

Staff summary of Issues & Recommendations ISAB Review of the 2009 Fish and Wildlife Program

*preliminary draft, please refer to full recommendations for complete review

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2009 Fish and Wildlife Program Section

Section VIII (page 66)

Recommendation Topics Synthesis

At the recommendation of WDFW (4), the Native Fish Society (60), and Trout Unlimited (67), the entire ISAB review of the 2009 program and associated recommendations is suggested as amendments to the program. In general, the ISAB finds the 2009 Program to have been a useful framework for providing context for the complex issues facing the altered Columbia River Basin ecosystem.

The concept of sustainability in ecology describes how biological systems remain diverse, robust, and productive over time. Sustainability can be enhanced by building ecosystem resilience and adaptability. Natural systems do not fluctuate within a fixed range of variability. What we have seen historically will not be a reliable indicator of the future, and we must seek to be more flexible and adaptable in our management responses. Uncertainty is inevitable and is an essential feature of resilience thinking, structured decision making, and adaptive management. Success is not a completed state, but a process requiring sustained monitoring, intentional learning, communication, and cooperation. The Program amendment can be considered as the learning phase of the adaptive management cycle, and as an opportunity to benefit from 30 years of experience.

Threats to sustainability

In this review, the ISAB has identified major threats to the sustainability of the Columbia River ecosystem and to the success of the Program. This list includes loss of biological diversity, climate change (both directly and indirectly through linkages to the ocean ecosystem), proliferation of chemicals and contaminants within the Basin (including the estuary), the emergence of hybrid food webs due to the spread of non-native and artificially propagated species, and a failure to understand and respect the carrying capacity of the Columbia River ecosystem.

Biological diversity arises naturally within diverse landscapes and habitats, and it provides the redundancy and options for ecological innovation that contribute to resilience and adaptability in the face of environmental variability and change. The ISAB recommends that the Program develop quantitative objectives for diversity and promote an active program of research to systematically collect information so that trends in biological diversity can be monitored and reported at the scale of the entire Basin.

Climate change predictions point toward changes in the timing and distribution of water flow, including extreme events such as floods and droughts. The concept of return periods of floods and droughts based on historical data may no longer be adequate for designing and planning for extreme events. Fisheries impacts due to warmer water temperatures include physiological effects such as lower growth rates that can result in higher predation, increased susceptibility to invasive and non-native species, and reduced cold water refuges. The ISAB recommends that the amended Program promote development of a comprehensive strategic plan to explore strategies to cope with potential impacts of climate change throughout the Basin. Modeling and analyses are needed to provide guidance for flood control and hydropower operations to enhance ecosystem resilience and adaptability under climate change.

Artificial chemical proliferation in the Basin is a priority for resolution. In addition to contaminants of the past, there is a growing concern about emerging contaminants. The estuary and the coastal ocean communities are particularly vulnerable to the accumulation of contaminants because of their spatial position in the watershed. There is an urgent need to quantify and map the spatial patterns of these chemicals; assess their transfer, accumulation, and persistence; and document their impact on native organisms and on the carrying capacity of the Columbia River ecosystem for juvenile salmonids. The Council has an opportunity to take an active role – through cooperation with regional partners – to ensure that monitoring of toxic contaminants and evaluation of their effects on fish and wildlife are addressed.

Non-native species' spread is a major issue confronting the Program. Policies and procedures are needed to address the risk posed by non-native species, as well as native species spreading outside of their native ranges within the Basin. The Program could play a key role in fostering development of policies and effective methods for monitoring and controlling the spread of these species.

The **limitation of the carrying capacity** for juvenile salmonids is an urgent and specific priority for research, management, and restoration activities in the Basin. It is not clear whether the Columbia River can provide sufficient food in the long term to support the large populations of artificially propagated fishes produced today, as well as natural salmonids and other organisms. The concept of carrying capacity for target species in the Basin must ultimately constrain Program objectives related to the abundance and productivity of those species. The amended Program should explicitly address carrying capacity for juvenile salmonids when integrating and prioritizing plans for hatchery production and habitat restoration. The ISAB also sees a need to conduct empirical investigations and to develop bioenergetic models to estimate trophic demands on food supplies by native and non-native competitors of juvenile salmonids.

