modified operations for any Columbia River Basin hatchery program. The ISRP recommends to the Council that the ISRP/ISAB be requested to peer review the RAMP tools and provide advice on implementing the tools as part of the ongoing APRE efforts. This effort would complement the recent ISRP/ISAB review of the AHA model (ISRP and ISAB 2005).

## F. Ocean and Estuary

The Council's 1994 FWP included the statement that "*Because most of the loss of salmon and steelhead production as a result of hydroelectric development has occurred above Bonneville Dam, the Council will continue to focus its efforts in this area.*" Since 1994, the region has become more aware of the extent that anadromous fish are affected by changes in the estuary, nearshore and ocean conditions and the potential negative effects of operation of the hydropower system on those areas.

The 1996 Power Act amendment added to these concerns by calling for the Council to consider the impact of ocean conditions on fish and wildlife populations in making funding recommendations. The Council's initial policy response to this charge was adopted in an issue paper entitled "*Consideration of ocean conditions in the Columbia River Basin Fish and Wildlife Program*" (Issue Paper 97-6), on June 3, 1997. In 2000, at the Council's request, the ISAB (with significant overlap of membership with the ISRP) released a report examining the impacts of estuarine conditions and management on the Council's mission to "*...protect, mitigate and*

*enhance...*” fish and wildlife in the Columbia River as affected by development and operation of the hydroelectric system (ISAB 2000d, 2000-5). The ISAB recommended the development of an aggressive experimental program targeted to reduce the likelihood of prolonged uncertainty about the impact of estuarine conditions. Such a program should incorporate monitoring of the physical environment (such as currently begun via the CORIE program, Oregon Graduate Institute) combined with evaluation of large-scale manipulations of estuarine habitats. The intent of these manipulations would be to study changes presumed to have had negative impacts and at a scale that can be measured within the natural environment. These types of programs would be consistent with the vision statement in the 2000 Fish and Wildlife Program.

The ISAB, ISRP, and other advisory groups have recommended funding of projects to understand the impacts of ocean, estuary, and nearshore conditions on anadromous fish populations and the interaction of human management actions with those environments. In general, the Council has supported funding of these projects, recognizing the importance of the estuary and Columbia plume to anadromous fish population. In an obvious and important shift from the 1994 FWP, the Council included the strategy in its 2000 FWP to identify the effects of the marine environment (the freshwater plume, the near-shore, and the high seas) on anadromous fish and use this information to evaluate and adjust inland actions. Research efforts since 2000 have made great strides in understanding ocean cycles of variability, and in documenting habitat variability in the estuary, nearshore, and plume environments; however, our understanding of these areas is in its infancy and the ability to manage inland habitat and fisheries programs based on variable climate, environmental, and productivity cycles in the estuary and marine environments is distant and likely to remain so for some time.

Consideration of the impact of ocean conditions on fish and wildlife populations is not exclusive to the Council’s Fish and Wildlife Program. A number of multidisciplinary efforts and programs, whether regional, national, or international, continue to devote significant efforts on research, monitoring and evaluation to understand the forces driving variability in the northeastern Pacific Ocean and how these affect ecosystem productivity. Of particular interest to the Council’s Program are the Estuary and near-shore studies funded by the Corps of Engineers Anadromous Fish Evaluation Program. However, these latter studies funded by BPA’s Reimbursable Program are not fully amendable to scientific review (see the RM&E section) and have not been adequately reviewed by the ISRP. The U.S. Environmental Protection Agency has initiated research on the estuary as part of its National Estuary Program.

## Specific ISRP and Council Actions with respect to the Estuary and Ocean

### **First Interactions of the ISRP and the Council on Estuary and Ocean Projects**

The Council recommended that an amount of money be reserved in the FY98 budget for a research project to study the impact of the hydroelectric development and operation on the Columbia River estuary and near-shore plume. These funds were obligated in anticipation that the information could be immediately useful in understanding whether the Columbia flow regime might be re-regulated to improve estuary and near-shore conditions for anadromous fish. The study, was originally conceived as a target for an open solicitation process. However, the

National Marine Fisheries Service (NMFS) proposed a long-term study in the estuary and plume of the Columbia River entitled *Ocean Survival Of Juvenile Salmonids In The Columbia River Plume*, which received a largely favorable recommendation from the ISRP. Because of the close relationship between the Council's proposed study and the effort by NMFS, a decision was made by BPA to merge both needs under the common umbrella provided by this NMFS project.

The Council sponsored a *Symposium on Ocean Conditions and the Management of Columbia River Salmon* on July 1, 1999. This event was convened to underscore and discuss contemporary regional perceptions about the interaction between salmon and a variable ocean environment. The day-long symposium gathered a select group of experts in the fields of climatology, oceanography, and fishery sciences (including representatives from the ISRP), to expand many of the arguments, emphasize fundamental principles, and provide a more detailed account of current thinking regarding the variability of the marine environment and the need for life history diversity of anadromous fish populations. In review of project proposals for the estuary and ocean, the ISRP has continued to support the view that the natural strategy utilized by salmon to negotiate this variability is through a diverse pool of life history traits, such as migration and spawning time, size of individuals, growth patterns, and maturation rates. This diversity allows for the survival of different populations as the environment shifts over time.

In FY 2001, the ISRP reviewed proposals in response to the Council's solicitation for innovative projects. A proposal for a feasibility study of Pacific Ocean salmon tracking (POST) received a favorable review and endorsement from both CBFWA and the ISRP to: (1) evaluate new acoustic salt water tags for tracking anadromous fishes, and (2) design an acoustic monitoring network to track movement of juvenile Chinook, steelhead, and coho salmon smolts in the estuary, into the ocean, and along the continental shelf to areas of ocean residency. For some species, this would potentially provide valuable information on mortality in the ocean, migration to the open ocean, residence in areas along the coast for an extended period, and exposure to ocean fisheries. The project was endorsed by the Council and funded.

### **Estuary Province Review**

In review of the Estuary Province, the ISRP favorably reviewed several research initiatives concerning the effects of the Columbia River plume and offshore ocean. These included survival and growth of juvenile salmonids in the plume, optimization of FCRPS impacts on juvenile salmonids, an acoustic tracking array for studying ocean survival and movements of Columbia River salmon, holistic habitat and food-web linkages of juvenile salmon, and ocean salmon survival research on the Canada-USA shelf. With the exception of ocean survival research, the Council agreed in general with the ISRP recommendations. However, the optimization study was not funded due to budget limitations, and two projects to investigate how juvenile salmon utilize the plume and continental shelf were moved to the Mainstem/Systemwide review for consideration. The Council also judged that some of this research is more appropriately funded by NOAA Fisheries as part of its normal coast wide investigations.

There were three new projects submitted for the Columbia Estuary Province that addressed habitat restoration (Blind Slough, Columbia River Estuary Islands, and general habitat

restoration for the Columbia Estuary and the Lower Columbia River). All three received generally favorable recommendations from the ISRP. The Council supported parts of all three projects to protect and enhance 10,000 acres of tidal wetlands over 10 years. The Council agreed with BPA and the ISRP that the concerns raised by ISRP about monitoring should be addressed and a monitoring plan developed, with ISRP and Council approval, prior to any implementation actions occurring.

Two projects reviewed in the Columbia Estuary Province were specifically related to monitoring. One would monitor and evaluate changes in habitat attributes and juvenile salmonid use before and after the Chinook River estuary restoration project; it received support from both the ISRP and the Council. The other would develop protocols, procedures, and indicators for measuring habitat condition, assess exposure levels to toxic contaminants, and develop an ecosystem restoration information center for housing and accessing data specific to lower Columbia River and estuary. The Council agreed with the ISRP's positive funding recommendation, but asked that the sponsors submit a more comprehensive description of the monitoring plan, to ISRP and Council satisfaction, prior to the initiation of those tasks. The ISRP has conducted iterative reviews of these plans, finding that good progress has been made, but more work needs to be done on the plans to ensure that effectively inform project implementation (ISRP 2004-16 and 2004-9).

### **Subbasin Plan Review: Mainstem Lower Columbia and Estuary**

The ISRP participated in review of the Mainstem Lower Columbia River and Columbia River Estuary Subbasin Plan that includes the Columbia River plume and extends 146 river miles up the tidal freshwater river to Bonneville Dam (ISRP&AB 2004-13). The plan is generally consistent with the scientific elements of a subbasin plan, as described in the Council's 2000 Fish and Wildlife Program. Limiting factors for anadromous species include severe channelization in the lower mainstem, the resulting subsequent loss of backwater habitat, and riparian degradation. The primary recommendation was that the plan should be broadened to be an ecosystem-based subbasin plan that addresses the subbasins beyond anadromous issues. The subbasins have many species of value, but the focus on the mainstem and, recently, estuary habitats has resulted in inadequate attention to these species.

Research, monitoring, and evaluation (RME) efforts that are developed specifically to implement this subbasin plan are included as part of the LCFRB Lower Columbia Salmon and Steelhead Recovery Plan. The subbasin plan states that this, along with substantial ongoing RME planning efforts, can be used to evaluate this plan's strategies and measures.

**Recommendation:** The ISRP and the 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 remains 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 is either a gauntlet common to all up-river and Willamette River salmonids, or could be viewed 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. In addition, the ISRP is concerned that the principle emphasis of the Estuary RME plan will be on the lower estuary and less attention will be paid to the part of the estuary extending from RM 46 to Bonneville Dam.

**Recommendation:** A more thorough assessment and increased attention in regional RME plans are needed for the mainstem Columbia River between Puget Island (upper estuary) and Bonneville Dam.

## **Appendix. The Evolution of Scientific Review in the Fish and Wildlife Program**

This appendix is summarized in the main report, Section II. ISRP Review Process and Recommendations. Although there is much redundancy between that section and the appendix, the ISRP wanted to provide a complete description of the peer review process in a stand-alone piece. CBFWA's reports on implementation provincial review recommendations also provide thorough descriptions of the FWP project selection process and the roles of the various management and decision making entities (see CBFWA 2004).

### **I. Rationale and History of Peer Review**

The 1996 Northwest Power Act amendment made a significant change in BPA's funding process for fish and wildlife projects by requiring scientific peer review. This appendix describes the rationale for establishing peer review as an integral part of the Fish and Wildlife Program and the influence of the ISRP's predecessors who informed the formation and implementation of the ISRP. The section is intended to describe the ISRP's operation and the project selection process in sufficient detail that 1) other large programs interested in establishing scientific peer review can get a clear picture of the Columbia River Basin model, and 2) the strengths and weaknesses of approaches tested-to-date inform future solicitations and reviews.

#### **The Basics of Scientific Peer Review**

Peer review is an established tradition in research and development enterprises. It can help decision-makers ascertain the quality of scientific information available to inform a decision and help ensure that environmental decision-making reflects the best available scientific knowledge. Peer review is a process by which knowledgeable colleagues ("peers") evaluate project proposals, project status, or draft publications for their scientific and technical quality. "Quality" is generally assessed against a common set of criteria appropriate for the type of work under review. The purpose of peer review is to ensure that the proposed work is consistent with current knowledge, has clear objectives, and employs recognized methods that are not naive, impractical, or unrealistic. Reviews of ongoing work seek evidence of progress toward objectives. Funding institutions or publishing organizations usually select reviewers who are independent of the projects, have no conflicts of interest, and in many cases they remain anonymous to the project staff. Other peer reviews are by formal independent advisory groups (such as the ISRP and Independent Scientific Advisory Board (ISAB)) or ad hoc review teams that may or may not meet with those being reviewed.

#### **A National Standard**

The Government Accountability Office and the Office of Science and Technology Policy have stressed the need to include peer review in the operating policies of federal funding agencies and the need for other reforms to ensure fairness in funding selections (General Accounting Office

1994). Independent scientific review at the federal level is broadly instituted (McGarity 1994). It is a hallmark of the National Research Council in their efforts to provide scientific and technical advice on important national issues (National Research Council 1989). The National Institutes of Health and the Environmental Protection Agency also have well-established peer review programs. Peer review could be considered a “best management practice” or “industry standard” for scientifically based programs worldwide.

## Peer Review in the Columbia River Basin

### **The ISRP and ISAB**

In the Columbia River Basin, the magnitude of scientific research and science-based resource management being undertaken and uncertainties that remain are staggering. Independent scientific review can assess the quality of ongoing and proposed work, identify where there is consensus or disagreement among scientists and help focus implementation and research on those areas most relevant to management and policy decisions. Currently, independent scientific review for the Fish and Wildlife Program is implemented by two groups: the ISRP and ISAB. Each group provides unique services to the program. The ISRP reviews, for the Council, individual fish and wildlife project proposals prior to being funded by Bonneville Power Administration and makes recommendations on matters related to those projects and their programmatic implications. The ISAB operates in conjunction with the Council, NOAA Fisheries and the Columbia Basin Indian Tribes in reviewing particular programmatic and scientific issues in the basin, either at the request of those agencies, or as identified by the ISAB itself. The present retrospective report focuses on ISRP project reviews, but that effort is intertwined with the ISAB’s programmatic reviews. The two groups share members, ideas, and frequently work together on assignments. The ISRP often identifies programmatic issues that would benefit from ISAB analysis, such as a programmatic review of supplementation of salmon and steelhead populations. Prior to establishment of the ISRP, the ISAB and its immediate predecessor, the Independent Scientific Group (ISG) conducted some project-specific reviews. Relevant findings from ISAB reports are incorporated in this report.

### **The Early Years: the Fish Propagation Panel and the Scientific Review Group**

Evaluating the accomplishments of the ISRP should be considered in the context of the steps that led up to its establishment. Instituting peer review in the Fish and Wildlife Program has been an iterative and evolving process that began with the inception of the Council’s first program in 1982. The Northwest Power Act of 1980 called for the Council to depend upon the “best scientific advice” in developing its fish and wildlife program. During development of the first fish and wildlife program, the Council gave (and continues to give) deference to the Basin’s fishery agencies and tribes. The 1982 program included designation of a Fish Propagation Panel, which was intended to formalize the process for obtaining scientific advice from the fishery agencies and tribes, particularly on the topic of hatcheries and fish production. The Fish Propagation Panel was made up of representatives of the fishery agencies, tribes, and electric power producers. It lasted only about a year but introduced the role of a scientific advisory group into the program. Perhaps one of its more significant recommendations was that the Council’s planning for restoration of fish and wildlife be organized on a subbasin basis.

Three other advisory bodies, the Scientific Review Group (SRG), the Independent Scientific Group (ISG), and the ISAB, sequentially supplanted the Fish Propagation Panel. These scientific advisory bodies focused on programmatic review of key scientific issues and management approaches. The SRG, ISG and ISAB all stressed the need for peer review and provided recommendations on specific policies and procedures to assist Bonneville and the Council in developing a peer review process responsive to federal initiatives (Coutant and Cada 1985; SRG 1990; ISG 1994). Brief accounts of these groups' formation and efforts follows.

Early in the implementation of the Council's 1982 program, Bonneville assumed the lead role. Decisions on funding of specific projects were guided by BPA staff in consultation with agency and tribal representatives and others. To a degree, some decisions were subject to lobbying influence of the fishery agencies and tribes. In reaction, Bonneville commissioned a study of the project evaluation practices of a number of major scientific and applied fisheries agencies and requested recommendations for their use in its Implementation Planning Process (Coutant and Cada 1985). Bonneville also brought in other national experts to review the fish and wildlife program and instituted an annual program review consisting of presentations by most projects to a gathering of peers. However, a rigorous project-review process with well-defined roles was not instituted.

In 1987, Bonneville recognized the need for a systematic way to plan and implement the fish and wildlife program. The fishery agencies and tribes had organized themselves into the Columbia Basin Fish and Wildlife Authority (CBFWA) as a mechanism through which the basin's fish and wildlife managers might reach agreement on a suite of projects appropriate for Bonneville funding, rather than each of them lobbying BPA independently. In that year Bonneville and CBFWA entered into an understanding, which created the Implementation Planning Process for the fish and wildlife program. This formal, participatory process was used to develop a work plan and other documents annually to guide Bonneville's completion of program responsibilities. In 1989, BPA and CBFWA established the Scientific Review Group (SRG) as the independent scientific advisory body for the process. The SRG was to ensure objective, scientific review, design and statistics, as well as ensure evaluation, and monitoring at the project and program levels.

Shortly after its formation, the SRG was asked to review five supplementation proposals. The SRG concluded that the proposals were technically inadequate and suggested that for future reviews, research proposals should follow the standard proposal preparation guidelines used by many federal agencies. In response to a request for such guidelines, the SRG provided a summary of proposal guidelines and formats used in various agencies (SRG 1990). While the SRG had recommended adoption of a formal peer review process in the first years of its existence, it was lent support by the publication of the Government Accounting Office's 1994 critique of federal agency peer review policies (GAO 1994). The SRG believed that peer review of BPA-funded projects was vitally important to attaining and maintaining a high level of technical quality in the fish and wildlife program that would more likely lead to salmon restoration. Foreseeing that implementation of peer review might be an unwelcome disruption of the status quo and cause some confusion among project managers and reviewers, the SRG

developed two booklets for use by BPA explaining project and proposal peer reviews (SRG 1994a and 1994b).

In 1994, the Council amended the Fish and Wildlife Program to strengthen its role in overseeing implementation of the Fish and Wildlife Program. Among other steps, the amendment called for appointment of an Independent Scientific Group (ISG), under Council jurisdiction. The duties and responsibilities defined were similar enough to those of the SRG that there was considerable support for continuing the SRG members in that role. As a result, the SRG (1989-1994) was supplanted by the Independent Scientific Group (1994-1995). In 1995, NMFS (now NOAA Fisheries) prepared a draft Recovery Plan (Snake River Salmon Recovery Team 1993) in response to the listing of certain salmon stocks under provisions of the Endangered Species Act. The draft recommended that NMFS appoint an independent scientific group to assist in evaluation of proposed actions aimed at recovery of listed species. To assure coordination, NMFS and the Council decided to form a joint group and created the ISAB. Since the ISG already existed, it was logical to move the ISG into this new joint role.

