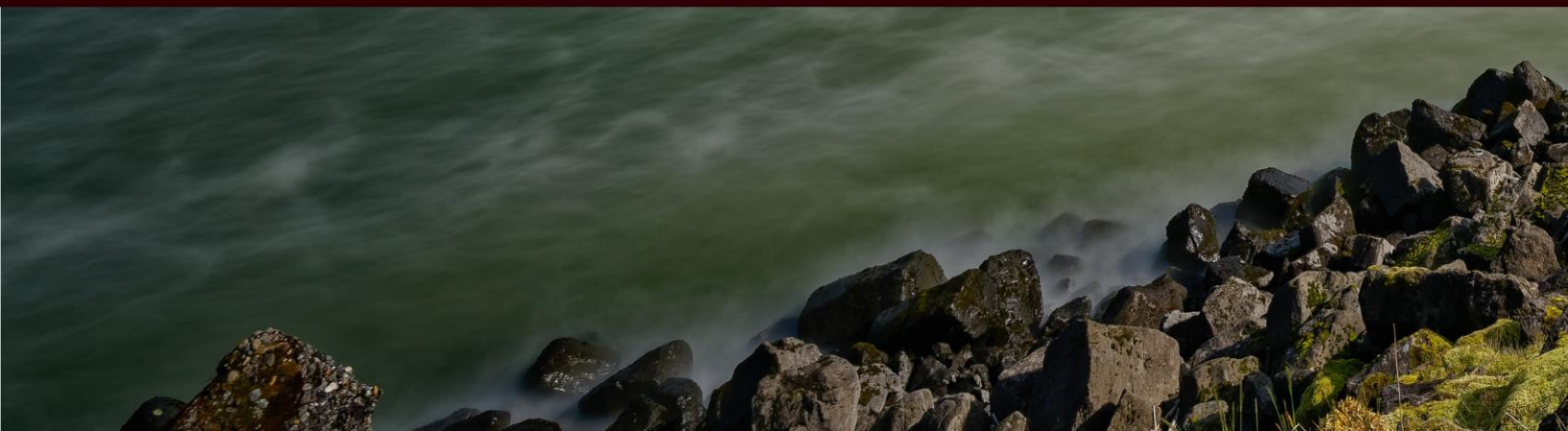




INDEPENDENT SCIENTIFIC REVIEW PANEL

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Final Report:
Mainstem and Program Support
Category Review



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199007700	Development of Systemwide Predator Control	Pacific States Marine Fisheries Commission	Qualified	30
199702400	Avian Predation on Juvenile Salmonids	Oregon State University, Real Time Research	Yes	35
200800400	Sea Lion Non-Lethal Hazing	Columbia River Inter-Tribal Fish Commission (CRITFC)	Yes	37
Climate Change				
200900800	Climate Change Impacts	Columbia River Inter-Tribal Fish Commission (CRITFC)	Yes	41
Habitat RM&E				
201600100	BPA Project Action Effectiveness Monitoring (AEM) Programmatic	Cramer Fish Sciences, Natural Systems Design	Yes	48
200725200	Hyporheic Flow Assessment in Columbia River Tributaries	Umatilla Confederated Tribes (CTUIR)	Yes	56
201700300	Yakama Action Effectiveness Monitoring	Yakama Confederated Tribes	Qualified	58
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200201301	Water Entity - CBWTP	National Fish and Wildlife Foundation	Yes	64
Freshwater Mussels				
200203700	Freshwater Mussel Research and Restoration	Umatilla Confederated Tribes (CTUIR)	Qualified	68
Data and Information Sharing				
200400200	Pacific Northwest Aquatic Monitoring Program (PNAMP) Coordination	US Geological Survey (USGS)	Yes	73
198810804	StreamNet - Coordinated Information System (CIS)/ Northwest Environmental Database (NED)	Pacific States Marine Fisheries Commission	Yes	79
200850500	StreamNet Regional Library	Columbia River Inter-Tribal Fish Commission (CRITFC), Idaho Department of Fish and Game (IDFG), Montana Fish, Wildlife and Parks (MFWP), Northwest Power and Conservation Council, Oregon Department of Fish and Wildlife, Pacific States Marine Fisheries Commission	Yes	83
200850700	CRITFC Inter-Tribal Monitoring Data	Columbia River Inter-Tribal Fish Commission (CRITFC)	Qualified	86
201102000	Data Management Project	Kalispel Tribe	Qualified	90
199800401	Columbia Basin Bulletin	Intermountain Communications	Not applicable	93

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Lamprey				
199402600	Pacific Lamprey Research and Restoration Project	National Oceanic and Atmospheric Administration, Umatilla Confederated Tribes (CTUIR)	Qualified	96
200830800	Willamette Falls Lamprey Escapement Estimate	Confederated Tribes of Warm Springs	Yes	100
200847000	Yakama Nation Ceded Lands Lamprey Evaluation and Restoration	Yakama Confederated Tribes	Qualified	103
200852400	Implement Tribal Pacific Lamprey Restoration Plan	Columbia River Inter-Tribal Fish Commission (CRITFC)	Qualified	107
201101400	Evaluate Status & Limiting Factors of Pacific Lamprey in the lower Deschutes River, Fifteenmile Creek and Hood River Subbasins	Confederated Tribes of Warm Springs	Qualified	113
201700500	Lamprey Conservation Initiative	Bonneville Power Administration, Pacific States Marine Fisheries Commission, US Fish and Wildlife Service (USFWS)	Qualified	117
Snake River Fall Chinook M&E				
199102900	Research, monitoring, and evaluation of emerging issues and measures to recover the Snake River fall Chinook salmon ESU	University of Idaho, US Fish and Wildlife Service (USFWS), US Geological Survey (USGS)	Yes	122
Chum and Fall Chinook in the Lower Columbia				
200871000	Chum Salmon Restoration in the tributaries below Bonneville Dam	Washington Department of Fish and Wildlife (WDFW)	Yes	124
199900301	Evaluate Spawning of Fall Chinook and Chum Salmon Just Below the Four Lowermost Mainstem Dams	Oregon Department of Fish and Wildlife, Pacific Northwest National Laboratory, Pacific States Marine Fisheries Commission, Washington Department of Fish and Wildlife (WDFW)	Qualified	126
Artificial Production RM&E				
198909600	Genetic Monitoring and Evaluation (M&E) Program for Salmon and Steelhead	National Oceanic and Atmospheric Administration	Yes	131
199305600	Advance Hatchery Reform Research	National Oceanic and Atmospheric Administration	Yes	134
200203100	Growth Modulation in Salmon Supplementation	National Oceanic and Atmospheric Administration, University of Washington	Yes	137
Harvest Monitoring and Mitigation				
200852700	Zone 6 Fisheries CRITFC Accord project	Columbia River Inter-Tribal Fish Commission (CRITFC)	Not applicable	138
200850200	Expanded Tribal Catch Sampling	Columbia River Inter-Tribal Fish Commission (CRITFC)	Qualified	139
Conservation Enforcement				
200739100	Tribal Conservation Enforcement-CRITFC	Columbia River Inter-Tribal Fish Commission (CRITFC)	Not applicable	141
200739000	Tribal Conservation Enforcement-Umatilla Tribe	Umatilla Confederated Tribes (CTUIR)	Not applicable	143
200810600	Tribal Conservation Enforcement-Colville Tribe	Colville Confederated Tribes	Not applicable	145