Artificial production, used to mitigate for lost harvest opportunities, must be reconciled with the objectives of ESA recovery and threats such production poses to the restoration of healthy natural populations. Implementation of artificial production must consider scientific insights about the need to maintain the diversity of heterogeneous populations and habitats that confer resilience. Hatchery fish provide important benefits to some of the Basin's stakeholders and populations, but the trade-off in costs to natural production and other environmental consequences remain poorly understood. The ISAB recommends that the artificial strategies be revised to incorporate conclusions from the Hatchery Scientific Review Group's review and that

supplementation, harvest, and habitat restoration programs must be well integrated to be effective.

Harvest plans need to be scientifically justified and consistent with subbasin and other plans that establish viability parameters for salmon and steelhead populations. It is not clear whether harvest management plans have been scientifically reviewed and analyzed to assess compatibility with the Program. If not, an independent scientific review should be encouraged. The amended Program should also promote development of capability to monitor hatchery and natural-origin fish separately so that the productivity and abundance of the naturally-reproducing stock can be tracked and used to develop escapement goals and harvest rates.

Three fundamental issues warrant reconsideration in amending the Program. First, it would be timely for the Council and region to **re-evaluate the scientific foundation** in light of accomplishments of the Program during the past 30 years. A review of the Program's foundation might lead to reassessment of the long-term objectives and the strategies to achieve those objectives. Second, there is a need to move away from qualitative goals toward **quantitative objectives with specified timelines**. Third, there is a need for **increased socioeconomic engagement** as part of a landscape approach. The current Program is intended to be habitat-based but in reality, relies heavily on artificial production; the amended Program should be ecosystem-based and fully acknowledge social aspects of the Program that can contribute to its success.

The ISAB believes that the **scientific foundation** should be modified to more explicitly consider the basis of resilience and adaptability, and to include additional emphasis on the landscape approach to fish and wildlife management (ISAB 2011-1, 2011-4). Accordingly, the ISAB proposes six revised principles based on recent advances in scientific knowledge about the nature of ecosystems. These new principles are intended to replace the original eight principles, but they retain most of the original content.

Establishing **quantitative performance goals** both for the biological objectives and restoration strategies is an essential feature of adaptive management and provides measurable thresholds for determining success. True objectives are focused and measurable benchmarks whereas many of the "objectives" identified in the 2009 Program express general intentions as un-quantified goals or strategies to achieve goals. The amended Program should include quantitative biological objectives that can be regularly monitored and evaluated as a means to determine whether the Program is on target or in need of change.

Social aspects of the Program should include stronger efforts to foster leadership and to build the structures that provide governance needed for broad collaboration and effective integration across science-management disciplines and social, political, and ecological boundaries. The revised Program should recommit to regional partnerships and explore similar ideas to strengthen regional coordination efforts, and share information and learning among projects with common settings or issues. The Program should be amended to describe techniques for engaging broader public involvement and to explain how socioeconomic engagement will be measured and monitored.

A primary conclusion of this review is that continuing to implement the Program on its existing trajectory is highly uncertain to achieve the Council's biological objectives for the Basin. The ISAB suggests a revised focus on **sustainability** with strategies to protect **diversity** and **resilience**, and to build **adaptability**. The ISAB is concerned that artificial propagation is a risky foundation for restoration, and that adaptive management, long considered an integral component of the Program, has not been conducted in the manner originally envisioned. A landscape perspective, drawing from broader community involvement, could help build consensus on Program objectives and strategies, or at least help to create strategies that keep options open, consistent with a diversity of visions for the future. The ISAB recommends that Council decisions be guided by the **precautionary principle** and **structured decision making**, within an **adaptive management** cycle.

Full ISAB Review: www.nwcouncil.org/fw/isab/isab2013-1/

Recommendation Summary and Synthesis

Scientific principles

The ISAB recommends that the scientific principles be revised in the following manner:

- Principle 1: The abundance, productivity, diversity, and spatial distribution of organisms are sustained by complex and adaptive ecosystems.
- Principle 2: Biological diversity allows ecosystems to persist in the face of environmental variability.
- Principle 3: Human health and well-being are tied to ecosystem conditions.
- Principle 4: Biological and cultural diversity provide the raw material for reorganization and adaptability during unexpected transitions to new ecosystem regimes.
- Principle 5: Ecosystem management is adaptive and experimental.
- Principle 6: Socioeconomic understanding and engagement is required to make management actions more sustainable.