In addition to program or issue specific reviews, the SRG, ISG, and ISAB conducted specific requested reviews of a subset of proposals, for example smolt monitoring and supplementation proposals. The SRG and ISG noted, however, that it was not clear whether its recommendations regarding scientific adequacy for funding or modifications of proposals to improve the scientific quality were being followed. Part of this disconnect was because the Council's role in the process was ill defined, and the scientific group's project reviews and guidance on peer review informed a project selection process that did not have clear decision points. There was no clear mechanism to effectively and transparently institute peer review across ongoing projects and new proposals. These science groups demonstrated that the process of depending upon an independent group of experts for peer review is a good, workable model for use in selecting and evaluating progress of projects undertaken to restore fish and wildlife. However, despite these efforts, before the formation of the ISRP by congressional mandate in 1996 routine peer review of proposals and existing projects had never been part of the Council's fish and wildlife program. In addition, it was not clear that reviews that were done had an effect on improving the proposals, nor on funding decisions.

### **Institutionalizing Peer Review with the ISRP**

Prior to 1995, the Bonneville Power Administration, with input from CBFWA, chose which measures in the fish and wildlife program to implement and then selected the specific projects and contractors. In 1995, BPA and the Council adopted a procedure that formally included the Council and the basin's fish and wildlife managers, represented through CBFWA in the process leading to project selection and funding. This new approach called on CBFWA to prioritize all proposed projects and present them to the Council in the form of an Annual Implementation Work Plan. The Council could then either ratify or revise the managers' priorities before submitting them to Bonneville for funding. Also in 1995, the Clinton Administration agreed to a six-year budget for BPA's fish and wildlife costs. This meant that proposed projects had to be prioritized within a fixed budget. A primary concern with this process was that CBFWA members were also the recipients of the very funds they were prioritizing, so there was at a minimum an appearance of a financial conflict of interest.

The 1996 Amendment to the Northwest Power Act addressed this conflict of interest and provided the needed incentive to formally establish routine independent scientific review in the selection and funding of fish and wildlife program projects. The ISRP was created and directed to annually review the projects proposed for funding for their scientific merit and consistency with the Program and to make recommendations to the Council based on the reviews. The review results were to be reported to the Council before the Council adopted prioritization recommendations. The Council was obligated to explain in writing if its recommendations for project funding disagreed with the ISRP's report.

It was necessary to separate the ISRP from the ISAB functions because NOAA Fisheries personnel are deeply involved in implementation of the Program with projects funded by BPA. Some ISAB members became members of both groups, while members were also added to the ISRP in order to meet the anticipated workloads and augment expertise in wildlife, economics, and ocean ecology. The Council solely administers the ISRP.

The amendment was well crafted and was the critical piece needed to institute effective peer review in the program. The integration of the ISRP review into the funding process and the clause requiring the Council to explain in writing its disagreements with ISRP recommendations established a strong and transparent link between peer review and decision-making. The amendment language also allowed flexibility in instituting peer review but provided meaningful review criteria as primary guidance. The original amendment had a termination clause of September 2000 giving the ISRP and Council four years to test this experiment in large-scale independent scientific review. Due to the perceived success of the ISRP review process and the continued need, the 2000 termination clause for the amendment was removed and the scope of the ISRP review expanded beyond the Council's fish and wildlife program to include all fish and wildlife projects funded or reimbursed by Bonneville.

Developing independent peer review and the other project selection changes made in 1995 into a smoothly functioning process has been a cooperative, iterative, and educational effort involving the Council, the ISRP, the fish and wildlife managers through CBFWA and separately, Bonneville, and interested non-governmental entities. These efforts have resulted in significant changes to accustomed practices, changes that have been widely viewed as positive. A disconnect may still be present in the implementation step taken by BPA. BPA is under no requirement, such as the Council is, to justify in writing any decisions that might differ from Council or ISRP recommendations when it chooses projects for funding or modifies proposal content to fit what BPA may perceive as a better fit to its needs.

Over the years, the SRG, ISG, ISAB and ISRP have demonstrated their value as advisors to policy makers, and gained credibility with project sponsors. The process that has evolved is very effective in assuring that the ISRP receives full cooperation from the sponsors of projects proposed for funding under the Fish and Wildlife Program. The quality of proposals and the resulting work to implement the Fish and Wildlife Program has improved considerably since the early stages when the SRG was somewhat isolated from the Council.

The various elements of the ever-evolving project selection and review process are described below: membership of the ISRP and Peer Review Groups, scope/scale of the review, and project review approaches and issues.

## **II. The ISRP: Expertise and Independence**

### Expertise

The 1996 Amendment specifies that the ISRP be composed of eleven members augmented by Scientific Peer Review Groups consisting of a pool of scientists sufficient in size and expertise to assist the ISRP in its review responsibilities. ISRP membership is to include scientists with expertise in Columbia River anadromous and resident fish ecology, statistics, wildlife ecology, ocean and estuary ecology, fish husbandry, genetics, geomorphology, social and economic sciences, and other relevant disciplines. The Program further describes that there should be a balance between scientists with specific knowledge of the Columbia River Basin and those with more broad and diverse experience. Members should have a strong record of scientific accomplishment, high standards of scientific integrity, the ability to forge creative solutions to complex problems, and a demonstrated ability to work effectively in an interdisciplinary setting.

The fifty individuals who have served on the ISRP and Peer Review Group reviews have covered this wide range of expertise. Members have included experts in fish and wildlife ecology, hydrosystem passage, fish genetics husbandry, statistics, mathematical modeling, civil engineering, range management, and natural resource economics. In advising the Northwest Power and Conservation Council, the National Research Council has been a strong advocate for this multi-disciplinary approach to provide a broader, longer-term perspective of fish and wildlife management and research. This wide range of expertise and perspectives has been extremely valuable, because projects submitted for review have covered a wide range of subjects, including habitat improvements and restoration, fish hatcheries, hydrosystem passage studies, regional databases, innovative water right transactions, fish and wildlife population enhancements, and ecosystem dynamics.

Review teams usually include a mix of disciplines with at least one reviewer who is an expert on the proposal's subject matter. The common currency across disciplines for successful participation on a review team is an understanding of experimental design and basic statistics. The farther a member's discipline is from the project or topic under review, the more important it is that the member's work experience be with fish and wildlife resources or Columbia River Basin issues; for example, the resource economist works in fisheries, the modeler in endangered species issues, and the statistician in wildlife monitoring.

In addition to a mix in expertise, a key to the ISRP's effectiveness has been a mix of consultants and others employed by agencies or universities. Consultants, often retired professors or senior scientists from resource management agencies, have provided the flexibility and time commitment to allow the ISRP to complete major reviews in a short time. Members are compensated for their time and reimbursed for travel; these incentives are key to implementing peer review on this scale.

## Appointment Process

Selection of ISRP and ISAB members is coordinated and follows three steps. The first two steps are the same for each group. First, the Council, in cooperation with NOAA Fisheries and the Columbia River Indian Tribes, invites the region to submit nominations. Second, a three-member committee of the National Academy of Sciences, assisted by the National Research Council (NRC), evaluates the credentials of the nominees, submits additional nominees if necessary, and recommends a pool of qualified candidates for potential appointment. This pool of candidates spans the areas of needed expertise and meets the ISRP and ISAB membership criteria. The pool is intended to be robust enough to last through several rounds of appointments. The third step, the appointment procedure, varies for the ISRP and ISAB. Representatives from the Council, NOAA Fisheries, and the Columbia River Indian Tribes appoint ISAB members. The Council alone appoints ISRP and Peer Review Group members.

The appointment process has proved to be cumbersome, yet worth the effort. The two primary weaknesses of the process are: 1) difficulty in making timely appointments to replace members who resign before the end of their terms; and 2) ensuring nominees will be available when appointment opportunities arise. Although the Council and NRC have tried to maintain a robust pool of nominees, service on the ISRP can be a significant time commitment and finding scientists who can participate at the needed level can be difficult. Despite those weaknesses, the process invites regional participation, brings in an independent party (the NRC), and rests final decision making with the Council. The NRC plays an important role not only in screening candidates but also in providing advice on the direction of the ISRP and ISAB and emphasizing a multi-disciplinary approach. The NRC also gives the Council confidence in appointing candidates and representing the quality of the candidates to the public. For example, one appointee was challenged by the public based on research he had done, but with the support of the NRC recommendation, the Council felt confident in making the appointment.

## Member Terms

ISRP and ISAB membership terms are three years, not to exceed two terms. Term limits of the members are staggered and can be extended to maintain continuity of effort. Peer Review Group members do not have specific terms, but the pool of Peer Review Group members is reviewed and updated by the Council and ISRP, when appropriate. To ensure coordination and avoid redundancy of efforts between the ISAB and ISRP, the Council's 2000 Fish and Wildlife Program specifies that at least two members of the ISRP shall be on the ISAB. Other ISAB members are considered for appointment to the Peer Review Group. Significant turnover of members with long-term participation on the ISRP and predecessor groups is occurring at the time of this report. Depending on the success of the transition, the specified term limits may need to be revisited. Three- and even six-year term limits are short given the complexities of Columbia River Basin fish and wildlife ecology and institutions.

## Conflict of Interest and Independence

The meaning of “independent” in the Independent Scientific Review Panel is, foremost, that reviewers do not have a conflict of interest, specifically a financial one. The ISRP, ISAB, and Peer Review Group members are subject to conflict of interest standards that apply to scientists performing comparable work for the National Academy of Sciences. The Council has developed conflict of interest standards specific to the ISRP and ISAB that are consistent with the Academy standards but better reflect potential issues that arise in the Columbia Basin. The value of having ISRP members who do not have even the appearance of a conflict of interest has become increasingly apparent over time. It is much easier to make a blanket statement that none of the reviewers receive funds through BPA, than to justify the use of a reviewer who does receive BPA funds even though they are unrelated to the review at hand. Fortunately, the pool of Peer Review Group members is large and diverse enough that finding the needed expertise is generally not an issue. The area of expertise most difficult to fill is hydrosystem passage, because many of the top scientists in that areas are either involved in BPA funded projects or are in high demand elsewhere.

Another important aspect of “independence” and conflict of interest is bias. The ISRP and ISAB’s conflict of interest policy states that “bias” relates to views stated or positions taken that are largely intellectually motivated or that arise from the close identification or association with a particular point of view or the positions or perspectives of a particular group. Such potential sources of bias are not necessarily disqualifying and, in fact, membership of the ISRP and ISAB is intended to include individuals with a variety of interests, backgrounds and expertise. However, where bias impairs a member’s ability to view matters in a scientific manner and give fair consideration to new information it can jeopardize the member’s usefulness to the groups.

Questions have been raised in some quarters as to whether the ISRP and ISAB members may be biased against hatcheries. It is true that the ISRP places a certain burden of proof on hatcheries to show whether they will harm wild fish (an ESA concern) and that projects need a sound experimental design to measure the wild and hatchery fish interactions (a Fish and Wildlife Program requirement). But these concerns are based in science, both empirical and theoretical, and informed by legal mandates; thus, the ISRP’s view is more appropriately characterized as a scientific standard rather than a bias. In practice, the ISRP has reviewed numerous artificial production programs and found some technically sound and others not. These reviews are described in greater detail in the artificial production section of this report.

In addition to conflict of interest and bias, “independence” of a review panel or advisory board includes independence in making and reporting recommendations. On occasion the Council and fish and wildlife managers have questioned the ISRP with regard to recommendations that may seem to go beyond technical issues into areas of policy. Consequently, the ISRP has made a concerted effort to clearly describe a proposal’s technical merit to justify recommendations. The ISRP believes, however, that it can offer useful comments on cost-effectiveness and programmatic issues that draw from the ISRP’s unique position of reviewing all the proposals across the basin as well as the long-term experience of members in research and management institutions. The ISRP makes an effort to define its boundaries outside of the policy arena by adhering to standards of scientific rigor. It is to be emphasized that the ISRP is not a decision-

making body. It makes evaluations and recommendations to the Council, which is free to counter them, as long as it explains the reasons for doing so. The issue of effectively providing scientific recommendations in a policy arena is further discussed in the Criteria and Evaluation subsection below.

The final characteristic of “independent” is the ability of a scientific review body to self-generate assignments so that controversial but critical scientific questions can be addressed. This is particularly important when sponsoring agencies are unwilling to ask the questions for political reasons. For large and controversial programs, it is imperative that a scientific body exists that has the ability to identify important scientific questions. The Independent Scientific Advisory Board plays that role for the Columbia River Basin program. The primary role of the ISRP is to review proposals and implementation programs at the request of the Council. The ISRP does not self-generate assignments.

## The Original ISRP and the ISAB’s Contribution

The first eleven ISRP members were appointed by the Council in December 1996 and began work in January 1997. Eight of the original members came from the existing ISAB, the other three members provided expertise in wildlife, oceans, and natural resource economics. This significant overlap with the ISAB proved fortuitous. These eight ISAB members had either just completed the ISG’s *Return to the River* report (1996), which reviewed the science behind the Council’s 1994 Fish and Wildlife Program, or the National Research Council’s *Upstream* (1996) report which looked at the status of salmon and salmon management in the Pacific Northwest. In addition, these members included the same individuals who recommended and laid out a process for institutionalizing peer review in the Basin. Consequently, the ISRP was able to bring significant institutional knowledge to its first review. After several years of ISRP basinwide reviews, the ISRP was able to reciprocate and bring an intimate knowledge of Fish and Wildlife Program implementation and individual proposals to the ISAB. In fact, the ISRP and ISAB frequently conduct joint reviews that overlap both groups’ charges including reviews of subbasin plans and basinwide monitoring and evaluation plans. The ISAB has the authority to add members on an ad hoc basis, when it feels that the deliberations will benefit by including a person with a specific expertise; ad hoc ISAB members are often ISRP members.

## Peer Review Group

For the first two years of reviews, the ISRP primarily relied on the eleven ISRP members; however, as the ISRP’s workload and the number of proposals to review increased, the ISRP utilized the services of Peer Review Group members selected from within and outside the region. These members represented a broad spectrum of scientific and technical expertise from the academic, management, and consulting communities. The addition of Peer Review Group members enabled the ISRP to develop in-depth comments on each proposal. Importantly, there was strong concordance between the reviews of independent Peer Review Group and ISRP members. From the FY 2000 review in 1999 through the subbasin plan reviews in 2004, Peer Review Group members have been major contributors to the ISRP effort. In fact, throughout this document the acronym “ISRP” should be considered synonymous with the combined ISRP and Peer Review Group.

The combination of a standing panel augmented by a large pool of qualified scientists is an excellent model for instituting peer review. The standing panel ensures a consistent application of criteria across reviews and an understanding of institutional structures so that project evaluation and programmatic recommendation are presented in the most effective manner to inform decision-making and improve projects. The Peer Review Group provides a pool (currently over 140 scientists) that the panel can draw upon to fill in needed areas of expertise and to complete very large reviews, such as the subbasin planning review that included over 30,000 pages of plans to review, five weeks of meetings, and over a thousand pages of reports to draft in just over two months.

### **III. The ISRP Review Process**

#### **A. Scope of Review**

The amended Northwest Power Act and subsequent Congressional report language define two major ISRP focus areas that inform the “retrospective” report, first, review of projects directly funded by BPA, and second, review of “reimbursable” projects, sponsored by the Corps of Engineers and others, whose costs are reimbursed by BPA.

##### **1) Direct Funded Projects**

The 1996 Amendment to the Northwest Power Act directed the ISRP to advise the Council regarding projects that are directly funded by Bonneville Power Administration under the Council’s Fish and Wildlife Program. The Program’s goals are to protect, mitigate and enhance fish and wildlife, and related spawning grounds and habitat, of the Columbia River Basin that have been affected by hydroelectric development. There are some 211 dams in the Columbia River Basin and the effects of this development are significant in the four states represented on the Council, Idaho, Montana, Oregon, and Washington, but also occur in all corners of the Basin including Canada, Wyoming, and Nevada (see Figure P-1 in the main report). With the exception of a few projects, the approximately 300 direct funded Fish and Wildlife Program projects are in the four Council-represented states.

The most direct impacts of the hydrosystem development are the blockage of habitat historically used by anadromous fish, estimated to be about 52% percent of the basin (ISG 1996; 2000), as well as the inundation of riparian and lowland habitat by reservoirs behind the dams. This inundated area covers almost the entire Columbia River mainstem, with the exception of the Hanford Reach and the river below Bonneville Dam. Dams in tributaries also block habitat formerly open to salmon and steelhead. The Snake River is the largest tributary. Many dams that block salmon from historical habitat in tributaries are non-Federal projects such as the Hells Canyon complex in the Snake River. In addition to blockage, operation of the system has delayed the time of maximum outflow of water from early spring, associated with snow melt, to later in the year, depending upon requirements for flood control, irrigation storage and hydropower production. Operation may also lead to rapid and large changes in flow as the system is manipulated to meet demand cycles for power. Thus, there are significant mitigation

responsibilities for anadromous fish, wildlife, and resident fish that depend upon free flowing rivers. In addition, hydrosystem development is intrinsically linked to agricultural and urban development.

Consequently, projects funded through the Fish and Wildlife Program constitute an extremely comprehensive and often creative mix. Projects include: resident and anadromous fish hatcheries that produce fish intended to mitigate for losses associated with the blocked area and mortality at the passable dams; land acquisition projects for wildlife to mitigate for inundation losses; land management projects that bring best management practices to farmlands and roadways including culvert replacement, irrigation intake fish screens, experimental no-till practices, as well as other efforts leading to more efficient use of water; and associated research and monitoring projects that are intended to survey existing fish and wildlife populations, track physical changes in habitat, and address key uncertainties that could lead to more effective mitigation and restoration activities -- i.e. adaptive management. Figure A-1 shows that the majority of funds are spent on mitigation of anadromous fishes and only a small percentage on resident fish and wildlife, although the amount of funding devoted to resident fish and wildlife has increased steadily since about 1995.