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Harvest – Selective Gear Evaluation				
200810500	Selective Gear Deployment	Colville Confederated Tribes	Qualified	147
Coded Wire Tags				
198201301	Coded Wire-Tag Pacific States Marine Fisheries Commission (PSMFC)	Pacific States Marine Fisheries Commission	Yes	151
201003600	Lower Columbia Coded Wire Tag (CWT) Recovery Project	Washington Department of Fish and Wildlife (WDFW)	Qualified	153
Passage and Survival Monitoring and Support				
198331900	New Marking and Monitoring Technologies	National Oceanic and Atmospheric Administration	Yes	155
200500200	Lower Granite Dam Adult Trap Operations	National Oceanic and Atmospheric Administration	Yes	157
201800200	Integrated In-stream PIT tag Detection System Operations and Maintenance	Quantitative Consultants Inc	Yes	158
198712700	Smolt Monitoring by Non-Federal Entities	Fish Passage Center, Pacific States Marine Fisheries Commission	Yes	161
199008000	Columbia Basin Pit-Tag Information	Pacific States Marine Fisheries Commission	Yes	162
199403300	Fish Passage Center	Fish Passage Center, Pacific States Marine Fisheries Commission	Yes	163
199602000	Comparative Survival Study (CSS)	Columbia Basin Fish and Wildlife Foundation, Fish Passage Center, Pacific States Marine Fisheries Commission, US Fish and Wildlife Service (USFWS)	Yes	164
200851800	Upstream Migration Timing	Columbia River Inter-Tribal Fish Commission (CRITFC)	Qualified	166
199302900	Survival Estimate for Passage through Snake and Columbia River Dams and Reservoirs	National Oceanic and Atmospheric Administration	Qualified	168
199105100	Modeling and Evaluation Statistical Support for Life-Cycle Studies	University of Washington	Yes	170
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198910700	Statistical Support for Salmon	University of Washington	Yes	173

ISRP Final Report: Mainstem and Program Support Category Review

I. Background

Project reviews increase Fish and Wildlife Program accountability and transparency; improve project design, implementation, and overall effectiveness; help track project and Program performance; and facilitate information sharing and adaptive management. This report provides the Independent Scientific Review Panel's (ISRP) final comments and recommendations on 48 projects in the Mainstem and Program Support Category (see Table of Projects, pp iii-v). The ISRP finds that 27 projects meet the ISRP's scientific review criteria and 16 projects meet scientific criteria with some qualifications. The ISRP expects the qualifications to be addressed during contracting, implementation, future annual reports, or the upcoming 2020 and 2021 Category Reviews. The ISRP recommends *not applicable* for 5 proposals that were not amenable to scientific review.

This Category Review covers a broad array of topics. We provide a brief overview of the issues and key findings in this section. Section II explains the ISRP review process, and Section III includes programmatic comments and recommendations on issues general to many projects; Section IV includes detailed comments and recommendations on the individual projects.

The programmatic comments in Section III are intended to help inform the future direction of the Fish and Wildlife Program. General topics covered include the need for projects to establish quantitative objectives, employ adaptive management, easily share information, conduct proper data management/analysis, and communicate uncertainty. More specific topics include quantifying the benefits of conservation enforcement, understanding variation in smolt-to-adult survival estimates, resolving issues related to fish marking, quantifying the effects of toxic contaminants, and the need to consider the complexity and novelty of the Basin's hybrid-ecosystem.

Passage, Predation, and Survival of Salmonids—Freshwater and Ocean

Approximately a quarter of the projects in this Category Review addressed issues related to passage and survival of juvenile or adult salmonids in the hydrosystem and lower mainstem Columbia River. For instance, some projects (e.g., [1987-127-00](#); [1994-033-00](#); [1996-020-00](#)) collected daily measurements of flow, spill, water temperature, and dissolved gas saturation,

which were incorporated into models and statistical analyses to estimate how in-river conditions affect the survival and migration timing of juvenile salmonids. Data from PIT-tag interrogation sites were used to estimate stock-specific juvenile survival and travel times through individual reservoirs, the lower river, and the entire hydrosystem ([1987-127-00](#)). Biological and environmental data across the region were integrated to forecast smolt migration timing past mainstem dams ([1996-019-00](#)). Managers have used the forecasts to adjust flows and spill rates to improve juvenile survival.

PIT tag detections and genetic samples were also used to track migration timing, abundance, survival, and straying of specific populations of adult salmon ([2008-518-00](#)). Data on origin (including wild versus hatchery), age, migration timing, and travel rate were collected and used to parameterize life-cycle models ([2005-002-00](#)). Additionally, PIT tag detection arrays placed in the Snake River Basin were useful in estimating escapement levels in spring/summer Chinook and steelhead populations—a cost-effective approach that promises to be widely applicable in the future ([2018-002-00](#)).

All these assessments rely on the capacity to obtain, store, retrieve, analyze, and interpret data. Each year, over 1.5 million fish are PIT tagged and over 16 million detections are recorded at approximately 300 PIT-tag interrogation sites in the Basin. To be useful, tag codes for individual fish must be linked to detections at specific sites. The PIT Tag Information System (PTAGIS) makes these connections and serves as the region's repository for PIT tag data ([1990-080-00](#)). Efforts are being made to increase the utility of PIT tags. For example, one project ([1983-319-00](#)) is developing and evaluating a new detection array to identify PIT-tagged fish as they pass over dam spillways. Two new detection devices—flexible net-like PIT-tag antenna arrays that can be towed, and vertical detection wands that can be mounted on barges—are being tested to improve PIT tag detection in deep and wide river habitats. A rich and sophisticated suite of statistical tools and software has been developed to analyze mark-recapture data from the region's tagging programs ([1989-107-00](#); [1991-051-00](#)).

Regional managers recognize that survival of juvenile and adult salmonids through the hydrosystem is affected not only by physical conditions in the river but also by vulnerability to potential predators. Salmon predators benefit from a number of anthropogenic changes in the Basin: dams and reservoirs that impede fish migration, expand habitat for predators, and increase vulnerability to predation; predictable releases of large numbers of hatchery origin juveniles; and dredge spoil islands that can be used as breeding sites by piscivorous colonial birds. One of the first studies to investigate predation on juvenile salmonids focused on northern pikeminnow, channel catfish, smallmouth bass, and walleye in the John Day Reservoir ([1990-077-00](#)). Results led to the funding of an ongoing sport-reward fishery that annually seeks to reduce the abundance of northern pikeminnow >200 mm by 10 to 20% in mainstem reservoirs. This removal of northern pikeminnow is estimated to have decreased predation on

juvenile salmonids by ~32%. However, a number of questions remain unanswered about the extent of compensatory responses (i.e. changes in abundance, diet, growth, and relative condition) by other fish predators following the continuing suppression of northern pikeminnow. Additionally, there is a need to update the methods used to estimate abundance, and to explore the possible advantages of targeting predator removal around dams where predation is high. New research is needed to more fully evaluate the benefits from this project. Another project ([1997-024-00](#)) has demonstrated that predation by colonial water birds is the greatest source of smolt mortality for some Endangered Species Act (ESA)-listed salmonid populations.

The number of adult salmon eaten by pinnipeds below Bonneville Dam and at Willamette Falls has increased in recent years. New research is underway to estimate pinniped abundance and the impact of their predation ([2008-004-00](#)). Efforts to dissuade pinniped predation by hazing were found to be ineffective and new policies have been enacted to increase culling of pinnipeds as warranted. The effects of these removals need to be carefully appraised. To date, most of the attention on pinniped predation has focused on losses of adult salmon. Predation of juvenile salmon by pinnipeds, primarily harbor seals, also warrants further investigation.

NOAA's ocean survival project ([1998-014-00](#)) has shown that a number of indices of conditions encountered during early marine life including the Pacific Decadal Oscillation, the Oceanic Niño Index, surface and deep-water temperatures, salinity, and the availability of high energy zooplankton, are useful for predicting smolt-to-adult survival. Pending adequate funding, this long-term project is well poised to (a) examine direct causes of marine mortality, (b) ascertain if forage fish act as a buffer against predation, (c) quantify current qualitative survival estimates, and (d) elucidate the relative roles that freshwater and marine conditions impose on survival.

