Northwest **Power** and **Conservation** Council



September 6, 2017

**MEMORANDUM**

**TO:** **Council Members**

**FROM:** **Central office and State Fish and Wildlife Staff**

**SUBJECT:** **Briefing on Fish and Wildlife Program Implementation Assessments**

**Presenter**: Laura Robinson, Patty O'Toole, and all Fish and Wildlife Staff

**Summary**: Council staff recently completed the attached draft report which assesses the progress made on the 2014 Program measures and strategies. The Council adopted the Columbia Basin Fish and Wildlife Program (Program) in October 2014. Since then implementation has occurred in many areas of the Program while some barriers exist that hinder progress.

A few key aspects of the Program are the 22 strategies, the goals and objectives, and the adaptive management framework within the Program. Attached are ***draft* Program Implementation Assessments** for those Program elements. Staff made an initial effort to identify issues and briefly summarize progress on measures adopted to implement each strategy or topic area. Staff brought these assessments to the Fish and Wildlife Committee for discussion at both the July and August committee meetings, and also plan to discuss these at the Regional Coordination Forum on September 11. Council staff sees the benefit in these assessments to understand program implementation, promote regional dialogue, and lay the groundwork for the next program amendment process.

It's good to note that within a strategy, similar measures may have been merged for the sake of clarity and measures may have been summarized for brevity. Reference to the Program can be made for the exact wording

of each measure. Also, progress has been made in other Program areas that are not being discussed in this memorandum, such as the O&M and Cost Savings workgroups for example, which have been addressed separately before the Council. The Program also contains many subbasin-specific measures (Appendix O of the 2014 Program). This assessment does not evaluate the progress towards implementation of the subbasin measures.

**Relevance**: Status update on Fish and Wildlife Program Implementation

**Background**:
The 2014 Columbia Basin Fish and Wildlife Program (Program) was adopted more than two years ago. It is timely to assess how implementation of the program is progressing. Generally, successes and accomplishments exist for each strategy -- significantly so in some instances. However, barriers also exist and hinder progress on some measures for a variety of reasons. The table below identifies significant challenging issues within each strategy. Staff has discussed the Program Implementation Assessments with the Committee members and also received some feedback from the fish and wildlife managers, which was used to correct the first draft assessments.

| **Issues Identified by mid-Program Implementation Assessments** | |
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| **Program strategy/topic** | **Issues needing resolution** |
| Goals and objectives | From the compiled list of existing objectives, the Council and its partners will need to consider if these are adequate for the Program or whether additional work is needed. |
| Ecosystem function | Human population growth, introduced and displaced species, global and local environmental changes, and ongoing hydropower system operations present continuing challenges to restoration of a properly functioning Columbia River Basin ecosystem. |
| Habitat | Identifying and focusing on the habitat actions that will provide the greatest off-site mitigation benefit. The Program principles and the sub-basin plans provide overall guidance, but how well the actions follow those principles may need to be assessed. While all agree that there are benefits to tributary habitat restoration, questions remain about how to assess those benefits at a population scale and how those benefits relate to hydrosystem losses, the Program, and requirements under the Endangered Species Act |
| Strongholds | While some formal salmonid strongholds have been established in the Pacific Northwest, and areas managed for wild fish exist, no formal stronghold designations have been made in the Columbia River Basin under the Council's Program. |
| Non-native and invasive species | Non-native and invasive species imperil native species in the Pacific Northwest's ecosystems through predation, competition for food, interbreeding, disease transmission, food web disruption, and physical habitat alteration. The Program seeks to prevent |

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| | introduction of non-native species and reduce competition with juvenile and adult salmonids. |
| Predator management | Altered habitats in the Columbia River support native and non-native predator species, and the Program aims to improve the survival of salmon and steelhead and other native focal fish species by managing and controlling predation rates. In some instances predator populations continue to grow, and there is concern that their impacts continue to grow as well. Formation of a technical work group should be considered to develop a common predation metric. |
| Protected areas and hydroelectric development and licensing | Implementation of the Protected Areas and Hydroelectric Development and Licensing Strategy continues without any significant issues at this time. |
| Water quality | The Columbia and Snake rivers are affected during high flow and high spill years by high total dissolved gas (TDG) levels, occasionally in excess of water quality standards. Elevated water temperatures occur in much of the basin during July and August, usually, and during hot or low flow years can occur earlier and continue later. Also, there is growing concern about toxic contaminants throughout the water of the basin. |
| Climate change | Most temperature records in the Columbia Basin indicate a warming climate, with associated precipitation shifts to more rain and less snow. Extreme events are expected to increase, resulting in more and higher winter floods and longer and lower summer low flows. Temperature sensitive species, such as Bull Trout, are experiencing more and larger thermal barriers resulting in range reductions and less interconnectivity of strongholds. Rising sea levels may result in inundation of some habitat restoration projects in the Estuary and intrusion of salt water further into the lower Columbia River. Increased awareness of the observed and potential climate changes has not resulted in significant changes in on-the-ground restoration and protection actions. Recent administrative changes point to the potential for less emphasis on climate change by the federal action agencies. |
| Mainstem hydrosystem flow and passage options | Actions to improve conditions for non-listed species such as lamprey and sturgeon are limited; thus, these components of the measures are lagging. In the near term, agency efforts related to mainstem effects on salmon and steelhead will focus on implementing a court-ordered spill operation and completing a new biological opinion and environmental impact statement for the operation of the Columbia River dams. Tracking these actions and conveying the Program priorities, including the need for appropriate monitoring of the benefits/impacts of increased spill, will be an important Council effort, as is the need to ensure that important non-listed species get sufficient consideration in decisions and implementation about water management and passage. |
| Estuary | Questions remain regarding 1) whether actions address all species affected by construction and operation of the hydrosystem or just listed species; 2) whether the increased estuary investment provides the anticipated benefits; and 3) whether some limiting |

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| | factors, such as the presence of contaminants, negate the benefits from habitat restoration. |
| Plume and nearshore ocean | In recent years research and monitoring to implement Program measures indicated that ocean conditions were not favorable for anadromous fish survival, resulting generally in lower than average adult returns in 2017. Warm ocean conditions in 2015 and 2016 are believed to have resulted in poor feeding conditions for Columbia River salmon. Improved tracking of all Program research, described in the Council's 2017 Research Plan, would benefit implementation of this strategy by clarifying what questions have been addressed and for which stocks of anadromous fish. |
| Wildlife mitigation | Implementation of wildlife mitigation continues but progress toward full mitigation remains unclear. Policy differences exist between Program direction for wildlife mitigation and implementation by BPA in both the wildlife mitigation obligation and in addressing species-response to wildlife mitigation. |
| Fish propagation including hatchery programs | Many of the measures associated with this strategy are being addressed. However several await a broad-scale approach to hatchery monitoring, as described in the recommendations of the Ad Hoc Supplementation Workgroup and the 2012 conceptual biological opinion project titled Columbia River Hatchery Effects Evaluation Team (CRHEET). |
| Wild fish | Artificial production is an important mitigation tool used in the Program, but artificial production activities must protect the genetic diversity of native wild fish so that they retain the ability to adapt to a variety of perturbations and conditions throughout their varied life stages. |
| The use of hatcheries for reintroduction | One use of the hatchery tool is for reintroduction into areas where the native population had been eliminated. The purpose is to rear, reproduce, and encourage the fish to naturally repopulate the habitat. Reintroduction includes both resident and anadromous fish species, and may utilize minimal intervention (adult and juvenile translocation) to extensive conservation and restoration hatchery practices to assist in the recovery of extirpated species. |
| Anadromous fish mitigation in blocked areas | Some of the Columbia River Basin's most productive core anadromous fish populations have been extirpated by the inundation and blockage of more than half of the anadromous habitat area by the development of the hydrosystem. This loss of capacity is a major consideration in the Act's mitigation obligation. |
| Resident fish mitigation | Resident fish and other native aquatic species, including freshwater mussels, white sturgeon, burbot, and several native trout species, have been impacted by the construction and operation of the hydrosystem. Impacts include losses to abundance, genetic diversity, life history diversity, spatial diversity and movements of these species, as well as modification of their habitat resulting from inundation. Resident fish losses from hydropower dam construction have not been determined for most of the Columbia River Basin. The 2014 Program recommended development of a standardized methodology for resident fish habitat loss assessments but this has yet to occur. |

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| Sturgeon | The key issue for Columbia River Basin sturgeon is fragmented habitat from the construction and operation of the hydropower system that has isolated populations and limited access to food and suitable spawning and rearing habitat. The Kootenai population is geographically isolated and listed under ESA as endangered. Action agency focus in the mainstem has been on listed salmonids with little progress on the sturgeon measures, except for the Kootenai population. |
| Lamprey | The development of a synthesis report, as recommended by the Council in its 2011 review of Research, Monitoring and Evaluation and Artificial Production Projects remains an important need. Continued support and implementation of lamprey measures is needed. |
| Eulachon | The main focus of Eulachon measures in the Program is understanding the extent to which Eulachon are affected by the hydrosystem and what restoration actions can be taken to improve productivity and survival. |
| Public engagement | Public engagement measures are incorporated in the program to encourage 1) regular communication through multiple types of media with the public beyond our usual community at Council meetings, and 2) tracking of how effectively we communicate with the public. |
| Investment | Seven priorities were identified in the program including the key priority to fix, repair, replace or otherwise protect past infrastructure and property investments. |
| Adaptive Management: Monitoring | Accessibility of monitoring data and reporting of derived information such as abundance must be secured for program accountability and to inform the program and project implementation. This access will become more challenging with continued level funding and increasing costs associated with the program's data management efforts. |
| Adaptive Management: Effectiveness | Following the development of a Program-focused habitat monitoring and evaluation approach adequate support will be needed for its proper implementation. |
| Adaptive Management: Research | Research projects funded through the Program must improve on how they clearly communicate their hypotheses, how they connect to a critical uncertainty, and must specify an end date by which findings will be available. |
| Adaptive Management: Data Management | Improvements are needed to adequately manage and make information accessible in an informative manner for Program publications, aquatic habitat data, and fish focal species data. The progress achieved for salmon and steelhead through StreamNet and the Coordinated Assessment effort will require adequate funding to be maintained. The level of funding for the StreamNet data management project, lack of dedicated funding for the Coordinated Assessment effort, and future funding for the Regional StreamNet Library post-accord are concerns. |

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| Adaptive Management: Reporting | Further improvements in annual project reports to Bonneville, such as separating research reports from monitoring reports, remains an ongoing need. |
| Adaptive Management: Evaluation | An area that would benefit from renewed attention is the regional approach for evaluating hatcheries and their effectiveness. Ongoing support continues to be needed in all Program areas to ensure continued and improved synthesis and reporting of information to guide project implementation and to inform the Program, e.g. species conditions and action performance. |

**Attachments:**

***Draft* 2014 Columbia River Basin Fish and Wildlife Program Implementation Assessment Report**

***DRAFT***

# 2014 Columbia River Basin Fish and Wildlife Program

# Implementation Assessment Report

# September 6, 2017

Northwest Power and Conservation Council staff

*****Assessments are initial staff estimates of the implementation progress of Program measures and are subject to change with updated information.

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# Part I. Implementation Summaries for Strategies

## Goals and Objectives

**Issue statement:** The Program has goal statements and objectives related to species, habitat, and hydrosystem operations. These serve to track progress made by Program measures toward achieving the Program vision. To better track and communicate this progress the Program needs a realistic set of quantitative objectives that are measureable. The Council and the region's fish and wildlife agencies and tribes have worked on this issue with varying degrees of success. The 2014 Program outlined a step-by-step approach consisting of Council staff working with others in the region to refine quantitative objectives. Compilation of existing objectives for fish will be completed by the end of 2017. During 2018, regional review of these fish objectives and discussions about refining objectives for the Program will be initiated. Work on hatchery salmon and steelhead indicators is ongoing through the Coordinated Assessment process. Aquatic habitat objectives are being addressed through the Pacific Northwest Aquatic Monitoring Partnership (PNAMP). Development of pubic engagement goals and objectives will be addressed internally prior to the amendment process and will utilize existing efforts to monitor website usage. The Council and its partners will need to consider if existing objectives are adequate for the Program or if different or additional objectives should be developed and amended into the Program in order to better understand the Program's progress over time.

**Discussion:** The Program currently has qualitative goal statements and quantitative objectives at the basin and mainstem scale listed in Appendix D, and at the subbasin scale in the Program's subbasin plans. Council staff is working with others in the region to refine basin and mainstem objectives to produce a realistic set of quantitative objectives for Program focal species and habitat that assess and communicate progress. Council staff have compiled existing quantitative objectives for natural origin adult salmon and steelhead, lamprey, sturgeon, eulachon, bull trout, cutthroat trout, and kokanee. The salmon and steelhead compilations have been reviewed by co-managers and are accessible through the Program's interactive objectives mapping tool. This mapping tool is also informing NOAA's Columbia Basin Partnership Task Force effort under the Marine Fisheries Advisory Committee. Objectives compiled for the other fish species will be reviewed by co-managers by early 2018 and added to the objective mapping tool. Work on hatchery salmon and steelhead indicators has been initiated through the Coordinated Assessment collaborative forum. Work related to the ecosystem function, habitat and hydrosystem objectives is currently focused on aquatic habitat through a collaborative PNAMP regional habitat indicator project. Work on the last set of objectives addressing public engagement has not been initiated.

**Progress report on the 2014 Program measures:**
Number of measures total: Four
Number of measures that have made progress: Three

See **Part II** for the detailed Progress report on these measures.

## Ecosystem Function Strategy

**Issue statement:** Human population growth, introduced and displaced species, global and local environmental changes, and ongoing hydropower system operations present continuing challenges to restoration of a properly functioning Columbia River Basin ecosystem.

**Discussion:** The Ecosystem Function Strategy in the 2014 Program is an overarching Program strategy that incorporates many other strategies which will be assessed for implementation separately. The Program recognizes that ecosystem functions in the Columbia River Basin cannot be restored solely through mainstem actions at and between the hydrosystem dams. Thus, mitigation work to restore ecosystem functions relies heavily on an 'offsite' mitigation program, largely in the tributaries, as well as on mainstem actions such as flow and passage mitigation.

State, tribal, local, and federal government entities are actively working to restore ecosystem functions throughout the basin, often in collaboration with NGOs, electrical power utilities, and others. Hundreds of ecosystem protection and restoration projects have been completed. Independent science review has resulted in increased use of best available science and a steady improvement of these projects.

Natal habitats and migration corridors have been protected, restored, and improved, and much has been done to improve water quality and quantity in critical areas. Mainstem Columbia and Snake rivers ecosystems have benefited from flow and passage improvements through the hydrosystem and by habitat restoration efforts in the estuary. Fish spawning and rearing tributary habitats have been improved through removal of barriers, riparian restoration, floodplain reconnection, and upland runoff control. Significant land and water acquisitions have protected and enhanced ecosystem function in critical portions of the basin. Much work remains to restore ecosystem functions within the Columbia River Basin.

**Progress report on the 2014 Program measures:**
Number of measures total: 14, implemented by 11 sub-strategies which are discussed in more detail individually following this two page summary.
Number of measures that have made progress: 14

See **Part II** for detailed Progress report on these measures.

## Habitat Strategy

**Issue statement:**
Habitat actions are implemented to provide off-site mitigation for the impacts of operation of the hydropower system. One key issue is identifying and focusing on the habitat actions that will provide the greatest off-site mitigation benefit. The Program principles and the sub-basin plans provide overall guidance, but how well the actions follow those principles may need to be assessed. While all agree that there are benefits to tributary habitat restoration, questions remain about how to assess those benefits at a population scale and how those benefits relate to hydrosystem losses, the Program, and requirements under the Endangered Species Act.

**Discussion:**
Habitat actions, as off-site mitigation in the Columbia River tributaries, has been a major part of the Program since the early 1980's. In 2016, direct expenditures in the habitat restoration and protection category (from the Council's Columbia River Basin Fish and Wildlife Program Costs Reports) were nearly $118,000,000. Most habitat work under the program occurs in the tributaries and is primarily intended to benefit focal anadromous and resident salmonids. In addition, other native aquatic species often benefit from habitat actions either directly, through the intended scope of a project, or indirectly, as a result of the fish-focused project. Habitat work is implemented in all four states, from the estuary to the upper reaches of the Columbia River tributaries. There has been much less effort placed on identifying and implementing mainstem habitat actions, with the exception of the estuary. More focus could be placed on identifying mainstem habitat restoration opportunities.

Through time, efforts have shifted from smaller discrete habitat projects to integrated watershed scale 'ridgetop to ridgetop' habitat restoration efforts. Computer models and tools such as EDT have helped practitioners prioritize their habitat restoration activities, often implemented over a multi-year time period. Increasing numbers of partners are collaboratively developing, funding and implementing habitat restoration activities, for the longer term, larger scale projects.

The Program invests significantly in tributary habitat improvements based on the assumption that improvements in tributary habitat conditions not only boost survival and productivity of fish in the tributaries but also contribute to survival benefits at the population scale. Uncertainties remain regarding the relationships between tributary habitat efforts and benefits at the population scale. In turn there are uncertainties as to the appropriate monitoring and evaluation needed to determine those relationships. Reviews are underway to evaluate and refine the approach and methods for assessing the benefits of tributary habitat improvements.

**Progress report on the 2014 Program measures:**
Number of measures total: 19, including 12 mainstem measures
Number of measures that have made progress: 12
*Note there are many additional specific subbasin measures in Appendix O of the 2014 Program. Some are implemented, and some are not at this time (June 2017).

See **Part II** for detailed Progress report on these measures.

## Strongholds Strategy

**Issue statement:** This "build from strength" habitat sub-strategy is focused on *acknowledging, identifying, designating and conserving* habitat considered strongholds for native fish based on a set of particular characteristics. The general premise is to protect areas that already support relatively intact habitat and relatively healthy fish populations so that the fish will be able to maintain genetic diversity and "weather the storms" of natural and human impacts. While some formal salmonid strongholds have been established in the Pacific Northwest, and areas managed for wild fish exist, no formal *stronghold* designations have been made in the Columbia River Basin under the Council's Program.

**Discussion:** While the concept of strongholds is not new, the Council first included stronghold language in the 2009 Program when the regional initiative to define and identify salmon and steelhead strongholds through the North American Salmon Stronghold Partnership (NASSP) was just getting started. The effort from NASSP diminished after years of developing criteria, characteristics and candidate stronghold areas.

So what does it mean to have strongholds acknowledged or designated in our Program? The Council opted for flexibility to fund/not fund specific actions in stronghold areas and asked that the designations come from agreement between the states and tribes within each state. If and when specific strongholds areas get adopted in the Program, the Council could inventory the currently funded investments in those areas to assess their ability to maintain stronghold characteristics. The Council could also consider if and how to invest additional funding to those areas.

**Progress report on the 2014 Program measures:**
Number of measures total: Six
Number of measures that have made progress: Two (indirectly)

See **Part II** for detailed Progress report on these measures.

## Non-native and Invasive Species Strategy

**Issue statement:** Non-native and invasive species imperil native species in the Pacific Northwest's ecosystems through predation, competition for food, interbreeding, disease transmission, food web disruption, and physical habitat alteration. In coordination with regional partners, the Council has committed to measures to prevent the introduction of non-native and invasive species in the Columbia River Basin, and where possible, reduce competition with juvenile and adult salmonids.

**Discussion:** Implementation of actions associated with this strategy are mixed, the challenges sizable, and the risk significant. In their report *Critical Uncertainties for the Columbia River Basin Fish and Wildlife Program* (ISAB/ISRP 2016-1), the ISRP stated that little progress is being made, and raised a number of concerns including constant incursion and establishment of non-native species while Council-focused eradication efforts are directed at native species like northern pikeminnow, birds and pinnipeds; undermining of otherwise successful habitat and native fish restoration efforts; changes in biotic interactions and the creation of novel ecosystems; and once established, efforts to remove non-natives are typically unsuccessful. Even while we have good coordination with our region partners and are making some progress, a number of challenges remain for both invasive mussels and invasive fish. One of the Program's emerging priorities for implementation is to preserve Program effectiveness by aggressively addressing non-native and invasive species.

**Progress report on the 2014 Program measures:**
Number of measures total: Six
Number of measures that have made progress: Five of six, but vigilance and action are required.

See **Part II** for detailed Progress report on these measures.