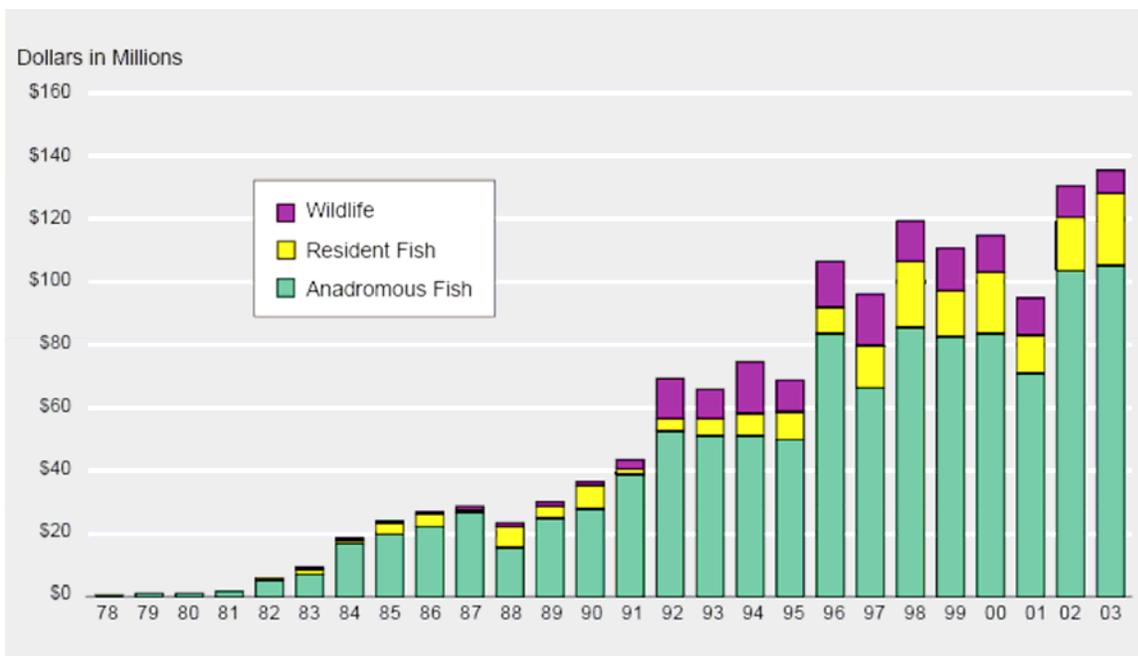


Figure A-1. BPA Fish and Wildlife Obligations 1978-2003 (Council 2005)

ISRP reviews of Fish and Wildlife Program projects have included three annual reviews of all ongoing projects and new proposals, a geographically based provincial rolling review of all ongoing projects and new proposals staggered over two and half years, targeted reviews of innovative proposals, and in-depth reviews of complex artificial production initiatives (Three Step Reviews).

The 1996 amendment to the Northwest Power Act specifically states: "The Panel and Peer Review Groups shall review a sufficient number of projects to adequately ensure that the list of prioritized projects recommended is consistent with the Council's program." Although the language, "review a sufficient number of projects" infers that the ISRP could review a subset of proposals submitted during a Fish and Wildlife project selection process, one common aspect of all Program solicitations, since the inception of the ISRP, is that the ISRP has reviewed all the proposals submitted to meet the solicitations. Consequently, it is the ISRP's understanding that every project funded through the Fish and Wildlife Program has undergone ISRP review at least once and some over four times. Every solicitation, however, does not include every ongoing project; e.g., provincial and innovative project solicitations. The Council's deliberate effort to have all proposals receive ISRP review before being funded has established a solid record of decision-making and consequently administrative accountability for the Fish and Wildlife Program. The ISRP also sees the "sufficient number of projects" as adding flexibility to the process, for example, to allow focused review on a subset of ongoing projects that address a particular strategy that is highly uncertain, or have received critical reviews in the past. In addition, it allows the Council and ISRP to schedule the ISRP workload so the ISRP does not exceed its \$500,000 annual budget.

## 2) "Reimbursable" Projects

In 1998, the U.S. Congress' Senate-House conference report on the fiscal year 1999 Energy and Water Development Appropriations bill directed the ISRP to annually review all fish and wildlife projects, programs, or measures included in federal agency budgets that are reimbursed by Bonneville. Many of these projects are not directly referenced in the Council's program. The ISRP is to determine whether the proposals are consistent with the criteria specified for direct program projects in the 1996 Amendment.

The four major components of the reimbursable program include:

- Columbia River Fisheries Mitigation Program (Corps of Engineers)
- Fish and Wildlife Operations and Maintenance Budget (Corps of Engineers)
- Lower Snake River Compensation Plan (U.S. Fish and Wildlife Service)
- Leavenworth Hatchery (Bureau of Reclamation).

The ISRP has released three reports regarding the Corps' Columbia River Fish Mitigation Program (CRFMP), which implements capital construction and research for mainstem dams and fish passage improvements. The first ISRP review conducted in 1999 relied on the Independent Scientific Advisory Board's (ISAB) congressionally directed Corps Capital Program review (see ISRP 1999-1). For that review, the ISAB completed a series of reviews covering Corps' projects and studies related to adult passage, John Day Dam extended length turbine intake screens, the Bonneville Dam bypass system outfall, and dissolved gas. In addition, the ISAB provided a broader conceptual review of the Corps' program (ISAB 1999-4). The second ISRP review, conducted in 2001, covered the decision-making process on Bonneville Powerhouse I bypass options (ISRP 2001-11).

The third ISRP review, conducted in 2003 and 2004, focused on the US Army Corps of Engineers (Corps) Anadromous Fish Evaluation Program (AFEP) for Fiscal Year 2004. The AFEP's main purpose is to produce scientific information to assist the Corps in making engineering, design, and operations decisions for the eight mainstem Columbia River and Snake River hydroelectric projects. These decisions are intended to support safe, efficient passage of fish through the mainstem migration corridor. The AFEP review was the most significant ISRP "reimbursable" review, taking over a year and encompassing reviews of the technical merits of proposals, the project selection process, and the program in general. Although some of the AFEP proposals are linked with the Corps' Operation and Maintenance program funding, the ISRP has not conducted a comprehensive review of that program, which includes dam maintenance, wildlife mitigation, and contribution to hatchery operations. The ISRP is scoping a potential review of projects funded through that program, such as state-operated hatcheries. Similarly, the ISRP has not yet conducted a comprehensive review of Leavenworth Hatchery but has reviewed a proposal to update the hatchery facilities.

The ISRP has conducted two reviews of the Lower Snake River Compensation Plan program (LSRCP), which compensates for losses of fish in the Columbia and Snake rivers due to construction and operation of the hydroelectric system – specifically Ice Harbor (1961), Lower Monumental (1969), Little Goose (1970), and Lower Granite (1975) dams.<sup>13</sup> The LSRCP oversees operation and maintenance expenses for ten hatcheries and sixteen satellite facilities. The projects include adult trapping and juvenile acclimation and release facilities on/or for the lower Snake, Salmon, Clearwater, Walla Walla, Grande Ronde, Imnaha, Tucannon, Touchet, and Walla Walla subbasins.

In April 1999, the ISRP completed its first review of the LSRCP, which was limited to a description of the program elements and recommendations to reschedule and improve subsequent reviews (ISRP 1999-1). The second review, completed in 2002, was incorporated into the provincial review of Fish and Wildlife Program funded projects and included a technical review of LSRCP proposals in the context of other mitigation and enhancement efforts undertaken and proposed through the Fish and Wildlife Program (ISRP 2002-6). This was a forward step in presenting at least a subset of the multitude of salmon recovery efforts in one venue.

The ISRP also has participated in reviews of subbasin plans and basinwide monitoring and evaluation plans. The ISRP was assigned these review efforts because of its familiarity with the Columbia River Basin's institutional, physical, and biological landscape gained through proposal reviews.

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<sup>13</sup> Water Resources Development Act of 1976, Public Law (P.L.) 94-587.

## B. Project Selection and Review Approaches

ISRP review of these projects and programs has taken many forms. This section describes the various proposal review and solicitation approaches taken, and the lessons learned that were applied to improve the efficiency and effectiveness of project selection processes and should be considered for future processes. Much of the content in the ISRP's first two reports was directed toward developing a project review process that would meet the requirements of the 1996 Amendment, namely that proposals include the necessary information to conduct a scientific review. To do this, the Council, BPA, CBFWA, and the ISRP developed a formal peer review process with a uniform proposal format, review procedures, and evaluation criteria. The ISRP was a key contributor to defining the process because ISRP members contributed knowledge from their experiences with other peer review models and funding processes including National Academy of Science programmatic reviews and grants programs, NASA's science program, US Department of Energy research and development program, and other state, federal, and private funding processes. Several members also had experience on the Scientific Review Group drafting guidance booklets on developing a Fish and Wildlife Program project selection process. Most of the ISRP's recommendations on establishing an effective and efficient scientific review process have been implemented, but others have not been fully tested and are worth considering as the Council and BPA develop future solicitations.

### The Role of the ISRP in the Project Selection Process

The ISRP plays a specific role in the project selection process for the Fish and Wildlife Program in which ISRP recommendations and comments on the technical merits of proposals directly apply to project selection decisions. Specifically, the Council must fully consider the ISRP's technical recommendations when making its recommendations regarding funding, and provide an explanation in writing where its recommendations to BPA diverge from those of the ISRP. In addition to the Council and the ISRP, BPA, CBFWA, and the public also play critical roles.

In describing the project review process for the Fish and Wildlife Program and how it developed, it is useful to organize the discussion around the last major proposal review process used for Fiscal Years 2001 through 2003, the Provincial "Rolling" Review. The provincial review was very responsive to past ISRP review recommendations and public feedback on issues such as geographic context, sequenced multi-year reviews, site visits, project presentations, and response loops. As described in the Council's 2000 Fish and Wildlife Program, the project selection process was shifted from a basin-wide exercise to one that focused on needs identified at a province and subbasin scale. The Council hoped that in focusing the review on a limited number of provinces and subbasins each year, a more in-depth review of proposed projects could be accomplished.

The provincial reviews included:

1. **Informational Meetings.** The Council held meetings in each province to explain the review process to those interested in how Bonneville funding may be used within that province. The ISRP participated in many of these meetings to describe the ISRP review process and expectations.

2. **Subbasin Summaries.** CBFWA coordinated the development of subbasin summaries that provided a snapshot of current fish and wildlife efforts and needs in a subbasin. Bonneville solicited for project proposals to meet the needs identified in the subbasin summaries.
3. **Open Solicitations.** The Council and BPA solicit proposals to meet program needs. Solicitations are open to any individual or entity interested. ISRP and CBFWA review criteria were included in solicitation packets.
4. **Project Proposals and Supporting Documents.** Project sponsors including tribal, federal, and state fish and wildlife managers, universities, and local and private entities from throughout the region submit proposals. Project sponsors submitted project proposals that included plans for the next three years, descriptions of results to date (if ongoing), and summaries of supporting documents. Proposers could also submit relevant planning, research, and background documents to give a complete picture of the project. Information on the proposal's consistency with the subbasin summaries was requested. Reimbursable programs within that province were requested to provide similar information, which the Lower Snake River Compensation Plan program successfully did.
5. **Bonneville Review.** Bonneville was requested to review proposed projects and budgets to ensure that regulatory needs, including compliance with applicable federal laws, were considered, and that questions about the adequacy or appropriateness of proposed budgets and other issues were resolved in the Council's recommendation process. Initially, Bonneville's role was most active after the scientific reviews were complete. By the time systemwide and mainstem projects were solicited, Bonneville had a visible presence in defining Biological Opinion (BiOp) needs for monitoring and evaluation in the solicitation, attending provincial review meetings, commenting on proposals, and working with project sponsors to revise projects to meet BiOp needs.
6. **ISRP Proposal Review.** ISRP review teams of at least three members reviewed each proposal and supporting documents in the context of subbasin summaries and the fish and wildlife program. The ISRP used one set of review criteria for all proposal types. The ISRP and CBFWA review criteria were included in the solicitation packet from Bonneville. The ISRP's review steps are described in more detail below.
7. **Provincial Review Workshops (site visits and presentations).** The ISRP conducted subbasin/province workshops with project sponsors, managers and others. The workshops were split into three stages: a) province tours / site visits by the ISRP and CBFWA review teams (one to two days), b) project presentations and question and answer session by project sponsors (one to two days), and c) ISRP evaluation meetings (ISRP only).
8. **Preliminary ISRP Report.** After the visit, the ISRP produced a preliminary report on all proposals, including draft recommendations and specific questions. This preliminary

report was provided to the public and project sponsors for comments and proposal revisions.

9. **Response Loop and Public Comment on Preliminary ISRP Report.** The project sponsors responded to the preliminary report.
10. **CBFWA Draft Annual Implementation Work Plan.** CBFWA considered the ISRP's preliminary report, the project sponsor responses, and its own technical and management review of proposals and developed a prioritized list of projects reflecting management priorities in the basin.
11. **ISRP Final Report.** The ISRP addressed the responses of the project sponsors and issues in a final report that included project specific and programmatic recommendations to the Council. For most of the provinces, the ISRP made formal oral presentations on findings to the Council focusing on programmatic issues rather than discussing individual proposals.
12. **Public Comment.** The public was provided the opportunity to comment on the ISRP's and CBFWA's recommendations.
13. **Council Decision.** The Council considered: the ISRP report; CBFWA, BPA, NOAA Fisheries, and public comment; and other statutory and programmatic considerations in making final funding recommendations on program implementation to BPA (see Figures A-2 and A-3). The Council's decisions described in writing its recommendations when they differed with the ISRP's recommendations. The Council also provided comments on the funding of projects within the reimbursable programs to Congress and the relevant federal agencies.
14. **BPA Decision and Contracting.** BPA was then expected to fund projects consistent with the Council's recommendations (Figures A-2 and A-3). As part of its decision-making process, Bonneville conducted its own review of projects and with NPCC proposal recommendations, identified projects to be funded and appropriate levels of funding. Bonneville gave deference to Council recommendations; however, decisions were ultimately based on Bonneville's opinion of what is required by the Biological Opinions, hydropower mitigation needs, and its obligations as a federal agency to Native American tribes.

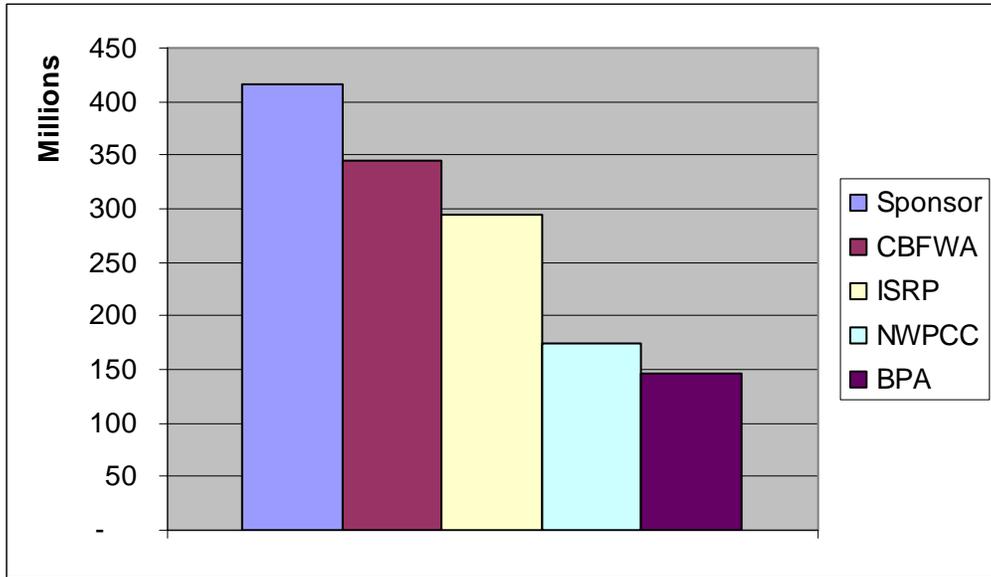


Figure A-2. Funding implications to projects as they move from sponsors request, to CBFWA, Council, and ISRP recommendations and finally to BPA’s funding decision.