Monitoring, Evaluation, and Research

- Recommendations intended to address uncertainty and levels of evidence:
 1. Require all project proposals to acknowledge uncertainty. Proposals should describe areas of uncertainty and what will be done to deal with the uncertainties. Consideration of uncertainty is essential for effective adaptive management and structured decision making.

2. Recognize that uncertainty is inevitable and encourage efforts to enhance resilience. The importance of resilience and enhancement strategies are included elsewhere in this review.
- Recommendations regarding monitoring strategies:
 1. Support development and evaluation of HLIs.
 2. Implement monitoring to evaluate progress against new quantitative objectives, for example diversity performance, artificial production programs, and habitat restoration benefits.
 3. Implement social monitoring to better evaluate and improve acceptance of the Program at local scales in the region, for example, by regular surveying of public opinion about progress and strategies for achieving the vision.
 4. Design monitoring to support adaptive management and structured decision making by providing data to test current knowledge and revise management programs.
 - Recommendations regarding information sharing:
 1. Accelerate efforts to improve data availability and sharing through emerging monitoring programs to ensure that these tasks are completed in next two to three years and that data access and sharing become functional. Further, the ISAB or another group should be directed to identify additional basic data that should be acquired and shared, for example, measures of genetic diversity.
 2. Initiate and support a comprehensive citizen science program. Identify citizen science programs that already exist in the Basin. Promote a comprehensive citizen science program by starting in a few selected subbasins with existing programs with a view to expand these programs to all parts of the Basin within in a few years and linking them to the appropriate agencies and Tribes. Partnerships and mechanisms to guide new efforts can be encouraged through funding or broad recognition.
 3. Organize and support “communities of practice” and support technology transfer and education (e.g., workshops) on issues of importance to the ecological province. Collaboration at the ecological province scale is essential for effective restoration.
 4. Use HLIs and information from other monitoring programs to engage the public and develop a common Program vision. Conduct regular press and other briefings; use fact sheets and message boxes to define the issues. Use of “mobile apps” is one example of effective information sharing.
 5. Convert ISAB, ISRP, and Council reports into short documents, briefings, and other forms of information sharing that can be broadly understood and appreciated by a diverse public.

Threats to Sustainability

- Recommendations related to diversity:
 1. The Council should consider revising the Program objectives for biological performance to include quantitative measures of diversity. Council staff and others who are working to develop and refine HLI should explore simple measures of population viability that depend on life history diversity and spatial structure (and are provided in periodic status reviews) as potential HLI to represent population diversity across recovery units.
 2. For nearly two decades the Program has recognized the need to understand biological diversity as the critical foundation for resilience and sustainability. It is now possible to develop new measures to monitor biological diversity at the scale of the entire basin. An active program of research implemented through focused RFPs should be initiated.
- Recommendations related to Climate Change:
 1. Develop a comprehensive strategic plan on the potential impacts of climate change on the entire system, including the estuary and ocean, and develop a suite of strategies within the amended Program.
 2. Provide guidance for potential revisions to flood control and hydropower operations to enhance ecosystem resilience and adaptability under climate change. Management options considered in experiments and modeling should not be limited to current operating constraints.
 3. Examine management options under climate change scenarios by using monitoring data and modeling tools where possible.
 4. Assess and appropriately revise ongoing monitoring to optimize collection of data regarding species responses, interactions and production under climate change.
 5. Require project proposals and management plans to consider the potential impact on project outcomes of climate change and its associated variability and uncertainty. Create a resource of references to the current science that can be shared with project designers and managers.
- Recommendations related to Chemicals and contaminants:
 1. Actively investigate the impact of chemicals on restoration activities by fully implementing a water quality program. This initiative will require working partnerships with the Federal Action Agencies and others as well as initiating modeling of climate-temperature effects for all parts of the Basin.
 2. Work with other regional agencies to implement the interagency Columbia River Basin Toxics Reduction Action Plan. Update the plan regularly, so that current and future

chemical insults to the system can be addressed in timely fashion, before they become even more serious problems. The nature of the issue dictates that this will be a large, ongoing, and collective regional effort.