## Predator Management Strategy

**Issue statement:** Altered habitats in the Columbia River support native and non-native predator species, and the Program aims to improve the survival of salmon and steelhead and other native focal fish species by managing and controlling predation rates. In some instances predator populations continue to grow, and there is concern that their impacts continue to grow as well. Formation of a technical work group should be considered to develop a common predation metric using the ISAB Predation Metric Report to help determine the effectiveness of predator-management actions.

**Discussion:** The Program recognizes that operations of the FCRPS dams, as well as disposal of dredge spoils in the lower river and estuary, have altered historical habitats and created new, hybrid habitats that support a wide range of native and non-native predator species.

The Program contains measures for predation on fish by birds, other fish, and seals and sea lions. Actions are underway by the federal action agencies, state agencies, tribes, and others to address predation on salmon, but effectiveness of these actions varies, and overall effectiveness of predation management on salmon populations basinwide remains uncertain. These efforts may provide some predation relief for other resident and anadromous fish, however, predation efforts are really focused on protecting salmon.

The Program directs the federal action agencies in cooperation with the Council, fish and wildlife agencies, and tribes to convene technical workgroups to determine the effectiveness of predator-management actions and develop a common metric to measure the effects of predation on salmonids. The Council asked the ISAB to formulate a Predation Metric Report to advise the future technical workgroup before it is formed. Progress on predation measures since adoption of the Program should make clear the degree to which a technical workgroup can be effective in furthering efforts to manage predation throughout the basin.

**Progress report on the 2014 Program measures:**
Number of measures total: 14
Number of measures that have made progress: 10

See **Part II** for detailed Progress report on these measures.

## Protected Areas and Hydroelectric Development and Licensing Strategy

**Issue statement:**
Implementation of the Protected Areas and Hydroelectric Development and Licensing Strategy continues without any significant issues at this time. Staff should continue tracking proposals for new hydropower projects in protected areas. The Council may want to consider the merits of deliberate tracking of the additional elements of this strategy.

**Discussion:**
The Protected Areas measure, intended to protect streams and fish habitat against future hydroelectric development in areas that retain fish and/or wildlife values, has been in the Council's Fish and Wildlife Program since 1998. This measure protects 44,000 unimpounded stream miles from hydro development where the Council believes such development would have unacceptable risks of loss to fish and wildlife, their productive capacity, or their habitat. The state of Oregon, in its small hydroelectric water right permit process, has language that the state may not grant a license to a project that would be inconsistent with the provisions of the Council's Fish and Wildlife Program.

The Program was amended in 2014 to reinstate the opportunity for the Council to grant, under conditions described in Appendix F of the Program, exceptions to the Protected Areas. That amendment drew significant public comment, both in opposition and support. To date, since the 2014 amendment, no petitions for exception have been received by the Council. A separate element includes Program standards for hydroelectric development and relicensing outside of protected areas. The Council expects the Federal Energy Regulatory Commission (FERC) to exercise of its licensing authority under the Federal Power Act, taking the Council's hydroelectric development standards and protected areas designations into account to the fullest extent practicable. Staff continues to monitor proposed actions related to several preliminary permits issued by FERC. These include: the Black Canyon Hydroelectric Project in in Washington; the Sunset Fish Passage and Energy Project in Washington; and the Eagle Creek Hydroelectric Project in Oregon.

The Program also contains standards to protect fish and wildlife that FERC should apply in any consideration of a hydropower license or relicense, even if outside a protected area. Staff does not actively track all relevant FERC proceedings to make sure this happens but instead addresses these issues as we learn about them from others. Experience has demonstrated that these standards get raised in licensing processes, through FERC's own standards and through the involvement of the various agencies, tribes and environmental groups in licensing processes. Close tracking by the staff of all relevant FERC proceedings has not been done. Continued monitoring of Protected Areas should continue.

**Progress report on the 2014 Program:**
Number of measures total: Two
Number of measures that have made progress: One
Number of measures that have made partial progress: One

See **Part II** for detailed Progress report on these measures.

## Water Quality Strategy

**Issue statement:** The Columbia and Snake rivers are affected during high flow and high spill years by high total dissolved gas (TDG) levels, occasionally in excess of water quality standards. Elevated water temperatures occur in much of the basin during July and August, usually, and during hot or low flow years can occur earlier and continue later. Also, there is growing concern about toxic contaminants throughout the waters of the basin.

**Discussion:** Degraded water quality can have adverse effects on the health of aquatic life and wildlife populations and the ecosystem these populations depend upon, thus impeding mitigation and recovery efforts. The Columbia River Basin has been designated by the EPA as a priority Large Aquatic Ecosystem similar to Chesapeake Bay, the Great Lakes, Gulf of Mexico, and Puget Sound. While each of these other ecosystems has designated funding sources to protect and restore the water quality within their defined areas, the Columbia Basin does not. As a result little has been done to understand the effects of and mitigate for toxic contaminants in aquatic systems of the Columbia beyond some minimal research of adverse effects on some species.

Both 2017 and 1997 are water years with high runoff, forcing large involuntary spills, resulting in high TDG levels, at times exceeding 130% in many locations, well above the 120% water quality standard. High TDG is cumulative as water is passed from one hydro-facility to the next downstream. Elevated symptoms of gas bubble trauma have been observed in fish in both 1997 and 2017 as a result of high dissolved gas levels. Some dams are more likely to produce higher gas levels than others. Operations can minimize TDG levels to some extent unless they are operating under flood risk management scenarios.

In 2015 the basin experienced unusually warm weather and low runoff at the same time. The result was early and persistent elevated water temperatures in large parts of the mainstem rivers and the tributaries. Resulting fish mortality was very high for some species such as sockeye and elevated for most other anadromous runs, as well as for white sturgeon.

**Progress report on the 2014 Program measures:**
Number of measures total: 11
Number of measures that have made progress: six

See **Part II** for detailed Progress report on these measures.

## Climate Change Strategy

**Issue statement:** Most temperature records in the Columbia Basin indicate a warming climate, with associated precipitation shifts to more rain and less snow. Extreme events are expected to increase, resulting in more and higher winter floods and longer and lower summer low flows. Temperature sensitive species, such as Bull Trout, are experiencing more and larger thermal barriers resulting in range reductions and less interconnectivity of strongholds. Rising sea levels may result in inundation of some habitat restoration projects in the Estuary and intrusion of salt water further into the lower Columbia River. Increased awareness of observed and potential climate changes has not resulted in significant changes in on-the-ground restoration and protection actions. Recent administrative changes point to the potential for less emphasis on climate change by the federal action agencies.

**Discussion:** Regardless of beliefs about the causes of climate change, it is indisputable that most long term records for the Columbia River Basin indicate a gradual warming trend. This is resulting in projected decreases in snowpack, which is a critical natural storage component in the Columbia Basin. Most challenging is how to respond to climate change by altering the timing, location or techniques of dam operations, habitat preservation or fish propagation. Habitat restoration practitioners face many scientific, informational and institutional barriers to efforts to adapt actions to potential climate-induced changes.

Attempts to model future climate change effects and fish and wildlife responses are challenging due to uncertainties in climate data and models, as well as in species response to changing environmental conditions. Efforts are underway to develop predictions for future river flows and stream temperatures, but these efforts require significant investments of time and funding. Much of this work is not yet at a point at which it can be used to inform current and future restoration and mitigation efforts.

The hot dry year of 2015 may or may not be typical of future climate conditions; however, it provides a template for what may happen in the future. The situation in 2015 demonstrated the importance of improving information sharing and quickly responding to emerging problems. It also increased the urgency to locate and protect cold water ‘refugia’ and to understand how fish use those areas. 2015 also highlights the importance of genetic diversity of fish in sustaining populations during extreme events.

**Progress report on the 2014 Program measures:**
Number of measures total: 15
Number of measures that have made progress: 11

See **Part II** for detailed Progress report on these measures.

## Mainstem Flow and Passage Operation Strategy

**Issue statement:** The measures related to flow and passage for salmon and steelhead are largely on track. However, actions to improve conditions for other species such as lamprey and sturgeon are limited; thus, these components of the measures are lagging. In the near term, agency efforts related to mainstem effects on salmon and steelhead will focus on implementing a court-ordered spill operation and completing a new biological opinion and environmental impact statement for the operation of the Columbia River dams. Tracking these actions and conveying the Program priorities, including the need for appropriate monitoring of the benefits/impacts of increased spill, will be an important Council effort, as is the need to ensure that important other species get sufficient consideration in decisions about and implementation of water management and passage.

**Discussion:** The operation of the hydropower system has had both direct and indirect impacts on fish habitat and overall fish survival. For more than 35 years, the Program measures have resulted in changes to the hydropower system to improve habitat conditions and fish passage survival. For listed species, these measures have largely been incorporated into various ESA biological opinions. Additionally, many of the flow and passage measures in the Program are addressed through the federal agencies' Columbia River Fish Mitigation and Anadromous Fish Evaluation programs, including project funding and the activities of numerous work groups. In addition to listed species, the Council's Program also contains measures specifically focused on non-listed native species.

While actions to improve flow and passage have benefitted salmon and steelhead, there are still significant impacts to both juvenile and adult survival. Other species, such as lamprey and sturgeon, remain at historically low abundance and have benefitted only slightly, or not at all, from hydrosystem modifications benefiting anadromous salmonids. More focus is needed on measures to improve conditions for the other species. While fish passage and flows have been the focus of mainstem improvements, efforts to address mainstem habitat conditions and floodplain connectivity have received limited attention. Further emphasis is needed on these measures given the potential benefits of mainstem cold-water habitat. More information on other species and on habitat can be found in their respective strategy assessments.

**Progress report on the 2014 Program measures:**
Number of measures total: 21
Number of measures that have made progress: All have made some progress, but eight have major unaddressed components.

See **Part II** for detailed Progress report on these measures.

## Estuary Strategy

**Issue statement:** The Columbia River Estuary remains an important ecological area for the Program. All anadromous fish in the basin interact with habitat in this area. The Corps and Bonneville coordinate their implementation actions through the Columbia Estuary Ecosystem Restoration Program (CEERP) under the Endangered Species Act (ESA) Biological Opinion for the hydrosystem. This implementation appears to be consistent with the Council's strategy and measures, but questions remain regarding 1) whether actions address all species affected by construction and operation of the hydrosystem or just listed species; 2) whether the increased estuary investment provides the anticipated benefits; and 3) whether some limiting factors, such as the presence of contaminants, negate the benefits from habitat restoration. These questions should be considered ahead of the next Program amendment.

**Discussion:** As the Council states in the Program, the estuary is an important ecological area for all anadromous fish species, and it has seen significant alteration from the effects of the hydroelectric system. This area serves as both rearing habitat and as a migration corridor for all salmon and also contains the most healthy white sturgeon population in the Columbia River. The estuary gained significant attention and investment by the Council from the 2000 Program onward. The 2008 and 2014 biological opinions also focused upon increased estuary habitat actions to benefit survival of listed salmon and steelhead populations.

Because the 2008 and 2014 biological opinions relied so heavily on progress in the estuary, the Corps of Engineers (Corps) and Bonneville developed a comprehensive adaptive management framework, called the Columbia Estuary Ecosystem Restoration Program (CEERP) to accomplish habitat restoration actions and evaluate progress of those actions. CEERP implementation appears to be largely consistent with the Program's estuary measures.

CEERP principles indicate that protecting and restoring large landscapes close to the mainstem provides the greatest benefit for anadromous fish in the estuary. As a result, sponsors proposing habitat actions in the Lower Columbia and estuary have moved toward larger-scale, floodplain restoration actions that may have more significant benefits for anadromous fish. Action Agency monetary investment has increased about five-fold since the initiation of the Lower Columbia River Estuary Partnership projects and the first federal investments beginning around 2002. Today habitat restoration is funded by both Bonneville and the Corps as is research and monitoring, all coordinated under the CEERP.

The CEERP includes a monitoring program, funded by the Corp and Bonneville. Though some long term monitoring takes place, monitoring for Pacific lamprey remains a gap. The Council is currently working basinwide on a framework for effectiveness monitoring and those discussions and resolution will be important to the estuary as well as the tributaries.

**Progress report on the 2014 Program measures:**
Number of measures total: Six general measures
Number of measures that have made progress: Five, some with partial implementation

See **Part II** for detailed Progress report on these measures.

## Plume and Nearshore Ocean Strategy

**Issue statement:**
In recent years research and monitoring to implement Program measures indicated that ocean conditions were not favorable for anadromous fish survival, resulting generally in lower than average adult returns in 2017. Warm ocean conditions in 2015 and 2016 are believed to have resulted in poor feeding conditions for Columbia River salmon. The 2014 FCRPS Biological Opinion RPAs call for research and monitoring of plume and ocean characteristics and conditions and for evaluation of how listed stocks perform in these environments. The actions in these RPA Strategies generally overlap with the Program strategy and measures, differing primarily in specificity and in stocks of interest. It is uncertain what the next biological opinion will require for research in the plume and ocean. Improved tracking of all Program research, described in the Council's 2017 Research Plan, would benefit implementation of this strategy by clarifying what questions have been addressed and for which stocks of anadromous fish.

**Discussion:**
A 1996 amendment to the Northwest Power Act instructed the Council to "consider the impact of the ocean on fish and wildlife populations when making recommendations to Bonneville regarding projects to be funded." In response to the amendment and to ISAB recommendations, the 2014 Program includes three fundamental elements in the rationale and principles for the Plume and Nearshore Ocean Strategy:

- The ocean environment, in particular the plume, is an integral part of the Columbia River ecosystem.
- Baseline and real-time data is needed to identify and isolate the effects of ocean conditions on the survival, growth, and viability of Columbia River anadromous fish.
- Variations in ocean conditions play a large role in the survival of anadromous fish and other species in the Columbia River Basin. The Council supports management actions that help anadromous species accommodate a variety of ocean conditions by providing a wide range of life history strategies.

**Progress report on the 2014 Program measures:**
Number of measures total: Six general measures
Number of measures that have made progress: The six Program measures for this strategy are all currently being implemented, either via one Bonneville funded project (1998-014-00) or through the Council's Ocean and Plume Science and Management Forum (Ocean Forum). Some may be partially implemented as not all salmon stocks behave similarly and can be studied at the same time.

See **Part II** for detailed Progress report on these measures.

## Wildlife Mitigation Strategy

**Issue statement:** Implementation of wildlife mitigation continues but progress toward full mitigation remains unclear. Policy differences exist between Program direction for wildlife mitigation and implementation by BPA in both the wildlife mitigation obligation and in addressing species-response to wildlife mitigation.

**Discussion:** Previously, the Program quantified the identified losses to wildlife and their habitats from construction of the hydrosystem and the resulting inundation of the river. These are referred to as construction and inundation losses, or C&I losses. The Program provides mitigation for these losses through habitat units; though, with the push for settlement agreements, acres are now the preferred unit for mitigation measurement. Operational and secondary losses have not yet been quantified, but the Program calls on BPA to address these losses along with the quantified C&I losses.

In the Program, the Council continues to endorse 2:1 mitigation for any unaddressed losses since 2000 though BPA and some managers have not agreed to that crediting ratio. In comments to the Council regarding the Wildlife Advisory Committee (WAC) report in 2015, BPA stated that it believed 25 of 29 FCRPS dams were fully mitigated for C&I losses based on the 2011 Wildlife Crediting Forum Report and a 1:1 mitigation model. Under Program guidance, BPA continues to pursue mitigation agreements and stewardship funding with managers for the remaining four dams while applying 1:1 mitigation.

The Council uses the expertise of the wildlife managers and others in assessing the crediting of wildlife projects and proposing potential ways of assessing and addressing the wildlife operational impacts of the FCRPS. However, crediting measurement discrepancies exist between the loss assessments and how mitigation gets credited. Also, a lack of agreement exists on the level of monitoring funding to measure for habitat and species benefits under the 2014 Program, despite the Program's measures supporting such monitoring.

**Progress report on the 2014 Program measures:**
Number of measures total: 14
Number of measures that have made progress: Nine

See **Part II** for detailed Progress report on these measures.

## Fish Propagation Including Hatchery Programs Strategy

**Issue statement:** The Council's Fish and Wildlife Program generally uses fish propagation strategies in three approaches: in an integrated manner to complement habitat improvements by supplementing native fish populations that are as similar as possible, in genetics and behavior, to wild native fish; in a segregated manner to maintain the genetic integrity of the local populations in order to expand natural production while supporting harvest of artificially produced stocks; and to replace lost salmon and steelhead in blocked areas. These strategic approaches have multiple purposes including preservation/conservation, research, restoration, and harvest augmentation. Many of the measures associated with this strategy are being addressed. However several await a broad-scale approach to hatchery monitoring, as described in the recommendations of the Ad Hoc Supplementation Workgroup and the 2012 conceptual biological opinion project titled Columbia River Hatchery Effects Evaluation Team (CRHEET).

**Discussion:** Hatcheries continue to play a vital role in mitigating for habitat loss, including operation of the hydropower system. They are often used as a recovery tool that can help rebuild natural production. The social, cultural, and economic benefits of fish harvest are immense and provide significant value.

The purpose of most hatchery production is to provide fish for harvest. However, in recent years a number of programs have been operated for purposes of restoration of depressed stocks to aid in recovery programs. Hatcheries provide mitigation for the loss of habitat quantity and quality that has resulted from the construction and operation of dams and other development activities. They serve as a substitute for lost or degraded habitat. Within the Columbia River Basin the majority of the habitat that was available historically to anadromous fish is no longer accessible.

**Progress report on the 2014 Program measures:**
Number of measures total: 15
Number of measures that have made progress: Nine

See **Part II** for detailed Progress report on these measures.

## Wild Fish Strategy

**Issue statement:** Native wild fish and wild fish assemblages possess genetic diversity, life history traits, and resilience to adapt to adverse habitat conditions in a dynamic ecosystem. In the past, reintroductions of wild fish helped rebuild extirpated populations, and this practice may continue in the future. Artificial production is an important mitigation tool used in the Program, but artificial production activities must be structured to protect the genetic diversity of native wild fish so that they retain the ability to adapt to a variety of perturbations and conditions throughout their varied life stages.

**Discussion:** The Council understands and recognizes the need to protect and help perpetuate native wild fish populations and does this through ongoing policy and Program reviews. Implementation of the strategy occurs primarily through projects to improve habitat conditions in tributaries and to minimize ecological and genetic risks through the fish propagation strategy. Project reviews and scientific forums help inform Council decision-making about projects that implement both strategies.

The Council should continue to account for the needs of wild fish when considering new proposals for habitat and artificial production activities and through all facets of Program implementation.

**Progress report on the 2014 Program measures within the Wild Fish Strategy:**
Number of measures total: Two
Number of measures that have made progress: Two

See **Part II** for detailed Progress report on these measures.

## The Use of Hatcheries for Reintroduction Strategy

**Issue statement:** One use of the hatchery tool is for reintroduction into areas where the native population had been eliminated. The purpose is to rear, reproduce, and encourage the fish to naturally repopulate the habitat. Reintroduction includes both resident and anadromous fish species, and may utilize minimal intervention (adult and juvenile translocation) to extensive conservation and restoration hatchery practices to assist in the recovery of extirpated species.

**Discussion:** Almost all of the Fish and Wildlife Program's hatcheries have multiple goals, but the majority have a common purpose of restoring native species to an area where they had been extirpated. This includes both anadromous and resident species at currently operating Program hatcheries and also those being planned and reviewed through the Program.

**Progress report on the 2014 Program measures:**
Number of measures total: Two
Number of measures that have made progress: Two

See **Part II** for detailed Progress report on these measures.

## Anadromous Fish Mitigation in Blocked Areas Strategy

**Issue statement:** Some of the Columbia River Basin's most productive core anadromous fish populations have been extirpated by the inundation and blockage of more than half of the anadromous habitat area by the development of the hydrosystem. This loss of capacity is a major consideration in the Act's mitigation obligation. With the 2014 Program came stronger language directing the Council, Bonneville, and the region to pursue investigating the feasibility of reintroduction of anadromous fish, including in the blocked U.S. waters of the upper Columbia. Most of the reintroduction work to date in the upper Columbia has been funded by the tribes, not by Bonneville and the action agencies. More work is needed, and the Council should continue to call on the federal agencies to fund necessary studies.