Harvest and Conservation Enforcement

Basic information on salmon abundance, harvest, and escapement is needed to manage tribal, commercial, and recreational fisheries in the Basin. Several projects in this review are using coded-wire tags (CWTs), PIT tags, and genetic samples to obtain this information. Additionally, recovery of tags and genetic information are being used to evaluate the effectiveness of hatchery operations and to provide data that can be used to track the status of populations at risk ([1982-013-00](#); [2010-036-00](#)).

To monitor tribal salmon and steelhead fisheries in Zone 6 (mainstem Columbia River between Bonneville and McNary Dams), tribal staff use aerial and on-the-water creel surveys to estimate catch and catch per unit effort by species and mark type ([2008-502-00](#)). Creel data are shared with the U.S. v. Oregon Technical Advisory Committee and used to fulfill this fishery management agreement's monitoring requirements. Harvest rates in Zone 6 are not currently

estimated for individual stocks, but this task appears to be technically feasible if random samples from harvested fish were provided regularly to Columbia River Inter-Tribal Fish Commission (CRITFC) geneticists.

Enforcement of fishing regulations is an essential part of fisheries management, and Bonneville Power Administration (BPA) funds three tribal enforcement projects ([2007-390-00](#); [2007-391-00](#); [2008-106-00](#)). These projects provide visible efforts at enforcement and public outreach that likely deter illegal harvest. Quantifying the conservation benefits of these enforcement operations will be challenging but needs to be done in the future.

A tribal project in the upper Columbia is refining the use of purse seines and weirs to selectively catch hatchery Chinook both for tribal harvest and to reduce the proportion of hatchery origin fish that spawn naturally (pHOS) ([2008-105-00](#)). Results are encouraging, but the benefits of this approach for reducing pHOS have yet to be quantified.

Artificial Propagation and Salmon Recovery Projects

Artificial propagation of salmonids is used in the Basin both to provide harvest opportunities and to conserve natural populations. In a typical supplementation program, natural-origin adults are taken from the wild, so their offspring can be reared in a hatchery and released as juveniles. Adults produced from first-generation hatchery parents are expected to return to spawn in their natal streams. However, supplementation is a controversial strategy, because exposure to hatchery conditions has been shown to alter the physiology, behavior, morphology, and demographics of salmonid populations. These changes can lead to inadvertent domestication and a concomitant loss of fitness in the natural environment. Two projects, Growth Modulation ([2002-031-00](#)) and Advanced Hatchery Reform ([1993-056-00](#)) are developing and evaluating rearing protocols to create growth patterns that more closely resemble those of natural-origin fish. More natural growth in hatcheries is expected to reduce the prevalence of early maturing minijack Chinook and residual steelhead, and to increase the life history diversity of steelhead. Such refinements should help to reduce domestication in hatcheries. The impacts of continued supplementation on genetic diversity are also being examined in Chinook and steelhead populations in the Snake River Basin (e.g., by the Genetic Monitoring and Evaluation Program for Salmon and Steelhead [[1989-096-00](#)]). To date the supplementation efforts in the Snake River Basin, appear to have had little effect on the genetic diversity of the populations studied. Further details on these three projects can be found in the Research Project Status Review report ([ISRP 2018-8](#)).

Environmental degradation and lack of access to spawning areas have substantially reduced chum salmon abundance in the Basin. Prior to mainstem dam development, chum salmon spawned in tributaries and mainstem areas as far upstream as Celilo Falls, and annual harvests

ranged from half-a-million to one million fish. Current annual abundance of adult spawners now ranges from the 1,000s to 10,000s, mostly in areas below Bonneville Dam. The precarious status of chum salmon in the Columbia River led to an ESA-listing in 1999. Recovery efforts began just prior to the listing, supported by a number of separate BPA projects and some additional work funded by state, federal, and local entities. Now these efforts are funded through a single mainstem project ([2008-710-00](#)) that aims to identify extant stock structure, determine limiting factors, assess habitat, and then prioritize recovery actions. Protected spawning sites (spawning channels) are being created and evaluated as a recovery tool. A companion project ([1999-003-01](#)) focuses on an important natural spawning site immediately below Bonneville Dam. Daily measurements of water temperature and water levels from this spawning site are used by hydrosystem managers who regulate flows to protect the spawning and incubation habitats adjacent to the dam.

Fall Chinook abundance in the Snake River was impacted by the creation of impassable barriers and other habitat degradation. Dams in the Snake River Basin blocked access to 75% of historical spawning sites and by 1990 only about 350 adults ascended past Lower Granite Dam ([ISRP 2014-4](#)). A supplementation effort led by the Nez Perce Tribe ([1983-350-00](#)) and the Lower Snake River Compensation Plan has substantially increased fall Chinook abundance. At present, the Lyons Ferry and Nez Perce Tribal hatcheries annually release 900,000 yearling and 4.6 million sub-yearling fall Chinook. Many of these fish are reared and then released from acclimation sites located throughout the Snake River Basin. Returns of hatchery- and natural-origin adults now number in the tens of thousands. One of the mainstem projects ([1991-029-00](#)) is assessing the ecological effects of the supplementation effort by collecting data on natural emergence timing, juvenile size, abundance, growth, survival, genetic composition, dam passage timing, and other metrics on Snake River fall Chinook. It has been discovered that many of these fish exhibit a novel juvenile life history by rearing in reservoirs and emigrating as yearling smolts instead of moving downstream as they likely would have done in a free-flowing river. Strong density-dependence in fall Chinook recruitment was also documented, which the proponents attribute to superimposition of redds in spawning sites. However, other possibilities, such as environmental capacity to produce juveniles, were not considered and should be evaluated. A two-stage, state-space life-cycle model was developed to estimate spawner capacity, productivity, and recruits-per-spawner; this model will also be useful for analyzing factors that affect these metrics.

Pacific Lamprey

Many of the same factors that reduced salmon abundance and degraded salmon habitat (e.g., dams, irrigation diversions, logging practices, agricultural land use and contaminants) also affected Pacific lamprey. Fifteen years ago, little was known about the biology of Pacific

lamprey. Because Pacific lamprey are an important food and source of medicine for the Basin's indigenous peoples, tribal biologists, and their partners launched an effort to restore the species abundance and distribution through a suite of well-coordinated research and supplementation projects. Regional tribes, states, and federal agencies have recently become partners in the Lamprey Conservation Initiative ([2017-005-00](#)), a project that seeks to prioritize and obtain monies for unfunded, but high priority actions, designed to conserve and enhance Pacific lamprey populations. The five projects ([1994-026-00](#); [2008-308-00](#); [2008-470-00](#); [2008-524-00](#); [2011-014-00](#)) evaluated as part of this mainstem project review have produced some impressive results. In aggregate, these projects have:

- developed and used methods to mark or tag juvenile and adult lamprey and to estimate the abundance of adults and juveniles;
- identified barriers to migration, and designed and installed passage structures that effectively pass adults and juveniles;
- made substantial advancements in methods of artificial propagation and tested the effectiveness of transplanting hatchery juveniles;
- demonstrated that translocation of adults can be an effective tool to restore the abundance and distribution of Pacific lamprey;
- collected samples to assay contaminant concentrations in juvenile and adult lampreys as well as their habitats;
- developed and applied genetic tools to identify lamprey species, sex, and parentage; to develop parent-based tags (PBTs); and to examine population structure in both neutral and adaptive genes;
- conducted radio-telemetry studies to determine preferred adult holding and spawning habitat and juvenile settlement areas;
- engaged the public through numerous outreach events and materials to emphasize the ecological and tribal importance of Pacific lamprey; and
- completed a master plan (see [ISRP 2018-5](#) for a review) with a well-formulated approach for restoring Pacific lamprey.