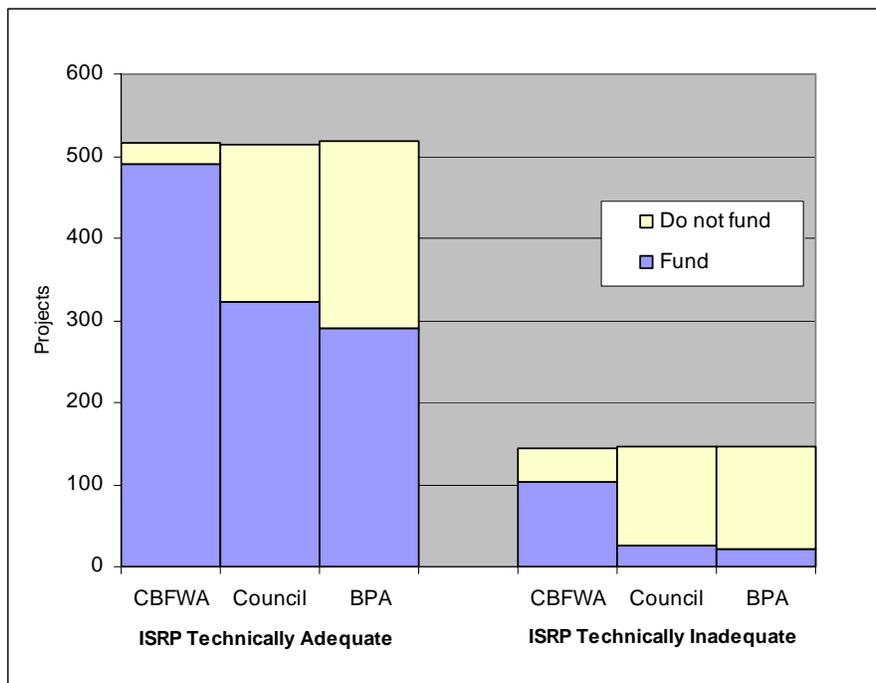
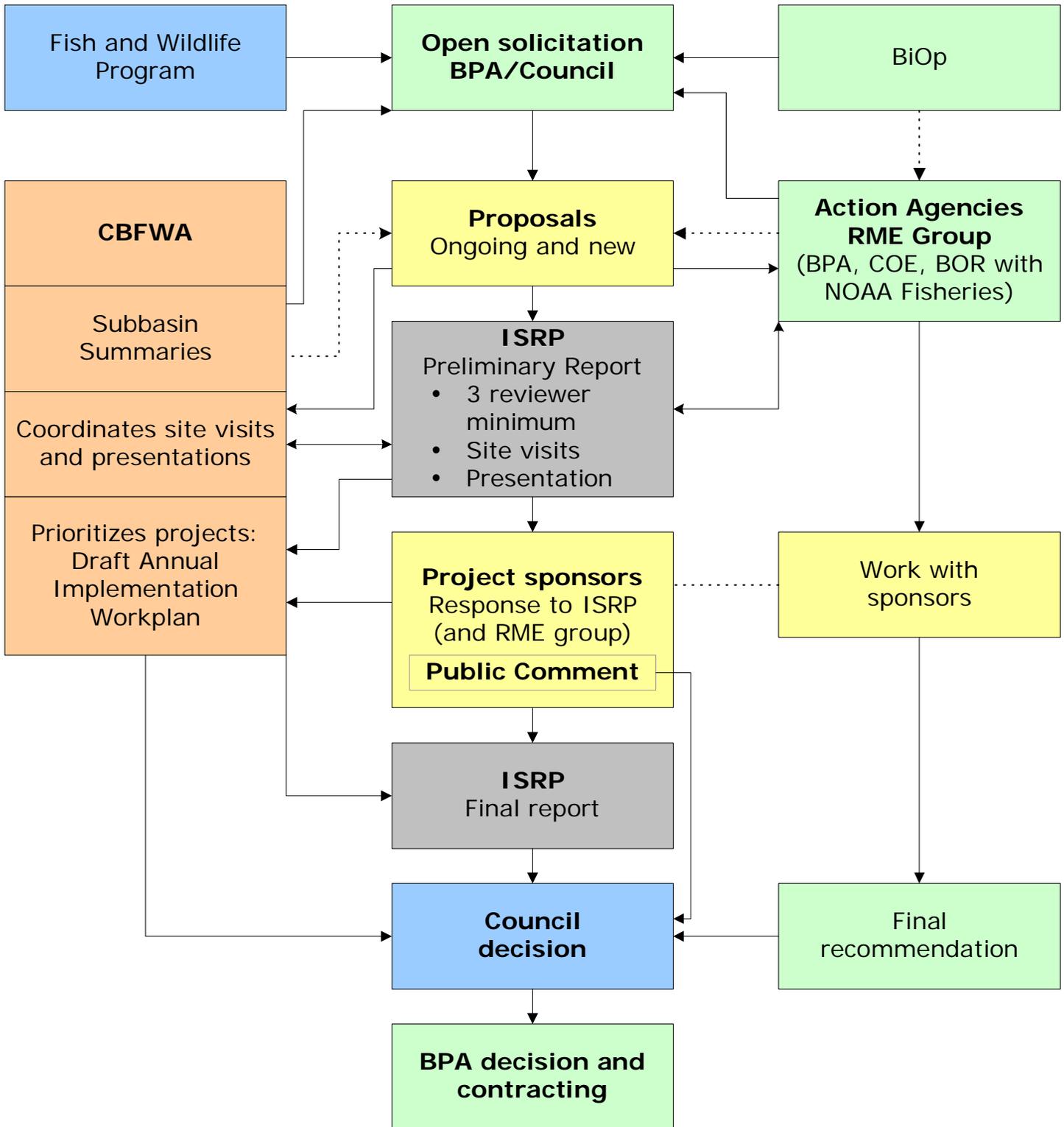


Figure A-3. Comparison of ISRP final proposal recommendations of technically adequate (fundable) and inadequate (not fundable) with CBFWA, Council, and BPA recommendations of fund and do not fund (or no recommendation) in the Provincial Reviews. The Council recommended funding for about 18% of the proposals that the ISRP recommended as not fundable (26 of 146).

A flowchart showing how these steps were used in the most recent provincial review process for mainstem and systemwide proposals is provided in Figure A-4, which highlights the complexity of this highly participatory and public process. The process integrates many, sometimes competing, mandates (treaties, ESA, NW Power Act). It assembles input from state and tribal fish and wildlife managers, federal agencies responsible for the ESA (NOAA Fisheries, USFWS), independent scientists (ISRP), the public, political appointees (the Council), and the funding entity responsible for meeting the mandates (BPA). The Council, with the ISRP's cooperation and insistence, has maintained and defended the ISRP's role of an independent reviewer in the process.

The process generally has functioned successfully. However, if aspects of BPA's funding decisions are inconsistent with the Council's recommendations, there is no formal procedure for documenting those differences. The legal requirement is that Bonneville make expenditures from its fund in a manner consistent with the Council's Fish and Wildlife Program. This requirement is broad. Without specific reporting mechanisms in place, it is uncertain whether BPA deviates from the scientific quality obtained through peer review. The ISRP sees the need to compare BPA funding decisions (including their contractual Statements of Work) with the ISRP-approved proposals. To accomplish this comparison, the ISRP recommends that a sample of funded projects be examined to ensure that the scientific quality obtained in peer review is represented through the BPA procurement process. If major discrepancies are found then a legally binding process should be considered to identify and justify the changes (similar to the Council's obligation to explain in writing if it does not follow the ISRP funding recommendations).

# Columbia River Fish and Wildlife Program Project Selection Process



*Figure A-4. Mainstem and Systemwide Project Selection Flow Chart.*

## Types of Solicitations: Moving towards Efficiency, Competition, and Innovation

Solicitations for the Fish and Wildlife Program can be split into two basic categories, open and targeted solicitations. Open solicitations, as used in basinwide annual and provincial project selection processes, are for any type of restoration or enhancement action intended to benefit fish and wildlife resources in the Columbia River Basin by mitigating for impacts of the hydrosystem. In addition to the annual basinwide and provincial reviews, the ISRP participated in myriad other project selection and review processes that were more targeted than the basinwide and provincial review.

These “targeted” processes included:

1. Request for proposals (RFP) targeted at specific program needs,
2. Innovative proposal reviews,
3. Out-of-cycle emergency project selection processes to meet certain priority needs identified by BPA including 2001 Action Plan, High Priority, and 2005 Updated Proposed Action proposal reviews,
4. Review of project selection criteria for the Water Transactions and Riparian Easement Programs, and
5. Council Three-Step Reviews of artificial production programs.

Both open and targeted solicitations have been “open” in the sense that any individual or entity can apply to meet the need described in the solicitation. The ISRP’s experiences with both types of solicitations are summarized below. Descriptions of the processes and specific issues that arose in the reviews follow the summaries. Table 1, in the main report, shows a snapshot of the review effort.

### Open Solicitations

The ISRP has conducted what amounts to three comprehensive reviews of all ongoing and proposed projects funded through the Fish and Wildlife Program. The ISRP’s first review for Fiscal Year 1998 did not include reviews of individual proposals, but the annual reviews for Fiscal Years 1999 and 2000 and rolling provincial reviews for Fiscal Years 2001 through 2003 included comments and recommendations on each proposal submitted. Substantial improvements in the process were made with each review.

#### *The First Annual Review for Fiscal Year 1998: Program Implementation Review*

The ISRP’s first report covered the projects submitted in 1997 for FY 1998 funding (ISRP 1997-1). The project selection process for FY 1998 was not specifically organized for an ISRP review but was primarily organized for CBFWA’s development of a draft annual implementation work plan rather than an independent scientific review; consequently, the ISRP found proposals to be generally inadequate for scientific review and decided it could not effectively provide comments and recommendations on individual projects. Instead the ISRP’s evaluation focused on process issues and a programmatic review of the implementation of the Fish and Wildlife Program (FWP). To do this, the ISRP reviewed all 225 project summaries submitted and compared them against the measures in the Fish and Wildlife Program with the context of the current state of the science as described in the Independent Scientific Group’s *Return to the River* (1996; 2000) and the National

Research Council's *Upstream (1996)*. This provided the value of comparing the projects with the FWP and both the projects and the FWP with the current state of science.

The ISRP also made a number of recommendations aimed at developing and improving the review process. These process recommendations were directed at increasing coordination, creating a uniform set of standards and policies for review of new and continuing project proposals, implementing a competitive grants program, and developing a more information-rich accounting and reporting system to facilitate the prioritization and review of ongoing and needed work.

The ISRP based this particular review solely on written documents submitted for review and did not hold briefings or interact with project sponsors.

### ***The Second and Third Annual Reviews for Fiscal Years 1999 and 2000: Basinwide Review of All Ongoing Projects and New Proposals***

The FY 1999 and FY 2000 solicitations and reviews were very similar. The Council and BPA sent out an open solicitation and received 400 proposals for each year. Although BPA's solicitation letter for FY 2000 described budget limitations in funding new proposals, the number of proposals did not substantially decrease from FY 1999. In addition, for FY 2000 approximately 37 umbrella proposals describing linkages between proposals were added that did not request funding. A major difference between the FY 2000 review and the ISRP's first two reviews is that the ISRP made extensive use of the Peer Review Groups (PRG) enlisting 27 additional reviewers for a total of 38 reviewers.

For both reviews, the ISRP organized the proposals into geographical grouping - subregions and subbasins - consistent with CBFWA's groupings for their draft annual implementation work plan. The ISRP also intended to review the proposals from a topical perspective (i.e., a comparison of all hatchery or wildlife acquisition proposals), but there was not enough time. Instead, the ISRP focused on how the projects fit together to address limiting factors and meet objectives at a geographic scale. This review approach led to ISRP recommendations to create umbrella proposals in FY 2000, subbasin summaries for the provincial reviews, and eventually subbasin plans to provide better assessments and documentation to justify and prioritize projects.

The ISRP based these reviews solely on written documents submitted for review and did not hold briefings with project sponsors. In the FY 2000 review, however, a post hoc "fix it loop" review was added for project sponsors to respond to the ISRP's comments. The ISRP then reviewed the responses and revisited its recommendations.

### ***Provincial Reviews of all Ongoing and New Proposals, Fiscal Years 2001 through 2003***

For Fiscal Years 2001 through 2003, the Council and BPA embarked on a new project selection process that was responsive to past ISRP review recommendations and public feedback on issues such as geographic context, multi-year reviews, site visits, presentations, and response loops. The new process was called the Rolling Provincial Review Process. For the review, the Columbia River Basin was divided into 11 ecological provinces, plus a mainstem and systemwide category of projects was defined. See Figure P-2 in the main report.

Each province is comprised of groups of adjoining subbasins that have similar ecological attributes. Solicitations and reviews for each of these provinces was staggered over 2 1/2 years beginning with

the Columbia River Gorge and Inter-Mountain provinces for Fiscal Years 2001-2003 and ending with the mainstem and systemwide set of projects for Fiscal Years 2003-2005. This in-depth review, conducted within a more structured subbasin and province context, enabled the Council to recommend multi-year funding for projects.

Subbasin summaries were created partly in response to ISRP recommendations in its FY 1999 and 2000 reviews that additional information was needed on the geographic context of proposals, and the relationship and coordination of ongoing and proposed projects. The information provided in the subbasin summaries was a significant improvement over the umbrella proposals submitted in FY 2000. Many subbasin summaries provided substantial information towards fulfilling the content requirements of subbasin plans.

In sum for the rolling provincial reviews, the ISRP reviewed 704 proposals and 537 responses to ISRP preliminary reviews of those proposals. These 704 proposals submitted for the provincial solicitation represents an approximately 57% increase from the 400 proposals submitted for each of the basinwide FY 1999 and FY 2000 solicitations. This increase in proposal submittals is evidence that the local outreach by the Council and CBFWA was effective in generating local interest. The large percentage of proposals requiring responses, 76%, was also evidence of the increased role of the ISRP in providing peer advice to project sponsors intended not only to ensure scientifically sound, accountable proposals but to improve project justification, methods, and monitoring and evaluation.

The ISRP recommends that the Council not go back to a review of all new and ongoing projects in one annual review cycle. That process does not allow time for ISRP and project sponsor interaction through site visits, presentations, and response loops. Instead, the ISRP recommends that future processes be modeled after the sequential multi-year provincial reviews with potential alterations to more efficiently address program needs through topical (wildlife O&M, systemwide RM&E, lamprey) and targeted reviews.

The benefits of the 2001-2003 provincial review process were manifold and bear repeating: 1) the ISRP gained an unprecedented level of understanding of individual projects and of the Fish and Wildlife Program; and 2) project sponsors were supportive of the process, which they saw as fair and equitable as it gave them opportunities in the site visits and presentations to make certain that the ISRP accurately understood their projects and concerns. A consequence of this systematic and measured review approach was that project sponsors were generally accepting of the ISRP review results, even when proposals did not fare particularly well. Often project sponsors had the opportunity to address ISRP concerns through the “fix-it” loop process. Considerable good will was generated throughout the basin via the provincial review process toward the Council, the ISRP, and the Fish and Wildlife Program.

## **Targeted Solicitations and other Specific Reviews**

### ***Request for Proposals***

In the ISRP’s first several annual reviews, the ISRP noted that the majority of the proposals reviewed were for continuing projects that have been in existence for a number of years and which required further commitments for relatively long periods of time (5 to 10 years). The ISRP felt that the past procedures for funding projects may have encouraged “business as usual” without granting adequate opportunity for the Council to direct work or research into needed areas. In response to

this perceived problem, in almost every major ISRP report, the ISRP recommended the use of targeted Requests for Proposals (RFPs) as a method of addressing specific critical uncertainties or information gaps.

In FY 1999, the Council and BPA, with assistance from the ISRP, developed two targeted RFPs. These addressed specific critical uncertainties about Chinook salmon intended to further define the roles of mainstem habitat use and needs of Chinook salmon as well as providing information on their population and genetic structure. The reports and analysis that resulted from these RFPs were extremely informative and well done (see Battelle 2000, Brannon et al. 2002). The ISRP found this initial experience with the targeted RFP approach promising and recommended use of the approach again to help resolve critical and controversial uncertainties.

The next specifically focused competitive grants solicitation was developed by the Action Agencies' Research, Monitoring and Evaluation (RME) group in March 2004 to meet three research gaps related to hatchery and wild fish interactions and the potential for reconditioning steelhead kelts (repeat spawners) as called for under Reasonable and Prudent Alternatives in the NOAA Fisheries' 2000 Biological Opinion (BiOp) on the operation of the Federal Columbia River Power System (see ISRP 2003-9). The Request for Studies (RFSs) was necessary because although the Mainstem and Systemwide solicitation called for proposals to meet research needs identified in the BiOp, it did not specifically target the hatchery and wild salmon interaction uncertainties at a specific enough level to generate sufficient interest from the research community. The ISRP found that promising proposals were submitted for two of the RFSs but adequate proposals were not submitted for one of the RFSs, in part because the one month provided to develop proposals was too short.

The ISRP recommends that the Council continue the practice of developing RFPs targeted to specific problems including systemwide information gaps or key limiting factors in a particular watershed. This should become an annual procedure with a specific budget allocation. We further recommend that requests for proposals to conduct the work or research be widely distributed to individuals, companies, and government agencies. The Council might also want to explore the use of pre-proposals to screen qualified proposals to be developed into full proposals. This approach was employed for the FY 1999 RFPs.

### ***Innovative Proposal Solicitations***

In its first several annual reviews, the ISRP noted that the failure to arrest the declines in salmon abundance and bring about recovery suggested some emphasis should be placed on innovative ideas. Those ideas often come from outside the inner circles of salmon management institutions. In the experience of ISRP members, and in the history of the FWP itself, there are many examples of successful innovative projects that needed special attention to get started. Within the FWP, one need only name the adaptation of transponder identification tags to salmonid marking (PIT tags; developed originally for uses such as marking racehorses and commodity shipments). Many funding organizations and research laboratories maintain specific categories of funds for exploratory, high-risk, potential high-payoff activities as investments in the future.

Consequently, the ISRP recommended that the Council and BPA establish a special funding category to encourage innovative projects with the justification that a relatively small investment in a competitive solicitation for innovative projects could provide substantial improvement in the quality of research and recovery actions in the Columbia River Basin. This recommendation was based in

part on language in the 1994 FWP (Section 13.1F) that called for solicitation of proposals to advance new ideas and means for reducing uncertainties in the fisheries restoration effort.

In response to the ISRP recommendations and FWP language, the Council established a funding mechanism for innovative projects with the goal to improve knowledge, encourage creative thinking, and directly benefit fish and wildlife. For FY 1999, the Council funded two projects submitted in response to RFPs described above, and for FY 2000 funded a number of projects submitted in response to the annual solicitation and identified and recommended by the ISRP as innovative. For FYs 2001 and 2002, Bonneville and the Council created specific solicitations for innovative fish and wildlife project proposals with a budget of \$2 million. Innovative projects were defined as those which rely primarily on a method or technology that (1) has not previously been used in a fish or wildlife project in the Pacific Northwest, or (2) although used in other projects, has not previously been used in an application of this kind.

The ISRP's review process for innovative proposals was anonymous, meaning there was not any ISRP interaction with project sponsors – no project presentations, site visits, or response loops. Also unlike the basinwide and province reviews, the ISRP ranked the proposals based on technical merit and potential benefits. This ranking was possible because the proposals targeted a specific need and the set of proposals was small enough for the ISRP to discuss and compare all the proposals in a consistent and equitable manner. For FY 2001, 66 proposals were submitted that in total requested almost \$20 million. From the ISRP's ranked set, the Council recommended and Bonneville funded nine projects at just over \$2 million. For FY 2002, 37 proposals were submitted for funding with a requested budget of about \$6 million. Based on the ISRP's review and ranking of the 37 proposals, the Council recommended eight projects to Bonneville for funding. After the selection process was completed, Bonneville funded only two of the recommended proposals, citing the Bonneville fiscal crisis as the reason. Three issues arose in the FY 2001 and 2002 solicitations that should inform future innovative solicitations: 1) limit project scope to a pilot or test of concept level, 2) focus innovative solicitations on innovative projects, and 3) commit to the advertised allocation and solicitation criteria.

The FY 2001 solicitation capped individual proposal budget requests to \$400,000, which inadvertently encouraged the submission of larger-scale proposals with pilot and implementation phases. The ISRP suggested that the FWP would be better served by funding a larger number of pilot-scale projects of moderate budget with 12-18 month testing periods than by supporting fewer large budget, long-term projects. The ISRP believes that a major purpose of the innovative funding category is the “proof of concept”, and innovative projects should be pilot-scale, operate on modest to moderate budgets, and be of relatively short duration. The ISRP suggested that future solicitations cap budgets of innovative projects at \$250,000 and recommend a range of \$50,000 - \$150,000. For FY 2002, the Council adjusted the selection process for innovative proposals and solicited for “pilot projects” rather than full-scale projects and limited their duration to a maximum of 18 months.