**Discussion:** For some time, the Fish and Wildlife Program has included a provision calling for investigations into the passage and reintroduction of anadromous fish above Chief Joseph and Grand Coulee dams if, when, and where feasible to address salmon and steelhead losses that were first adopted in the Council's 1987 Program. In 2014, the Council adopted a science-based, phased approach, including passage studies at the dams; habitat availability, suitability and salmon survival potential in habitats; potential selective releases of salmon and steelhead; and the scientific feasibility and possible cost of upstream and downstream passage options. In 2016 the Upper Columbia United Tribes (UCUT) presented work that their member tribes will be collaborating on with federal agencies, Washington Department of Fish and Wildlife, and other Columbia Basin Tribes and First Nations in British Columbia on habitat investigations, donor-stock assessments, life-cycle modeling, and other Phase 1 tasks. Some work has been completed for Phase I, but more remains. The Council completed a review of high-head fish passage technologies, and the Spokane Tribe of Indians (STI) received funds to begin a habitat assessment, but the amount of funds provided is insufficient to complete the assessment.

The Program includes pilot releases of anadromous fish in the blocked waters as a potential activity, but this has yet to be funded. While the Council is anticipating the results of the STI habitat assessment and UCUT's report on Phase I, the 2014 Program calls for Bonneville and the action agencies to fund research for the critical uncertainties above Chief Joseph Dam, which has not occurred. Studies needed include the pilot fish releases, reservoir studies to determine the use of Lake Roosevelt by juvenile salmonids, temperature studies within the reservoir, and flow studies both within the reservoir and in the tributaries.

Fish passage strategies in the Willamette Basin have continued. The Corps released its Configurations and Operations Plan in 2015 with several objectives and tasks laid out for the Corps to complete in an attempt to address juvenile passage in the Willamette Biological Opinion. Two recommendations of note were the pursuit of a different type of juvenile fish collector in Cougar reservoir and additional assessment in the Middle Fork prior to initiating juvenile passage measures.

**Progress report on the 2014 Program measures:**
Number of measures total: 10
Number of measures that have made progress: 10

See **Part II** for detailed Progress report on these measures.

## Resident Fish Mitigation Strategy

**Issue statement:** Resident fish and other native aquatic species, including freshwater mussels, white sturgeon, burbot, and several native trout species, have been impacted by the construction and operation of the hydrosystem. Impacts include losses to abundance, genetic diversity, life history diversity, spatial diversity and movements of these species, as well as modification of their habitat resulting from inundation. Resident fish losses from hydropower dam construction have not been determined for most of the Columbia River Basin. The 2014 Program recommended development of a standardized methodology for resident fish habitat loss assessments but this has yet to occur.

**Discussion:** The program recognizes the importance of all native resident fish and other freshwater species in maintaining ecosystem diversity and function and contributing to cultural aspects in the Columbia River Basin. The Program relies on a diversity of strategies to address those losses, including habitat mitigation, hatcheries, harvest augmentation, modification of hydrosystem operations, and research to identify and prioritize limiting factors and guide habitat mitigation projects. These strategies and projects target weak and recoverable populations in areas where anadromous fish are not present and that can support fisheries while also providing benefits to wildlife. The program also supports acquisition of land to preserve and enhance fish habitat equal in quality to the lost habitat, focusing on land that connects areas of healthy riparian and stream habitat. These land acquisitions could serve to inform assessments of native fish losses that resulted from blockages or inundation where habitat gains – acres, stream miles -- are credited against losses.

Resident fish losses from hydropower dam construction have not been determined for most of the Columbia River Basin other than in the Flathead and Kootenai rivers as the result of the construction of Hungry Horse and Libby dams. The 2014 Program recommended development of a standardized methodology for resident fish habitat loss assessments to serve as an approach for guiding resident fish loss mitigation, but this has yet to occur.

**Progress report on the 2014 Program measures:**
Number of measures total: Nine
Number of measures that have made progress: Six

See **Part II** for detailed Progress report on these measures.

## Sturgeon Strategy

**Issue statement:** The key issue for Columbia River Basin sturgeon is fragmented habitat from the construction and operation of the hydropower system that has isolated populations and limited access to food and suitable spawning and rearing habitat. White Sturgeon are highly migratory, and historically spent time wandering expanses of the mainstem and large tributaries. The strongest populations of sturgeon in the basin are those below Bonneville Dam with access to the marine environment. The Kootenai population is geographically isolated and listed under ESA as endangered. Sturgeon are unique fish given their size, unusually long-lives, late maturation, and ability to transition in and out of the salt zone (plume and ocean). Action agency focus in the mainstem has been on listed salmonids with little progress on the sturgeon measures, except for the Kootenai population.

**Discussion:** The 2014 Program has the most sturgeon measures of any Program to date. Fish and wildlife managers recommended sturgeon measures based on many aspects including mainstem passage, dam operations and flow, mainstem habitat, toxic containments, predation, research, artificial production, fishery monitoring, and stock assessments. While the federal Action Agencies have the responsibility to implement dam passage and operations improvements and studies, they are focused on salmonids and meeting FCRPS biological opinion requirements. While the states bring sturgeon research projects to the Corps of Engineers (COE) each year, the COE limits work to salmon and steelhead BiOp requirements and improvements for lamprey. The COE sturgeon activities focus on reducing mortalities from turbines and dewatering operations, and generally occur without direct expenditures of funding.

In areas where recruitment failure is severe, managers are relying on artificial production to help maintain and restore populations. This work is being led primarily by state agencies, tribes and PUD's and generally is guided by key regional sturgeon planning documents. Sturgeon work in the Kootenai includes habitat restoration, research, and hatchery production. Work in the lower mid-Columbia is focused on monitoring and evaluation of the isolated group and is currently studying the possibility of artificial production to restore these populations. In the fall of 2017, sturgeon managers in the basin will conduct a workshop to discuss many strategies to restore and protect sturgeon in the basin.

**Progress report on the 2014 Program measure:**
Number of measures total: 28

- Number of measures that have made progress: eight.
- Number of measures that have made some progress (limited to a specific geographic location and limited in scope): seven.
- Number of measures that have made no progress: 13.

See **Part II** for detailed Progress report on these measures.

## Lamprey Strategy

**Issue statement:** Efforts to improve lamprey survival are a priority in the Program as evidenced by the 20 measures and the several strategies (hydrosystem flow and passage options, predation control, and adaptive management) that are intended to address the needs of this species. Collaborative efforts have made progress in gathering and understanding the current status and needs of lamprey in the Columbia River Basin in recent years. The development of a synthesis report, as recommended by the Council in its 2011 review of Research, Monitoring and Evaluation and Artificial Production Projects remains an important need. Continued support and implementation of lamprey measures is needed.

**Discussion:** Lamprey efforts and support through the Program's five projects have allowed managers to continue to make progress on this culturally and ecologically important species. Since 2013, activity has been focused on the Lamprey Conservation Agreement Regional Implementation Planning Conservation Team (CT) that comprises a collaborative effort to identify and prioritize high-value lamprey projects by subbasin. In addition, efforts are in full swing with the USFWS Pacific Lamprey Data Clearinghouse; efforts to improve mainstem adult passage involving the Corps of Engineers and others; developing technologies to more effectively monitor out-migrating larval lamprey; developing and implementing genetic monitoring approaches; estimating abundance and escapement at Willamette Falls; and continuing to research lamprey supplementation strategies. Though much progress has been made regarding Program measures, the activities have only been making progress over the last 10 years, and more support and continued implementation of current activities are noted and needed.

**Progress report on the 2014 Program measures:**
Number of measures total: 20
Number of measures that have made progress: 17

See **Part II** for detailed Progress report on these measures.

## Eulachon Strategy

**Issue statement:** The main focus of Eulachon measures in the Program is understanding the extent to which Eulachon are affected by the hydrosystem and what restoration actions can be taken to improve productivity and survival. In the past, the Program contributed to the annual spawning stock biomass surveys, but no longer funds any monitoring or assessment work specific to Eulachon.

**Discussion:** Eulachon (smelt) are anadromous, listed as threatened, and managed by NOAA Fisheries. They are limited geographically in the basin to below Bonneville Dam and spawn primarily in the Grays, Cowlitz, and Sandy Rivers.

Eulachon measures in the program generally relate to NOAA's recovery plan and understanding the relationship between an altered system and smelt survival. Measures involve monitoring and evaluating species composition, abundance, and life stage requirements in the estuary and plume; understanding the causal mechanisms (shifts, timing, magnitude, and duration) of the hydrograph of the Columbia River and their relation to eulachon; and identifying migration/ behavior characteristics affecting survival of larval eulachon during their first weeks in the estuary-plume-ocean environment.

**Progress report on the 2014 Program measures:**
Number of measures total: Five
Number of measures that have made progress: Two

See **Part II** for detailed Progress report on these measures.

## Public Engagement Strategy

**Issue statement:** Public engagement measures are incorporated in the program to encourage 1) regular communication through multiple types of media with the public beyond our usual community at Council meetings, and 2) tracking of how effectively we communicate with the public.

**Discussion:** The Council's Public Affairs Division has the primary responsibility for communicating with the public. While the Division has not focused its communications specifically on the 2014 Program since it was adopted, the Division has expanded its use of social media, video, photos, and blogs since 2014 to try to reach a wider audience with news about the Council, including the Fish and Wildlife Program.

**Progress report on the 2014 Program measures:**
Number of measures total: Three
Number of measures that have made progress: Two

See **Part II** for detailed Progress report on these measures.

## Investment Strategy

**Issue statement:** The Council included the Investment strategy consisting of principles and priorities in its Program to provide clear expectations for implementing 2014 Program strategies and measures, and to provide a mechanism to dedicate funds to specifically address the Program's priorities. Seven priorities were identified and a key priority is to fix, repair, replace or otherwise protect past infrastructure and property investments. There has been no new funding in the Program outside the 2008 Fish Accords; therefore advancement or progress of non-accord-identified work has been significantly limited in the last ten years.

**Discussion:**

Protecting past Program investments was a predominant recommendation the Council received in the last Program amendment process. The investment protection comes largely in the form of operation and maintenance funds, which have not kept pace with level of infrastructure development. Progress on other emerging priorities (largely defined by Program recommendations) has been limited by the lack of available funds. Specific actions to address the priorities has come from workgroups, forums, public Council meetings, white papers and solicitations.

The strategy calls on Bonneville to fund any new obligations from identifying savings within the current program and, as necessary, from additional expenditures and to report annually on progress. New funds have not been available since the 2008 Fish Accords were established. All new work to implement the Council's 2014 Program have come from reductions in project expenses. The Council formed the Cost Savings Workgroup (CSW) to identify savings, based on a programmatic methodology for guidance and accountability. The role of the CSW workgroup expanded in during 2016 and 2017 to include preparing funding recommendations to the Council for implementation.

**Progress report on the 2014 Program measures within the Investment Strategy:**
Number of measures total: 10
Number of measures that have made progress: Nine

See **Part II** for detailed Progress report on these measures.

## Adaptive Management: Monitoring and Effectiveness (combined)

**Issue statement:** Overall, monitoring and effectiveness measures in the Program are being implemented in a consistent manner. However, there continues to be a need to assess the effectiveness of habitat actions implemented under the Program in a manner that will both inform the Council and improve the Program. To further advance the effectiveness of habitat actions, in 2016/2017, Council staff reviewed, with regional input, information produced and products developed under the ISEMP and CHaMP projects for their relevance to program needs and overall progress. In general, staff found that these projects are not fully addressing the program's habitat information needs, and thus, Council staff are currently working with the region to develop a program-focused habitat monitoring and evaluation approach. Additionally, there remains concerns about the adequacy of support for data management and sharing projects that facilitate program assessment and reporting.

**Discussion:** The Program strategy for habitat and habitat-related measures is currently the focus of staff work to improve access and synthesis of information to facilitate adaptive management of work related to this strategy. In this process, staff identified the need for a common synthesis tool to evaluate whether habitat actions have effectively reduced limiting factors to benefit targeted focal species' life stages.

The Council's Program relies on monitoring data to understand the state of the Columbia River Basin and to assess whether Program measures are contributing to achieving the Program's objectives, goals and vision. These monitoring data inform the Council about what actions have been implemented (implementation monitoring); the status and trend of focal species impacted by the hydrosystem (status and trend monitoring); and the habitat conditions and progress in addressing limiting factors to benefit focal species (effectiveness monitoring).

Monitoring information for salmon and steelhead is being synthesized to communicate status and trends using viable salmonid population indicators through the Coordinated Assessment effort, although funding for this effort is tenuous. Synthesis of monitoring information for other fish species is limited to various project reports, published papers, and individual agencies. The Council uses accessible monitoring information to regularly update and display status and trend information on the Program's fish information site, subbasin dashboards, high-level indicators report sites, and the annual report to the Northwest governors on Bonneville's fish and wildlife costs.

Additionally, it is important for the Council and ratepayers to understand whether actions implemented through the Program are having the intended outcome and achieving hydrosystem-impact mitigation. These mitigation actions are diverse and are intended to improve tributary and estuary habitat, hydrosystem operation and passage, hatchery programs, and instream flows for fish. Understanding why and how particular actions help address impacts will help guide the level and effort of future program investments. The Program's mitigation approach is based on the assumption that actions will create a desired change that benefits focal species and their habitat. Program strategies contain measures that guide actions, and those actions are assessed for effectiveness. The effectiveness component of the Program's Adaptive Management section focuses on improving effectiveness

assessments for water transactions and habitat actions, however evaluating the effectiveness of actions addressing all Program strategies is equally important.

**Progress report on the 2014 Program measures:**
**Monitoring:**
Number of measures total: Nine
Number of measures that have made progress: Nine

**Effectiveness:**
Number of measures total: 1
Number of measures that have made progress: 1

See **Part II** for the detailed Progress report on these measures.

## Adaptive Management: Research

**Issue statement:** One of the ways the Council intends to improve the Program is to increase scientific knowledge through research. All research projects must be consistent with the scientific method and appear likely to produce an outcome within a designated timeframe. Research funded under the Program needs to be tightly aligned with the Program's needs and produce findings in a manner timely to inform mitigation. Implementation of these criteria and tracking of results has been inconsistent across Program research projects. To this end the research projects funded through the Program must improve on how they clearly communicate their hypotheses and how they connect to a critical uncertainty, and must specify an end date by which findings will be available.

**Discussion:** To ensure that the Program directs effective mitigation, critical uncertainties need to be resolved and new methods and technologies developed. Priority critical uncertainties underlying mitigation actions implemented through the Program include whether improving habitat will address limiting factors and benefit the species' life stages and whether hatcheries are achieving their intended outcomes. As a mitigation program, the Council funds research that aims to inform management decisions and guide Program strategy and implementation in a timely fashion. To this end, research projects must address critical Program needs within a specified timeframe and with clearly defined hypotheses. The results from this research must be made available to the Council and all Program implementers that would benefit. These criteria are outlined in the Program and the Council's Columbia River Basin Fish and Wildlife Program Research Plan, which was completed in 2017.

**Progress report on the 2014 Program measures:**
Number of measures total: Five
Number of measures that have made progress: Three

See **Part II** for the detailed Progress report on these measures.

## Adaptive Management: Data management

**Issue statement:** Data gathered through Program-recommended projects needs to be provided in a manner that is informative both to the general public and for program reporting needs, not left solely as unedited field data. Data management has progressed but further improvements are needed to adequately manage and make information accessible in an informative manner. For example, estimates of aquatic habitat for fish other than salmon and steelhead are lacking. Funding remains the biggest drawback for most data management needs and for reporting derived estimates. Further improvements to ongoing efforts to secure documentation that provides information related to these data, including methods, protocols, reports, publications, and digital photographs and videos of projects should also be explored.

**Discussion:** Data gathered through the Program are a public resource. These data need to be accessible upon request and as feasible through websites. These data include biological and physical field measurements, derived estimates, as well as photographic and video documentation of the work and resulting changes that are achieved. Access to field data is important, and equally important is access to collaboratively derived estimates that better inform stakeholders about the condition of species and their habitat, what actions have been implemented, and how effective these actions have been in addressing limiting factors to benefit the targeted focal species life-stages. Improvements have been made in securing Program-funded data by, for example, Bonneville requesting that projects collecting data provide information about the database used and, as needed, report the data to the StreamNet database or data store. Improvements have also been made in providing access to salmon and steelhead adult and juvenile estimates. Improvements to documenting data-related information such as methods and publications has been made through Bonneville's development and support of PNAMP's MonitoringResources.org and the Regional StreamNet Library. A further need includes securing photographs and videos of projects as these are valuable information sources for conveying the Program's progress.

Bonneville and co-managers have supported StreamNet as a regional database for fish information, mainly salmon and steelhead. Through the collaborative Coordinated Assessments effort, co-managers have worked together to improve data sharing and to provide salmon and steelhead estimates for regional reporting. The current funding for data management by StreamNet and collaborative development of shared estimates has been level for many years. This has limited the speed of progress and may threaten the integrity of the Program's infrastructure and access in the future. Access to regional resident fish estimates is lagging due to a lack in prioritization and investment from the Council and Bonneville. Development of regional habitat databases was initiated through the ISEMP/CHaMP and programmatic AEM projects, but the databases are not easy to access and currently do not provide derived estimates in a manner informative to co-managers or the Program.

**Progress report on the 2014 Program measures:**
Number of measures total: three
Number of measures that have made progress: two

See **Part II** for the detailed Progress report on these measures.

# *DRAFT* 2014 Fish and Wildlife Program Implementation Assessment Report

## Adaptive Management: Evaluation and Reporting (combined)

**Issue statement:** Evaluation of information that can inform the Program and its implementation is an ongoing need. Bonneville continues to improve how it provides information about implemented actions and projects, and the Council continues to improve how Program-related information is made accessible by developing outreach tools that summarize relevant information in a more easily-consumable manner for non-technical audiences. However, further work is needed to synthesize and efficiently evaluate and report relevant data and convey progress toward Program goals and objectives. Some areas that the Council should focus on are the condition of species and habitat impacted by the hydrosystem, and progress made in addressing limiting factors to benefit species' life-stages. Evaluation is also needed to demonstrate whether Program-implemented actions are having the intended effect, such as reducing limiting factors and providing fish for harvest without adversely impacting other fish. Further improvements in annual project reports to Bonneville, such as separating research reports from monitoring reports, remains an ongoing task.

**Discussion:** The Program has long supported projects that gather data to inform various decisions. These data need to be analyzed, summarized, and interpreted at various scales to inform decisions at all levels, such as whether fish in management units need to be managed differently or whether the overall fish population abundance is trending as expected. To improve the Program, there is a need to ensure that relevant data are evaluated at the scale needed to support Program-level reporting and to inform the Program amendment process. Program information is summarized and made available at different scales, including data, graphically displayed information, derived estimates, summarized reports, and other formats. Bonneville, co-managers and others implementing the Program contribute to this overall task of providing information in a manner that addresses stakeholder interest, such as by graphically displaying population-level estimates, improving management of data, collaborating in providing estimates, and assisting with development and updating of Program reporting sites. To this end, the Council has worked with the region to maintain and refine its Program data reporting sites, including high-level indicators, the fish information website, subbasin dashboards, and reports to the Northwest governors on Bonneville's fish and wildlife costs.

In light of past collaborative efforts, an area that would benefit from renewed attention is the regional approach for evaluating hatcheries and their effectiveness. Over time, the evaluation process for other Program strategies and measures will need to be discussed.

**Progress report on the 2014 Program measures:**
**Reporting:**
Number of measures total: 4
Number of measures that have made progress: 4

**Evaluation:**
Number of measures total: four
Number of measures that have made progress: four

See **Part II** for the detailed Progress report on these measures.

# Part II. Detailed Progress Report for 2014 Fish and Wildlife Program Measures

## Goals and Objectives

**Progress report on the 2014 Program measures:**
Number of measures total: Four
Number of measures that have made progress: Three

*Update on active measures:*

- ***Measure 1****: Objectives for adult salmon and steelhead*
  **Update:** Existing objectives for natural origin adult salmon and steelhead have been compiled and reviewed by co-managers. These objectives are organized into three categories, and are viewable by subbasins, major population groups, and by populations. All compiled objectives are viewable on the Program Resource Maps for Fish Objectives. Further work on refining Program salmon and steelhead objectives is being coordinated with the NOAA Columbia Basin Partnership Task Force effort. Hatchery-origin salmon and steelhead indicators work is ongoing by the co-managers through the Coordinated Assessment process. The co-managers are currently working on providing natural-origin indicators to Bonneville, and once these are completed the effort will shift to the hatchery indicators task.
- ***Measure 2****: Other anadromous and resident fish objectives*
  **Update:** Staff is compiling existing lamprey, sturgeon, eulachon, bull trout, cutthroat trout, and kokanee objectives. Staff co-organized a bull trout workshop with StreamNet and Montana Fish, Wildlife, and Parks to receive preliminary input on the bull trout objectives. Staff plans to have all compiled objectives for these fish species reviewed and accessible through the Program Resource Maps for Fish Objectives by early 2018.
- ***Measure 3****: Ecosystem function, habitat, and hydrosystem objectives*
  **Update:** Staff is collaborating with the Pacific Northwest Aquatic Partnership regional habitat indicator project to identify existing aquatic habitat objectives that could be considered for the Program. This effort is ongoing and has focused on water quality, stream temperature, flow, and macroinvertebrates indicators.