- Recommendations related to Non-natives and Predation:
 1. Develop, with basin co-managers, a process for dealing with non-natives. Lead development of a non-native prevention program as the first, the most critical, and the most cost-effective approach to avoid introductions of non-native species. Develop well-reasoned procedures to deal with non-native species that are already present.
 2. Develop a system for regularly monitoring the status of non-native species across the entire Basin.
 3. Support research to understand or mitigate past ecological changes created by the hydrosystem that have led to current conditions fostering the proliferation of predators and their impacts on salmonids, sturgeon, lamprey, and other species.
 4. Support research to understand trophic interactions involving non-native species in hybrid and novel ecosystems with reference to improved diversity, abundance, and productivity.
 5. Recognize and develop methods for addressing divergent public views regarding many non-native (problematic) predator species. Play a proactive role informing and educating the public about non-native species issues in the Basin.

- Recommendations related to Carrying capacity for juvenile salmonids:
 1. Explicitly address carrying capacity for juvenile salmonids when integrating and prioritizing plans for artificial propagation and habitat restoration.
 2. Conduct empirical investigations and develop bioenergetic models to estimate trophic demands on food supplies by native and non-native competitors of juvenile salmonids.

- Recommendations related to Artificial production strategies:
 1. Evaluate whether the multiple objectives of recovering ESA-listed species, establishing healthy natural populations, and mitigating harvest opportunity using artificial production can be reconciled and address any trade-offs explicitly.
 2. Recognize and address the need to quantify the cumulative impacts of artificial production on natural production and ecosystem processes at population, subbasin, and basin scales.

3. Revise artificial production strategies to incorporate HSRG advice. Recognize and address the need to develop quantitative objectives for each artificial production program based on HSRG recommendations.
 4. Treat integrated supplementation (for conservation) and harvest as distinct programs requiring their own standards of operation.
 5. Specify that segregated artificial production requires removal of hatchery fish before they reach spawning grounds to maintain the genetic integrity of local populations.
 6. Commit to establishing more empirical evidence concerning the effect of supplementation on rebuilding natural populations and improving integration between artificial production supplementation and habitat restoration programs. Address the importance of evaluating limiting factors by life-stage, including density-dependent effects of artificial production fish on production of natural-origin adult fish.
 7. Adopt guidelines, benchmarks, and a basin-level experimental framework specifically for reintroduction of salmon and steelhead into watersheds from which they have been extirpated.
 8. Develop quantitative goals and basin-scale monitoring for artificial production.
- Recommendations related to Harvest strategies
 1. Assess the extent to which harvest slows recovery of naturally-reproducing populations that are below the replacement level ($R/S < 1$) and delays the objective of establishing healthy naturally-reproducing populations.
 2. Recognize and address ecosystem-scale effects of harvest and potential fisheries-induced evolution. Address whether harvest management plans have been scientifically reviewed and analyzed to assess compatibility with the Program.
 3. Consider revising harvest strategies to reflect HSRG conclusions. Determine the circumstances in which selective harvest confers a conservation benefit to wild populations.
 4. Evaluate the impacts that limitations in the extent of hatchery fish harvest have on natural spawning populations through factors such as overexploitation and straying. Address whether hatcheries are being terminated as recommended in the 2009 Program.
 5. Develop the capability to monitor hatchery and natural-origin fish separately so that the productivity and abundance of the naturally reproducing stock can be tracked and used to develop escapement goals and harvest rates. Recognize that this monitoring has been an important “term and condition” in some NMFS hatchery Biological Opinions.

Knowledge Gaps

- Recommendations related to Hydrosystem impacts:
 1. Continue to foster and support more formal adaptive management experiments designed to provide information on hydrosystem operations and their effects on salmon and other species.
 2. Foster and support efforts to monitor and improve white sturgeon passage through lower mainstem dams and conduct research on factors in the mainstem hydrosystem (including aspects of reservoirs) that affect natural spawning, reproduction, and recruitment success (Consistent with Council direction to the 2012 Columbia River Basin White Sturgeon Planning and Passage Workshop).
 3. Develop a unified plan for lamprey restoration efforts conducted under the Program, The U.S. Army Corps of Engineers' Anadromous Fish Evaluation Program (AFEP), as well as by tribal, state, and federal entities (Consistent with ISRP 2012-19).
 4. Evaluate the feasibility and cost-effectiveness of steelhead kelt reconditioning, particularly in relation to mainstem hydrosystem operation and passage issues.
 5. Investigate the potential impacts of short-term fluctuations in water releases and of reservoir habitat and water levels on access to habitat, growth and survival of larval and juvenile fishes and other species.