Habitat

Successful restoration of salmonids, lamprey, and other fish and wildlife species requires the presence, persistence, and natural evolution of functional habitats. A great deal of aquatic habitat restoration has occurred and is ongoing in the Basin. Determining how to evaluate the

local and Basin-wide effects of restoration actions remains a daunting challenge for restoration science, but some headway has been achieved. The Action Effectiveness Monitoring project ([2016-001-00](#)) is using multiple-before-after control-impact (MBACI) and extensive post-treatment (EPT) designs to examine reach effects of barrier removal, large woody debris (LWD) enhancements, riparian planting, and floodplain restoration. Results showed that fish colonized newly opened habitat when barriers were removed, and the abundance of both salmonids and other fishes increased after LWD was installed. Analyses of the possible effects of riparian planting are continuing. Even though the project randomly sampled study sites from a broad collection of BPA projects, sample biases may occur. Consequently, it will be difficult to assume that similar restoration actions will bring about comparable results. This is especially true in stream reaches located in more degraded watersheds that have experienced different historical events (e.g., fires, recent logging events, adjacent agriculture), undergone different combinations of restoration actions, or possess complex logistical challenges for restoration. The AEM project can assist practitioners by thoroughly explaining the appropriate contexts for applying project findings and the limits for extrapolating results to entire watersheds, subbasins, and evolutionary significant units (ESUs). Nevertheless, progress is being made and more appropriate protocols are now being applied in this important project.

Another mainstem project ([2007-252-00](#)) has been using floodplain assessment procedures to evaluate the importance of geomorphic diversity, temperature patterns, and hyporheic exchange on salmonid productivity. Previous work in the Umatilla Subbasin showed that diverse floodplains possess thermal and physical habitats that salmonids require. Due to human alterations these conditions are now rare. The project highlights the value of creating a uniform assessment of hyporheic flows in stream reaches that can be used to detect and protect such habitats. The ultimate goal of the project is to identify the location of prospective restoration sites by using rapid assessment tools based on hyporheic, geomorphic, hydrologic, and biological data. This approach could have great utility in the upper and middle Columbia River and Snake River subbasins where low flows and high summer water temperatures are impacting salmonid survival and limiting abundance.

Water Transactions

The volume and temperature of hyporheic waters depends on the quantity, flow, and the thermal history of surface waters. For this, and other reasons, surface water has become an important restoration commodity. Legal water withdrawals during peak agricultural growth periods, for example, commonly cause many stretches of the Basin's streams and rivers to run unacceptably low or become completely dry. Both conditions imperil already depressed populations of salmonids, lampreys, and other native fishes. The Columbia Basin Water Transaction Program ([2002-013-01](#)), a mainstem project, works with qualified local entities

(QLEs) to acquire water rights to augment instream flows. To date, this program has been involved with 540 water rights transactions that have returned approximately 1.6 million-acre feet of water to priority reaches. At present, the project has 232 active projects that are spread uniformly across the Basin. New and renewed transactions occur each year and, on average, approximately 33,650 acre-feet and 165 cubic feet per second (cfs) of water are returned annually to bolster river and stream flows during critical periods. Also noteworthy is the impact of the program with respect to fostering the improvement of state and QLE administrative rules and policies for more effective and efficient allocation of acquired water to instream use.

Freshwater Mussels

Along with anadromous salmonids and native trout, three native species of freshwater mussels may also benefit from habitat restoration actions, including flow augmentation due to the Water Transaction Program. Freshwater mussels were once widely distributed and abundant in the Basin and were an important source of food for tribes. Mussels are also a good indicator of water quality and aquatic habitat health. Current conditions in the Basin, including water availability, introduced species, loss of host fish species, urbanization, logging, and agriculture have reduced the distribution and abundance of native mussels (see Xerces Society [Freshwater Mussels of the Pacific Northwest](#)). A mainstem project started in 2002 (Freshwater Mussel Research and Restoration; [2002-037-00](#)) has the goal of developing and implementing restoration actions for freshwater mussels in the Umatilla Subbasin. Substantial progress has been made. Areas of mussel population increases and decreases have been identified, and genetic analyses have added important data on mussel systematics, identification, and biology. Guidelines for reintroductions and a decision process to identify suitable out-planting habitat based on genus have been produced. While monitoring temporal trends in abundance provides important information, modeling of population dynamics to better understand the trends is an important next step. The project would be strengthened if factors such as fecundity, recruitment, stage-specific survival, immigration, and emigration were linked to observable rates of change.

Climate Change

There is a clear need to understand how to prioritize reservoir operations and restoration actions across the landscape based on expected future conditions. One of CRITFC's mainstem projects (Climate Change Impacts; [2009-008-00](#)) has developed a model (CRITFC Information System or CIS) that simulates multiple Columbia River hydrosystem operations under climate change. Ultimately, CIS modeling is expected to allow the tribes to look at expected impacts on first foods due to changes in reservoir operations, flow regimes, water temperature, or quality. In addition to model development, the project also provides technical support for the tribes to

participate in a range of regional planning and regulatory activities around river management and climate change. This ambitious project includes many moving parts that require strategic focus on tangible outcomes to produce its greatest impact. For example, work to identify and prioritize where restoration will have the greatest benefits under new climate regimes is particularly constructive.

Data Management, Storage, and Dissemination of Information

Data, methods, results, and associated information from the Basin's projects need to be checked for quality, cataloged, and made available for further analyses. Objectives of two of the mainstem projects ([2008-507-00](#); [2011-020-00](#)) are designed to fulfill these needs. The remaining four projects in this category serve slightly different purposes. The Pacific Northwest Aquatic Monitoring Program (PNAMP; [2004-002-00](#)) provides leadership and resources to support effective monitoring, data sharing, and training. The resources include their development and support of [MonitoringResources.org](#), where regional experts can upload their methods and protocols making them accessible to other Basin scientists.

StreamNet ([1988-108-04](#)) is another data management project that disseminates information to managers and researchers. It is a cooperative information and data project that plays a pivotal role in the Basin's anadromous fish management. Users can download data in tabular formats or as maps and GIS layers. Along with PNAMP, StreamNet leads the implementation of the Coordinated Assessments Project (CA) that records, stores, reports, and shares High Level Indicator data for anadromous salmon and steelhead populations. These indicators include spawner and pre-smolt abundance, smolt-to-adult return rates, adult and juvenile recruits-per-spawner, as well as proportionate natural influence (PNI) values in supplemented populations. A similar data management project is critically needed for other species (e.g. sturgeon, lamprey etc.) in the basin. There is also a StreamNet Library ([2008-505-00](#)) that stores, manages, organizes, and provides access to fish and wildlife literature on the Columbia River Basin and region. The library focuses on grey literature, a valuable approach as many of these reports are not readily available.

Public support for the Basin's many projects requires that results be communicated widely and effectively. For over twenty years the Columbia Basin Bulletin ([1998-004-01](#)) has admirably served this purpose. This electronic bulletin not only reports on results of formal studies but also provides details on the outcomes of Council meetings and other negotiations taking place among agencies, tribes, and parties operating in the Basin. BPA funding for the Bulletin apparently is ending in FY 2020 or sooner. The ISRP hopes that future funding can be obtained for the Bulletin because it provides a valuable service to Basin administrators, managers, and scientists.

II. ISRP Review Process

Review Criteria

ISRP reviews are based on criteria provided in the 1996 amendment to the Northwest Power Act that directs the ISRP to review projects for consistency with the Northwest Power and Conservation Council's Fish and Wildlife Program and to evaluate if projects 1) are based on sound scientific principles, 2) benefit fish and wildlife, 3) have clearly defined objectives and outcomes, and 4) contain provisions for monitoring and evaluation of results. The ISRP is also charged with reviewing the results of Program expenditures.