*Update on measures lacking action or agreement:*

- ***Measure 1****: Ecosystem function, habitat, and hydrosystem objectives*
  **Update:** Staff has not initiated work on the ecosystem function and hydrosystem objectives. Potential hydrosystem objectives for lamprey were submitted during the 2014 Program amendment, and these could be considered during the next Program amendment.
- ***Measure 2****: Public engagement quantitative objective*
  **Update:** Staff has not initiated work on this task. This task is described as an internal Council process and likely could be completed prior to the next Program amendment process.

## Ecosystem Function Strategy

**Progress report on the 2014 Program measures:**
Number of measures total: 14, implemented by 11 sub-strategies which are discussed in more detail individually following this 2 page summary.
Number of measures that have made progress: 14

*Update on active measures:*

- ***Measure****:* Identify and protect mainstem habitat for spawning, resting, rearing, and migrating fish; protect aquatic conditions connections to floodplains.
  **Update:** *Habitat and passage conditions have been improved in many areas of the basin but more work needs to be done.*
- ***Measure:*** Support expansion of productive populations and to connect weaker and stronger populations.
- **Update:** *Improvements in passage restrictions, reintroduction efforts, and the use of genetic information to manage and develop localized broodstocks have resulted in improvements in some, but not all, areas.*
- ***Measure:*** Protect, enhance, restore, and connect freshwater habitat.
  **Update:** *Water acquisitions and barrier removals have improved connectivity in many, but not all areas*.
- ***Measure:*** Protect and enhance subbasin-scale aquatic habitat connectivity.
- **Update:** *Long-term funding agreements have increased implementation of large-scale 'ridgetop to ridgetop' habitat restoration projects that appear to be successful.*
- ***Measure:*** Allow for diversity to increase among and within populations and species to increase resilience to natural variability.
- **Update:** *Many habitat restoration projects seek to restore floodplain and channel complexity, which provides a range of habitat types used by a diversity of organisms.*
- ***Measure:*** Ensure that changes in water management have fish and wildlife benefits.
- **Update:** *Existing and anticipated water management actions and operations in the mainstems is largely premised on fish benefits, along with flood control and power generation. Managing water in the tributaries for the benefit of fish works well in some, but not all, tributaries.*
- ***Measure:*** Frame habitat restoration in the context of measured trends in water quantity and quality, including reducing high water temperature.
- **Update:** *Widespread monitoring systems are in place but need to be rationalized and made more efficient. Basinwide increases in water temperature suggest a need to emphasize protection and expansion of cold-water habitat in upland areas.*
- ***Measure:*** Consider the effect of the estuary and near-shore plume on the diversity of salmon and steelhead populations.
- **Update:** *Estuary and plume ecosystem functions are better understood, some estuary habitat has been restored, and progress has been made to restore ecosystem function. The threat of sea level rise to estuary habitat restoration actions has generally not been considered.*
- ***Measure:*** Understand the status of habitat and other ecosystem functions to better inform decisions.

- **Update:** *Widespread monitoring systems are in place that can generate qualitative information, but there is an ongoing need for monitoring efforts to be rationalized and made more efficient. Quantitative habitat information that describes ecosystem function is generally beyond the state of the science.*
- ***Measure:*** Develop metrics of juvenile recruits-per-spawner in order to evaluate habitat effectiveness.
- **Update:** *Natural-origin recruits-per-spawner metrics have been developed for many priority salmon and steelhead populations through the Coordinated Assessments process. It will not be possible to develop these metrics for all natural-origin populations.*

**Habitat Strategy**

**Progress report on the 2014 Program measures:**
Number of measures total: 19, including 12 mainstem measures
Number of measures that have made progress: 12
*Note there are many additional specific subbasin measures in Appendix O of the 2014 Fish and Wildlife Program that address the Program's habitat strategy. Some are implemented, and some are not at this time (June 2017).

*Update on core general measures:*

- ***Measure 1****: Removing fish-passage barriers*
  **Update:** 938 miles of habitat made accessible to fish since 2014
- ***Measure 2:*** *Screening water diversions*
  **Update:** 38,029 acre feet of water screened since 2014
- ***Measures 3, 5 and 6:*** *Protecting and improving riparian, floodplain and terrestrial habitats in all areas of the Columbia River Basin including land purchases.*
  **Update:** 3,026 stream miles, or 194,264 acres of habitat restoration, and 134,084 acres of other lands protected since 2014.
- ***Measures 4 and 7:*** *Improve flows through water acquisitions*
  **Update:** 480,161 acre-feet of water acquired or secured since 2014

*Update on Mainstem measures*:

- ***Measure:*** *Protecting and enhancing mainstem riparian areas and wetlands*
  **Update:** 2,395 acres of wetlands and shallow-water habitat were restored in the lower Columbia River and estuary in 2015 and 2016.
- ***Measure:*** *Identifying, protecting, restoring, and managing thermal refugia*
  **Update:** EPA, Oregon DEQ, the USACOE and LCEP are collaborating to compile a report and map of cooler-water areas along the mainstem Columbia used by salmon and steelhead.
- ***Measure:*** *Coordinating actions with flow measures to improve ecosystem function.*
  **Update:** The Dalles Dam: improvements to the east ladder auxiliary water supply to improve ladder reliability. Lower Granite Dam: fish ladder modifications to the auxiliary ladder intake pumps and discharge routing to reduce temperature differences. Also, upgrades to the juvenile bypass system were begun. Ice Harbor Dam: modification of

the spillway chute and deflector for the spillway weir bay for improving downstream migration.

*Update on mainstem measures lacking action or agreement:*

- ***Measures:*** *Protecting and creating more mainstem shallow-water habitat including lateral channels and alcoves*
  **Update:** Some work has been done in the lower river and more in the estuary. Limited work has been completed in other mainstem areas.
- ***Measures:*** *Reconnecting protected and enhanced lower tributary habitats to protected and enhanced mainstem habitats*
  **Update:** No significant work has been done.
- ***Measure:*** *Increasing mainstem spawning habitat for salmon, sturgeon, and lamprey.*
  **Update:** No significant work has been done to increase mainstem spawning habitat

**Stronghold Strategy**

**Progress report on the 2014 Program measures:**
Number of measures total: Six
Number of measures that have made progress: Two (indirectly)

*Update on active measures:*

- ***Measure*** *Request states to identify strongholds.*
  ***Update:*** The Council has not made a formal request of the states; therefore no candidate strongholds have been considered to date.
- ***Measure:*** *Consider for recognition, stronghold areas designated by states and tribes.*
  ***Update:*** *No responses to date; therefore no formal consideration process needed.*
- ***Measure:*** *Keep up-to-date maps of strongholds and areas managed for wild fish.*
  ***Update***: No universally agreed-upon strongholds to map. However StreamNet created early maps overlaying the NASSP's candidate stronghold polygons over protected area maps.
- ***Measure:*** *Inventory past and current actions taken in stronghold areas.*
  **Update:** No inventory of actions has been taken; no stronghold designations.
- ***Measure:*** *Support habitat actions to improve strongholds.*
  **Update:** No current stronghold designations exist***.*** The program funds some habitat work in areas commonly thought to be stronghold areas. No targeted or extra investments made explicitly in or for stronghold areas.
- ***Measure:*** *Support actions that eradicate non-native invasive species from or prevent introduction to strongholds.*
  **Update:** The program funds non-native and invasive species prevention work in areas in the basin, as well as in or near river reaches commonly thought to be stronghold areas. No targeted or extra investments have been made explicitly in or for non-designated stronghold areas.

*Update on measures lacking action or agreement:*

- ***Measure:*** *Request of states to identify strongholds, and consider for recognition into the program.*
  **Update:** Two big challenges for establishing an agreed-upon stronghold designation include agreement on selection criteria and wariness of potential management changes within the area, (e.g. land use restrictions, project funding, and other management implications). Despite the social difficulties, some progress has been made with individual states in designating areas as wild salmonid management zones, wild fish management areas, or wild steelhead gene banks. These designations share many of the same principles as strongholds with the primary focus being on limiting or restricting hatchery releases. To the extent that individual states make these designations through public review and adoption processes, the Council could consider to acknowledge them in the program. In July 2016, WDFW presented to the Council on their Steelhead gene bank areas. The comparison was made to strongholds, but no request was made to the Council to consider them strongholds. The Council members may play a key role in gauging interest and progress in the area within their own states.

- ***Measure:*** *Mapping, tracking, and supporting strongholds*
  **Update:** These are dependent on having recognized strongholds. If none is identified and considered, then the mapping, tracking, and supporting measures are moot.

**Non-native and Invasive Species Strategy**

**Progress report on the 2014 Program measures:**
Number of measures total: Six
Number of measures that have made progress: Five of six, but vigilance and action are required.

*Update on active measures:*

- ***Measure*** *(paraphrased): Prevent establishment: The Council encourages federal and other regional entities to monitor, manage, suppress, reduce, or control non-native invasive fish species where identified; to develop public outreach tools; and directs BPA and other federal agencies to assist the Northwest states to prevent the establishment of quagga and zebra mussels.*
  **Update:** The Columbia River Basin (CRB) Team, comprised of state, federal, Tribal, and university ANS managers and researchers, has been established as part of the 100th Meridian Initiative to 1) prevent the spread of zebra mussels and other aquatic nuisance species (ANS) into the western United States and 2) monitor and control zebra mussels and other ANS if detected in these areas. Most of the Initiative's activities are centered on monitoring and education. The Pacific States Marine Fisheries Commission (PSMFC) and the Bonneville Power Administration are designated as the lead agencies to coordinate vulnerability assessments at all Columbia River Basin hydropower facility structures. As of January 2017, Vulnerability Assessments have been completed at four Canadian dams, 12 Army Corps of Engineers dams, three Snake River dams and one Snake River gauge. Vulnerability assessments are planned at Brownlee, Swan Falls, and Bliss Dam on the Snake.

A newly implemented U.S. Army Corps of Engineers (Corps) cost-share program will add significant resources to efforts to prevent establishment of quagga and zebra mussels in the Columbia River Basin. The cost-share program will support Watercraft Inspection and Decontamination Stations (WIDs) and monitoring of quagga and zebra mussels in Oregon, Washington, Idaho, and Montana. The Corps completed a letter report and Environmental Assessment to support their participation in the cost-share program, which is coordinated through PSMFC, and secured funding for Fiscal Years 2016 and 2017. The Council has written to Congress in support of continued funding for this effort in Fiscal Year 2018.

- ***Measure:*** *Monitor and control non-native species introduction and dispersal: Each of the four Northwest states should continue to implement the preventative strategies in their respective state aquatic nuisance species management plans and coordinate their prevention efforts closely with the other Northwest states and British Columbia.*
  **Update:** All four northwest states have Aquatic Nuisance Species management plans, and most also have Rapid Response Plans specific to Dreissenid Mussels. However, invasive mussels remain a serious threat.
- ***Measure:*** *Removal and eradication of non-native species: Agencies and tribes shall apply existing and new scientific research on the most effective control methodologies; use appropriate removal, and monitor effectiveness; employ lethal take when appropriate; prioritize non-native species control actions to address the most significant threats; and require that BPA and other federal agencies, along with FERC-licensed utilities, support regional rapid-response efforts if quagga and zebra mussels become established.*
  **Update:** In the fall of 2016, tests came back positive for aquatic invasive mussels in the Missouri drainage of Montana. Montana is using decontamination stations, closures and restrictions; expanding watercraft inspection stations and strengthening the statewide invasive species programs. Montana is developing a Future Rapid Response Plan for Invasive Species. Yellowstone National Park is installing movable barriers in front of boat launches to keep uninspected boats from entering Yellowstone and Lewis Lakes when entry points and check stations are not staffed.
  Northern Pike, a voracious and invasive predator species, have become established in the Box Canyon and Lake Roosevelt reservoirs. Once detected, growth is shown to be exponential, and removal efforts must begin immediately and be sustained. The co-managers in the relevant reservoirs are working diligently to address this threat.
- ***Measure:*** *Reduce competition: The federal action agencies, other federal and state agencies, tribes, and the Council should continue to review, evaluate, develop, and implement strategies to reduce competition from non-native fish species with juvenile and adult salmonids.*
  **Update:** For species like bass and walleye, little has been implemented to reduce competition. State agencies are faced with established fisheries for some non-native populations. This remains an unresolved policy issue. Targeted and co-managed netting operations in Lake Roosevelt have been designed to prevent further establishment of invasive Northern Pike below Chief Joseph Dam, with the objective of protecting upper Columbia salmon and steelhead, as well as other populations lower in the Columbia River system.

- ***Measure:*** *Regional coordination: The Council will continue to coordinate regional stakeholder groups; assist with communication, coordination and public outreach efforts; facilitate regional science/policy forums as appropriate; support and coordinate with the PSMFC 100th Meridian Initiative-Columbia Basin Team, requesting regular reports; and assist regional entities with legislated prevention efforts.*
  **Update:** The Council continues its support of the PSMFC 100th Meridian Initiative-Columbia Basin Team, with briefings by Stephen Phillips (PSMFC) and Lisa DeBruyekere of Creative Resource Strategies, LLC on the framework for a regional defense against quagga and zebra mussels; and the Council blogs on emerging and timely issues like Northern Pike and other nuisance and invasive species. The Council also continues to support federal appropriations for the Corps' cost-share program and other federal invasive species initiatives.

*Update on measures lacking action or agreement:*

- ***Measure:*** *Evaluate potential adverse impacts: The Council, in coordination with the federal action agencies, other federal, state and tribal entities, and regional organizations should request regional power producers to evaluate the invasive potential and ecological risks of using non-native bioenergy feedstock species, cultivars, and hybrids.*
  **Update:** No action to date. It is not clear that an action is required at this time.

**Predator Management Strategy**

**Progress report on the 2014 Program measures:**
Number of measures total: 14
Number of measures that have made progress: 10

*Update on active measures:*

- ***Measure****: Management of Predator Birds.*
  **Update:** The Program encouraged more aggressive efforts by the Corps of Engineers (COE) and others to make the fullest possible use of their existing authority to remove or manage avian predation that is impacting wild fish populations and to implement predator-bird management plans and actions.

  COE's Anadromous Fish Evaluation Program (AFEP) Avian Predation Studies reported results in 2016 on each of the four studies cited in the ISAB's Critical Uncertainties Report, three of which set out to provide status and trends data on Caspian tern breeding rates at the most significant colonies in Washington and Oregon and one modeling study to estimate the level juvenile salmonid survival rates would be reduced by modifying avian habitat to deter predation. These four AFEP avian predation studies are closely integrated and complement the Avian Predation on Juvenile Salmon Project which has successfully monitored trends in the abundance and feeding rates of piscivorous (fish eating) birds in the estuary, Columbia Plateau, and at alternative sites where the COE has relocated nesting habitat.

Further AFEP reports on 2016 monitoring, research and management plan implementation and associated actions taken were reported at the end of 2016:

- The COE is leading management efforts to reduce predation rates by Caspian terns by reducing the size of the nesting colony on East Sand Island (ESI) and preventing terns from nesting elsewhere in the estuary. BPA funded management and effectiveness monitoring to reduce nesting habitat for Caspian terns on ESI during 2016. Birds were encouraged to nest in COE-constructed islands in Southeastern Oregon and Northern California.

- COE and the Bureau of Reclamation implemented the Inland Avian Predation Management Plan (IAPMP) to dissuade Caspian terns from nesting in the Columbia Plateau region and, as a result, eliminate breeding colonies from nesting on Goose Island in Potholes Reservoir and Crescent Island in McNary Reservoir. Management was fully successful in 2016, thereby nearly eliminating predation on juvenile salmonids by Caspian terns nesting at these two sites.

- COE developed the Double-crested Cormorant Management Plan for the Estuary, and the action agencies adopted monitoring strategies on East Sand Island to help determine how many birds to cull. In 2015, the COE began culling the East Sand Island population by shooting adult birds and spreading oil on cormorant eggs in their nests so they wouldn't hatch. The COE plans to cull 10,000 birds through 2019.

- ***Measure:*** *Management of Predator Fish.*
  **Update:** PSMFC Northern Pikeminnow Sport Reward Fishery aims to control this predator in the lower Columbia and the Snake. WDFW and ODFW administer the program. This project also involves the Pacific States Marine Fisheries Commission (PSMFC) and is primarily focused on status and trends monitoring, with some additional research. Additional objectives are to characterize population dynamics of pikeminnow, smallmouth bass, and walleye in the lower Snake River reservoirs and assess evidence of possible intra- and inter-specific compensatory responses by these predators related to the sustained removal of pikeminnow.

- ***Measure: Management of predator seals and sea lions.***
  **Update:** CRITFC administers non-lethal hazing from boats in the river up to Bonneville Dam to deter California Sea Lions from returning to the dam to prey on salmon. COE conducts monitoring at Bonneville Dam to determine abundance and distribution and track and identify individual pinniped behavior. WDFW and ODFW have legal authority to trap and remove specific animals who've been observed and marked as repeat predators. Sea Lions are at carrying capacity from Astoria to Bonneville Dam. In April 2017, NMFS reconvened the Bonneville Pinniped-Fishery Interaction Task Force regarding the application of Section 120 of the Marine Mammal Protection Act (MMPA). The group tasked to evaluate the efficacy of the five-year authorization that allowed the states' lethal take of sea lions under the MMPA. The group determined that inriver hazing from boats has been ineffective, yet recommended an increase in hazing at the

fish ladder. The group also recommended expanding monitoring from the current observation zone (currently only at the dam) and placing observers on ships moving upriver. The group also recommended deploying mobile observation via drones, and proposed enhanced techniques to identify and label predator sea lions for removal. The Task Force concluded that this issue remains complex but that the pinniped fishery interactions have not been eliminated by the state's removal program. The group was able to provide NMFS with a range of alternatives as it considers the program's efficacy and next steps, yet consensus was that the program is having only a modest degree of success at best.

- ***Measure:*** *Emerging Priorities #3: aggressively addressing non-native and invasive species.*
  **Update:** Control of non-native predators including Northern Pike, Smallmouth Bass, and Walleye is mostly limited to changes in state fishing regulations, as recreational fisheries for these species are popular. However, there are efforts to control the abundance of Northern Pike before they have the chance to migrate downriver. Significant efforts are being made in Lake Roosevelt to suppress Pike. The Spokane and Colville Tribes and WDFW are collecting population data, while the Kalispel Tribe is working on the problem in the Pend Orielle River. Similar efforts are being made in British Columbia. State fishing regulations place no limits on pike angling; anglers are encouraged to not release live fish after capture.

  Northern Pike numbers have grown exponentially in Lake Roosevelt this year, and it is becoming clear the problem may not be surmountable under current funding. The STOI recently submitted a request to the BOG for additional funding for more gillnets to get ahead of the problem. The ISRP reported the project meets scientific review, yet noted that much more analysis and policy development is needed to justify a long-term program to suppress northern pike in Lake Roosevelt. The ISRP posed qualifications for future review and encouraged the development of a monitoring program. Finally, the ISRP suggested that an overall strategy for controlling these predators requires broader discussion within the Fish and Wildlife Program.

*Update on measures lacking action or agreement:*

- ***Measure:*** *The federal action agencies, in cooperation with the Council, state and federal fish and wildlife agencies, tribes, and others, should convene a technical work group to: (a) determine the effectiveness of predator-management actions; and (b) develop a common metric to measure the effects of predation on salmonids, such as salmon adult equivalents, to facilitate comparison and evaluation against other limiting factors. Once developed and agreed upon, future predator-management evaluations funded by the action agencies should include a determination of the effectiveness of such actions and the common predation metric in their reports.*

  **Update:** The ISAB developed its Predation Metric Report per the Council's March 3, 2016 request to inform the future technical workgroup cited in the 2014 Program to develop standardized predation metrics to help determine the effectiveness of predator

management actions. The Council recommended deferral of the formation of a technical workgroup on predator-management issues until the ISAB could provide information to help inform the future workgroup's efforts. The ISAB report came out on October 5, 2016 and was presented to the Council in October. The technical workgroup has not been formed to date.