In addition to innovative projects, the FY 2001 solicitation requested work on nutrient supplementation, which confused the review process because strong nutrient supplementation proposals did not necessarily have to be innovative. The ISRP recommends that special topic solicitations should be developed as targeted RFPs rather than addressed through the innovative process.

In FY 2002, Bonneville's decision to fund just two projects from eight recommended by the Council was based on its review that the two projects met both the needs of the Fish and Wildlife Program

and the Biological Opinion. This “Biological Opinion” requirement was not described as a selection criterion in the solicitation. The ISRP recommends that application of post-hoc criteria be avoided in the future. Several proposals that the ISRP ranked high and found very promising were not funded, including a proposal to conduct research on shad whose impacts on salmon are a major uncertainty in the Columbia River Basin.

The ISRP recommends that an annual budget for the innovative proposal solicitation be committed to (especially if advertised in a solicitation) and perhaps increased, and that a separate budget be set aside for targeted Requests For Proposals (RFPs). While the Innovative Funding Category has been allocated at just over 1% of the Fish and Wildlife Program’s annual budget, results from several innovative projects have had important benefits to the region. The retrospective review by ESSA Technologies (Marmorek et al. 2004; Innovative Project 34008) of past habitat improvement actions and their effect on salmon survival and abundance led directly to many recommendations on data needs, and coordination among projects that are currently being addressed by the developing Research Monitoring and Evaluation plan.

### ***High Priority, Action Plan, and Updated Proposed Action Reviews***

In late 2000 and early 2001, before a majority of the provincial reviews were underway, BPA and the Council opened two solicitations targeted towards immediate habitat actions. The first was the “High Priority” solicitation that called for immediate actions that will assist Endangered Species Act (ESA) listed anadromous fish in the Basin. In just over a month, Bonneville received 96 proposals that offered actions ranging from replacing culverts to acquiring riparian habitat to testing selective fishing gear. The second was the “Action Plan” solicitation that called for immediate actions that would address impacts to ESA listed anadromous species and to unlisted fish directly affected by the declaration of a power emergency. Bonneville received 38 new proposals, and 12 “High Priority” proposals were resubmitted. Expedited review was requested in order to provide funding rapidly to worthy projects that could offset effects of the power emergency that year.

The ISRP conducted expedited reviews for both solicitations and ranked the set of “High Priority” proposals in six weeks and the “Action Plan” proposals in ten days. The review process for both reviews differed from the standard ISRP Provincial Review Process in several ways. Subbasin summaries were not provided, the ISRP did not conduct a site visit, project sponsors did not make oral presentations, and a response loop was not included. Consequently, the proposal review was not as interactive or rigorous as the provincial review and did not benefit from the contextual information provided by a provincial review, making the fit of the proposals within a subbasin strategy less apparent.

Like the “Innovative” solicitation, the “High Priority” and “Action Plan” solicitations included unique criteria that were much more specific than those provided by the 1996 amendment to the Power Act or provided in basinwide or provincial solicitations. The “High Priority” criteria required that eligible proposals address problems of ESA-listed anadromous fish, be designed for one-time funding, result in immediate on-the-ground benefits, and not be used to build infrastructure or capacity that require subsequent funding for implementation. Almost half the proposals failed the threshold criteria because they did not offer immediate actions that would result in on-the-ground benefits. Although Bonneville intended for the Action Plan projects to be short-term actions to help fish affected by the power system emergency in 2001, the subsequent contracts were not completed nor work initiated until 2002 (CBFWA 2004).

In March 2005, the ISRP reviewed a set of nine habitat projects in the Columbia Cascade Province intended to help achieve Biological Opinion tributary habitat goals for Upper Columbia Spring Chinook and steelhead. These projects were submitted to the Council and BPA for funding under the Fish and Wildlife Program, but were not submitted as part of any competitive solicitation. The Bureau of Reclamation developed these proposals in coordination with willing landowners, local governments, conservation groups, and tribes. Although some of the projects reviewed might have had significant biological merit, the proposals were not technically justified and received “not fundable” recommendations. The process employed to select these projects appeared very similar to ad hoc project selection processes that were employed before 1997 when the ISRP, Council, and BPA implemented a formal standardized review process. The ISRP recommended that any proposals for habitat work in the Upper Columbia River be coordinated with other entities that are active there, such as the Washington Salmon Recovery Board, and the mechanisms established as part of the Habitat Conservation Plans (HCPs) of Chelan and Douglas County PUDs.

In general, the quality of the High Priority, Action Plan, and UPA proposals fell below those in the provincial and “innovative” reviews. Based on the generally poor quality of proposals, the ISRP recommends against further short-time (one month from solicitation to submittal), special-circumstance solicitations. Such solicitations, if they occur too frequently and generate proposals of the low quality received in these reviews, could erode the improvements in the proposal review process gained over the past eight years with respect to accountability, transparency, and fairness.

### ***Review of Project Selection Criteria for Land and Water Transactions***

Another type of ISRP review has been to participate in the development of criteria that will be used by another entity to select site-specific projects, without ISRP review. This approach has been used for habitat restoration and protection projects and essentially applied by model watershed as well as irrigation screening projects. For example, the ISRP reviewed the Confederated Salish and Kootenai Tribes’ Habitat Acquisition and Restoration Plan to determine whether it provides scientifically sound criteria and a protocol to prioritize habitat acquisitions. The ISRP found the plan’s rationale for habitat acquisition and methods for acquiring acres of habitat (including guidelines, ranking criteria, and acquisition process) adequate for habitat acquisition and restoration of wildlife habitat. The ISRP suggested that the document could serve as a useful model to other habitat and restoration proposals with some minor revision of its monitoring and evaluation plans (see ISRP 2001-4).

The most recent example of this approach is the ISRP’s review of two sets of draft criteria, one for evaluating proposals for innovative water transactions to increase tributary flows proposals, the other to secure riparian easements to protect tributary habitat. The National Fish and Wildlife Foundation (NFWF), Pacific Northwest Regional Office, uses these criteria to select projects for implementation through the Columbia Basin Water Transactions Program funded by the Bonneville Power Administration. The riparian protection effort is new in 2005 and is an expansion of the Water Transactions Program, which has been implemented since 2003. The project selection process is as follows: NFWF receives, evaluates, and ranks proposals submitted by qualified local entities using the criteria reviewed by the ISRP; obtains BPA approval on selected projects; and facilitates the implementation of those BPA approved projects. Consequently, the ISRP’s role in reviewing the criteria is important because NFWF, not the ISRP, evaluates proposals. Given this absence of ISRP proposal review, the ISRP worked with BPA, the Council and NFWF to develop criteria that were consistent with the criteria from the 1996 Amendment to the Power Act and requested the necessary

information to scientifically review and prioritize water transaction and riparian protection proposals (see ISRP reports 2005-1, 2004-2, 2003-1, 2002-15).

The ISRP has not conducted a review on the success of the Salish and Kootenai Tribes wildlife acquisition project or the Water Transactions Program, but recommends that the programs be reviewed periodically like any other project. For example how effective has the Water Transaction Program been in restoring continuous flow to streams, especially in dry years. Such a review would also help the ISRP better understand the ability of potential participants to propose projects; i.e., whether the process and criteria are so onerous, e.g., requiring detailed hydrologic and biologic knowledge, as to discourage participation.

The ISRP is aware that the Council may pursue this model of project selection at the subbasin level to enfranchise locals, especially those involved in subbasin plans. This approach would be especially useful in providing an ongoing process for implementing new work between Council and BPA project solicitation, review, and selection cycles. The ISRP has recommended this type of approach for land and water acquisitions. The ISRP is optimistic that such an approach could be successful with: 1) sound criteria agreed upon by the project/program sponsors, BPA, the Council and ISRP, 2) participation by knowledgeable and independent evaluators (e.g., NFWF), and 3) periodic ISRP reviews of the programs, which could dictate revision of the criteria and ensure accountability.

### ***Council Three-Step Reviews***

In the ISRP's FY 1998 report (ISRP 1997-1), the Panel recommended that the Council permit funding for an individual artificial production project only if the project proponents can demonstrate they have taken specific measures or requirements of the FWP into account (e.g., ecosystem impacts) in the project design, and the Council concurred. To ensure that standard is met, the ISRP recommended that a project should be funded only after a positive recommendation from an independent peer review panel. In response, the Council developed the Three-Step Review process, which was built upon the existing multi-step design and review process recognized in the program and used by Bonneville for the design, review, approval and implementation of new production initiatives. In adopting the Three-Step Review process, the Council also agreed with the ISRP's recommendation to make use of independent peer review for projects as they move through each stage of the development process.

The ISRP has produced over twenty Three-Step Reviews, resulting in significant changes for several projects. For example, as a result of the iterative Three-Step review process, the Northeast Oregon Hatchery program's monitoring and evaluation plan improved significantly and has the potential if implemented to address some critical uncertainties pertaining to wild and hatchery interactions. It may also serve as a model for other supplementation programs in refining their monitoring and evaluation plans.

In the FY 1998 review, the ISRP also recommended that it (or the ISAB) be asked to conduct a formal peer review of major projects or project topics selected by the Council throughout the year. The results of these reviews would be available to reviewers and decision-makers in evaluations of continuation proposals. This recommendation has come to fruition in part through the Council's Three Step reviews. Although the Three-Step Review processes' guidance and criteria need to be revised to make the process more effective and efficient, the process is the most in-depth project specific review conducted by the ISRP and is very successful as a means to improve projects or

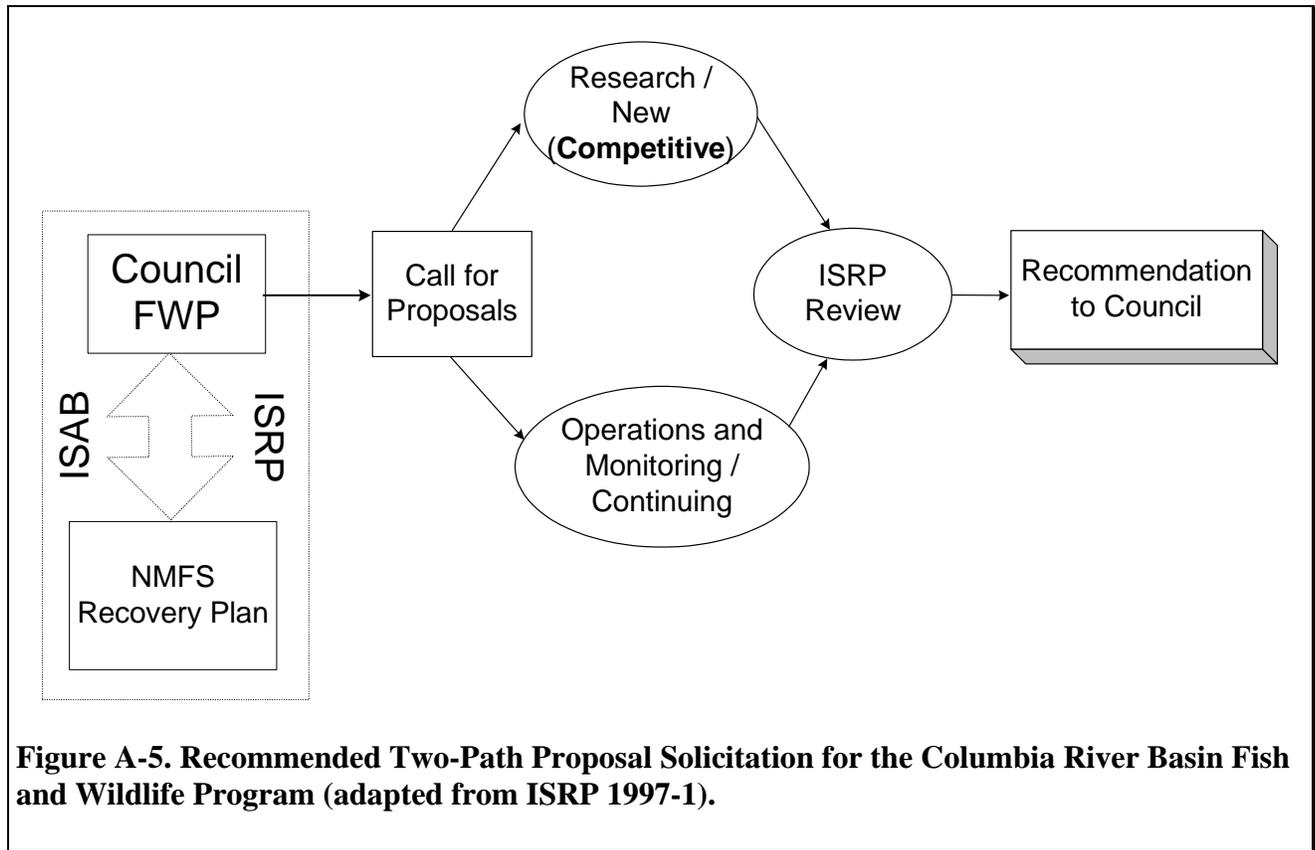
provide scientific rationale for not pursuing a particular approach or strategy under a particular set of ecological conditions. The Three-Step process often involves several interactions between the project sponsor, Council, and ISRP on the project's technical adequacy and consistency with the FWP. Time constraints during project selection processes do not allow for this level of scrutiny and interaction. The ISRP thinks the Three-Step review model of focusing in on a specific complex program and conducting an iterative review with specific criteria drawn from the FWP could be applied to other complex core programs.

### **Alternative Project Selection Approaches: Evaluating Different Kinds of Projects**

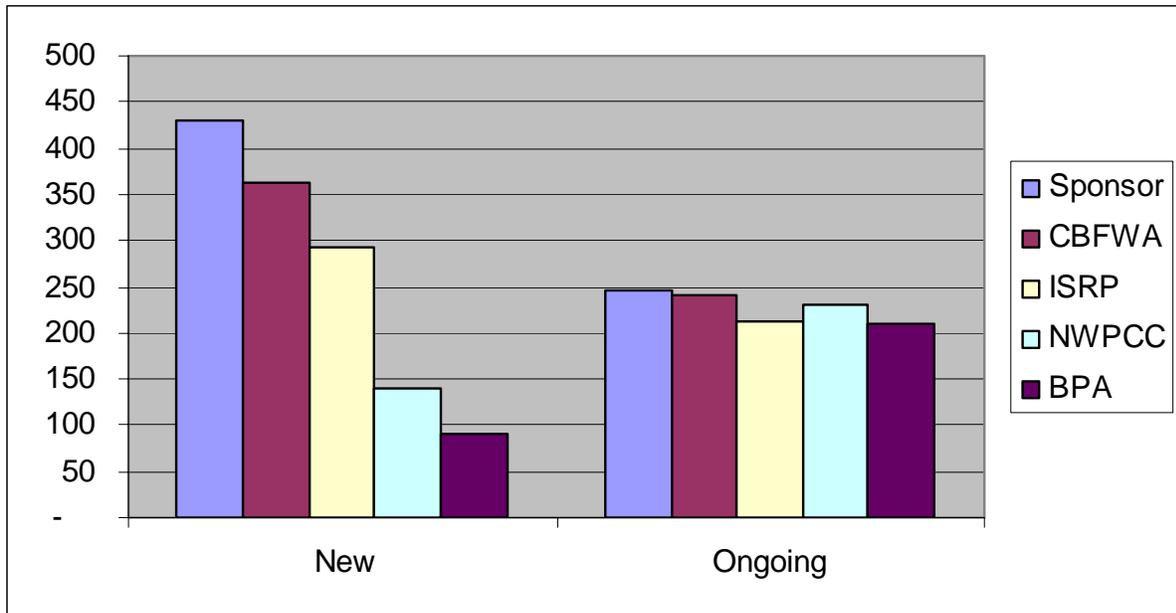
In its first report, FY 1998, the ISRP immediately recognized that the Fish and Wildlife Program consisted of an amalgam of projects, and that different types of projects would benefit from different types of reviews. Foremost among this consideration was how to treat ongoing operations, maintenance and construction projects versus new and ongoing research projects. Although the project review and selection process now accommodates continuing and new work (even innovative new work), the Council should continue to explore review approaches to make the review of different types of proposals most effective. In its first review, the ISRP noted that many funding agencies must consider both within-agency funding and funding of outside groups such as universities or commercial firms.

While the ISRP recommends that the FWP use a competitive grants or RFP approach for new work, a review process for continuing work may require a different approach and emphasis that focuses on project accountability and improvement. A large fraction of the Fish and Wildlife Program budget is for activities such as construction, acquisition, operations and maintenance, where the crucial issues are competence, efficiency and teamwork. The evaluation basis for individual project proposals in this category is largely a matter of ensuring that the project simply does what it is supposed to do within a reasonable budget and timeframe, and that results are monitored and reported. Because of the integration of these activities into the ongoing business of the agencies that are implementing various aspects of the salmon recovery effort, there may be sound reasons for relaxing the requirement for open competition at the discretion of the agencies (or in accordance with whatever their respective contracting rules may be).

In its FY 1998 report, the ISRP presented two case studies as examples of approaches to evaluate new and continuing work – the US Department of Energy's Strategic Environmental R&D Program and the Hudson River Foundation's Hudson River Fund. In examining these programs, the ISRP suggested the Council create a two-path process, as shown in Figure A-5. Each track (operations versus competitive projects) would produce full proposals for any new project and continuation proposals every several years.



Although a smattering of targeted, competitive solicitations for new work have been undertaken, the Council and BPA have not created a formal two-path process. Instead, the majority of project funding decisions occur in annual solicitations in which new and ongoing projects compete for funding. On its face, this approach has significant logical appeal to the ISRP because the competition provides incentives for the Fish and Wildlife Program to fund the most scientifically sound and cost effective projects. In practice, however, many continuing projects with ongoing operation and maintenance costs continue to form the foundation of the program (see Figure A-6). In addition, many potential restoration and mitigation projects are site specific and thus under the jurisdiction of various state, federal, and tribal entities. The ISRP continues to think that a multi-path process has merit and deserves further consideration. The ISRP recommends that alternative review paths be investigated for continuing projects heavy with out-year operating obligations and targeted solicitations for new or continuing work that does not involve routine operations.