Review Steps

The ISRP's review process to develop recommendations and comments followed several steps:

- **Council request and guidance.** The Council initiated the review process on November 16, 2018 with a [guidance letter](#) to project proponents describing the review process and requesting proposals and other supporting material by January 30, 2019. This deadline was extended for proponents affected by the partial federal government shutdown.
- **ISRP individual member reviews.** Each project was initially reviewed by three or more members who were selected based on expertise and previous experience reviewing the project. Each reviewer provided a preliminary and independent written evaluation of the project, which was then shared for discussion prior to step 3. Individual reviewer's comments and records of discussions are confidential and not available outside of the ISRP.
- **Project presentations.** From February 25 to 27 and on [March 18](#), 2019, the proponents presented their projects to the ISRP, Council staff, Bonneville Power Administration (BPA) staff, other proponents, and the public, and they answered questions from the group. The [presentations](#) and discussions were invaluable to the ISRP's understanding of the projects' progress, constraints, and contributions to the Fish and Wildlife Program.
- **ISRP evaluation meetings and preliminary report completion.** On February 28 and March 18, following the presentations, the ISRP met to discuss individual reviewer's comments, develop a consensus recommendation for each project, and ensure consistency across reviews. After the evaluation meetings, the individual reviewer's comments were synthesized into a consensus statement on each project. All members of the ISRP then evaluated and edited the draft consensus statements and developed programmatic comments to produce a preliminary report ([ISRP 2019-1](#)). We requested responses on 10 projects. Project proponents for those 10 projects were provided an opportunity to respond to our concerns by April 30, 2019. An additional project was

submitted late for administrative reasons and was reviewed in time to be included in the ISRP's final report.

- **Response review and completion of the final report.** On May 1, the ISRP received responses for the 10 projects for which a response was requested. The ISRP again followed steps 2 and 4 above: individual reviewers evaluated the responses; those evaluations were compiled; the ISRP met by teleconference to discuss the evaluations and further develop programmatic comments; and a final draft was circulated to confirm ISRP consensus. Of the 10 projects providing a response, the ISRP found that 5 projects met scientific review criteria and 5 projects met criteria with some qualifications.

Next Steps

The ISRP will present its findings at the Council's June 12, 2019 meeting. The public comment period on the report will be open until July 26, 2019. Council staff anticipates presenting recommendations for Council discussion at the Council's July 16, 2019 meeting, and the Council is tentatively scheduled to make recommendations at its August 13, 2019 meeting. See the [Council's review webpage](#) for details.

Recommendation Terms

For each proposal, the ISRP provides a recommendation using the following terms:

- Meets Scientific Review Criteria
- Meets Scientific Review Criteria (Qualified)
- Meets Scientific Review Criteria - In Part
- Meets Scientific Review Criteria - In Part (Qualified)
- Does Not Meet Scientific Review Criteria
- Not Applicable

For preliminary reviews, the ISRP also uses "Response Requested."

The full definitions of the ISRP's recommendation categories are:

1. Meets Scientific Review Criteria is assigned to a proposal that substantially meets each of the ISRP criteria. Each proposal does not have to contain tasks that independently meet each of the criteria but can be an integral part of a program that provides the necessary elements. For example, a habitat restoration project may use data from a separate monitoring and evaluation project to measure results as long as such proposals clearly demonstrate this integration. Unless otherwise indicated, a "Meets Scientific Criteria" recommendation is not an indication of

the ISRP's view on the priority of the proposal, nor an endorsement to fund the proposal, but rather reflects its scientific merit and compatibility with Program goals.

2. Meets Scientific Review Criteria - In Part is assigned to a proposal that includes some work that substantially meets each of the ISRP criteria and some work that does not. The ISRP specifies which elements do not meet the review criteria. In general, the proposal element that does not meet criteria is adequately described, but that element is not sound, is redundant, or would not benefit fish and wildlife. Required changes to a proposal will be determined by the Council and BPA in consultation with the project proponents in the final project selection process.

(Qualified) is assigned to recommendations in the two categories above for which additional clarifications and adjustments to methods, objectives, and results reporting by the proponent are needed to fully justify the entire proposal. Occasionally, the ISRP uses "Qualified" for proposals that are technically sound but appear to offer marginal or very uncertain benefits to fish and wildlife.

The ISRP expects that actions and changes needed to address the qualifications will be determined by the Council and BPA in consultation with the project proponent in the final project selection process. Regardless of the Council's or BPA's recommendations, the ISRP expects that, if a proposal is funded, subsequent proposals for continued funding and annual reports will describe how the ISRP's qualifications were addressed.

3. Does Not Meet Scientific Review Criteria is assigned to a proposal that is significantly deficient in one or more of the ISRP review criteria. One example is a proposal for an ongoing project that might offer benefits to fish and wildlife but does not include provisions for monitoring and evaluation or reporting of past results. Another example is a research proposal that is technically sound but does not offer benefits to fish and wildlife because it substantially duplicates past efforts or is not sufficiently linked to management actions. In most cases, proposals that receive this recommendation lack detailed methods or adequate provisions for monitoring and evaluation, and some propose actions that have the potential for significant deleterious effects to non-target fish or wildlife. The ISRP notes that proposals in this category may address needed actions or are an integral part of a planned watershed effort, but the proposed methods or approaches are not scientifically sound. In some cases, a targeted request for proposals may be warranted to address the needed action.

4. Not Applicable is assigned to proposals with objectives that are not amenable to scientific review.

5. Response Requested is assigned to a proposal in a preliminary review that requires a response on specific issues before the ISRP can make its final recommendation. This does not mean that the proposal has failed the review. In general, the ISRP requests responses on many proposals and most provide sufficient information in the response loop to meet the ISRP's scientific review criteria.

III. Programmatic Comments

Clearly Defined, Quantitative Objectives and Adaptive Management

Many of the projects evaluated in this report have been reviewed multiple times over the past two decades. These reviews represent a considerable investment of time and effort by proponents, the ISRP, and Council and BPA staffs. The review process effectively documents ISRP qualifications, questions, and comments, and many of these concerns are addressed by proponents in subsequent reports and responses. However, two key concerns have persisted from review to review and remain only partially addressed by many proponents, the Council, and BPA. The first persistent concern is that most project proposals do not include quantitative objectives that are specific, measurable, actionable, relevant, and time-bound (i.e., [SMART objectives](#)) to facilitate all stages of adaptive management, including implementation and effectiveness monitoring as well as ISRP review. The second persistent concern is that project proponents often neglect to develop or describe their adaptive management process at either the project scale or the larger Fish and Wildlife Program scale. The ISRP has consistently identified both concerns over the years and recently offered guidance and recommendations to address them in the programmatic comments section of the 2017 Wildlife Category Review ([ISRP 2017-7](#)).

The ISRP recommended that Council staff, with ISRP support as needed, organize an adaptive management workshop and select projects that would be used as examples to follow in developing quantitative objectives and adaptive management plans for other projects ([ISRP 2017-7](#), pages 10-11). The ISRP previously recommended this workshop-based approach for “umbrella” habitat restoration projects too ([ISRP 2017-2](#)). It is the ISRP’s understanding that this recommendation has not been adopted because of other regional planning priorities and because a Council survey showed a lack of interest by the project proponents.

To encourage proponents to address both persistent concerns in time for the current review, the ISRP and Council staff updated the proposal form [guidance document](#), provided instructions to clarify terms, described an adaptive management logic path, and included hypothetical examples. Despite this guidance, many proposals submitted for review still need [SMART objectives](#) and adaptive management plans. These deficiencies hinder the ISRP’s ability to assess progress and effectiveness of projects, as well as the proponents’ capacity to adjust priorities and strategies proactively when progress or funding is less than anticipated. Overall, the efficiency and effectiveness of individual projects and the overall program likely would benefit if these improvements were made.