**Protected Areas and Hydroelectric Development and Licensing Strategy**

**Progress report on the 2014 Program measures within the Protected Areas and Hydroelectric Development and Licensing Strategy:**
Number of measures total: Two
Number of measures that have made progress: One
Number of measures that have made partial progress: One

*Update on active measures:*

- ***Measure****: Ensure that new hydroelectric development is carried out in a manner that protects the remaining fish and wildlife resources of the Columbia River Basin and the Pacific Northwest and does not add to the region's and ratepayers' mitigation obligation.*
  **Update*****:*** *The Council's hydroelectric development standards are not actively monitored at this time, but staff believes that the basic standards are generally being met. The Council could consider if a more deliberate monitoring effort is necessary.*

- ***Measure****: The Council supports protecting some streams and wildlife habitats from hydroelectric development where the Council believes such development would have major negative impacts that could not be reversed.*
  **Update:** Implementation of Protected Areas is occurring. Staff monitors and corresponds with FERC as required.

**Water Quality Strategy**

**Progress report on the 2014 Program measures:**
Number of measures total: 11
Number of measures that have made progress: six

*Update on active measures:*

- ***Measure****: Project operators should continue to monitor TDG and water temperatures, develop and implement fish passage strategies, and complete water temperature modeling in the mainstem*
  **Update:**
  - Project operators monitor TDG and water temps in the forebays at each project. In recent years the action agencies began monitoring temps at fish ladders and developed criteria for ladder temperatures. A court-ordered spill operation will occur in 2018 as a strategy to improve fish passage. This could impact TDG levels.

  - Implement fish passage strategies. See above – during warm water years and months fish ladder temperatures are monitored and managed to maintain safe passage for adult migration.
  - There has been no action on the water temperature modeling in the mainstem.
- ***Measure:*** *The Corps should continue to develop and use the SYSTDG model for estimating TDG production and develop and use CE-QUAL-W2 for estimating effects of cold-water releases from Dworshak*
  **Update:** The Corps has plans to use both SYSTDG and CE-QUAL-W2 in their analysis for the new Environmental Impact Statement and biological opinion.
- ***Measure:*** *To address toxic contaminants, the Council will support and coordinate periodic science/policy workshops on state of the science and will assist regional parties in advancing public education and information*
  **Update:** The Council is participating with basin partners in an effort to develop maps of toxic contaminants across the Basin. A pilot effort with Polycyclic Aromatic Hydrocarbons (PAHs) is occurring; data from multiple agencies has been merged, and the partners are looking for support from the Council to create a publically accessible map.
- ***Measure:*** *The federal action agencies should partner with and support ongoing efforts by other agencies to monitor, assess and map high priority toxic hot spots and assess the effects of toxic contaminants on native fish*
  **Update:** See previous measure on PAH mapping exercise
- ***Measure:*** *The federal action agencies should partner with and support other agencies to conduct targeted monitoring of vulnerable native fish and wildlife for specific, high-priority toxic contaminants and the effects on reproductive success*
  **Update:** NOAA Fisheries, in cooperation with USGS, USFWS, EPA and BPA, conducts research and monitoring on the effects of toxic contaminants on salmon, however there are still many data gaps and uncertainties.
- ***Measure:*** *At each federal hydropower project, operators should monitor and report spills and develop and implement best practices for reducing spills and leakages of oils and lubricating fluids*
  **Update:** The operators have plans in place for this. Information is reported through the Technical Management Team and associated sub-teams.

*Update on measures lacking action or agreement:*

- ***Measure:*** *The Council urges Congress to provide funding to protect and restore water quality in the Basin including contaminants*
  **Update:** Federal funding for cleanup of contamination of Columbia River waters has been limited -- including some grants and loans for waste water treatment plant upgrades, a few pesticide turn in programs and some limited emergency removal actions in the Northport WA area and near Portland Harbor.

- ***Measure:*** *The Action Agencies, FERC and non-federal operators, in collaboration with EPA and other agencies (federal, state, tribes) should update and implement a water quality plan, and implement measures to improve water temperature and TDG*
  **Update:** A water quality plan has not been created although actions to improve water temperatures and TDG are ongoing.

- ***Measure:*** *The Federal Action Agencies should incorporate TMDL provisions into their operations*
  **Update:** No action
  ***Measure:*** *Federal Action agencies, in cooperation with EPA and other agencies, should support implementation of the regional 2010 Columbia Basin Toxics Reduction Action Plan, and should monitor and implement measures to reduce toxic contaminants*
  **Update:** The Columbia River Basin Restoration Act (CRBRA) was signed into law on December 16, 2016 as part of the Water Infrastructure Improvements for the Nation (WIIN) Act. The CRBRA authorizes a grant program administered by the U.S. EPA to help local groups voluntarily clean up, monitor, and reduce the use of toxics within the Columbia River Basin. Congress has not appropriated funds for implementation.
- ***Measure:*** *Action agencies should identify where aquatic habitat restoration projects may be affected by toxic contaminants and incorporate pollution reduction and mitigation techniques into design*
  **Update:** PCB cleanup at Bradford Island terminal has been conducted by the U.S. Army Corps of Engineers. A remedial investigation report completed in 2012 concluded that additional cleanup work is needed, as indicated by high contaminant levels in some fish. A comprehensive assessment of where aquatic habitat restoration projects are affected by toxic contaminants has not been conducted.

**Climate Change Strategy**

**Progress report on the 2014 Program measures:**
Number of measures total: 15
Number of measures that have made progress: 11

*Update on active measures:*

- ***Measure****:* The federal action agencies shall support the development of improved and earlier runoff forecasting measures and techniques, including expansion of the network of surface weather and streamflow stations in the high-altitude mountainous regions
  **Update:** The action agencies are aware of this need and gradual improvements to the forecasting tools and infrastructure are being implemented.
- ***Measure:*** The federal action agencies shall assess whether climate change is effecting river flows, water temperature or other habitat attributes and assess whether alternative water management strategies could minimize effects of climate change
  **Update:** There is an ongoing effort among the COE, BPA and university scientists (RMJOCII) to update river flows in the Basin using newly developed climate models.
- ***Measure:*** The federal action agencies shall evaluate the effectiveness and feasibility of possible actions to mitigate the effects of climate change, e.g. selective withdrawal or cold-water refugia.
  **Update:** Selective withdrawal technologies were implemented at Lower Granite Dam by the COE. The COE is also designing water temperature control structures for some high head Willamette subbasin dams. EPA and other agencies are conducting studies on mainstem cold-water refugia and use by salmonids.

***Measure:*** The federal action agencies shall advise on ongoing monitoring efforts to ensure collection of data on key species responses under climate change.
**Update:** Several federal agencies are actively working to locate and characterize cold water habitat for focal species such as Bull Trout and burbot. An expansive federal effort, the NorWeST database is compiling data on climate change impacts on stream temperatures and linking that information to effects on salmon and other species.

- ***Measure:*** The federal action agencies shall implement long-term habitat protections for resident fish and wildlife
- **Update:** Bonneville is supporting habitat restoration and protection projects throughout the basin.
- ***Measure:*** Management agencies shall strive to help native species accommodate a variety of climate and ocean conditions by providing a wide range of life-histories
  **Update:** Life history diversity preservation is a value of all fish and wildlife management agencies in the basin and is an intended outcome of many other Program measures.
- ***Measure:*** The Council supports ongoing studies and development of assessment methods by federal action agencies
  **Update:** The Council's recently adopted Research Plan supports this measure.
- ***Measure:*** The Council continues to encourage, monitor and promote public awareness of climate change research and assess how it should influence mitigation efforts
  **Update:** The Council frequently highlights climate change issues on the Council blog and through the Council newsletter.

*Update on measures lacking action or agreement:*

- ***Measure:*** The federal action agencies shall continue to promote public awareness of climate change research and assess how it should influence program mitigation
  **Update:** Recent policy changes are de-emphasizing the importance and urgency of responding to climate change.
- ***Measure:*** The federal action agencies shall investigate the feasibility of mitigating climate change impacts in the estuary and plume through hydropower operations
  **Update:** Several estuary and lower river habitat improvement actions have been implemented that may also have climate change mitigation value. Much more work is needed.
- ***Measure:*** The Council, in collaboration with the federal action agencies, shall convene one or more science/policy workshops on climate change effects in the Basin
  **Update:** Not implemented.
- ***Measure:*** The Council continues to require project sponsors to consider and plan for different climate change scenarios that could affect their work.
  **Update:** All project sponsors are required to consider climate change when filling out project proposals. However, most projects do not incorporate climate adaptation into their project design and implementation.

**Mainstem Hydrosystem and Flow Strategy**

**Progress report on the 2014 Program measures:**
Number of measures total: 21

Number of measures that have made progress: All have made some progress, but eight have major unaddressed components.

*Update on active measures:*

- ***Measure:*** *The current biological opinion (BiOp) provides the baseline flow and passage measures for the Council's Program.*
  **Update:** The AAs are currently preparing a new BiOp, along with an Environmental Impact Statement (EIS). The EIS will include a range of alternatives for long-term system operations and evaluate the potential environmental and socioeconomic impacts on flood risk management, irrigation, power generation, navigation, fish and wildlife, cultural resources, and recreation. It will be important to track and engage in this process.
- ***Measure:*** *Using adaptive management, continue to investigate and update flow and passage measures.*
  **Update:** Studies conducted under AFEP, along with studies on issues such as mainstem cold-water refugia and migration timing, continue to provide updated information. During the high temperature, low flow conditions of 2015, regional collaboration and communications demonstrated adaptive management in action.
- ***Measure:*** *Fish Passage Center (FPC), Columbia River Data Access in Real Time (DART) and other entities contribute to and house information relevant to the Program. The FPC Oversight Board annually reviews the FPC's performance*
  **Update:** The data centers continue to operate in a coordinated fashion to provide extensive real-time information on fish passage across the basin. The need for the FPC oversight board has not been seen as necessary for several years. The ISAB annually reviews the FPC report on the Comparative Survival Study.
- ***Measure:*** *AAs and Mid-Columbia PUD shall continue to implement operations to protect fall Chinook in the Hanford Reach.*
  **Update:** Currently being implemented.
- ***Measure:*** *FERC relicensing of Hells Canyon Complex.*
  **Update:** Ongoing process with negotiations underway between Oregon and Idaho.
- ***Measure:*** *Passage at mid-Columbia PUD dams.*
  **Update**: Actions implemented per FERC. Grant PUD implemented a surface sluiceway route for juveniles at Preist Rapids Dam.
- ***Measure:*** *Maintain and improve juvenile fish passage survival.*
  **Update:** Studies, reviews, and infrastructural changes ongoing through the AFEP process.
- ***Measure:*** *Spill considerations.*
  **Update:** A court-ordered spill operation will be conducted in 2018 to increase spring spill operations up to the state Total Dissolved Gas (TDG) caps. The design of that spill is under development by the agencies. Monitoring and adaptive management need to be emphasized, as do the impacts/benefits of spill on non-listed species.
- ***Measure****: Juvenile fish transportation where there are demonstrated benefits to fish.*
  **Update:** Transportation continues to be evaluated under an adaptive management framework.
- ***Measure:*** *AAs should continue to implement improvements to adult fish passage.*

**Update:** Research, monitoring, and evaluation continues throughout the hydropower system. Capital improvements have occurred in some locations; PIT-tag and other monitoring tools are being utilized and improved.

- ***Measure:*** *Power system considerations (3 measures).*
  **Update:** The current power system consideration is focused on the generation and revenue effects of the court order to increase spill. Another power system issue related in part to the Fish and Wildlife Program is the spring hydropower oversupply problem. Council staff may be asked to investigate the effects of these issues on the regional power system.

Update on mainstem measures lacking action or agreement with one major unaddressed components:

- ***Measure****: The Action Agencies (AAs) shall manage waters and provide flows and reservoir conditions to promote productive populations of anadromous and resident fish.*
  **Update:** Flows and spill have been adjusted over time to better meet the needs of native fish. However, reservoir conditions continue to deviate from normative conditions. Reservoir conditions have allowed some undesirable resident fish populations, such as pikeminnow, to expand significantly. At the same time, many other native fish species, such as lamprey, Bull Trout, and White Sturgeon, have experienced marked declines in abundance, migration corridors, and habitat quality.
- ***Measure:*** *The AAs shall design mainstem passage actions to benefit a broad range of species.*
  **Update:** Passage improvement for salmon and steelhead is addressed through Columbia River Fish Mitigation (CRFM) funding and the Anadromous Fish Evaluation Program (AFEP), and significant improvements have been realized. Bonneville and John Day dams have lamprey improvement structures installed. In 2018 an investigation will be conducted for The Dalles Dam to determine why lamprey are not reaching the ladder. There is also ongoing work for lamprey at McNary and Ice Harbor dams. Passage improvements for sturgeon are lagging.
- ***Measure:*** *Action agencies should collaborate with the Council to protect habitat and improve survival of species not covered under the BiOp.*
  **Update:** Non-listed fish have not received much attention from the action agencies; little has been done in the mainstem to address lamprey and sturgeon.
- ***Measure:*** *Council supports AAs' current reservoir operations at Libby and Hungry Horse dams.*
  **Update:** Implementation continues; in 2014 the Council encouraged consideration of the adjustments recommended by Montana and the Kootenai Tribe, especially to winter operations at Libby. Status unclear; may need assistance from the Council.
- ***Measure:*** *Investigate infrastructure changes at Albeni Falls Dam.*
  **Update:** No action; further discussions with AAs should be pursued.
- ***Measure:*** *Bureau of Reclamation and NOAA should work with federal fish and wildlife agencies and tribes to evaluate alternative operations at Grand Coulee Dam to improve conditions and survival for all fish important to the Program.*
  **Update:** Not considered or implemented by the Bureau. The new EIS may address these issues.

- ***Measure:*** *Investigate potential to improve ecosystem function and floodplain connectivity.*
  **Update:** Work ongoing in estuary; some evaluation of floodplain function in the mainstem; this effort is limited in extent and investment (See Habitat Strategy assessment).
- ***Measure:*** *Develop and implement adaptively managed spill experiments (e.g. spill above gas cap).*
  **Update:** Not implemented at this time; focus is on court-ordered spill. Still might be considered as a way to improve smolt-to-adult survival to meet program goals.

**Estuary Strategy**

**Progress report on the 2014 Program measures:**
Number of measures total: Six general measures
Number of measures that have made progress: Five, some with partial implementation

*Update on active measures:*

- ***Measure****: The Corps and Bonneville shall implement in partnership with fish and wildlife agencies and tribes and other organizations:*
  - *Assessments of opportunities for floodplain reconnection and removal or lowering of dikes and levees that block access to habitat, or installing fish-friendly tide gates for habitat reconnection, protection, and restoration of riparian areas and off-channel habitat.*
    **Update:** Floodplain reconnection has become the mainstay of the habitat program in the estuary, and the bulk of implementation occurs on this measure. This work goes through various assessment and planning exercises in relation to the 2014 FCRPS Biological Opinion.
  - *Effectiveness monitoring of habitat-restoration actions using a programmatic approach to mirror effectiveness monitoring elsewhere in the Columbia Basin.*
    **Update:** A monitoring program for action effectiveness and status and trend monitoring is a part of the CEERP. Effectiveness monitoring throughout the basin is being assessed as the Council and others in the region consider revising current approaches. The Council's current work to articulate a monitoring framework for the Council's Fish and Wildlife Program will apply to the estuary as well.
  - *A long-term, continuous, status and trend monitoring and evaluation program for salmon, steelhead, and Pacific lamprey migration and survival that shall include monitoring habitat in the lower Columbia River, estuary, and the near-shore plume environment.*
    **Update:** Implementation of this measure is ongoing, through a three-tiered monitoring program, with funding by the Corps and Bonneville, but has focused on salmon and steelhead, not on Pacific Lamprey.
  - *Research and evaluation on the effects of flow regulation, dredging, and water quality (Including toxics) on estuary habitat and food webs to better understand the relationship between estuary ecology and salmon and steelhead productivity, abundance, and diversity.*

**Update:** The effects of flow regulation on the estuary and plume are addressed through modeling efforts in part funded through a Bonneville ocean and plume project. Staff is uncertain if the effects on dredging are being evaluated, and are researching that question. Some food web research is underway, funded by the Corps, and some monitoring of water quality is occurring. Staff is continuing to research these elements.

- *Work with partners in the estuary to establish biological objectives and estuary indicators for habitat restoration and ecosystem function that will serve to prioritize future actions*.
  **Update:** Through the CEERP, estuary indicators have been established and are incorporated into the three-tiered monitoring program and adaptive management process. The CEERP has begun development of objectives for habitat restoration by 2030 and 2050, mapping potentially restorable acreage and areas that provide habitat but need protection. These targets may help concentrate habitat actions in the most significant areas. Challenges include the fact that the estuary has limited opportunity for restoration, given the ESA-CEERP focus on large projects near the mainstem channel.

*Update on measures lacking action or agreement:*

- *Receive from Bonneville and the Corps a summary report on the results of action-effectiveness, status, and trend monitoring and research uncertainties in March 2015. The report must provide information to help improve and substantiate the effectiveness of habitat actions implemented in the estuary by parties that do not monitor their own habitat actions.*
  **Update:** A comprehensive adaptive management effort including habitat restoration, monitoring and research is being implemented and associated reports are available. However, a specific report addressing this measure has not been provided to the Council. In 2012 the ISAB reviewed the CEERP documents and in 2014 the ISAB reviewed the Expert Regional Technical Group process.

**Plume and Nearshore Ocean Strategy**

**Progress report on the 2014 Program measures:**
Number of measures total: Six general measures
Number of measures that have made progress: Six
*The six Program measures for this strategy are all currently being implemented, either via one Bonneville funded project (1998-014-00) or through the Council's Ocean and Plume Science and Management Forum (Ocean Forum). Some may be partially implemented as not all salmon stocks behave similarly and can be studied at the same time.

Update on active measures:

- ***Measure****: Support monitoring plume and nearshore ocean conditions and inriver restoration actions to determine actions of greatest benefit and to separate the effects of ocean-related mortality from that caused in the freshwater part of the life cycle.*

**Update:** Implementation continues through a study on juvenile salmon as they enter the ocean and during the first few months of residence in the ocean to better understand the physical, biological, and ecological mechanisms that control survival of salmon in order to inform management decisions within Columbia River Basin. Results are also being used in models to make distinctions between freshwater and marine sources of mortality. This will improve the characterization of habitat change on salmon survival.

- ***Measure:*** *The federal action agencies shall evaluate the effects of flow regulation on near-shore plume characteristics and salmon and steelhead productivity, abundance, and diversity.*
  **Update:** Evaluation of flow regulation on plume characteristics is occurring by calculating plume area, volume, and other physical metrics of relevance to salmon, both in the plume and in the estuary. Work continues to improve the modeling for coastal upwelling, plume dynamics and salinity intrusion to better characterize estuary and plume conditions for salmon. Salmon behavior modeling relates estuary and plume characteristics, such as plume size, to salmon movement and survival. Initial results show significant relationships for some stocks but not all.
- ***Measure:*** *…support continued monitoring of the Columbia River plume and ocean conditions, assessment of impacts on salmonid survival, and evaluation of the limits of restoration potential in the basin given variable ocean conditions.*
  **Update:** Monitoring and reporting of ocean conditions (e.g. stoplight chart) and the impacts of these conditions on salmonids continues. Work continues to improve study designs to establish stronger links between conditions in the river and estuary to the plume and nearshore ocean. Results from survival analyses are being used in models to put ocean mortality in the same context as freshwater mortality. As most of the variability in salmon mortality occurs in the ocean, this allows more accurate estimates of potential salmon responses to freshwater conservation and restoration actions, as well as to future climate effects.
- ***Measure:*** *… support coordination between ocean scientists and state fish and wildlife agencies and tribes to identify key uncertainties and opportunities to improve inriver management activities based on current ocean conditions.*
  **Update:** This has been occurring through the Ocean Forum and also through outreach to managers through various conferences and meetings.
- ***Measure:*** *The Council supports efforts by the Ocean and Plume Science and Management Forum and science/policy exchanges to encourage coordination and communication between ocean researchers and fish and wildlife agencies and tribes.*
  **Update:** The Ocean Forum continues, with an average of two meetings per year. The charter for the Forum expires at the end of 2017. Staff will prepare a report describing Forum discussions. The Forum has had regular participation. There will likely be continued interest in meeting once or twice per year even if the charter is not renewed.
- ***Measure:*** *The Council encourages scientists to develop an annual index of ocean survival from Bonneville Dam back to Bonneville Dam.*
  **Update:** Researchers are currently using PIT-tag data from smolts detected at Bonneville Dam and modeling survival back to Bonneville Dam. Results highlight aspects of the physical and biological environment that are correlated with ocean survival. Initial work has been completed for Snake River spring/summer Chinook and is currently being used in a life cycle model for this ESU. The lack of quantitative smolt

counts at Bonneville Dam prevents application of this method to the run at large, but will be expanded for additional PIT-tagged populations.