*Figure A-6. Tracking the number of new and ongoing provincial review proposals (2001-2003) as they moved through the review process from the sponsors request, to CBFWA, Council, and ISRP “fund” recommendations and finally to Bonneville’s funding decision. The graph shows the stability of the ongoing work through the process.*

In addition, many projects fall somewhere between the "research" category and the "operations" category, combining elements both of innovation and of routine implementation. The ISRP recommends that certain operations projects can be separated from other proposals and their review expedited. Early on, the ISRP discussed the approach of separating the design and interpretation-of-results component from the implementation (i.e., conducting the experiment or carrying out the monitoring operation) so that the respective components could be evaluated according to the appropriate review mechanism; however as the ISRP progressed through its subsequent annual reviews, we found that it was difficult to get a good picture of how the pieces of a project or a program fit together if the components of programs or projects were separated. Consequently, the ISRP placed the most emphasis in understanding the rationale and methods of a project or program in the context of all its parts as well as the objectives, activities and limiting factors in the watershed where the project was proposed. Although the reviews went in that direction, the ISRP thinks acknowledging the differences between types of projects including ongoing base program projects and research projects could lead to efficiencies in the review process. It might be possible to separate certain types of straightforward “operations” projects so that they could benefit from a coordinated and expedited review process.

### **Reimbursable Program Review Processes**

In addition to reviews of proposals funded through the Council’s Fish and Wildlife Program, the ISRP has conducted reviews of proposals for Bonneville’s “reimbursable” program. For the Lower Snake River Compensation Plan, ISRP project review was successfully incorporated in the provincial reviews. Most recently, the ISRP reviewed proposals submitted to meet needs for the Corps’ Anadromous Fish Evaluation Program (AFEP) (ISRP 2004-8). The ISRP did not participate in the development of the review process but rather engaged in the Corps’ project selection process

with the intention to gather sufficient information to 1) make project-specific and programmatic assessments on the substance, scale, scope, and process of the AFEP, 2) determine at what point in the Corps process it would be appropriate to insert an ISRP review of project proposals, and 3) compare the AFEP with the Council's Fish and Wildlife Program. The ISRP's review approach was selected to be least disruptive of the Corps' normal, annual cycle of selecting AFEP projects. The AFEP schedule and process of setting priorities and selecting projects were found to be significantly different from those of the Fish and Wildlife Program.

The ISRP found that the AFEP's current internal iterative process of proposal development did not lend itself to an independent proposal review process like the ISRP provides to the Council and BPA for Fish and Wildlife Program proposals. For example, the ISRP found that most of the AFEP pre-proposals were not well enough developed to be amenable to scientific review. The ISRP also observed that the current AFEP proposal review process appeared to have little bearing on the selection of proposals for funding. Unless the AFEP proposal development process is modified, future ISRP review of AFEP proposals will not be particularly useful, as the present AFEP process does not have clear decision points where ISRP review can provide value to the scientific quality of the proposed studies and inform project selection and funding. The ISRP recommends that the Council, Corps, and ISRP develop a clear place for ISRP input before another review of AFEP proposals is undertaken.

## Specific Review Issues

### **Review Protocols**

The ISRP maintains a minimum standard of three reviewers per proposal through all its reviews whether for basinwide, provincial, innovative or targeted solicitations. This standard reflects that of other peer review processes, such as for articles in peer-reviewed journals. Many proposals, especially those that constitute a complex program, receive individual reviews from five or more members. Individual reviewers evaluate the proposals and provide draft comments and scores for discussion by review teams. To ensure the most consistent and fair evaluation of proposals, standard formats and criteria are applied to all proposals. The ISRP review criteria were made available to the project sponsors in the solicitation packet. The information gained from the individual project reviews was used to determine the adequacy of individual proposals, analyze CBFWA's priorities, and make programmatic and process recommendations. In reaching recommendations, the ISRP review teams would meet in person to reach consensus. For example, it took 11 day-long meetings in FY 1999 to develop ISRP recommendations on the 400 proposals. Due to the many combinations of review teams across the many proposals, e.g., 38 reviewers divided into teams of three to review 400 proposals, the ISRP conducts a consistency review across proposal sets (subbasin or topic) to ensure that similar quality proposals receive consistent recommendations from review team to review team.

All ISRP reviews share the common characteristic that individual member's proposal evaluation comments and review team discussions are conducted in private and records of those discussions and evaluations are not made available outside the ISRP. Instead, the ISRP uses individual reviewer evaluations and notes from group discussions to draft consensus findings that are provided to the Council, project sponsors, and the public. These review protocols are an important attribute of the group's independence. The ISRP has been successful in reaching consensus, and no proposal review

or report has included a dissenting opinion. This review model is different than other review models in which independent scientists join local stakeholders or managers to develop funding recommendations. The ISRP has frequently been requested to provide individual members to represent the ISRP on various projects such as development of a regional research, monitoring, and evaluation plan, but members have declined the invitation and the ISRP has maintained its role as an independent review group.

## Review Criteria

The 1996 Amendment to the Northwest Power Act included the ISRP's base criteria. Again, ISRP project recommendations are based on a determination that projects:

1. are based on sound science principles;
2. benefit fish and wildlife;
3. have a clearly defined objective and outcome;
4. with provisions for monitoring and evaluation of result; and
5. are consistent with the Council's fish and wildlife program.

These criteria include the foundational elements needed for a scientific review and could serve as standard criteria for other statutorily mandated peer review processes related to adaptive management programs beyond the Columbia River Basin. For the benefit of project sponsors and review teams, the ISRP found it necessary to further define the criteria in a way that reflected both the standards outlined in the 1996 Amendment and conventional standards for peer review. The process of further defining the statutory criteria has been iterative. The FY 1999 review criteria were mostly geared towards research proposals, but research projects make up a minority fraction of the Fish and Wildlife Program. Consequently for FY 2000 the ISRP developed seven types of criteria to cover the full range of projects from watershed councils to research and monitoring to information dissemination. After one trial run in FY 2000, the ISRP determined that the use of multiple criteria was not tractable and abandoned the approach. Multiple criteria did not work because of the nature of the open solicitation, the organization of proposals geographically rather than topically, and the numerous proposals that multiple criteria types applied to.

For the provincial reviews, the ISRP matched its evaluation criteria with the proposal form and made the criteria comprehensive enough to cover any type of project. This approach to evaluations worked well and was less cumbersome than having multiple criteria for one solicitation. Criteria and proposal form topics included:

- 1) technical and scientific background,
- 2) rationale and significance to regional programs (and subbasin summaries),
- 3) relationships to other projects,
- 4) project history (for ongoing projects),
- 5) proposal objectives, tasks and methods,
- 6) monitoring and evaluation,
- 7) facilities, equipment and personnel,
- 8) information transfer,
- 9) benefits to fish and wildlife (criteria only).

In contrast to the open basinwide solicitations, targeted/competitive solicitations, such as the innovative solicitation, require the use of more defined criteria, which allow the ISRP to better compare and even rank projects based on their technical merit and likelihood of benefiting fish and

wildlife. With open solicitations, the ISRP's evaluation is basically on the technical merit of each proposal. The comparative value of such reviews is best at the bottom-line level of fundable or not fundable but is not at the level to distinguish between proposals that received favorable reviews. If the reviews were intentionally set-up to elicit comparison among like projects, the ISRP could provide reviews that would aid in prioritization. The ISRP recommends that the Council and BPA increase the practice of using targeted solicitations with specific criteria to meet program needs. This allows the ISRP to add value to reviews by ranking or indicating relative priority of proposals at satisfying a specific program need.

### **Evaluation Terminology: Finding the Right Approach**

The criteria and evaluation scores were useful in getting reviewers to consider the elements needing justification and explanation in a proposal, and review teams focused discussions on proposals with different individual team member scores. However, it quickly became clear that scoring would not form the basis of ISRP reporting of comments and recommendations or be provided to project sponsors or the public, because there were too many review teams across the set of proposals and too many types of proposals requiring too much work to report scores in a consistent and useful manner. Instead, the ISRP focused on providing consensus written comments with a bottom-line recommendation.

ISRP comments and recommendation are targeted towards several audiences, primarily the Council and the project sponsors. For the Council, ISRP comments need to be written concisely and clearly in lay terms to inform policy decisions, i.e., to provide enough justification for the ISRP's bottom-line recommendation so that the Council has adequate context to explain in writing if it disagrees with the ISRP. These are accountability functions of the ISRP review. In addition, an equally and increasingly important ISRP review function is to provide technical comments in enough detail that project sponsors can respond to the ISRP and improve the documentation, justification, and effectiveness of their projects. Increased attention by the ISRP to this collegial, tutorial, or peer function of the review has led to a greater acceptance of the review process among project sponsors and more value to the program.

The ISRP's recommendation terminology changed with each review to best fit the process and level of review. For FY 1999, the ISRP categorized each proposal by its technical "adequacy." For FY 2000, recommendations fell into "fund" categories. The ISRP began using "fund" rather than "adequate" because funding recommendations are the common denominator between the Council, CBFWA, and BPA allowing for a ready comparison between ISRP and CBFWA recommendations. For the provincial reviews, the ISRP switched from "fund" to "fundable" because the ISRP does not make funding decisions but makes determinations of technical adequacy. The "fund" terminology was criticized for creating the impression that the ISRP rather than the Council and BPA made funding decisions. In addition, "fund" was often characterized as an ISRP endorsement that a project be funded, when in fact it only indicated that the proposal met the basic review criteria. This progression of terms is indicative of the sensitivity of the Basin to the ISRP's reviews and the subsequent adjustments made so ISRP recommendations most effectively informed project selection decisions.

ISRP comments also included observations on budgetary and other issues that are not central to the scientific review. These observations did not dictate whether a project would receive a "fundable" recommendation. Instead, they were intended to flag issues for the Council, BPA, CBFWA, and the public that require further inquiry. For "not fundable" recommendations, the ISRP was careful to

provide sufficient scientific comments so that comments on policy or budget issues would not be viewed as the primary factor in the ISRP determination.

### **Proposal Content, “Grantsmanship,” and the Proposal Form**

During the initial annual reviews the ISRP, Council, BPA and project sponsors participated in the development of a proposal form. The form needed to meet the administrative and budget purposes of BPA, CBFWA and the Council as well as the scientific review needs of the ISRP and CBFWA. The ISRP consistently emphasized that the proposal is the single document evaluated by reviewers and represents the sole opportunity for proposers to present a convincing case for funding. The purpose of the proposal is to summarize the goals, objectives, methods and rationale of the proposed work. It is the means by which the research idea or a management need is presented to the larger scientific and management community, and it is the basis for determining the merits of individual projects within the context of the entire Fish and Wildlife Program. The proposal review, therefore, is not simply a bureaucratic exercise but is the fundamental core of evaluation and recommendation that ultimately determines the quality of program implementation.

After the FY 1998 and FY 1999 reviews, the ISRP concluded that the form created the impression that any answer provided in each section of the form meets the project manager’s reporting obligation; i.e., a “check the box” approach. In fact, in the FY 1999 review, the ISRP found that about 60% of proposals were adequate, but 40% were inadequate and did not meet the ISRP’s review criteria in the 1996 amendment. The ISRP noted that many problems with proposals stemmed directly from the fact that people were filling out a form rather than writing a full narrative proposal. For example, many proposals had incomplete or disjointed presentation of information, incomplete descriptions of the problem to be addressed (rationale), artificial division of projects into pieces represented on separate forms, and failure to think systematically about the project as a whole and its relation to other projects.

These shortcomings highlighted three process issues needing significant attention. First, project managers needed to systematically document the problems they proposed to research or manage and how those problems fit into the FWP. Second, project managers needed to think of the function of a proposal not as a bureaucratic requirement but as a communication and persuasion tool. Third, many project managers seemed not to see the proposal submission process as critical to their funding success and so did not prepare proposals that would adequately justify their work.

When project sponsors and fish and wildlife managers received the FY 1999 ISRP report that found 40% of the proposals to be inadequate, one response was that the ISRP was overly academic in its constitution and review, and that inadequacies in proposals were mainly a matter of “grantsmanship” or proposal writing, rather than technical deficiencies in the proposal or project. To address some of these concerns, CBFWA organized several proposal-writing workshops throughout the region, and the ISRP worked with BPA to develop a proposal guideline document that was made available with the FY 2000 solicitation. In addition, the ISRP, BPA, CBFWA, and the Council reworked the form to include a narrative section along with an administrative section. The narrative section was intended to change the incentive of the writer from one of providing the minimum information to fill out a form to one of providing the information necessary to make an integrated and convincing case for funding. The new form, although somewhat cumbersome, elicited the information necessary for peer review while maintaining the benefits of electronic management.

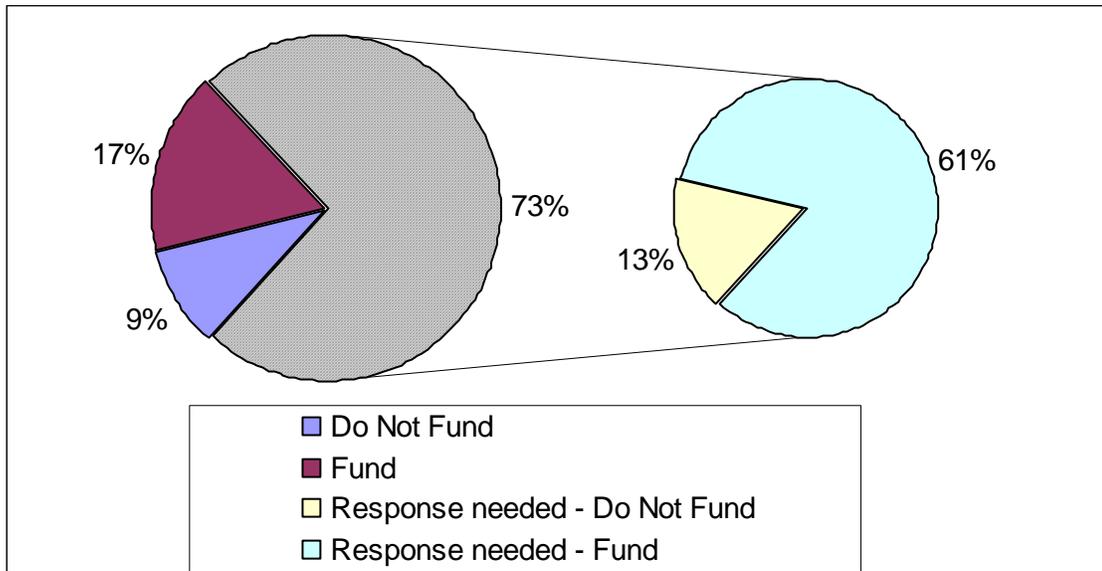
In FY 2000, the ISRP again found about 60% of the proposals to be adequate and 40% inadequate. Although these percentages match FY 1999 outcomes, the ISRP with the assistance of Peer Review Group members were able to scrutinize the proposals in greater detail and applied the review criteria more strictly than in FY 1999, knowing that project sponsors had one round of experience with the new peer review process. As a sign of progress, in the FY 2000 report, the ISRP stated that in the three-year period in which the ISRP had conducted annual reviews of project proposals, there was a general increase in the coherence and information content of the proposals. The ISRP identified many well conceived and executed proposals.

Despite improvements, however, many proposals continued to be poorly constructed. In response to characterizations that adequacy of proposals hinged on “grantsmanship,” the ISRP emphasized that poorly formulated proposals were suggestive of poor implementation and supervision, placing in question the likelihood that the project would ultimately benefit fish and wildlife. The ISRP took the firm position, that under the constraints placed on the Council by the 1996 Amendment, such projects should not be funded.

### **Response or “Fix-it” Loop**

After release of the ISRP’s FY 2000 report, the Council staff organized public meetings throughout the basin to describe how the Council was approaching the ISRP recommendations and to get input on how the process for FY 2001 and beyond might be improved. Foremost among past public feedback was that project sponsors asked for more interaction with the ISRP including site visits, presentations, review of ISRP draft recommendations, and submittal of additional materials beyond proposal forms. Managers of ongoing projects were concerned that the ISRP was reviewing the proposal and not the project. In reaction to the public comments, the Council provided project sponsors the opportunity to respond to the ISRP comments on FY 2000 proposals (ISRP 99-2, Volume II, 15 June 1999) and asked the ISRP to review those responses. This process became known as the “fix-it” or response loop. For the FY 2000 response loop, the ISRP stated that in the long run, too frequent use of such an interactive review process might undermine the review role of independent review groups like the ISRP. Despite the ISRP’s concerns with instituting a response loop, it became a fixture in the provincial review process (see Figure A-7). A primary rationale for incorporating the response loop in the review process was the obvious success projects had at providing further justification or altering their proposal in response to ISRP comments and receiving a favorable technical recommendation. For many, this was seen as a great value added for the ISRP reviews, moving the ISRP’s role beyond technical accountability and emphasizing the peer or tutorial aspects of the review.

In the provincial reviews the ISRP found that the process could be abused by the submittal of a “placeholder” type of proposal with the assumption more information could be added in the response loop. To discourage this strategy, the ISRP recommended “not fundable, no response warranted” for proposals that did not provide the basic foundation for a technically sound proposal. The ISRP now agrees that a response loop has been a good addition to the project review process. The response loop is an effective mechanism to ensure that the ISRP’s peer review advice is considered by project sponsors and in some cases used to improve the methods and monitoring employed by a project. The ISRP, however, cautions that the response loop be used equitably and primarily for review of solicitations that include ongoing projects. A response loop should not be necessary for competitive solicitations that are targeted entirely at new proposals such as for innovative projects.



*Figure A-7. ISRP Response Review Results for the Provincial Reviews. The pie on the right shows the preliminary review results, 73% of the proposals were requested to provide a response; the pie on the left shows response review results. 17% of proposal received fundable recommendations after the preliminary review. 78% of proposals received fundable recommendations after the response review. This does not include Lower Snake River Compensation Plan proposals.*

### Site Visits and Proposal Presentations

In its first several reviews, the ISRP recommended that the review process be expanded to include the use of site visits and presentations, which had been recommended by a sequence of advisory boards (SRG, ISG, ISAB) for nearly a decade. Project sponsors seconded the need for this type of increased interaction. The ISRP asserted that regular site reviews of related projects would contribute to enhanced program coordination and assist in evaluating progress toward meeting Program goals. As presented in the SRG's Guidelines for Project Reviews (SRG 1990; ISG guidelines to BPA 1994), related projects would be given a thorough on-site review every 3-5 years by a review panel. The information that could be obtained by such panels goes far beyond what is possible in the proposal review process, and contributes to resolving the problems of program fragmentation and lack of vision identified in the ISRP first three reviews. Reviews with site visits are especially valuable for projects related by geography or common purpose. The Council responded to the ISRP and public recommendations by including site visits and presentations as integral elements of the provincial review process.