Recommendations:

A more interactive approach among the ISRP, Council, BPA, and project proponents is needed to address the ISRP's long-standing concerns that most project proposals lack SMART objectives and adequate plans for adaptive management—addressing these concerns will help track and improve project and program performance, including cost effectiveness. However, this interactive approach must be tailored to allow the ISRP to maintain its independent review function. We recommend the following steps as part of an interactive process involving the Council, ISRP, BPA, and project proponents:

- Provide incentives for project proponents to develop SMART objectives and adaptive management plans at an appropriate level for each project by *requiring* them in contracts and *tracking* them at each stage from proposals to statements of work to annual reports.
- Provide guidance and training to project proponents in developing science-based proposals with SMART objectives and adaptive management plans by:
 - Choosing a small, diverse subset of scientifically sound proposals from the existing spectrum of Fish and Wildlife Program activities to serve as examples for other project proponents. The ISRP could work with the chosen proponents to ensure that their projects are presented as effective examples. Potential projects from this review set include:
 - 1998-014-00, Ocean Survival of Salmonids
 - 1997-024-00, Avian Predation on Juvenile Salmonids
 - 2002-013-01, Water Entity-CBWTP
 - 2007-252-00, Hyporheic Flow Assessment in Columbia River Tributaries
 - 2008-308-00, Willamette Falls Lamprey Escapement Estimate
 - 1991-029-00, Research, monitoring, and evaluation of emerging issues and measures to recover the Snake River fall Chinook salmon ESU
 - 2004-002-00, Pacific Northwest Aquatic Monitoring Program (PNAMP) Coordination
 - 1991-051-00, Modeling and Evaluation Statistical Support for Life-Cycle Studies
 - Organizing training sessions at the beginning of the proposal development process to guide project proponents in developing science-based proposals with SMART objectives and adaptive management plans based on advice from Council,

ISRP, and BPA staff. Example projects (as described in the previous bullet) should be used to facilitate training sessions.

- Organizing an adaptive management workshop to clarify Council expectations and to share and discuss example projects with other project proponents. It might be prudent to hold several smaller, sub-regional workshops or webinars as a way to reach a larger number of project proponents and reduce travel costs. The effectiveness of pilot workshops or webinars should be evaluated early in the process before several are conducted.
- Collaborating with state agencies, U.S. Geological Survey Cooperative Fish and Wildlife Research Units, universities, ISRP, Council, and BPA staff to explore other approaches for educating project proponents to develop adaptive management plans.
- Update the Taurus proposal form and guidance document based on feedback from project proponents, the ISRP, and Council and BPA staff, while ensuring the form meets the ISRP's needs for the scientific review criteria and the Council's and BPA's administrative and policy needs. Project proponents and ISRP reviewers have commented that the form has become unwieldy and inefficient to fill out and review, respectively. Changes are needed to facilitate the development and tracking of objectives, to reduce redundancy, and to distinguish the information required for administration from that required for scientific review.
- Emphasize the need for high quality annual reports for each project. ISRP reviews of ongoing projects are primarily based on the most recent annual report. Accordingly, those reports should provide a clear and comprehensive summary of the objectives, methods, cumulative results, and benefits of the project.

Budget Cuts

As part of an agency-wide effort to reduce the cost of hydroelectric power in an increasingly competitive market, BPA has been reducing Fish and Wildlife Program budgets and in some instances project funding. During this review process, many proponents expressed concern that cuts to funding are having or will have serious consequences for the success and effectiveness of their projects. The ISRP is concerned that some of these budget cuts are likely to affect the scientific merits of project design or the soundness of project findings. It is not clear to the ISRP how budget cuts are being allocated across project activities including planning, implementation, monitoring, analysis, and sharing of results. In particular, proponents note that restrictions on funding for monitoring, travel for conferences, training, and coordination

will reduce workforce capacity and pose obstacles to project success. The ISRP also expressed this concern as a programmatic comment in the Research Project Status Review ([ISRP 2018-8](#)).

Recommendations:

Although budget decisions are outside the ISRP's purview, the ISRP would, if requested, review projects to assess whether scientific standards and adaptive management are being maintained adequately following budget cuts. For example, the proposal for the Ocean Survival of Salmonids project (1998-014-00) included three scientific options, each requiring a different level of funding from BPA (with matching funding from NOAA) and offering commensurate benefits.

Another suggestion is to make provisions to allow proponents to compete for supplementary funding to cover demonstrated needs for additional research, monitoring, training, or travel.

The ISRP believes that budget decisions would be better informed by more explicitly linking relationships in the proposal form to project deliverables, their itemized costs, and the amount of time and personnel needed to complete them. The Council and BPA may wish to consider requiring that such linkages be described in future proposal requests.

BPA and the Council should inform the ISRP about any limitation on funding for specific actions, especially limits on project M&E. Better communication from BPA and the Council would provide important context to guide ISRP expectations while reviewing projects. Some ISRP comments may be unconstructive or frustrating for project proponents if we are unaware of prior constraints set by BPA or the Council.

Communication and Information Sharing

Communication, information sharing, and public engagement are critical to building the social, institutional, and scientific fabric needed for successful habitat mitigation and restoration in the Basin. As noted in [ISRP 2018-8](#) (page 14), "Information sharing is identified as a vital element of the current Fish and Wildlife Program and as a cornerstone of adaptive management. A lack of information sharing has been widely recognized as a main reason for restoration failures (Naiman 1992, National Research Council 1996, Naiman et al. 1998)."

The ISRP is concerned that many proposals lack elements that focus on communication and sharing of information at a range of scales (i.e., local, regional, and Basin-wide). Reductions in

funding will likely exacerbate this situation given the low priority given to communication and information sharing activities in most projects. In addition, none of the proposals in the current review describes an approach that could be used to evaluate the efficacy of its information sharing activities, as previously recommended in the Resident Fish, Data Management, and Regional Coordination [Category Review \(ISRP 2012-6\)](#). Such an approach should include evaluation of user satisfaction and the impact of information and databases on restoration design and decision-making, identification of new user needs, and assessment of the extent of actual application of new approaches and techniques.

Recommendations:

- Direct project proponents to report not only task completion and biological and physical results but also the broader *impacts* of their project by describing how they have influenced management, benefited society, or improved effectiveness and efficiency.
- Provide more support to disseminate project results to other practitioners and the public through open-access journals and forums. For example, policy makers should consider either (1) re-funding the Columbia Basin Bulletin or (2) developing replacement tools for comprehensive and timely, Basin-wide information sharing.
- Encourage and support workshops, webinars, and other web-based learning experiences on contemporary topics emerging at both sub-regional and Basin-wide scales. The culture associated with the Fish and Wildlife Program and the proponents conducting the restoration activities are evolving at an ever-increasing pace with the emergence of new technologies, knowledge, and environmental perspectives. The Program has an obligation to lead and assist in shaping the course of that evolution.

Data Analysis and Database Management

Analyses and Interpretation

Considerable effort is directed at collecting information and ensuring that it is catalogued and managed for both immediate and long-term retrieval. However, that information does not become enduring knowledge without insightful analysis and interpretation by experienced researchers. An appropriate balance of data collection and management versus analysis and interpretation is needed to create knowledge efficiently. The ISRP is concerned that a correct balance is not being achieved for projects within the Fish and Wildlife Program, especially for

habitat restoration projects. It appears that insufficient effort is being directed at analysis and interpretation relative to that directed at data collection and management. In contrast, a more effective balance of data management and analysis is evident in projects funded to assess mainstem passage, hatchery supplementation, and avian predation, although, even among these topics, more data analysis and synthesis across projects and species would be beneficial.

Information mapping: matrix of database sharing

Scientists and managers currently need access to many different databases to conduct large-scale analyses in the Columbia Basin. The ISRP believes that sharing of data among projects could be improved by compiling a matrix or map to indicate the kinds of data available from various projects and how these data are accessed. Some projects, especially those focused on data management, have similar goals and provide similar services, but often target different sets of users. This presents an opportunity to better coordinate these projects to reduce overlap or potential redundancy in how data products are delivered.