### Wildlife Strategy

**Progress report on the 2014 Program measures:**
Number of measures total: 14
Number of measures that have made progress: Nine

*Update on active measures:*

- ***Measure** (paraphrased): Bonneville shall work with agencies and tribes to develop, implement, and coordinate habitat restoration and acquisition activities.*
  **Update:** Bonneville has developed a guide for the acquisition process, and continues to secure management plans for existing and new acquisitions.
- ***Measure:** The agencies and tribes are encouraged to monitor and evaluate habitat and species response and develop a standardized approach to wildlife monitoring.*
  **Update:** Such an approach has not been completed, but the tribes of UCUT pooled their project-specific monitoring funds to develop a regional monitoring approach to assess species M&E for wildlife. This effort is currently under review.
  Individual project monitoring occurs on varying levels, but few, if any, projects conduct species response monitoring. Habitat monitoring takes place on varying levels
- ***Measure:** The Council will continue to endorse habitat units as the preferred unit of measurement for wildlife mitigation and the HEP methodology for estimating habitat units lost and acquired.*
  **Update:** Many managers have been taught how to conduct the Habitat Evaluation Procedure (HEP); so in November 2015 the Council recommended that the HEP project be closed out. All documents, photos, and reports compiled by the HEP Team have been transferred to StreamNet. Additionally, with the use of acres as the mitigation measurement in settlement agreements, the use of habitat units is phasing out.
- ***Measure:** Long-term agreements between BPA and the agencies and tribes shall take place whenever possible.*
  **Update:** BPA continues to purchase properties to fulfill the terms of the Willamette Wildlife Mitigation Program, which was signed by ODFW and BPA in October 2010; and the Southern Idaho Mitigation Agreement, which was signed by the State of Idaho and BPA in September 2014.
- ***Measure**: Develop and implement habitat acquisition and enhancement projects to fully mitigate for identified losses.*
  **Update:** Outside the work in the active settlement agreements, only a few projects have occurred, largely through Accord funding.
- **Measure:** *Coordinate habitat restoration and acquisition activities with fish mitigation efforts.*
  **Update:** Coordination has occurred though still dogged by the issue of how projects benefiting fish get credited against wildlife mitigation.
- ***Measure:** Maintain the values and characteristics of existing, restored and created habitat.*

**Update:** Most funding for current wildlife mitigation goes toward operations and maintenance of existing properties. Long-term O&M has been addressed through settlement agreements. The Council's O&M subcommittee is exploring ways of funding long-term O&M on wildlife projects.

- ***Measure:*** *The Council directs the WAC to examine the existing options and alternative for mitigation for wildlife operational losses.*
  **Update:** In October 2015, the Council received a detailed, non-consensus report from the WAC outlining the complexity of both providing definitions for operational and secondary losses and the level and nature of technical analysis needed to adequately characterize wildlife impacts from the operation of the FCRPS. Additionally, operational loss assessments between BPA and the agencies and tribes remain incomplete and cannot be resolved until wildlife crediting is determined.
- ***Measure:*** *There is a need for new methods to assess operational losses.*
  **Update:** The Kootenai Tribe has completed work with Montana Fish, Wildlife & Parks to develop an operational loss assessment. Neither the Council nor wildlife managers have determined the broader applicability of this tool.

  Additionally, a review of existing wildlife projects was initiated by the Council in early 2017 and will conclude in the fall of 2017.

*Update on measures lacking action or agreement:*

- ***Measure:*** *BPA shall work with the agencies and tribes to complete operational assessments where agreements already exist on the methodology.*
  **Update:** BPA has developed principles and issues for the Council to consider in the assessment of, and mitigation for, operational losses. Those include operational adjustments, previous mitigation done by the Corps and the Bureau, and the positive effects of FCRPS construction on wildlife. However, the managers do not agree with these principles.
- ***Measure:*** *BPA and the agencies and tribes will complete wildlife loss mitigation agreements for at least the remaining construction and inundation losses by 2016.*
  **Update:** BPA has completed no new agreements since the 2014 Program adoption.
- ***Measure:*** *BPA and the agencies and tribes will reach agreement on how both wildlife and fish mitigation projects should be credited toward identified losses.*
  **Update:** Agreement has not been reached on how fish mitigation projects would or would not count toward addressing wildlife losses.
- ***Measure:*** Allocation of habitat units should occur in the basin in which lost units were located unless otherwise agreed to.
  **Update**: Only one project outside settlement agreements has taken place. Staff presumes those units, if assessed, have been allocated to the correct basin and project, but we have no evidence of that allocation.
- ***Measure:*** *Provide habitat enhancement credits to BPA on net increases in habitat values at a 1:1 ratio.*
  **Update:** No activity or assessment of enhancement credits.

**Fish Propagation Including Hatchery Programs Strategy**

**Progress report on the 2014 Program measures:**
Number of measures total: 15
Number of measures that have made progress: Nine

**Update on active measures:**

- ***Measure****: For Bonneville-funded hatchery programs, Bonneville shall locate and operate propagation actions to complement the present and future management activities of the region's agencies and appropriate Indian tribes, including complements to habitat improvements by supplementing native fish populations.*
  **Update:** Currently the Program supports 40 artificial fish production projects, 23 of which are directly associated with the 14 Program hatchery facilities. The remaining 17 projects are artificial production activities that are in planning and review, or supporting production, but not through Program facilities.
- ***Measure:*** *The Council's research plan will identify critical uncertainties related to hatchery performance in the Northwest. This includes determining the effectiveness of hatchery programs in meeting their intended purposes and minimizing adverse impacts to natural-origin fish.*
  **Update:** The Council approved a revision of the research plan on June 13, 2017. Fish propagation research is one of two priority themes to focus near-term science and policy assistance.
- ***Measure:*** *Where feasible, trends in abundance, productivity, distribution and, diversity of supplemented populations shall be compared to non-supplemented populations in "reference streams" before, during, and after implementation of the production effort*.
- **Update:** The Program has funded three efforts that address aspects of this measure: in the Salmon subbasin, the Idaho Supplementation Studies was completed in 2016; in the Yakima subbasin is an ongoing supplementation study and a BiOp fast-track project for steelhead; and in the Grande Ronde subbasin, work is focused in the Minam and Wenaha rivers.
- ***Measure:*** *Recovery plans have been or are in the process of being developed for each of the listed salmon ESUs and steelhead DPSs in the Columbia River Basin. Each recovery plan includes or will include viability criteria, or targets that are based on the biological parameters of abundance, productivity, spatial structure, and diversity. Viability criteria, together with threats criteria, are considered when determining whether a species warrants delisting.*
  **Update:** Currently there are seven recovery plans, three that have been completed (Snake River Sockeye, Mid-Columbia steelhead and Upper Columbia Chinook and steelhead) and two near completion (Snake River Fall Chinook and Snake River Spring Chinook and steelhead), that encompass the Interior Columbia Basin and the Willamette and Lower Columbia that address the needs of the 13 listed species.
- ***Measure:*** *Hatchery program implementation, monitoring, and evaluation results for all hatchery programs in the Columbia River Basin should be made electronically available and hatchery operators and funders should coordinate annual summary presentations to the Council.*

**Update:** Ongoing effort through the Coordinated Assessment process and eventually with a broad-scale monitoring program such as the Columbia River Hatchery Effects Evaluation Team.

- ***Measure:*** *To promote a diversified approach to hatchery management, hatchery operators will aspire to improve hatchery program performance and, in coordination with agencies and tribes, will seek-out opportunities to test and monitor alternative hatchery strategies and approaches and alternative hatchery practices.*
  **Update:** Hatchery program evaluations, science/policy type workshops and the continued confirmation of BMPs are ongoing.
- ***Measure:*** *To facilitate compliance monitoring, agencies and tribes will monitor their hatchery programs for compliance with federal, state, and other relevant requirements and will make this information readily available.*
  **Update:** Program hatchery facilities are included in the Council's resource maps. These links along with information at cbfish.org -- compliance and contact information -- are available to the public.
- ***Measure:*** *The Council continues to support PIT tagging and detection, coded wire tagging and recovery, acoustic and radio tagging and tracking, and genetic tagging and recovery. These all work together to help assure adequate effectiveness monitoring, and other monitoring as necessary, throughout fish life cycles and across various fish environments.*
  **Update:** Emerging technologies and methods dominate this measure, including advancements in genetic identification. This progress will assist in achieving cost-effectiveness and program effectiveness.
- ***Measure:*** *In consideration of best available scientific information the Council will rely on information provided by the independent science panels and the agencies and tribes regarding hatchery science. The agencies and tribes will continue and expand their investments in research, monitoring and evaluation for the purpose of reducing uncertainties and improving hatchery performance, including developing a better understanding of the benefits and risks of hatchery programs.*
  **Update:** This measure is a cornerstone of the three-step review process and project reviews. Currently, eight hatcheries are in a step review.

Update on measures lacking action or agreement:

- ***Measure:*** *Bonneville should support the use of standardized performance measures by the agencies and tribes to inform effectiveness of various propagation strategies in meeting intended hatchery goals.*
  **Update:** Action agencies proposed a regional monitoring BiOp project titled Columbia River Hatchery Effects Evaluation Team (CRHEET); however, implementation of this "Team" is on hold until the NMFS completes hatchery consultations in the region. Formation of CRHEET will be informed through collaboration with the states and tribes to develop an agreed-upon regional hatchery strategy.
- ***Measure:*** *The Council intends to use available reporting mechanisms where possible.*
  **Update:** This is an ongoing effort through the Coordinated Assessments and eventually with CRHEET, if it is formed.
- ***Measure:*** *The Council requests that NOAA Fisheries annually update the Council on the status of ESA reviews for state and tribal HGMPs.*

**Update**: There have been no annual updates. NMFS is aiming to complete ESA consultations on all hatchery programs associated with U.S. vs Oregon by the end of Calendar Year 2017.

- ***Measure:*** *The Council requests that NOAA advise the Council on the utility of updating the list of reference streams first identified by the Ad Hoc Supplementation Workgroup that are linked to distinct population segments (DPSs), and populations within evolutionarily significant units (ESUs).*
  **Update:** The Council is not aware of any action by NOAA.
- ***Measure:*** *The Council also requests NOAA share with the Council the results of NOAA status reviews of Columbia Basin salmon and steelhead ESUs and DPSs as the reviews are completed.*
  **Update:** Five year status reviews were completed last year (2016), but they have not been supplied to the Council.
- ***Measure:*** *Hatchery summary presentations should include adaptive management actions implemented or planned to improve effectiveness in meeting intended hatchery goals or changes in goals to meet broader basin management strategies.*
  **Update:** Partially addressed through the Program's step reviews, projects reviews, and regional production symposiums. Fully addressing this measure would be an aspect of CRHEET.

**Wild Fish Strategy**

**Progress report on the 2014 Program measures:**
Number of measures total: Two
Number of measures that have made progress: Two

*Update on active measures:*

- *Measure: The Council will consider the needs of wild fish in all facets of its fish and wildlife program including: hydrosystem passage, fish propagation facilities, climate change, predation, strongholds, research, carrying capacity, and habitat actions.*
  **Update:** The measure is broad, and so is its implementation. The Council implements this measure through a variety of projects and project review processes. The most robust accounting for the needs of wild fish occurs through artificial production and habitat projects taking into account native wild fish assemblages. However, projects considering carrying capacity or the needs of wild fish for hydrosystem passage appear lacking. Since 2014, the Council and the Independent Scientific Review Panel have conducted project reviews that considered impacts to wild fish involving kelt, sturgeon, Walla Walla Spring Chinook, and Mid-Columbia Coho.

  The Independent Scientific Advisory Board has considered impacts on wild fish in its reports to the Council on density dependence, predation metrics, and the annual review of the Comparative Survival Study. Similarly, other reports to the Council and fish-policy workshops have addressed wild fish in the context of cold-water releases and habitat, distribution of native bull trout, predation science, floodplain habitat, and threats from climate change. As the Council conducts project reviews in 2018, it should continue to

ask implementers to consider the needs of wild fish and implementation of the wild fish strategy.

- *Measure: Consistent with the Council's quantitative objectives for adult salmon and steelhead, the Council will collect, organize, and review biological objectives for wild fish.*
  **Update:** The Council has compiled an initial list of existing objectives for salmon, Steelhead, Bull trout, Kokanee, White Sturgeon, Pacific Lamprey, Eulachon, and Cutthroat, Redband, and Westslope trout. The next steps are to have the regional fish and wildlife managers verify the objectives and review them for gaps and inaccuracies.

**The Use of Hatcheries for Reintroduction Strategy**

**Progress report on the 2014 Program measures:**
Number of measures total: Two
Number of measures that have made progress: Two

*Update on active measures:*

- ***Measure**: Bonneville shall locate and operate hatcheries to re-establish salmon and steelhead where they have been extirpated, and substitute for extirpated salmon and steelhead in blocked areas.*
  **Update**: Of the approximately 40 resident and anadromous Program artificial production projects that are implemented or in planning, 32 are linked to restoration-type practices.

- ***Measure:** The goals, objectives, timelines, benchmarks, and experimental framework for reintroduced populations will be developed by the agencies and tribes and submitted to the Council.*
  **Update:** In adopting the three-step review process, the Council identified three logical points (i.e., steps) in the design/planning process. The step process includes ISRP review of responses to the technical elements of each step. In addition, these step processes may be supplemented with issues and conditions raised in previous project reviews and Council decisions, directly addressing the measure above. These planning process steps allow a meaningful amount of progress to take place while providing decision points to explore options before expending effort on unrealistic or unrealized goals. Currently, eight hatcheries are in a step review.

**Anadromous Fish Mitigation in Blocked Areas Strategy**

**Progress report on the 2014 Program measures:**
Number of measures total: 10
Number of measures that have made progress: 10

*Update on active measures:*

- ***Measure:** Pursuing a science-based phased approach, investigate the reintroduction of anadromous fish into the blocked waters of the upper Columbia.*

**Update:** In 2016, Council staff completed a review of fish passage technologies that can be used at high-head dams. This paper was written in consideration of comments from the ISAB, IEAB, federal and state agencies and tribes, and other interested parties, as well as the Fish and Wildlife Committee. In December 2015, the Council released an RFP for a habitat assessment in the blocked U.S. waters above Chief Joseph Dam. STI submitted a proposal that was ISRP-reviewed and recommended by the Council to Bonneville for funding up to $200k (not including cost-share). In 2016, STI received funds from the Bureau of Reclamation and Bonneville, though not enough to fully fund the proposal. In May 2017, STI received the remainder of the funds from Bonneville; however, the project was not funded completely and so the assessment will not cover everything the Council had requested in the RFP. The Colville Confederated Tribes (CCT), STI, and the UCUT each have separate pieces they are working on to further explore the feasibility of reintroduction: a donor-stock assessment, a risk assessment, various habitat assessments that include Intrinsic Potential and Ecosystem Diagnostic Treatment modeling, a life-cycle model, and a review of the economic benefits of ecosystem function. Preliminary results from the habitat assessments being conducted by STI and CCT show promising habitat for steelhead and Chinook. UCUT is currently drafting a Phase I report for the Council and the region. Once the STI completes its habitat assessment, the Council can consider whether to advance to Phase II. One piece of Phase I that has yet to be pursued is selective releases of salmon and steelhead. This is an important piece to investigate feasibility as assessments will need to be done to understand how fish use the system in the blocked area.

- ***Measure:*** *The U.S. should pursue transboundary reintroduction with Canada.*
  **Update:** While a joint program has not been created, many conversations are being had between U.S. and Canadian parties. Canadian entities are becoming aware of the work being done in the U.S. for reintroduction and are beginning to investigate and/or discuss feasibility and passage at their locations.
- ***Measure:*** *Bonneville and relevant federal action agencies, working with state and federal agencies and tribes, shall investigate and, if warranted, implement passage and reintroduction of anadromous fish into suitable habitats within the United States, including funding research associated with critical uncertainties at Chief Joseph and Grand Coulee dams and funding work required for Phases II and III, based on Council recommendations.*
  **Update:** Various assessments are being conducted by the tribes in the Upper Columbia, in collaboration with Washington Department of Fish and Wildlife, associated with the critical uncertainties at the dams. However, Bonneville and the federal action agencies are not funding these – the tribes are. CCT is currently assessing habitat, donor stock, and disease and genetic risk of reintroduction, and UCUT is creating a life cycle model.
- ***Measure:*** *The Corps and Bonneville should support and implement anadromous fish passage measures in the Willamette River Basin according to the Willamette BiOp.*
  **Update:** Juvenile fish passage in Willamette has fallen behind the schedule originally contemplated in the Willamette BiOp. No passage structures are currently in place and none will be until 2020 at the earliest. Operational measures have taken place at Fall Creek and appear promising. The Corps released its Configurations and Operations

Plan (COP) in October 2015. The COP analysis focuses on biological modeling and evaluating the feasibility of several downstream passage alternatives at the Willamette dams, and provided a timeline for installing fish passage facilities or making operational changes to the dams to attract, collect, and safely pass downstream migrating juvenile fish. The recommended work for the Corps from the COP is implementing downstream passage at Detroit through a selective withdrawal tower, weir box, and floating screen structure (FSS); upgrading the weir at Foster to improve downstream fish passage; working on an FSS for downstream passage at Cougar since the portable floating surface collector was deemed unsuccessful; upgrading the adult fish facility at Fall Creek and continuing the deep water withdrawals for juvenile passage; changes to hatchery management; and continuing to evaluate, in consultation with NOAA Fisheries, the feasibility for reintroduction in the Middle Fork before pursuing fish passage. The estimated total cost of current BiOp measures has increased from $300 million to $757 million by Fiscal Year 2023.

**Resident Fish Mitigation Strategy**

**Progress report on the 2014 Program measures:**
Number of measures total: Nine
Number of measures that have made progress: Six

*Update on active measures:*

- ***Measure** (paraphrased): Bonneville shall preserve, enhance, and restore native fish in native habitats*.
  **Update:** Program implementation continues with the 50 resident projects in the Program. Activities include monitoring, habitat and artificial production (restoration and augmentation purposes).
- ***Measure:** Bonneville shall develop interim fisheries where native fisheries have been lost, or where native populations and habitats are actively being recovered, and need protection.*
  **Update:** Bonneville continues to support interim fisheries. Efforts focus on harvest augmentation and put-and-take efforts. Transition to restoration of native species is also occurring.
- ***Measure:** In areas where losses may be most effectively mitigated by acquiring interests in real property, Bonneville shall acquire fish habitat equal to the quality of habitat lost through the acquisition of appropriate interests in real property at a minimum ratio of 1:1 mitigation to lost distance or area.*
  **Update:** Bonneville continues to support acquisition of resident fish habitat. Acquisitions have occurred since the 2014 Program was developed, and discussions continue between Bonneville and project sponsors on future acquisitions.
- ***Measure:** Bonneville shall support evaluating the size of non-native fish populations to determine the potential effect of predation and implement a predator management program where appropriate in the Columbia River Basin, for example in Lake Roosevelt.*

**Update:** Bonneville continues to support work to assess and control non-native fish populations preying on focal fish species – this is a high-priority item and has led to the initiation and urgent support of efforts in Lake Roosevelt to suppress Northern Pike.

- ***Measure:*** *Bonneville shall support efforts to address all limiting factors affecting resident fish. This might include efforts to eradicate and suppress non-native species, research on critical uncertainties, impacts from ongoing operation of the hydrosystem, and other impacts.*
  **Update:** Bonneville continues to support projects addressing limiting factors affecting resident fish - several projects include this activity in their project scope. In addition, no assessment of operational losses has occurred.
- ***Measure:*** *Bonneville, the Corps of Engineers, and the Bureau of Reclamation shall restore passage for native resident fish where feasible, including at Albeni Falls Dam.*
  **Update:** Work is ongoing. The Kalispel Tribe continues to work with the Corps on bull trout passage at Albeni Falls Dam.

*Update on measures lacking action or agreement:*

- ***Measure:*** *The Council will convene a work group of fish and wildlife agencies and tribes, and Bonneville, to develop a standardized methodology for habitat loss assessments to assist areas that currently do not have the capacity to complete this assessment and do not have a mitigation settlement agreement, and to ensure a consistent level of accuracy across the basin.*
  **Update:** Not initiated.
- ***Measure:*** *Once loss assessments are completed and adopted by the Council, the Council encourages Bonneville to negotiate settlement agreements, as described in Appendix K*.
  **Update:** Loss assessments are not yet completed or adopted.
- **Measure**: *Bonneville shall continue to support projects directed at other native freshwater species and the progression of these projects from a research and assessment phase into a restoration and monitoring phase.*
  **Update**: Loss assessments are not yet completed or adopted.