- Recommendations related to Freshwater habitat requirements:
 1. Uncertainties concerning the success of habitat restoration efforts should be addressed. There is a need to view habitat restoration as an experimental process that will require much better sampling designs at multiple scales. The ISRP has commented that the effectiveness of habitat restoration will depend not only the success of a specific action (e.g. planting riparian zones, fencing, flood plain reconnection) but also on how those actions are arranged within a watershed. For example, in many subbasins, actions are implemented through willing landowners, not through a prioritized strategy – and the success of such an opportunistic approach is questionable (ISAB 2011-4).
 2. Consider habitat restoration as a long-term effort focused on creating the landscape and ecological conditions that underpin resilience. The Program should encourage project sponsors to recognize that habitat restoration may take a long time to show positive effects, particularly if it is focused appropriately on processes constraining or degrading habitat rather than on the structure or condition of the habitat itself (i.e., the symptoms; ISAB 2011-4). Incorporation of the rules of thumb from the landscape report in the revised Program could help emphasize a broader perspective.
 3. Establish quantitative objectives and timelines and require detailed evaluations, or formal reviews to evaluate whether habitat restoration efforts are really providing the anticipated

benefits. Quantifiable objectives are required to provide clear direction and context. An audit/review process involving experts (such as was done for hatcheries by the HSRG), but with a focus on habitat and landscape restoration, could be used to explore the current state of restoration actions in the Basin. A formal review of the results from ISEMP and CHaMP should be highlighted and shared broadly with all engaged in Program projects.

4. Consider the potential for conflict among the diverse efforts at conservation and restoration in the Basin. The Program is not the only habitat restoration program in the Basin, and as pointed out in the ISAB Landscape Report, many other entities have authority over actions that lead to degraded watershed conditions. For example, Program project participants might be removing roads to improve salmon habitat while other stakeholders in the same subbasin might be adding new roads at faster rate (e.g., Forest Service mitigation efforts for fuels). Successful habitat restoration requires integration and collaboration among all actors in the landscape.
 5. Encourage the sharing of experience and information among programs engaged in similar actions. Innovation and diffusion of ideas, successes, and failures across the Program can strengthen the capacity to adapt and refine restoration actions. By supporting “communities of practice” (Rogers 2006), the integration of information across projects becomes a basic principle of effective habitat protection and restoration activities.
- Recommendations related to Terrestrial wildlife restoration strategies:
 1. Validate the relationship between the HEP habitat units and some real measure of value of the habitat, consistent with an ecosystem approach, such as abundance, productivity, diversity, and spatial extent for key species.
 2. Encourage integration of wildlife mitigation projects with fish mitigation projects, consistent with an ecosystem approach.
 - Recommendations related to Estuary strategies:
 1. Develop detailed strategies for the estuary in conjunction with the mainstem and ocean. Consider developing a coordinated Estuary Plan that meshes with amendments to the Mainstem Plan and Ocean Strategies.
 2. Develop methods to measure the potential increase in survival of Chinook and steelhead that benefit from estuary restoration.
 3. Develop methods to monitor diversity in the estuary to track diversity in time.
 4. Develop a comprehensive plan for monitoring estuary restoration. Long-term effectiveness monitoring of representative habitat restoration projects will be essential for evaluating outcomes as part of adaptive management.

5. Reassess factors limiting production in the estuary, including contaminants, in light of new research. As suggested earlier by the ISAB, it may be appropriate to update and peer review the Estuary Module.
 6. Consider redefining the boundaries for the estuary subbasin to include the tidal regions at the mouth of tributaries draining into the estuary.
- Recommendations related to Ocean strategies:
 1. Emphasize that the productivity of anadromous populations in all subbasins of the Columbia River Basin is affected by physical, biological, and ecological conditions in the ocean. Expand the primary strategy beyond survival to include ocean effects on growth and viability (abundance, productivity, spatial structure and diversity) and recognize interaction effects among these processes.
 2. Revise and reorder the ocean strategies as follows:
 - a) first priority, to understand and isolate effects of ocean conditions on anadromous fish survival and growth to increase the power of analyses to detect the effects of restoration actions in the Basin;
 - b) second priority, to determine limits to restoration potential or the effectiveness of actions taken in the Basin given the variability of ocean conditions that affect anadromous fishes;
 - c) third priority, to predict future ocean conditions with a view to adjusting actions in the Basin to achieve greater benefits and/or efficiencies.
 3. Emphasize coordination of ocean strategies across subbasins and ecosystems to increase benefits from research, monitoring, and evaluation in the Program.