As noted in a previous review ([ISRP 2012-6](#), pages 14-15), “In order to reduce any creep toward redundancy the ISRP recommends development of a summary matrix by Council staff or the ISRP that identifies characteristics of each data management project. The matrix could be updated as new proposals are evaluated.” Partly in response to this and other Council and ISRP recommendations, BPA developed [A Framework for the Fish and Wildlife Program Data Management: Issues and Policy Direction for Development of a Data Management Strategy and Action Plan \(June 04, 2013\)](#). In 2013, the Independent Scientific Advisory Board (ISAB) reviewed this document and recommended that Appendix B provides a good overview of Columbia River Basin databases, but that “a master index (similar to Table B.2) will be needed to help guide users to the relevant data and show them how the different sources for the same (apparent) data differ” ([ISAB 2013-2](#)).

The Fish and Wildlife Program supports both distributed and centralized data management strategies, but the choice of strategy should depend on the ultimate purpose of the data collection and analysis effort ([ISRP 2012-6](#)). For example, StreamNet proponents are identifying pathways from data collection to standardization, storage, and sharing. However, tribes and agencies still need their own data stewards and databases, and the onus is on individual project proponents to describe how they will share the data with other users at the local and regional scales. Consequently, it is essential to bring data stewards together with managers, on a regular basis, to use centralized databases more effectively.

Strategic plans needed to meet long-term goals

Many data management proposals state mid- and long-term goals without describing a strategy or listing the key activities and timelines needed to achieve these goals. Consequently, their long-term vision lacks connection to near-term activities, which are largely determined by day-to-day needs. Developing a time x task matrix like a [Gantt Chart](#) can be helpful to projects, particularly ones with a lot of objectives, tasks, or cooperators and can help proponents allocate resources and staff.

Monitoring of user needs and satisfaction

Often data management projects are designed to meet the needs of diverse user groups and expand the number and types of users. However, most of these projects lack a meaningful process to track total usage, user identity, user satisfaction, and user requests for added features and services. The ISRP recommends that this type of monitoring and evaluation of usage should become standard for database management projects in the Program.

Data stewards: developing and retaining expertise

Decision makers need to be aware of the vitally important role of data stewards in managing data effectively. Attention and resources are needed to attract and retain highly trained data stewards.

Collection, curation, and sharing of data for non-salmonid species

At the direction of BPA, StreamNet focuses their collection, curation, and sharing of data through the Coordinated Assessments on salmonids. StreamNet has been effective and efficient at completing this work. Its impact has also highlighted the need for similar activities focused on other vulnerable species in the Basin, including lamprey, sturgeon, eulachon, resident species, and potentially wildlife and hatchery-origin salmon and steelhead.

Recommendations for data analysis and database management:

- Develop and financially support projects to analyze and interpret collected data, especially projects with broad spatial and temporal perspectives (e.g., the Comparative Survival Study).

- Facilitate data sharing among projects by compiling and publishing a dynamic matrix or map to communicate the kinds of data that are available from various projects in the Basin and how these data are accessed.
- Ensure that data management proposals include strategies and actions to guide progress toward long-term goals.
- Require that all database management projects in the Fish and Wildlife Program routinely monitor and evaluate database usage, user identity, user satisfaction, and user requests for added features and services.
- Support data stewards, where the need is identified, to foster development and retention of expertise.
- Include available information on non-salmonid species (e.g., Pacific lamprey, white sturgeon, American shad) in databases like StreamNet to broaden their value and usage, as is accomplished for salmonids through the Coordinated Assessments.

Communicating Uncertainty

Innovative methods for communicating results and identifying potential applications could greatly enhance the dissemination of monitoring information and improve projects throughout the Basin. The ISRP's 2018 Research Project Status Review ([ISRP 2018-8](#)) stated:

“A critical challenge for RME projects is providing information that can be directly applied to management issues throughout the life of the project, not just at the end. This requires agreement at the start of the project between the funders and the investigators about the degree of uncertainty that decision makers and managers are willing to accept and the format for reporting. More discussion and agreement on formats and delivery of interim information at the outset of future monitoring programs will be useful.”

Recommendations:

- Discuss and reach agreement at the outset of future monitoring programs on the format and schedule for delivery of information during the life of each project. As recommended in the Research Project Status Review ([ISRP 2018-8](#)), the RM&E strategy being developed by BPA, Council, and NOAA should include explicit guidance

and requirements to ensure research is designed and communicated to meet the needs of both restoration practitioners and decision makers.

- Communicate the uncertainty of project results and include clearly defined limits to inferences and management applications. This context is needed to prevent unwarranted and misleading generalizations and avoid inappropriate applications.

Conservation Enforcement

The ISRP recommendation for all tribal conservation enforcement projects in this review is “not applicable.” It was not possible to assess the scientific merit of these individual enforcement projects because they typically involve just one or a few officers who must respond flexibly and opportunistically to events. They also may lack the time, skills, or staff support to compile and analyze the results of their enforcement actions. However, it would be useful to conduct a science-based review of the conservation enforcement projects in aggregate. For example, performance indicators based on enforcement actions could be compiled to facilitate evaluation of temporal and spatial trends in threats to the resource. Perhaps proponents of the enforcement projects could engage with biologists from CRITFC and other agencies to link enforcement activities to biological metrics relevant to the objectives. Such quantitative assessments might improve the adaptive management cycle by allowing for more effective review of methods, prioritization of enforcement activities, evaluation of performance outcomes, and sharing of lessons learned.

Recommendation:

Develop a separate project to track spatial and temporal trends in enforcement activities among tribes, quantify their cumulative enforcement actions, assess changes in threats over time, and relate these activities to biological objectives.

Examining the Strengths, Weaknesses, and Causes of Variability in SAR Estimates

At least three BPA-funded projects in the Basin produce estimates of smolt-to-adult return rates (SARs). These SAR estimates often differ and are prone to different kinds of bias among projects because they are based on data from different sources. For example, some

investigators use PIT-tag data (e.g., NOAA-Fisheries, Comparative Survival Study, CSS) whereas others rely on coded-wire tag (CWT) data (e.g., John Skalski's group at the University of Washington; project 1989-107-00). Disparities arise, in part, because the different tag types are released and recovered at different locations. The project proponents agree that the best choice of data for analysis depends on the particular questions being asked. PIT-tags are more useful for tracking smolt and adult survival through the hydrosystem because they can be detected repeatedly at different interrogation sites. CWTs typically provide larger sample sizes (i.e., more tags are released and recovered) leading to more precise estimates of overall SAR. However, the reliability of SAR estimates also depends on various sources of bias associated with differences between the tag types and their respective sampling regimes. Biases related to differences in detection probability or tag loss associated with mortality or shedding are currently being investigated by the Cumulative Survival Study.

The recent advance in parentage-based tagging (PBT) has introduced an additional opportunity to estimate SARs for untagged fish. Some researchers suggest that PBT could soon replace the need for CWT (Beacham et al. 2018¹). Alternatively, perhaps PBT could be used to characterize and account for disparities in SARs based on CWT and PIT-tags.

Recommendation:

Evaluate alternative approaches for estimating SARs with respect to underlying assumptions and applicability and compare the resulting SAR estimates in a single review. This review could be undertaken by: (1) the project proponents working collaboratively, (2) an independent analyst, or (3) the ISAB.

Snake River Fall Chinook Marking

A large proportion (20% or more) of the millions of Snake River fall Chinook reared in hatcheries annually are released without marks. Moreover, the unmarked proportion varies from year to year and among release sites. This high and variable proportion of unmarked hatchery fish greatly reduces the certainty of inferences about the status of natural populations. It also complicates the selective harvest of hatchery fish in tributaries where spawners exceed the

¹ Beacham, T.D., and 9 coauthors. 2018. Comparison of coded-wire tagging with parentage-based tagging and genetic stock identification in a large-scale coho salmon fisheries application in British Columbia, Canada. Evolutionary Applications DOI: 10.1111/eva.12711

capacity of a stream to support them. The value and feasibility of selective harvest to increase the proportion of natural origin salmon in hatchery broodstock (pNOB) and to reduce the proportion of hatchery-origin salmon spawning naturally in streams (pHOS) is nicely demonstrated by the Colville Tribe’s Selective Gear Deployment project (2008-105-00) in the upper Columbia Basin. A similar initiative could be useful for fall Chinook in the Snake River.