**Sturgeon Strategy**

**Progress report on the 2014 Program measures:**
Number of measures total: 28

- Number of measures that have made progress: eight.
- Number of measures that have made some progress (limited to a specific geographic location and limited in scope): seven.
- Number of measures that have made no progress: 13.

*Update on measures:*

- ***Measures – Hydropower dam operations and passage (nine summarized):***
  The Action Agencies are the responsible parties to:
  - *Study effects of and mortality from spillway weirs and turbines.*
    **Update:** No progress

- *Assess the importance and cost, benefit, and risks of passage improvements, and opportunities for non-volitional passage.*
  **Update**: No progress. While there is likely some limited and possibly non-intentional passage of adults through the navigation locks, no monitoring occurs.
- *Continue to refine and develop protocols that reduce mortality during dam maintenance operations and on turbine startup.*
  **Update:** Operations follow protocols; no recent updates to protocols. Slow rolls on startup, specific protocol for tail log installation to bring a turbine unit down, restrictions on wicket gate openings. No maintenance-related sturgeon mortality in a few years and few sturgeon salvaged from the draft tubes and ladders in recent years.
- *Seek opportunities to operate the hydrosystem to benefit sturgeon and operate the system balancing the needs of sturgeon, salmonids, and other native fish.*
  **Update:** No new progress. Libby Dam is the only one where flows have been adjusted for sturgeon, and that was a biological opinion action.

- ***Measures - Mainstem Habitat (four summarized):***
  - *Identify, evaluate, protect, and enhance mainstem habitats that are associated with and will improve natural recruitment for sturgeon (spawning, rearing, and resting habitats).*
  - *Understand key areas to avoid while dredging the mainstem.*
    **Update:** No new progress. Habitat enhancements are very limited in the Program and are mostly focused in the Kootenai through the biological opinion. The COE generally conducts dredging to minimize mortality on sturgeon.

- ***Measures* – Monitoring (six summarized):**
  - *Monitor and evaluate how sturgeon respond to restoration actions and environmental conditions consistent with key sturgeon planning documents.*
    **Update:** To the extent that restoration actions include artificial production and outplanting, there is consistency.
  - *Report on the status of sturgeon throughout the basin regularly.*
    **Update:** This is done for sturgeon populations from the Lower Columbia River to McNary Dam and also for the Lower Snake River. Updates from the mid- and upper Columbia are expected in the fall of 2017.
  - *Monitor and evaluate effects of climate change and environmental conditions and develop adaptation strategies.*
    **Update:** The heat-related loss of nearly 200 spawning-age sturgeon in the Columbia River in the summer of 2015 caused sturgeon partners to consider management actions that included monitoring and tracking mortalities, appointing a point person for reporting, consideration of cold-water controls in the mainstem, and suspending harvest in key areas.
  - *Support harvest monitoring along with other strategies where natural recruitment is limited.*
    **Update:** No new progress. The Council supports a geographically limited harvest enforcement program from Bonneville Dam to McNary Dam. The enforcement

isn't specific to sturgeon as it includes other species as well as responding to community calls not related to fish and wildlife.

- o *Develop a spawning and rearing habitat model in conjunction with FCRPS operations.*
  **Update:** No progress.
- o *Evaluate project operations on reproductive success in each of the pools behind the FCRPS and Mid-Columbia dams.*

**Update:** No new progress.

- ***Measures: Hatchery (two summarized):***
  - o *Continue to support the Kootenai Tribe Integrated Fish and Wildlife Program to avoid extinction of endangered Kootenai white sturgeon.*
    ***Update****: The Kootenai program continues to operate and learn, integrating habitat restoration, genetics, and public outreach.*
  - o *Consider hatcheries as a mitigation strategy to supplement populations where recruitment is severely limited and when implemented though the step process (with specific sub-measures)*
    **Update:** Much effort is going into artificial production in the mid-Columbia area and transboundary Upper Columbia funded by the Council's Program and by others (PUDs and tribes). The lower Columbia River tribes are working on a master plan for a production facility in the lower mid-Columbia and lower Snake rivers.

- ***Measures* – Upper Columbia specific (three summarized):**
  - o *Conduct baseline population assessments to monitor hatchery and natural-origin sturgeon populations and limiting factors.*
    ***Update:*** This is the final year of a five-year population assessment including abundance estimates by hatchery/year class and, for wild fish, size, growth, reproductive assessment, maturation rates, distribution, and habitat use.
  - o *Implement measures based on knowledge gained through assessments and planning documents.*
    **Update:** Successful larvae collection and translocation based on assessments. Have refined methodologies enough to begin testing recruitment failure hypotheses. Hatchery fish survived at much greater rates than anticipated and now can release to maximize survival. As a result, the Spokane Tribe has recently opened a fishery for White Sturgeon in Lake Roosevelt.
  - o *Continue hatchery production and PIT tag at 100 percent.*
    **Update:** Currently being implemented.

- ***Measures -Predation (two sturgeon measures:***
  - o *Action agencies and others are to evaluate the impact and extent of pinniped predation and look for ways to reduce mortalities by pinnipeds*.

**Update:** No new progress. The program co-funds non-lethal hazing at Bonneville Dam. While this might benefit sturgeon, it is geared toward predation on Chinook. No Program-funded progress on assessment of predation on sturgeon other than at-dam observations by the COE and Columbia River Inter-Tribal Fish Commission.

- ***Measures -Water Quality (two summarized):***
  - *Identify and assess the effects of toxic contaminants on sturgeon.*
    **Update:** No progress to date.

**Lamprey Strategy**

**Progress report on the 2014 Program measures:**
Number of measures total: 20
Number of measures that have made progress: 17

Update on active measures:

*Hydropower system (the action agencies shall)*

- ***Measure****: Identify and seek opportunities to address effects of hydrosystem operations, including reservoir elevation fluctuations and an altered hydrograph on adult and juvenile lamprey*
  **Update:** USACE has initiated efforts with USGS and USFWS to model shoreline implication effects for lamprey with flow fluctuations.
- ***Measure****: Monitor passage at mainstem Columbia and Snake river dams and in the Willamette Basin to identify operations causing delay, promoting fall-back, obstructing, or killing migrating adult and juvenile lamprey*
  **Update:** Numerous studies are under way by the USACE, NOAA/NMFS and partners monitoring adult lamprey passage at Columbia and Snake projects. Monitoring of areas of showing passage difficulty and effectiveness of passage modifications are being conducted. The Pacific Lamprey Technical Workgroup recently completed the final draft of the "Practical Guidelines for Incorporating Adult Pacific Lamprey Passage at Fishways".
- ***Measure:*** *Establish an interim passage standard for adult Pacific Lamprey.*
  **Update:** The Lamprey Technical Workgroup has formed a subgroup working on lamprey passage metrics.
- ***Measure****: Evaluate dam passage, assess passage efficiency and direct mortality, and other metrics*
  **Update**: The USACE, NOAA/NMFS, and partners are studying dam passage efficiency and dam-to-dam conversion rates.
- ***Measure****: Install lamprey-friendly passage structures for adult and juvenile lamprey*
  **Update:** Lamprey Passage Structures (LPS) are under way for adults at Bonneville and The Dalles dams; at other dams, existing fishways have been modified. Passage structures have not been installed for juvenile lamprey.
- ***Measure****: Monitor and report predation on adult and juvenile lamprey during passage at mainstem dams.*

**Update:** Nothing specific other than what is captured by the avian and sea lion predation projects.

- ***Measure:*** *Assess the impacts of dredging on lamprey around hydropower dams and navigation facilities.*
  **Update:** The Lamprey Technical Workgroup has formed a subgroup working on dredging effects on lamprey.

*Mainstem and tributary habitat (The action agencies, in coordination with agencies and tribes, shall)*

- ***Measure:*** *Implement instream habitat projects to minimize mortality to lamprey by consulting the "Best Management Practices for Pacific Lamprey (BMP)"*
  **Update: BMP have** been utilized by many implementing instream restoration projects. BPA requires use of BMP and reporting of lamprey observations in all contracts.
- ***Measure:*** *Continue to identify, protect, and restore habitat areas and ecological functions, such as stream channel complexity and function, that are associated with productive spawning, resting, rearing, and migrating lamprey*
  **Update:** Many of the Program's habitat projects identify lamprey as a focal species. Restoration guide provided habitat implementers' direction. CT's Regional Implementation Plans (RIP) have been developed for almost all 17 regional management units in basin. Plans identify and prioritize restoration needs. .
- ***Measure:*** *Install appropriate and effective juvenile lamprey screening for tributary water diversions*
  **Update:** Studies have been conducted by USBOR, USGS, USFWS and Columbia River tribes. Modeling research and studies are ongoing to keep lamprey out of diversions in lieu of screening, and salvage operations associated with ditch maintenance.

*Monitoring (The action agencies, in coordination with agencies and tribes, shall)*

- ***Measure****:* Create f*ramework on the status of lamprey in the basin.*
  **Update:** The Pacific Lamprey Conservation Initiative is a framework that analyzes and reports on the status (The Pacific Lamprey Assessment and Template for Conservation Measures) and is currently being revised in 2017. The RIPs also report on effectiveness of restoration efforts.
- ***Measure:*** *Report passage counts at dams annually and map lamprey distribution every five years.*
  **Update:** Passage counts at dams on the Columbia and Snake rivers are reported on the Fish Passage Center website (www.fpc.org/lamprey/lamprey_home.php). The CT operates the Lamprey Data Clearinghouse, which houses distribution maps for the whole U.S. range of Pacific Lamprey.
- ***Measure:*** *Conduct occupancy and distribution surveys where lamprey abundance is unknown*
  **Update:** Through our Program efforts and others, occupancy and distribution surveys are ongoing. Managers are working collaboratively to fill in areas where distribution is unknown.
- ***Measure:*** *Develop tags suitable for monitoring and evaluation.*
  **Update:** PNNL has been developing a miniature acoustic tag for lamprey (Juvenile Lamprey Acoustic Tag - JLAT). A prototype has been created, and lab studies are

currently underway. Field studies are planned for 2017-2018. Larval and juvenile lamprey are now being marked with PIT tags.

*Propagation*

- ***Measure:*** *The action agencies, in coordination with the agencies and tribes, shall evaluate the potential role of lamprey propagation and translocation as a way to mitigate for lost lamprey production when passage and habitat improvements alone are insufficient to restore lamprey populations*
  **Update:** Three of the Program's five lamprey projects have ongoing studies on artificial propagation. This includes long-term translocation studies and a supplementation framework.

*Other (The action agencies, in coordination with agencies and tribes, shall)*

- ***Measure:*** *Determine effects of climate change.*
  **Update:** Climate change vulnerability assessments have been ongoing since 2012. USFWS, CRITFC, Yakama Nation, Cow Creek Tribe, USGS and other partners are collaborating on these assessments. Risks to various geographic lamprey populations from projected climate change scenarios are being assessed.
- ***Measure:*** *Include Pacific Lamprey in the tables of measures associated with the Upper Willamette Conservation and Recovery Plan for Chinook Salmon in Appendix O.*
  **Update**: Appendix O now includes Pacific Lamprey.

**Update on measures lacking action or agreement:**

*Monitoring (The action agencies, in coordination with agencies and tribes, shall)*

- ***Measure:*** *Develop a regional strategy for monitoring passage into tributaries to better understand differences in counts of adult lamprey between dams*
  **Update:** More work is needs to be done.

*Other (The action agencies, in coordination with agencies and tribes, shall)*

- ***Measure:*** *Complete a loss assessment for lamprey*
  **Update:** More work needs to be done.
- ***Measure: Assess v****ulnerability to toxin accumulation in water and sediment and to chemical spills, and the exacerbation of such risks in the vicinity of mainstem hydroelectric dams*
  **Update:** Limited contaminants studies have been conducted on toxin accumulation in lamprey. More work needs to be done.

**Eulachon Strategy**

**Progress report on the 2014 Program measures:**
Number of measures total: Five
Number of measures that have made progress: Two

*Update on active measures:*

- ***Measure(s):*** Once the recovery plan is complete, the Council will incorporate appropriate eulachon information into the Program related to: the extent they are affected by the hydrosystem, measures to protect or restore them, and actions that may be implemented. The Council also will consider developing:
    - Biological objectives for the eulachon population characteristics and habitat needs.
    - A high-level indicator for eulachon abundance.
    - Monitoring and evaluation of the status of eulachon and evaluation of the characteristics affecting their survival.

  **Update:** The draft eulachon recovery plan has been in the works since the 2014 Program was adopted and is scheduled to be finalized by the end of Fiscal Year 2017. The recovery plan will focus on gap analysis for data that when assessed may lead to an identification of site-specific actions. The recovery plan would help guide actions for restoration.

- ***Measures*** for Mainstem and hydrograph
    - Hold a science/policy forum in 2015 with regional partners to discuss the state of the science on biological requirements of eulachon and the relationship between flow and current hydropower dam operations. Report on reasonable next steps in the assessment process and a recommendation for incorporating into the recovery plan.
    - **Update:** Complete. Report used to inform the recovery plan.

Update on measures lacking action or agreement:

- **Measure:** The Council supports implementation of two eulachon conservation recommendations found in the 2014 FCRPS Biological Opinion:
    - Monitor eulachon abundance in the Columbia River via annual spawning stock biomass surveys.
    - Address uncertainties regarding changes in the hydrograph of the Columbia River and adverse effects to larvae and juvenile survival in the estuary, plume, and ocean

  **Update:** The Council is no longer funding any work specific for Eulachon though habitat projects below Bonneville may benefit the species.

- **Measures** for Mainstem and hydrograph
  Monitor and report eulachon abundance at Bonneville Dam.
  **Update:** Nothing formally designed or implemented. There have been no eulachon observed at Bonneville Dam since 2013.
  *Study the role of eulachon as an alternative prey for sea lions.*
  ***Update****:* None funded through our Program, but possible opportunity to assist in analysis of scat studies being done by others (may be completed later in 2017).

- ***Measure:*** Monitor and evaluate the importance of the tidal freshwater, estuary, plume and nearshore ocean environment to the recovery of eulachon in the Columbia River Basin.
  **Update:** None funded under the Program. This will be informed, in part, by the recovery plan.

**Public Engagement Strategy**

**Progress report on the 2014 Program measures:**
Number of measures total: Three
Number of measures that have made progress: Two

*Update on active measures:*

- ***Measure****: (synopsis) Inform and involve the public through various types of media, subbasin dashboard updates, and other opportunities in addition to Council meetings.*
  **Update:** Since 2014, the Public Affairs Division has published numerous blogs about fish and wildlife issues related to the Program (efforts to control predation, for example), and individual projects (habitat restoration, for example) and collaborated with the Fish and Wildlife Division on efforts to improve accessibility and visibility of the Program, including participating in the annual Sturgeon Festival in Vancouver, Washington and helping to develop the Program story site online. Additional subbasin dashboards for the blocked areas have been developed since the adoption of the Program, among other maintenance updates. From time to time staff of the fish and wildlife and public affairs divisions have participated in regional, national, and international conferences, given guest lectures in university classes, and written speeches for Council members about the Program. The Council has sponsored numerous conferences, and in 2016 the Council fully funded CRITFC's technical workshop for the Future of Our Salmon conference, as the topic was floodplain reconnection, which is one of the Program's emerging priorities.

  Since the 2014 Program was adopted, the Public Affairs Division updated its Pocket Guide, which includes facts about the Council, the hydropower system, and the power plan and fish and wildlife program, and also the printed and online versions of the Field Guide, which is a brochure about the Fish and Wildlife Program featuring stories about projects that implement the Program in each state. The Division also opened social media accounts to improve our outreach, including Facebook, Instagram, Vimeo, Twitter, Linkedin, and Flickr. The Council has also begun work with a local website-development firm, OMBU, to recreate our Council website.

- ***Measure:*** *Monitor the success of outreach and involvement efforts.*
  **Update:** The Public Affairs Division monitors traffic on its website using Google Analytics and is able to track interest in fish and wildlife issues generally and news releases about fish and wildlife topics specifically.

*Update on measures lacking action or agreement:*

- ***Measure:*** *Publicly recognize and acknowledge entities that provide good examples of productive partnerships across social and ecological boundaries*
  **Update:** From time to time the Council has invited citizen groups and government agencies to discuss their projects and collaboration, and the Public Affairs Division has written news releases about successful partnerships, such as efforts to improve stream flows and habitat in fish-spawning creeks in the Stanley Basin of Central Idaho and Columbia River tributaries in North Central Washington. But the Council has not initiated an award program or other type of public recognition.

**Investment Strategy**

**Progress report on the 2014 Program measures:**
Number of measures total: 10
Number of measures that have made progress: Nine

*Update on active measures:*

***Measure*** *emerging program priorities:*
*A. Bonneville will take the necessary steps to integrate these priorities into the program progress.*

- *Provide for funding long-term maintenance of the assets that have been created by prior program investments. Also see specific measures in Appendix P. - Maintenance of Fish and Wildlife Program Investments*
  **Update:** Creation of, and ongoing work on the O&M Strategic Plan subcommittee address this priority.
- *Implement adaptive management (including prioritized research on critical uncertainties) throughout the program by assessing the effectiveness of ongoing projects, developing program objectives when appropriate and taking into account the effects of climate change.*
  **Update:** In 2017, the Council approved a Research Plan for the Program. Other work is ongoing to collect, identify and refine Program and basin quantitative objectives. Ongoing project reviews (ISRP) and science reviews (ISAB) assist the Council with assessing the effectiveness of projects. In addition, the Council is conducting program-area policy reviews as another means to assess effectiveness. Since 2014, the Council has been involved in presentations, regional meetings and discussions related to the general effects of climate change; though those discussion do not address impacts of climate change at the project level.
- *Preserve program effectiveness by supporting: (1) expanded management of predators; (2) mapping and determining hotspots for toxic contaminants; and (3) aggressively addressing non-native and invasive species*
  **Update:** Expanded management of predators/aggressively address non-native species: Additional funding for Northern Pike suppression has been dedicated with cost savings. The Council is participating with basin partners in an effort to

develop maps of toxic contaminants across the Basin. A pilot effort with Polycyclic Aromatic Hydrocarbons (PAHs) is occurring.
    - *Investigate blocked area mitigation options through reintroduction, passage and habitat improvement, and implement if warranted.*
    - **Update:** Initial work for Phase I - investigate feasibility for reintroduction of salmon in the blocked areas above Chief Joseph and Grand Coulee has been funded in part using cost savings in the program. Passage improvements have also occurred on the Willamette system through the use of COE reimbursable funds.
    - *Implement additional sturgeon and lamprey measures (passage and research)*
      **Update:** Additional sturgeon measures (research) are being implemented using cost savings in the program. No additional passage measures have been funded for sturgeon or lamprey through cost savings; however, the COE continues to make improvements for lamprey passage at some mainstem dams with reimbursable funds, and improvements to fish screens and diversions continue as part of the direct program. Additional lamprey measures will be explored for potential funding through costs savings in 2018 and beyond.
    - *Update the subbasin plans most in need of updates*
      **Update**: No updates to subbasin plans have occurred. There is some interest in updating the few that have had significant habitat changes occur (e.g. dam removal) since the original plans were completed.
    - *Continue efforts to improve floodplain habitats*
      **Update:** Beyond the project level floodplain work that is already being implemented in the Program, the Council has contributed to a basin-wide conference on the importance of large floodplain and cold water habitats.
- ***Measure:*** *Bonneville will report annually to the Council on A (above):*
  **Update:** The Staff, and Bonneville (when appropriate) report to the Fish and Wildlife Committee on program in implementing emerging priories at each monthly meeting.
- ***Measure:*** *Bonneville funding for emerging program priorities*
  *Bonneville should fund any new fish and wildlife obligations from identifying savings within the current program and as necessary, from additional expenditures.*
  **Update:** Since 2015, the Council formed a Cost Savings Work Group to identify and track savings found in the program, and make recommendations on how to redirect them. BPA has not provided additional expenditures. Some savings from projects were transferred to the BPA general fund in FY16 and FY17.