Moving Forward

- Recommendations related to Biological objectives:
 1. Develop quantitative biological objectives that can be regularly monitored and evaluated to determine whether the Program is on target or in need of change. Recommended modifications to existing objectives include:
 - a) Make the objective of 5 million salmon and steelhead by 2025 more specific with respect to wild and hatchery fish.
 - b) Develop quantitative and realistic objectives for harvest based on stakeholder input.
 - c) Develop productivity objectives that reflect differences among species and populations.
 - d) Establish quantitative biodiversity objectives for focal species and habitats that can be achieved by 2025.
 - e) Develop quantitative objectives for other species of fish and wildlife in addition to salmonids.

2. Develop quantitative objectives for the environmental (ecosystem) characteristics needed to achieve biological objectives for population performance.
- Recommendations for social engagement:
 1. Actively engage the general public, landowners, county planners, traditional stakeholders, and other groups, early in the Program planning process.
 2. Strengthen outreach to citizens, landowners, and other groups with diverse and non-traditional interests to engage in the implementation of the resulting Program (e.g., citizen science and monitoring).
 3. Measure the effectiveness of social engagement as part of an evaluation of Program success
 4. Create positive incentives for the general public to engage. Use narratives and stories linking personal well-being and personal commitment to landscapes. Emphasize benefits that come from ecological goods and services beyond simple numbers of fish. Develop financial incentives to support restoration and conservation (i.e., provide tangible support for efforts that help achieve the Program vision).
 5. Support and champion organizations that provide effective governance and support productive partnerships among the relevant sciences, between science, management and the public, and across social and ecological boundaries. Facilitate and support non-traditional organizations and approaches that can bring new capacity and vision to landscape and ecosystem approaches.
 - Recommendations for landscape and subbasin planning:
 1. Actively encourage and support a mid-scale planning process that provides the context for a more complete landscape approach, but not necessarily with physical boundaries of the established subbasins. A strict reliance on subbasins as the formal structure for mid-scale planning should be reconsidered if other structures exist. Benefits of engaging collaborative structures that already exist or develop through local efforts may be better adaptive learning, communication, and trust.
 2. Actively highlight particularly effective planning efforts, and the partnerships and organizations that support them, as outlined in the discussion of social engagement and leadership. This would step beyond the summary of existing subbasin coordination to publicize unique approaches in the implementation of landscape and ecological restoration. The intent is to share and focus attention of all planning groups on specific efforts that demonstrate particular success and innovation.
 3. Require proposed and continuing projects to demonstrate their relevance in the broader context of mid-scale social and ecological conditions. This requirement was basic to the original subbasin planning efforts, but understanding of habitat capacity and the physical

and biological processes relevant at the scales of entire watersheds and riverbasins are continually being refined. Proponents should clearly demonstrate the anticipated benefits of any project relative to the scale of the problem being addressed.

4. Evaluate how effectively mid-scale planning efforts articulate objectives for artificial and natural production and integrate supplementation and habitat restoration efforts.
 5. Conduct periodic surveys of stakeholders to determine the effectiveness of communication and coordination efforts and to identify the most influential pathways for new information.
- Recommendations for moving forward:
 1. Acknowledge that artificial production alone cannot achieve the Program’s biological objectives for salmon and other species, and revise artificial production strategies appropriately. Adopt a landscape approach and implement strategies that unambiguously establish the necessity and primacy of an environment sufficient to maintain self-sustaining natural fish and wildlife populations.
 2. Acknowledge that adaptive management is not being practiced as originally intended and seek opportunities for “intentional learning” as part of the adaptive management cycle. As well, it would be timely to explore institutional changes (adaptive governance) to focus on diversity, redundancy, and multiple levels of management to include local knowledge and actions.
 3. Encourage Structured Decision Making (SDM) as a tool within the Program. SDM can augment the adaptive management cycle with a decision process that addresses uncertainty and engages stakeholders, scientists, and decision-makers in an iterative manner.
 4. Revise the scope of projects and project selection process to capture the best professional skills in the region. Key aspects of the Program would benefit from broader analyses and better communication, and these require appropriate projects. Outcomes may include province-scale analyses of restoration actions; a basinwide understanding of how fish biodiversity contributes to recovery and resilience; better decisions and increased local responsibility through SDM; and improved leadership in addressing complex issues like chemical contaminants.