The purpose of the tours was to give the reviewers a basic understanding of the ecological conditions and limiting factors in the province so that the projects were placed in their geographic and ecological context. In addition, the review teams visited a cross section of ongoing wildlife, habitat restoration, and artificial production projects in each province. The second stage of the workshop was dedicated to project presentations. Each project proponent was given the opportunity to provide a concise presentation of their proposal and answer ISRP questions on their project.

CBFWA organized these meetings in an effective and efficient manner balancing the needs of the review teams with the requests and demands of the project sponsors. CBFWA's role in the process

changed the dynamic between the ISRP and CBFWA. Their relationship was no longer anonymous and the ISRP depended on CBFWA staff to be responsive to ISRP needs and run the review process. In addition, CBFWA managers were able to participate in the process to inform their own review and prioritization of projects.

The ISRP teams greatly appreciated the lively, informal exchanges and the chance to see the landscape and many project sites first-hand. These and the oral presentations were invaluable in making clear the nature of the projects. The site visits often revealed aspects of the landscape or general situation that profoundly affected the perception or the feasibility of the proposal, e.g. Arrowleaf and Salmon Creek proposals in the Columbia Cascade Province (Figure A-8). These site visits, however informative, were still not at the level that the SRG and ISRP had envisioned for complex, ongoing projects. The ISRP continues to recommend that periodic in-depth site visits be used for targeted reviews of complex ongoing projects so the ISRP can get a complete understanding of the scope of a project's effort, the ability of the project sponsors, and the quality of the facilities, methods, and other project resources.



*Figure A-8. The Methow River abutting Arrowleaf Property, identified in a proposal as salmon spawning habitat.*

When reviews include presentations and site visits where the project sponsors and the ISRP intermingle, the absolute level of reviewer anonymity is breached. The concern with this increased interaction is that reviewers will be unduly influenced by factors extraneous to the technical merits

of the proposal such as amount of time spent with a project sponsor at a particular project site or charisma of project sponsors. The ISRP has been fastidious in demanding that the proposal itself capture all the necessary information to meet the ISRP review criteria including technical soundness. This helps ensure a fair review process and maintains a record of the proposal and the review that justifies decision-making and better assures that aspects of a proposal agreed to by the sponsor, ISRP, Council, and BPA persist through implementation.

### **Multi-Year Review and Funding**

In the FY 1998, FY 1999 and FY 2000 reviews, the ISRP identified the need to change the project review and selection process so that adequate time was available to conduct a quality scientific review. The ISRP noted that the vast majority of projects that receive funding are ongoing projects with biological objectives that take years to achieve, yet project review and funding were determined and administered on a yearly basis. The ISRP recommended that the main opportunity for improvement was the replacement of a zero-base review process for the whole FWP (every project proposed and reviewed annually) with multi-year proposals and reviews for selected projects. The annual review process would thus concentrate on new proposals (for which an available amount of funding would be identified annually) and a subset of the continuing proposals then due for full review. Consequently, the ISRP would have more time and resources to better focus on specific sets of innovative proposals or scientifically controversial areas of the program.

The public feedback on the ISRP's FY 2000 review also emphasized the need for a multi-year review and funding cycle. Project sponsors felt that the implementation of their projects was beginning to suffer because the annual project selection process was taking up an unnecessary amount of their effort. In response to the ISRP's, the public's, and CBFWA's call for a multi-year process the Council and BPA made multi-year funding recommendations a prominent feature of the provincial review process.

### **Comparison with CBFWA's Prioritized List**

The 1996 Amendment calls for the ISRP to review a sufficient number of projects to ensure that the prioritized list of projects is consistent with the Fish and Wildlife Program. The ISRP took this to mean CBFWA's prioritized list. To meet this review charge, the ISRP would compare its recommendations with CBFWA's prioritized list of proposals in its draft AIWP, which included recommended funding allocations among projects. The ISRP's evaluation for each project includes a determination of whether its recommendations agree with CBFWA's. The ISRP notes the level of agreement with the terms "agree" and "disagree." This review function meets one of the intents of the 1996 Amendment to provide an independent review of the fish and wildlife managers' recommendations.

One outcome of this exercise was that the ISRP generated a list of proposals that it found to have high potential to benefit fish and wildlife, but CBFWA did not recommend for funding. The ISRP recommended nine such projects in FY 1999. ISRP and CBFWA recommendations were similar in most topic areas; however, the ISRP was less supportive of artificial production projects and more supportive of watershed and habitat projects than was CBFWA (Figure A-8). The Council did not recommend any of the nine proposals recommended for funding in FY 1999 by the ISRP, in part because the ISRP's report did not provide adequate justification to recommend funding of the proposals in what was already a tight budget. In the FY 2000 review, the ISRP identified 37 projects

that it recommended for funding, but CBFWA did not allocate a budget. The ISRP provided specific reasons for the recommendations to fund individual projects. Twelve of these proposals were funded. Public comments, primarily from individuals outside the normally funded project sponsors such as universities, stated that the open solicitation and the ISRP review encouraged the submittal of new work by sponsors not currently funded through the Fish and Wildlife Program.

Before the provincial reviews, CBFWA’s work plan would be released without the benefit of reviewing any type of ISRP finding. CBFWA had often asserted that its review should follow the ISRP’s review. The ISRP and Council argued that the 1996 Amendment called for the ISRP to look at the prioritized list of projects – e.g., CBFWA’s work plan. The provincial review process essentially satisfied both needs. CBFWA was able to review ISRP draft findings to inform its decision, and the ISRP’s final report included a comparison of its recommendations with CBFWA’s. One effect of this change in review step sequence was that as the provincial reviews progressed CBFWA provided more detailed technical comments, many of which matched those of the ISRP. The ISRP noted, however, that in some cases the CBFWA management recommendations seemed at odds with consistent ISRP and CBFWA technical comments that were critical of the project.

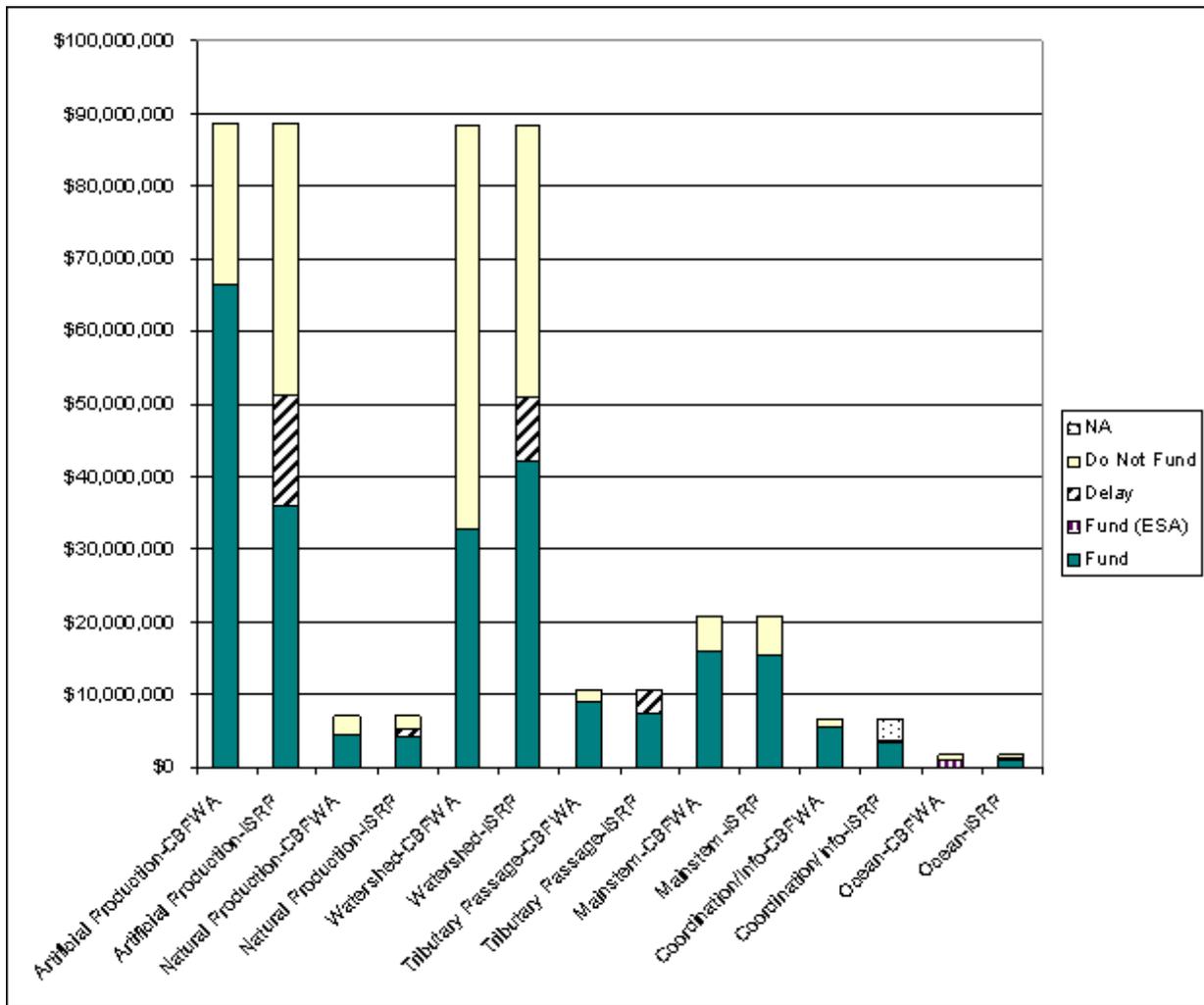


Figure A-8. Comparison of ISRP and CBFWA Recommendations 1999 showing ISRP and CBFWA differences in reviews of artificial production and habitat projects.

## Issues with Justification, Objectives, and Reporting of Results

Throughout its reviews, the ISRP highlighted several issues of proposal content that continue to need attention, including the need for better scientific justification for a project, description and definition of objectives, and reporting of results.

*Justification.* Many project sponsors attempted to justify their projects by citing language in the Fish and Wildlife Program, CBFWA's AIWP, BiOps, or BPA planning documents rather than describing the actual problem or need the proposal would address. While the ISRP agreed it was important that proposed projects be linked to policy measures or directives in the Council's Fish and Wildlife Program, such linkages even when directly and explicitly stated, did not constitute scientific or technical justification for the proposed work. The sponsor's proposal needed to clearly describe the scientific or technical background, foundation, and justification for the proposed work.

*Objectives.* A common, but critical shortcoming of many proposals was, and continues to be, their failure to articulate objectives in the proper form. The need for well-defined and well-stated objectives (and tasks) is important as evidenced by the 1996 Power Act amendment language that calls for proposals to “*have a clearly defined objective and outcome with provisions for monitoring and evaluation of results.*” Project objectives should be stated in terms of desired outcomes, rather than as statements of methods and tasks. Tasks or strategies should be described in a way that clearly addresses the proposal's objectives. For example, a project objective might be: “To increase the spawning success of fall Chinook salmon in Crawdad Creek,” not “improve spawning habitat for fall Chinook salmon in Crawdad Creek by road obliteration to reduce sediment deposition in the channel.” The idea of creating better spawning habitat might then be listed as a sub-objective, and the words about obliterating roads should be in the tasks or strategies section. Steps in the actual road obliteration process would be listed as subtasks or methods (work elements). Language explaining this distinction between objectives, tasks, and methods was added to the directions for filling out the narrative section of the proposal form. However, the practice of stating tasks as objectives has persisted and was evident in the subbasin plan review in 2004. The problem is more than a semantic one. Objectives give the program a biological benchmark against which to develop a monitoring and evaluation program to gauge the success of strategies.

*Results.* A proposal for an ongoing project should include a clear interpretive history of the project's past accomplishments. These should be stated in terms of the ultimate biological objectives of the Fish and Wildlife Program, i.e., the benefit to fish and wildlife in the basin and the preservation or restoration of self-sustaining ecosystems that maintain fish and wildlife. Biological goals and evaluation criteria should be clearly given, and data and statistical analyses cited in support of results. A list of tasks accomplished is one step in meeting the requirement for reporting of past accomplishments but it does not allow evaluation of how well a project is progressing toward the ultimate goal of benefit to fish and wildlife or to the ecosystems that sustain them. Many tasks that are believed to benefit fish or wildlife do not, in fact, do so everywhere, so some level of evaluation and reporting of outcomes remains necessary for each project. To facilitate better reporting of results, the proposal form included a table to capture past accomplishments in the administrative section and directions in the narrative form specifically requested reporting of biological results. Despite these direct calls for reporting of results, most proposals did not report accomplishments beyond completion of tasks. Consequently, data to support a comprehensive retrospective analysis of the biological results of past projects has not been available to the ISRP. This lack of data was

also evident in the subbasin plans, the guidelines for which also called for the reporting of project results in the inventory section.

The ISRP recommends that future solicitations and BPA's project tracking database be linked, emphasize reporting of both biological results and task completion, and contain mechanisms and protocols that ease reporting and compilation of results. In addition, BPA should explore requiring reporting of results at specific milestones as a condition to continued funding. BPA's new project tracking database, PISCES, appears to offer significant promise for tracking the status of tasks.

Publication of research results in peer-reviewed literature imposes an additional test of scientific quality that has not been applied to many projects in the Fish and Wildlife Program. Such publication makes information available to a wide audience and facilitates adoption of effective, efficient, and innovative methods and implementation of adaptive management. Several research projects funded through the Program have had good, even outstanding, publication records in peer-reviewed journals. Examples of such programs among others are the mainstem predator reduction program aimed at the northern pikeminnow (formerly the northern squawfish) and the smolt physiology program.

Plans for peer-reviewed publication of project results, however, are missing from most proposals. Although not peer reviewed, the DOE/BPA report series (now available only on the web) has the objective of publication of results, often as annual reports from each project. Its existence is a positive step, but for many projects and their results is not sufficient. The ISRP has recommended initiating a Columbia River Basin Journal or a Northwest Salmon Recovery Journal that could serve as a regional forum for publication of research and long-term monitoring and evaluation results of particular relevance to the region. While numerous fisheries and ecology journals exist, and many biologists and researchers in the basin publish in them, initiation of a regional-based peer review journal would consolidate regional scientific information on salmon recovery. In its first annual report to BPA (SRG 1990), the Scientific Review Group recommended that development of a suitable regional peer review journal be considered. The ISRP encourages Council to consider mechanisms for development of such a forum.

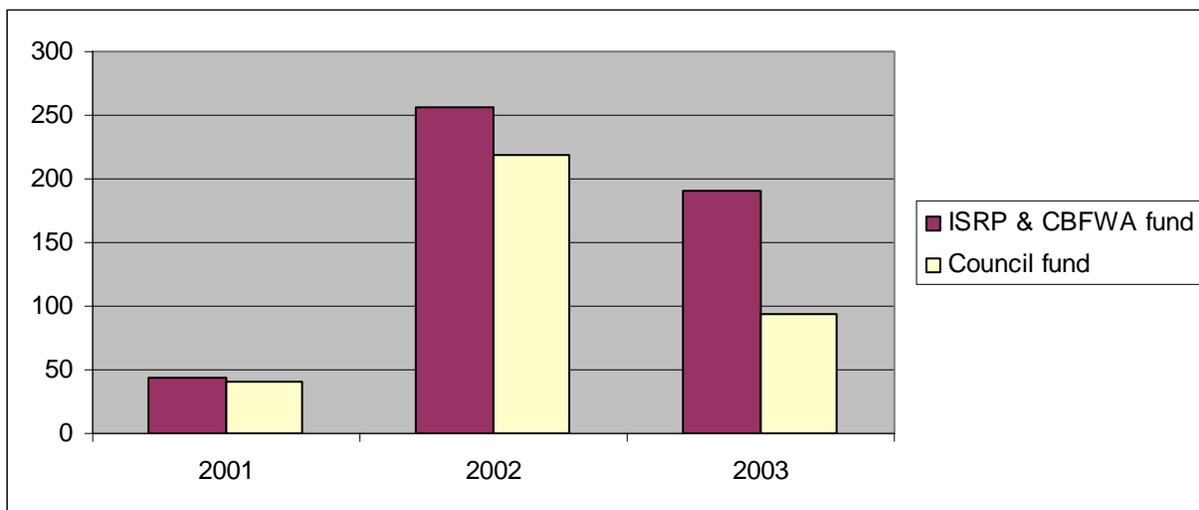
## **Review Schedules**

In the FY 1999, FY 2000, and provincial reviews, the ISRP noted that it barely had time to adequately review proposals for technical quality and provide constructive comments and a consistent level of review across projects. Reviewing the approximately 400 proposals in both the FY 1999 and FY 2000 cycles was a time-consuming endeavor that left the ISRP little time to perform review functions such as review of proposals across topical areas, and identification and description of broader scale programmatic issues, emerging scientific issues, and strategic planning. One of the goals of the provincial reviews was to stagger the annual review of proposals over three-years to allow the ISRP additional time to perform these other review functions. However, the process was condensed to two and a half years for policy reasons and more proposals were submitted (704 with 513 responses) than expected, again leaving the ISRP insufficient time to conduct these other review functions. This retrospective review opportunity is welcomed because it allows the ISRP to perform its other valuable functions. The ISRP recommends that in scheduling future reviews the Council and BPA work with the ISRP to organize a review approach and schedule that provides ample time for the ISRP to perform its full range of review functions.

## Allocation Issues

As the provincial review process was developed in 1999 and 2000, the ISRP met with the Council and others who described one of the goals of the provincial review was to define needs in the basin and to help shape future BPA allocations. The Memorandum of Agreement between the Council and BPA setting a specific BPA funding commitment for the Fish and Wildlife Program expired before the beginning of the provincial reviews. As the provincial review effort was launched, a specific funding allocation among provinces or even an overall funding commitment from BPA for the entire program was not agreed upon. Rather, there was an implicit assumption that the Fish and Wildlife Program's effort would be increased to speed recovery and mitigation efforts. As the provincial review played out, the scope and quantity of work proposed in the provinces demonstrated that there were potential unmet restoration and mitigation needs in the basin and the capacity of local entities to meet those needs.