**Adaptive Management: Monitoring**

**Progress report on the 2014 Program measures:**
Number of measures total: Nine
Number of measures that have made progress: Nine

*Update on measures that have made progress:*

- ***Measure 1****: The ISRP will use the risk uncertainty matrix to assess whether the level of monitoring is appropriate for the proposed project and measures.*

**Update:** The ISRP used and suggested improvements to the risk uncertainty matrix during its 2016 review of critical uncertainties that informed the Councils 2017 Research Plan. The ISRP also recommended that project sponsors apply the risk uncertainty matrix to determine the appropriate level of monitoring required for proposed actions in the 2017 Wildlife Project Review.

- ***Measure 2****: Bonneville will ensure that all monitoring projects report the accuracy and precision of their data.*
  **Update:** Project sponsors submitting an annual research, monitoring, and evaluation (RM&E) report to Bonneville are instructed in the reporting template how to include error bars indicating 95-percent confidence intervals. There does not appear to be an explicit requirement to report confidence intervals in the RM&E annual project reports. Those contributing data to the Salmon and Steelhead Coordinated Assessments effort also are requested in the data exchange standard to provide the confidence interval associated with their data estimates, which is a measure of precision.
- ***Measure 3****: Bonneville should continue to support and require the use of MonitoringResources.org, which is sponsored by the Pacific Northwest Aquatic Monitoring Partnership (PNAMP), to share information about how data are collected.*
  **Update:** Bonneville continues to support and require, albeit with moderate enforcement, the use of MonitoringResources.org for documenting project protocols and methods. To this end Bonneville supports PNAMP staff training and assisting Bonneville contracting officers (COTRs) and project sponsors on how to use MonitoringResources.org, as well as hosting training webinars for all interested parties. Bonneville also supports PNAMP staff to review the MonitoringResources.org content, assist in populating the content and overseeing it, and operating and maintaining the tools. The software development is provided by Sitka Technology.
- ***Measure 4:*** *Consistent with the goals and objectives section of this program, Bonneville should report annually on the number of juvenile fish released each year; the number of adults that contribute to harvest, are used for broodstock, and are present on the spawning grounds for all hatchery programs that receive Bonneville funding. Bonneville also should provide support to ensure that all managers have the capacity to collect this data and should support regional processes that standardize the data, facilitate reporting, and make this data publicly accessible*
  **Update:** Bonneville is supporting several endeavors that contribute to this measure:
  - Bonneville funds the Fish Passage Center, which on its website provides weekly, biweekly, and annual reports summarizing hatchery releases.
  - Bonneville funds StreamNet, which includes data stewards working with the four state fish and wildlife agencies, the U.S. Fish and Wildlife Service, and the Colville Confederated Tribes. This project facilitates data sharing and data access, including resident and anadromous information. CRITFC also participates in StreamNet meetings. Through the Salmon and Steelhead Coordinated Assessments effort, which is facilitated through the PNAMP and StreamNet projects, co-managers have collaborated in developing and sharing consistent indicators for regional reporting. The hatchery information requested in this measure would be addressed through the Coordinated Assessment ongoing work on hatchery information. Work on this measure has slowed due to the limited funding available and Bonneville's current emphasis on natural-origin salmon and steelhead data. The Coordinated

Assessment effort is supported by Bonneville-funded projects, external grants, and in-kind contributions. The submitted data is managed and made accessible by StreamNet. The combination of level budgeting for the StreamNet project, which has remained relatively constant since the 1990s, and increasing costs have limited the ability to address the Program's information needs in recent years.

- ***Measure 5:*** *Bonneville should require project sponsors to ensure data are secured in appropriate regional databases if those data contribute to Program and regional reporting needs.*
  **Update** Bonneville's 2013 publication *A Framework for the Fish and Wildlife Program Data Management* provided guidance for data storage. The StreamNet Database, for example, is the recommended repository for natural-origin salmon abundance estimates. The StreamNet data store is recommended for other data types. Projects gathering data are requested to identify where their data are stored. Bonneville has been working with StreamNet and project sponsors to ensure that salmon and steelhead data needed for reporting indicators are being submitted to the StreamNet database as appropriate.
- ***Measure 6****: Bonneville should identify preferred methods to guide future data collection and report back to the Council annually. The Council will request the ISAB or ISRP to review the methods identified by Bonneville, and based on its review, the Council will adopt methods into the program.*
  **Update:** MonitoringResources.org, which is supported by Bonneville, allows designation of preferred or required methods. These would contribute to Bonneville's identification of preferred methods for this Program measure. To date, however, this aspect of MonitoringResources.org has not been utilized by Bonneville. Bonneville has not identified preferred data collection methods for Council and ISAB/ISRP review since adoption of the 2014 Program. Bonneville has worked on improving reporting of protocols and methods used by project sponsors as part of the Bonneville-supported MonitoringResources.org. Bonneville requires project sponsors to fully describe their methods and protocols in MonitoringResources.org. MonitoringResources.org encourages sharing data protocols and methods and facilitates identifying similar protocols and methods that could be better aligned between project sponsors. Bonneville supports PNAMP in conducting methods review workshops aimed at facilitating discussion among co-managers about aligning commonly used methods and protocols that have slight differences among agencies. These methods review workshops have not been prioritized by Bonneville and the PNAMP Steering Committee. No methods or protocols are specifically identified in the 2014 Program.
- ***Measure 7****: Funding entities such as Bonneville, NOAA Fisheries, and the Oregon Watershed Enhancement Board should align their implementation metrics to share information about what, and where, actions are funded in the basin. This will improve their ability to work together to achieve cost savings.*
  **Update:** Bonneville uses work elements and quantifiable metrics displayed in PISCES to track the work completed by contractors. Many of these metrics, such as the number of fish screens installed or miles of stream bank protected through land acquisition, easement, or lease, are for habitat protection and enhancement actions and are the same ones used by the Pacific Coastal Salmon Recovery Fund.

- ***Measure 8****: Bonneville and its partners should continue to explore whether a programmatic approach for monitoring would be more cost-effective and efficient.*
  **Update:** Bonneville is working with Council staff in reviewing the programmatic approach to tributary habitat monitoring and effectiveness to determine whether existing approaches are cost-effective and whether improvements are needed to meet the Program needs.
- ***Measure 9****: For projects assessing species and habitat conditions in intensively monitored watersheds, Bonneville will require the project sponsors to provide information on the condition of these watersheds at least every three years in a format that can be used by the Council.*
  **Update:** Annual reports to Bonneville from the ISEMP/CHaMP projects contained information summarizing data from the Program's three intensively monitored watersheds and CHaMP watersheds. However, the reports have not provided a succinct description of the status of species and habitat.

**Adaptive Management: Effectiveness**

**Progress report on the 2014 Program measures:**
Number of measures total: 1
Number of measures that have made progress: 1

*Update on active measures:*

- ***Measure 1****:* Bonneville and its partners should continue to transform the effort to evaluate action effectiveness from monitoring individual projects into a cost-effective, independent third-party, standardized, and statistically-valid method for habitat projects and water transactions projects.
  **Update:** The Council and Bonneville continue to improve how best to assess effectiveness of actions. The effort to streamline effectiveness assessments most recently focused on moving away from having individual habitat projects assessing effectiveness of actions toward a broader approach that evaluates effectiveness of categories of habitat actions. Two key projects contributing to this broader approach are implemented by Bonneville: ISEMP/CHaMP and project action effectiveness monitoring (AEM). ISEMP/CHaMP, among other things, is focused on determining how to evaluate the effectiveness of actions at the watershed and population levels. AEM focuses on assessing the effectiveness of categories of actions at the site scale. The results from both ISEMP and CHaMP are often not at the appropriate scale for informing either on-the-ground actions or Program-level questions related to habitat action effectiveness. There are also indications that AEM, as currently implemented, is not providing guidance to habitat action sponsors and is not providing information to the Program about whether the action is having the intended effect. To address this gap in habitat action effectiveness, staff is working on developing a Program-focused habitat monitoring and evaluation approach.

  Assessing effectiveness of water transactions has improved with the Columbia Basin Water Transaction Program's (CBWTP) tiered monitoring approach, which assesses reach-scale response by detecting a hydrologic change in flow and habitat response. Determining the

effectiveness of habitat actions in reducing limiting factors and benefiting the targeted species life stage is being documented by some projects, however efforts to assess detectible benefits at the watershed- and population-scale remain inconclusive. The CBWTP effectiveness approach is being considered by staff in developing the Program habitat monitoring and evaluation approach.

**Adaptive Management: Research**

**Progress report on the 2014 Program measures:**
Number of measures total: Five
Number of measures that have made progress: Three

*Update on active measures:*

- ***Measure 1****: With federal and state fish and wildlife agencies and tribes, the Council will review and update its research plan every three years beginning in 2014. The review will begin with an update of how previous research funds were allocated to particular categories and critical uncertainties. The Independent Scientific Review Panel and the Independent Scientific Advisory Board will assist with updating the critical uncertainties, taking into account evolving topics and reporting on the results of past research. Each step of this update will include opportunities for public input. This process will give consideration to critical uncertainties submitted during the Program amendment process.*
  **Update:** The Council adopted a new Research Plan (Council Document 2017-4) in June of 2017. The ISRP/ISAB produced the report *Critical Uncertainties for the Columbia River Basin Fish and Wildlife Program* (Council Document ISAB/ISRP 2016-1) that addressed the review components outlined in Measure 1. The information from the ISAB/ISRP report and public input were essential in updating the research plan. The updated plan, though not a part of the Fish and Wildlife Program, serves as guidance to the federal agencies with legal responsibilities under the Northwest Power Act in implementing the research measures and priorities of the Program.
- ***Measure 2****: To assist with updating its research plan, the Council will co-sponsor Columbia River science/policy conferences to discuss scientific and technical developments in key policy areas. The Council will work with the Independent Scientific Advisory Board and others to develop the agendas.*
  **Update:** The Council continues to rely on science/policy conferences to be informed about state of the science and to serve as a resource for Program efforts, including its research plan. The Council engages in science/policy forums held by our partners, including CRITFC and LCEP. The Council has also convened science/policy forums, including since 2014, the Columbia River Eulachon (Smelt) State of the Science and Science to Policy Forum and the ongoing Ocean and Plume Science and Policy Forum. The Council is currently considering convening additional science/policy forums to inform the upcoming Program amendment process.
- ***Measure 3:*** *The Council will review the accomplishments of intensively monitored watersheds and the Integrated Status and Effectiveness Monitoring Project to ensure that it is cost-effective and produces useful results.*

**Update:** Bonneville provided an update on the Integrated Status and Effectiveness Monitoring Project (ISEMP) and CHaMP work during 2016 to the Council. In 2017 the Council directed staff to review the tools produced by ISEMP/CHaMP and to assess how these were used by co-managers to guide decisions. Based on the staff review that was informed by numerous meetings with co-managers and project sponsors, the Council directed staff to develop a Program-focused Habitat Monitoring and Evaluation Approach that would better address the Program's needs for guiding habitat action implementation and informing the Program about habitat action effectiveness.

*Update on measures lacking action or agreement:*

- ***Measure 1****: Bonneville will report annually to the Council on the publications resulting from program research.*
  **Update*:*** A bibliography was compiled by Bonneville for the Council in 2013. Staff is not aware of any recent updates or whether a current bibliography is accessible to the public. Information about publications may be included in annual project reports to Bonneville, and published literature can be accessed through the Program-funded regional StreamNet Library.
- ***Measure 2****: Bonneville should ensure that all contracts for research projects, including those covered by funding agreements, identify an end date.*
  **Update:** Some projects include end dates, but this does not yet appear to be consistently reported in annual project reports to Bonneville.

**Adaptive Management: Data management**

**Progress report on the 2014 Program measures:**
Number of measures total: three
Number of measures that have made progress: two

*Update on active measures:*

- ***Measure 1****:* Bonneville should ensure that data associated with broad categories of information (fish abundance, productivity, genetic diversity, geographic distribution, habitat conditions) are identified and accessible from a single, centralized website. Data users should be able to find references, data descriptions, and links to all the data collected in the program on fish abundance in such a website.
  **Update** The cax.streamnet.org site maintained by StreamNet provides access to salmon and steelhead indicators related to the viable salmonid parameters (VSP) as described in measure 2. Bonneville is funding two main projects tasked with securing documentation that provide information related to these data; (1) PNAMP's MonitoringResources.org is assisting in securing data description (e.g., metadata, methods, protocols), and (2) The Regional StreamNet Library secures references related to these data such as project reports and publications. Securing project digital photographs and videos should also be explored as these are a valuable information source for conveying the Program's progress, and the Regional StreamNet Library may be well suited for this task. Bonneville is also supporting the Fish Data Product contract which maintains the Program's Fish Information Site http://rs.nwcouncil.org/ . This site

compiles, displays, and links to Columbia Basin data sources for numerous fish species and information types organized by subbasin, species, and populations. The Fish Information Site summarizes information such as predation, abundance, hydrosystem passage and survival, hatchery releases, and connects to the natural-origin spawner abundance estimates from the cax.streamnet.org. Bonneville also funded the development of a centralized website for habitat data gathered through the multiple-watershed CHaMP/ISEMP project and the habitat and fish data gathered from multiple project sites by the Programmatic Action Effectiveness Monitoring (AEM) project. However, the centralized websites for CHaMP/ISEMP and AEM project need improvements to facilitate access of information by others. Lastly, Bonneville staff is working on refining a website that visually synthesizes the available salmon and steelhead data related to the viable salmonid population parameters (VSPs).

- ***Measure 2****:* Bonneville should ensure that all information about anadromous fish is summarized by specific life-cycle stages and made accessible from a single gateway location.
  **Update:** The Coordinated Assessment effort that is funded by Bonneville project sponsors, external grants, and in-kind contributions is making progress in making these data available through the StreamNet site. Currently, this site provides estimates of salmon and steelhead adult natural origin spawner abundance, juvenile outmigrant abundance, presmolt abundance, recruit per spawner, and smolt to adult returns (SAR). This site also connects to the data sources and to related data such as redd counts. The Coordinated Assessment effort is also working on hatchery indicators and considering providing access to resident fish estimates if there is support by the co-managers and Bonneville. The site connects to related data on the StreamNet database such as redd counts, and provides information about data providers that is being refined in collaboration with PNAMP, the regional StreamNet Library, and co-managers to properly attribute all data sources.

*Update on measures lacking action or agreement:*

- ***Measure 3****:* Bonneville should contract for complete data products (e.g., annual population estimates for adult and juvenile spring Chinook in the Entiat) and not only collaborative processes and preliminary data collection (e.g., redd counts or weir counts of fish). And when Bonneville pays for the development of standards or protocols, the contracts should include a viable strategy for adoption.
  **Update:** Staff is not aware of contracts that provide specific funding as described by this measure. The collaborative Coordinated Assessment that provides population-level estimates is not specifically contracted as a project by Bonneville.

**Adaptive Management: Reporting**

**Progress report on the 2014 Program measures:**
Number of measures total: 4
Number of measures that have made progress: 4

*Update on active measures:*

- ***Measure 1****: Bonneville should require all research, monitoring, and evaluation projects, including hatchery programs, to report annually, providing an electronic summary of their results and interim findings, as well as the benefits to fish and wildlife. A high priority is to separate research reports from monitoring reports. The former should address hypotheses and critical uncertainties and the latter should provide important data about implementation, status, and trends. As appropriate, action effectiveness should be reported as part of research and monitoring reports.*
  **Update:** Bonneville in collaboration with Council staff has developed a template for annual research monitoring and evaluation project reports. Bonneville has not yet separated research reports from monitoring reports. Council and Bonneville staff have been engaged in a pilot review of template reports. While some sponsors have utilized the template for reporting, many reports continue to omit key sections, and many don't use the template for reporting at all. The Programmatic AEM project provides annual reports on data gathered for assessing effectiveness of action categories. Action effectiveness data gathered by other projects are summarized in their annual reports.
- ***Measure 2****: Bonneville should continue working with the Council to implement a concise, useful template for annual reports for research and monitoring projects that can replace other more cumbersome, more costly, and less useful reports for individual projects. The Council will continue to work with Bonneville and the ISRP to identify and assemble the information needed to produce an annual summary of results for Council review.*
  **Update:** A template has been created for reporting. In 2014, Bonneville notified sponsors that utilization of the new research, monitoring, and evaluation template would be a requirement for Fiscal Year 2015 contracts, and future contracts. While some sponsors have utilized the template for reporting, many reports continue to omit key sections, and many don't use the template for reporting at all.
- ***Measure 3****: The Council, with the assistance of agencies, tribes and others, will periodically review and update the high-level indicators report to communicate accomplishments to Congress, the region's governors, legislators, and citizens of the Northwest. When the Council completes its work on biological objectives, it will update its high-level indicators to ensure they are consistent with these objectives.*
  **Update:** Council staff continues to collaborate with co-managers and others when developing and updating the information provided by the Program's HLI site and Fish Information site. The Council continues to work on refining Program objectives and thus has not reached a stage where the Program indicators need to be reviewed for consistency with these objectives.
- ***Measure 4****: The Council, with the assistance of agencies, tribes, and others, will maintain the program's dashboard and the HLI website report, and also will produce other reports as appropriate, such as one that tracks annual anadromous fish forecasts and actual run sizes. The Council expects others to provide data and reports on a regular basis and make them available to the public [see Reporting Appendix L for a list of Council-requested reports, which include HLIs; dashboard; anadromous fish forecast and actual run size; annual report to governors on Bonneville's fish and wildlife costs; annual hatchery juvenile fish releases; hatchery adults contributing to harvest; action effectiveness; ISRP reviews; and ISAB reviews]. This will provide easy access for the*

*public and allow the Council to review the accuracy of the pre-season run-size estimates.*
**Update:** Council staff continues to collaborate with co-managers and others when updating the information provided by the Program's HLI site and Fish Information site. The Council is also drawing on the work by the Coordinated Assessment effort for natural-origin spawner abundance by displaying these estimates on the Council's Fish Information Site and on the Council's Fish Objective Mapping Tool. The Council continues to receive updates about pre-season run-size estimates and actual run sizes from fish and wildlife managers at each March Council meeting. The Fish Passage Center continues to provide easily accessible information about hatchery juvenile releases, as well as other fish information, on their http://www.fpc.org/ website.

**Adaptive Management: Evaluation**

**Progress report on the 2014 Program measures:**
Number of measures total: four
Number of measures that have made progress: four

*Update on active measures:*

- ***Measure 1****:* Working with the region, the Council will develop an evaluation process that considers new information to verify or adjust assumptions, hypotheses, goals, biological objectives, strategies, measures, and indicators. This adaptive management approach will ensure program accountability.
  **Update:** The ongoing Council staff effort for developing a Program-focused habitat monitoring and evaluation approach specifically focuses on synthesizing information to guide and prioritize habitat actions for addressing limiting factors as well as regular reporting to track progress and assess effectiveness of these actions. This approach will rely on a core set of information directed at guiding adaptive management of habitat action implementation and thus improving the Program's habitat strategy and measures. An evaluation process for other Program strategies and measures is not being reviewed at this time.
- ***Measure 2****:* The Council, with input from the ISAB and ISRP, will request evaluation of data gathered over several years, with the evaluation approach overseen by those who gathered the data, to inform decisions and advance understanding supported by these data.
  **Update:** The Council has requested the ISAB and ISRP to review syntheses of information related to Pacific Lamprey and Kootenai White Sturgeon. In addition, the Council is currently awaiting the Upper Columbia Spring Chinook review. The Hungry Horse Dam retrospective was reviewed in August 2016. The Council, through its cost-saving workgroup, also recently reviewed the Relative Reproductive Success projects funded under the Program to inform Council decisions related to these projects.
- ***Measure 3****:* The Council supports continued research and life-cycle modeling to inform decision-makers of the biological benefits they could expect from implementing or synchronizing different suites of measures across the life cycle.

**Update:** There are various life-cycle models under development across the basin. If such models are developed in a timely manner, the Council supports those that are focused on providing management guidance or informing key mitigation actions for specific populations or species life stages. The Council is reassessing the Program's needs for life-cycle models that aim to address broader questions, as these models may not be necessary for informing the Program's mitigation actions.

- ***Measure 4****:* Bonneville, agencies, tribes, and other entities receiving Bonneville funding will assist the Council in compiling data in the appropriate format to inform the reports described in the reporting section. These include high-level indicators, subbasin dashboards, anadromous fish forecasts and actual run sizes, annual reports to Northwest governors on Bonneville's fish and wildlife costs, annual hatchery juvenile fish releases, hatchery adults contributing to harvest, action effectiveness reporting, and ISRP and ISAB reviews.
  **Update:** Bonneville, co-managers, and other project sponsors actively assist Council staff by providing requested information for the various reports.