This approach to developing a post hoc allocation, however, proved to be an inefficient way to approach a solicitation. When the BPA financial crisis of 2001 occurred, the assumption that the process would define increased program needs changed, and the Council developed project selection criteria that acknowledged the budget constraints and included such criterion as a preference to protect previous investments through funding of ongoing work. This change in policy and budget assumptions did not dampen the submittal of proposals in the later provincial reviews. Consequently, project sponsors submitted and the ISRP reviewed a large number of proposals that had little chance of funding, which resulted in an inefficient process with the potential to discourage project sponsors from participating in the future (see Figure A-9). The ISRP recommends that a specific budget be committed to and advertised as part of future solicitations.



*Figure A-9. Number of Province Review proposals that the ISRP and CBFWA agreed were fundable compared to proposals Council recommended for funding as the Provincial Reviews progressed -- 93% in 2001, 85% in 2002, 49% in 2003.*

## Miscellaneous Issues

### *In Lieu*

A common characteristic of the basinwide annual and provincial project selection processes are that the solicitations were open to any party proposing any type of restoration or enhancement action intended to benefit fish and wildlife resources in the Columbia River Basin that would mitigate for impacts of the hydrosystem development and operation. A key factor in considering such proposals is that full mitigation of effects of hydrosystem development and operation on fish and wildlife might not be possible “in place and in kind”, i.e. by improving passage or habitat at the dam or reservoir, thus leading to the concept of making up the difference in the tributaries. This off-site, out-of-kind mitigation is necessary because of the general inability to accomplish full mitigation in place and in kind. Nonetheless, reviewers, especially those unfamiliar with the Columbia Basin, struggled with what kinds of projects constituted mitigation and were appropriate for Fish and Wildlife Program funding. In the end, the ISRP took the approach that this was a policy decision, and the ISRP’s role was to review the projects for their technical merit and benefits to fish and wildlife.

Despite this review approach, in several reports including the FY 1999 and High Priority reviews (ISRP 1998-1 and 2001-1), the ISRP specifically raised the issue that many proposals were not clearly related to the effects of hydropower development in the basin and seemed to fall into areas of legal responsibility of other agencies or parties – *in lieu*. Although many of the proposed actions addressed high priority needs that posed imminent risks to listed stocks, the limiting factors actually resulted from management deficiencies under the present land owner or government authority: private, city, county, tribe, state agency (e.g. Highway Department) or federal (e.g. USFS). Without questioning the biological need for the proposed actions, the ISRP suggested that the Council address the policy issue of funding responsibility for these actions. Future solicitations would benefit from a clear expression of what constitutes an *in lieu* issue. What is the responsibility of the Fish and Wildlife Program to fund habitat improvements, culvert replacements, irrigation system modifications, intake screening and other actions for a variety of landowners who face responsibilities under numerous laws? A clear definition, depending on the policy, has the potential to 1) broaden participation, or the opposite 2) limit submittal of proposals to those actually eligible for funding, and/or 3) increase cost-share opportunities and coordination of efforts.

### *Confidentiality of Proposal Information*

Some ISRP reviewers raised concerns about the fact that proposals for BPA funding are not confidential documents and are made available to the public via the web upon submittal. The basic concern is that another entity will, in effect, steal someone’s original idea or method for their own benefit. Theoretically, such a concern could lead a project sponsor not to submit a proposal, and the entire program could suffer a lack of infusion of innovative ideas. This concern is heightened because the federal, state, and tribal fish and wildlife managers have long-established relationships and projects with the Fish and Wildlife Program and by sheer exposure to new ideas through the process could unintentionally co-opt innovative ideas. However, this is a public process with requirements for public presentations of proposals, public comment, agency review and the need to make proposals available to the public. In the end, the sponsors have to take the risk and rely on copyright and trademark laws for protection. The ISRP also informally acts as a check and could highlight potential problems of this nature to the Council. If the Council thinks this issue is limiting innovation, perhaps it could test the innovative solicitation as a confidential process.

***Rights to Technologies Developed with Public Funds***

The Council may want to articulate a policy regarding the public funding of private developmental research. Some projects are based on tests of developmental technologies that would, if successful, become patented products held by private companies. Technology development was a component of some proposals reviewed by the ISRP, but the appropriateness of using public funds to develop private technologies is a matter of policy rather than science and was not considered by the ISRP. Joint ventures between private companies and the Fish and Wildlife Program may be a possible funding mechanism.

## Table of ISRP Reports

Document Number	Title
<a href="#">1997-1</a>	Review of the Columbia River Basin Fish and Wildlife Program for Fiscal Year 1998 as directed by the 1996 amendment to the Power Act (225k PDF)
<a href="#">1997-2</a>	Review of "A Method and Criteria for Evaluating the Technical Merits and Feasibility of Watershed/Habitat Projects" (30k PDF)
<a href="#">1998-1</a>	Review of the Columbia River Basin Fish and Wildlife Program for Fiscal Year 1999 as Directed by the 1996 Amendment to the Northwest Power Act (425k PDF)
<a href="#">1998-1A</a>	Appendix A ISRP Comments on Proposals (240k PDF)
<a href="#">1999-1</a>	Review of the BPA Reimbursable Account Programs in the Columbia River Basin as Requested in the Senate-House Conference Report on FY99 Energy and Water Development Appropriations Bill
<a href="#">1999-2</a>	Volume I: Review of the Columbia River Basin Fish and Wildlife Program for Fiscal Year 2000 as Directed by the 1996 Amendment to the Northwest Power Act (600k PDF)
<a href="#">1999-2A</a>	Volume II: Review and Recommendations of Individual FY2000 Project Proposals (910k PDF)
<a href="#">1999-3</a>	Prioritized List of 42 Proposals Submitted for FY2000 Funding through the Columbia Basin Fish and Wildlife Program (140k PDF)
<a href="#">1999-4</a>	Response Review of Fiscal Year 2000 Proposals (310k PDF)
<a href="#">2000-1</a>	Step 1 of the Council's 3-Step Review Process: Review of Coeur d'Alene Tribe Trout Production Facility Master Plan (60k PDF)
<a href="#">2000-2</a>	Steps 1-3 of the Council's 3-Step Review Process: Review of the Tucannon River Captive Broodstock Master Plan (100k PDF)
<a href="#">2000-3</a>	Review of Databases Funded through the Columbia Basin Fish and Wildlife Program (590k PDF)
<a href="#">2000-4</a>	Review of the Confederated Tribes of the Umatilla Indian Reservation's "Restoration Plan for Pacific Lampreys ( <i>Lampetra tridentata</i> ) in the Umatilla River, Oregon" (15k PDF)
<a href="#">2000-5</a>	Partial Step 2 of the Council's 3-Step Review Process: Review of the Yakama Nation's Mid-Columbia Coho Reintroduction Feasibility Project (50k PDF)
<a href="#">2000-6</a>	Step 1 of the Council's 3-Step Review Process: Review of the Northeast Oregon Hatchery Spring Chinook Master Plan (50k PDF)
<a href="#">2000-7</a>	Partial Step One of the Council's Three-Step Review Process: Master Plan for Feasibility Assessment of a White Sturgeon 'Put and Take' Consumptive Fisheries in Oxbow and Hells Canyon Reservoirs, Snake River (70k PDF)

<a href="#">2000-8</a>	Preliminary Review of Fiscal Year 2001 Project Proposals for the Columbia River Gorge and Inter-Mountain Provinces (300k PDF)
<a href="#">2000-9</a>	Final Review of Fiscal Year 2001 Project Proposals for the Columbia River Gorge and Inter-Mountain Provinces
<a href="#">2000-9 addendum</a>	Addendum for Moses Lake proposal
<a href="#">2000-10</a>	Review of Fiscal Year 2001 Innovative Proposals for the Columbia River Basin Fish and Wildlife Program (100k PDF)
<a href="#">2001-1</a>	Review of FY 2001 High Priority Proposals for the Columbia River Basin Fish and Wildlife Program (190k PDF)
<a href="#">2001-2</a>	Preliminary Review of FY 2002 Project Proposals for the Mountain Columbia Province (120k PDF)
<a href="#">2001-3</a>	ISRP Review of the Final Design of the Shoshone-Bannock/ Shoshone-Paiute Joint Culture Facility (project #9500600) and August 6 addendum
<a href="#">2001-4</a>	Final Review of FY 2002 Project Proposals for the Mountain Columbia Province (includes addenda for Albeni Falls and Kalispel Wildlife projects)
<a href="#">2001-5</a>	Review of NMFS Proposal "Evaluate Hatchery Reform Principles"
<a href="#">2001-6</a>	Preliminary Review of FY 2002 Project Proposals for the Columbia Plateau Province (410k PDF)
<a href="#">2001-7</a>	Review of Fiscal Year 2001 Action Plan Proposals
<a href="#">2001-7a</a>	Final Review of Fiscal Year 2001 Action Plan Proposals including Responses to ISRP Comments
<a href="#">2001-8</a>	Final Review of Fiscal Year 2002 Proposals for the Columbia Plateau Province
<a href="#">2001-9</a>	Preliminary Review of FY2002 Project Proposals in the Mountain Snake and Blue Mountain Provinces
<a href="#">2001-10</a>	ISRP Comments on CRITFC proposal for a Collaborative Center for Applied Fish Science
<a href="#">2001-11</a>	Preliminary review of the United States Army Corps of Engineers' Bonneville Decision Document Juvenile Fish Passage Recommendation October 2001
<a href="#">2001-12A</a>	Final Review of Fiscal Year 2002 Proposals for the Mountain Snake and Blue Mountain Provinces
<a href="#">2001-12B</a>	Lower Snake River Compensation Plan Preliminary Proposal Review
<a href="#">2001-12C</a>	ISRP Step Two Review of the NEOH Spring Chinook Master Plan
<a href="#">2002-1</a>	Final Review: Arrowleaf/Methow River Conservation Project
<a href="#">2002-2</a>	Preliminary Review of Fiscal Year 2003 Proposals for the Upper and Middle Snake, Columbia Cascade, and Lower Columbia and Estuary Provinces

<a href="#">2002-3</a>	Protocols for the Inventory and Monitoring of Fish, Wildlife, and their Habitats in the Pacific Northwest; Statement of Work by David H. Johnson, Washington Department of Fish and Wildlife
<a href="#">2002-4</a>	Review of Council Staff's Draft Research Plan for Fish and Wildlife in the Columbia River Basin
<a href="#">2002-5</a>	Review of March 27, 2002 Draft Guidelines for Action Effectiveness Research Proposals for FCRPS Offsite Mitigation Habitat Measures
<a href="#">2002-6</a>	Lower Snake River Compensation Plan Final Proposal Review for Columbia Plateau, Blue Mountain and Mountain Snake Provinces
<a href="#">2002-7</a>	Preliminary ISRP Step Review - Kalispel Tribe Resident Fish, Project 199500100
<a href="#">2002-8</a>	Review of FY 2002 Innovative Proposals
<a href="#">2002-9</a>	Review of Revised Moses Lake Recreational Facility proposal
<a href="#">2002-10</a>	Review of project 200101500 - Echo Meadow Project
<a href="#">2002-11</a>	Final Review of Fiscal Year 2003 Proposals for the Upper and Middle Snake, Columbia Cascade, and Lower Columbia and Estuary Provinces
<a href="#">2002-12</a>	Final Step Review - Kalispel Tribe Resident Fish, Project 199500100
<a href="#">2002-13</a>	Preliminary Review of Fiscal Year 2003 Mainstem and Systemwide Proposals
<a href="#">2002-14</a>	Final Review of Fiscal Year 2003 Mainstem and Systemwide Proposals
<a href="#">2002-15</a>	Review of Criteria for Evaluating Proposals to Secure Tributary Water
<a href="#">2003-1</a>	Final ISRP Review of Criteria for Evaluating Proposals to Secure Tributary Water
<a href="#">2003-2</a>	Summary of ISRP Reviews and Interactions with the Action Agencies' RM&E Effort
<a href="#">2003-3</a>	Review of Draft Clearwater Subbasin Plan
<a href="#">2003-4</a>	Review of BPA's Draft Request For Proposals for RM&E
<a href="#">2003-5</a>	Review of Coeur d'Alene Tribe Trout Production Facility Master Plan (Step One Submittal)
<a href="#">2003-6</a>	Review of revised mainstem/systemwide proposals for Research, Monitoring, and Evaluation
<a href="#">2003-7</a>	Review of proposals for BPA's request for studies on RPAs 182 and 184
<a href="#">2003-8</a>	Review of Idaho Supplementation Studies
<a href="#">2003-9</a>	Final Review of Proposals Submitted in Response to Bonneville Power Administration's March 14, 2003 Request for Studies for Reasonable and Prudent Alternative Actions 182 and 184 of the 2000 Federal Columbia River Power System Biological Opinion
<a href="#">2003-10</a>	Review of the Umatilla Fish Hatchery Monitoring and Evaluation Project (199000500) document, "Comprehensive Assessment of Salmonid Restoration and Enhancement Efforts in the Umatilla River Basin"

<a href="#">2003-11</a>	Review of Protocols for Counting Salmonids, Resident Fish, and Lampreys in the Pacific Northwest
<a href="#">2003-12</a>	Step Two Review of the Northeast Oregon Hatchery Spring Chinook Master Plan
<a href="#">2003-13</a>	Review of the Action Agencies' Draft Estuary Plan
<a href="#">2003-14</a>	Review of Fiscal Year 2004 Pre-proposals for the US Army Corps of Engineers' Anadromous Fish Evaluation Program
<a href="#">2004-1</a>	Review of Draft Action Agency and NOAA Fisheries RM&E Plan
<a href="#">2004-2</a>	Review of Criteria for Evaluating Proposals to Secure Tributary Water for 2004
<a href="#">ISRP/ISAB 2004-2</a>	Comments on the Pacific Northwest Aquatic Monitoring Partnership's (PNAMP) Draft Recommendations for Monitoring in Subbasin Plans
<a href="#">2004-3</a>	Preliminary Review of Hungry Horse and Libby Proposal (also see final review)
<a href="#">2004-4</a>	Review of Draft Clearwater Subbasin Plan (November 2003 version)
<a href="#">2004-5 &amp;</a>	Review of Response to ISRP comments on Summer Spill Study Proposal: Estimating the survival of sub-yearling Chinook salmon through Bonneville Dam during two spill operation scenarios using Radio-Telemetry: 2004
<a href="#">2004-5a</a>	Review of Response to ISRP comments on Summer Spill Study Proposal: Estimating the survival of sub-yearling Chinook salmon through Bonneville Dam during two spill operation scenarios using Radio-Telemetry: 2004
<a href="#">2004-6</a>	Second Review of Proposal to Evaluate the Biological Effects of the Council's Mainstem Amendments on the Fisheries Upstream and Downstream of Hungry Horse and Libby Dams
<a href="#">2004-7</a>	Comments on Flathead and Kootenai Subbasin Plan Presentations
<a href="#">2004-8</a>	Final Review of the US Army Corps of Engineers' Anadromous Fish Evaluation Program for FY2004
<a href="#">2004-9</a>	Review of the Lower Columbia River Ecosystem Monitoring and Data Management Project
<a href="#">2004-10</a>	ISRP Step Two Review of the Northeast Oregon Hatchery (NEOH) Spring Chinook Master Plan: Monitoring and Evaluation Plan
<a href="#">2004-11</a>	Review of the Nez Perce Tribe-Department of Fisheries Resource Management-Watershed Division's statistical design for monitoring effectiveness of watershed restoration projects
<a href="#">2004-12</a>	Review of the U.S. Army Corps of Engineers' proposal: Review and evaluate the success and relevancy of the Chief Joseph Dam wildlife mitigation program
<a href="#">ISRP/ISAB 2004-13</a>	Scientific Review of Subbasin Plans for the Columbia River Basin Fish and Wildlife Program
<a href="#">2004-14</a>	Review of Captive Propagation Program Elements: Programmatic Issue 12 for the Mountain Snake and Blue Mountain Provinces
<a href="#">2004-15</a>	Review of Shoshone Paiute Tribe's Monitoring and Evaluation Plan for Project

	199701100
<a href="#">2004-16</a>	Estuary and Lower Columbia Habitat Monitoring and RME Plan Reviews
<a href="#">2004-17</a>	Review of Umatilla RM&E Plan
<a href="#">2005-1</a>	Review of Criteria and Checklist for Evaluating Proposals to Secure Riparian Easements to Protect Tributary Habitat
<a href="#">2005-2</a>	Review of the Chief Joseph Dam Hatchery Program Master Plan
<a href="#">2005-3</a>	Combined Step Review for Re-introduction of Lower Columbia River Chum Salmon into Duncan Creek
<a href="#">2005-4</a>	ISRP Preliminary Review of Sekokini Springs Master Plan
<a href="#">2005-5</a>	Review of the All-H Analyzer (AHA)
<a href="#">2005-6</a>	Step review of the Johnson Creek Artificial Propagation Enhancement Project
<a href="#">2005-7</a>	Step 1 Review of the Klickitat Subbasin Anadromous Fishery Master Plan
<a href="#">2005-8</a>	Review of the Select Area Fishery Evaluation Project
<a href="#">2005-9</a>	Review of Updated Proposed Action (UPA) Habitat Projects to Improve Survival of Upper Columbia River Spring Chinook and Steelhead
<a href="#">2005-10</a>	Interim Reply: Combined Step Review for Sekokini Springs Natural Rearing Facility and Educational Center, Hungry Horse Mitigation, Project #199101903
<a href="#">2005-11</a>	Review of Proposal to Improve the Lower Granite Dam Adult Salmonid Trap
<a href="#">2005-12</a>	Review of Nez Perce Tribe's Response to the ISRP's Preliminary Step Two Review of the Johnson Creek Artificial Propagation Enhancement Project
<a href="#">ISRP/ISAB 2005-13</a>	Preliminary Review of Draft Research Plan

Example citation for an ISRP report:

ISRP (Independent Scientific Review Panel). 2005. Retrospective Report. Northwest Power and Conservation Council. ISRP 2005-14. Portland, Oregon.

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