Recommendation:

The proponents and decision-makers involved with Snake River fall Chinook production, marking, and monitoring should fully consider the consequences of not marking hatchery-reared fish with respect to monitoring the status of natural fall Chinook populations, increasing harvests of hatchery fish in terminal areas, and reducing pHOS. If physical marking is ruled out, parentage-based tagging (PBT) should be considered—and financially supported—as an alternative.

Water quality

Reduced water quality and the proliferation of toxic chemical contaminants are key threats to the Columbia River ecosystem ([ISAB 2011-1](#), [ISAB/ISRP 2016-1](#)). Many BPA projects are concerned with water quality issues such as temperature and total dissolved gas (TDG), but there are virtually no projects considering toxic chemical contaminants. The Environmental Protection Agency’s (EPA) [Columbia River Toxic Reduction Work Group](#) has been in place for more than 10 years but has been relatively inactive in recent years. There is renewed interest and action based on the expansion of the Clean Water Act under Section 123 (i.e., Columbia River Basin Restoration Program). Section 123 has two elements for EPA: (1) establish a Working Group by invitation to the four states, tribes, non-governmental organizations (NGOs), land owners and general public; and (2) establish a grant program. Congress recently allocated \$1 million to the grant program, which could grow to \$5 million annually. EPA hopes to have the grant program in place by September 2019.

Recommendation:

The Council and BPA should encourage BPA-funded project proponents to collaborate with others in the region in this toxicant reduction program. This collaboration could take the form of sharing sampling equipment and coordinating sampling schedules to increase the cost efficiencies of projects.

Hybrid-Ecosystem Management

Project activities in the Basin are being conducted within a hybrid ecosystem—a mix of naturally occurring and introduced organisms that is heavily influenced by human development and climate change. This context must be considered when addressing many of the topics covered in this Category Review: ocean, predation, climate change, habitat RM&E, water transactions, lamprey, chum and Chinook salmon, artificial production, harvest, passage and survival monitoring, and conservation enforcement. Most mainstem projects depend on information that is integrated across spatial scales and time periods, but such information is often fragmented or unavailable. Many of these projects also contribute information needed to develop synthetic models for assessing full life cycle impacts on and the status of salmon and steelhead populations in the Basin.

The ISAB previously emphasized the need for a hybrid-ecosystem perspective by suggesting revisions to the four guiding principles of the 2014 Fish and Wildlife Program ([ISAB 2018-3](#)).

1. To restore salmon, steelhead, and other native fish and wildlife in the Columbia River Basin, policy makers, resource managers, and restoration practitioners need to take the entire ecosystem into account, including freshwater, estuarine, and ocean components, and the linkages and feedbacks between the natural and human systems.
2. To restore native fish and wildlife in the basin, managers need to consider the entire complex coupled natural-human system and understand the linkages and feedbacks that have reduced abundance of fish and wildlife.
3. Restoring salmon, steelhead, resident fishes, and other native fish and wildlife will require sustaining connections among all habitats that these species require in rivers, lakes, estuaries, oceans, riparian zones, and uplands at appropriate times throughout their life cycles.
4. Fish and wildlife live within complex ecosystems dominated by humans, so to achieve system resilience and persistence, policy makers, resource managers, and restoration practitioners will need to understand societal values for these animals and their ecosystems and incorporate these in their decision making.

This context is especially important when considering predator management, which is explored in detail in the ISAB's recent report on the effectiveness of predator management ([ISAB 2019-1](#)). For example, dredge spoil islands and altered flows have created habitat for piscivorous birds. Hatchery fish continue to provide an abundant and predictable food supply for a variety of predators during certain times of the year. Introduced non-native fish can fill predatory

niches left vacant when other fish are culled to reduce predation. The ISAB submitted an important conclusion and recommendation for hybrid-ecosystem management:

*“Human alterations have changed the dynamics of both juvenile and adult anadromous salmonids, abundance and distribution of native and nonnative predators, vulnerability of salmonids to predation, and complexity of food webs in the Columbia River Basin. Predator management in the Columbia River Basin currently focuses on individual predator species and survival of the portion of their prey that are salmon and steelhead. Most predation analyses to develop management actions in the Basin are fragmented and ignore other factors (e.g., hydrosystem operations, habitat degradation) that influence survival of focal species. **A Basin-wide, ecosystem-based approach for assessing and managing fish, avian, and pinniped predators collectively is needed to create a more effective and consistent approach for developing more biologically and economically effective predator control actions.**” [emphasis added]*

Recommendation:

- Incorporate Basin-wide information on the hybrid ecosystems of the Columbia River in life-cycle models to evaluate integrated effects of ecosystem conditions, predators, and human actions on fish and wildlife resources.
- Include past, present, and projected future conditions of the hybrid ecosystems of the Columbia River Basin in life-cycle models to retrospectively assess historical abundances and to forecast future recovery of salmon and steelhead.

IV. Projects and Comments

Ocean

199801400 - Ocean Survival of Salmonids

- Background info in Taurus: [Project proposal](#)

Proponent: National Oceanic and Atmospheric Administration

Recommendation: Meets scientific review criteria

Comment:

In 2010, the Bonneville Power Administration addressed the need to understand salmon survival in the ocean, stating "Salmon spend most of their lives in salt water. Most don't come back to the river to spawn. If just 1 to 2 percent more juvenile salmon survived through adulthood in the ocean, the number of adult salmon that spawn would more than double" (see [BPA document](#)). Since then, BPA's need to understand ocean survival of salmon has been reaffirmed by dramatic fluctuations in ocean conditions (favorable and unfavorable) that were correlated with adult Chinook salmon and steelhead returns to the Basin. Nevertheless, funding for the Fish and Wildlife Program's research program to understand salmon survival in the ocean has been reduced by about 75%.

In this "change-of-scope" proposal, the NOAA investigators responded to the ISRP's recent ([ISRP 2018-8](#)) scientific review by providing an innovative research plan to advance quantitative understanding of the physical, biological, ecological, and ecosystem processes that impact the early ocean survival of Columbia River salmon and steelhead. The proposal focuses on the practical needs to improve forecasting of adult salmon returns and to advance decision-making about management and mitigation options in the face of future (unpredictable) changes in climate and ocean conditions. Cognizant of budgetary constraints, the NOAA investigators provided three alternative funding scenarios for project implementation. The first scenario (Option A) indicates that present funding levels cannot maintain all of the project's current field and laboratory investigations, ones that are cornerstones of this project. For example, the May survey that provides the only empirical data on juvenile steelhead and associated ocean conditions would be eliminated. Considering the current poor ocean survival of Columbia River steelhead, this loss of information is untenable to the ISRP. The second scenario (Option B) continues the May survey but does not allow implementation of the full suite of proposed objectives that advance adaptive management and mitigation practices. Thus, the ISRP recommends full implementation of the proposed project (Option C), which would include

testing of hypotheses critical to understanding the top-down mechanisms (predation, predator-prey interactions) that control early ocean survival of juvenile salmonids (see [ISRP 2018-8](#)).

1. Objectives, Significance to Regional Programs, and Technical Background

This proposal is the only remaining Fish and Wildlife Program project, as well as the only project in US coastal waters, that directly addresses the effects of ocean conditions on growth and survival of Columbia River juvenile salmon and steelhead. During the past 21 years, the project has revealed several important relationships among ocean conditions, the Columbia River plume, and the distribution, abundance, and survival of juvenile Columbia River salmonids. The biological/physical objectives of the project are clearly defined. Three alternative scenarios for project implementation and scientific objectives for each option are provided. This "change of scope" proposal includes past objectives that were reviewed by the ISRP in 2018 and provides new objectives (depending on funding level). The new objectives will address the direct causes of early ocean mortality of juvenile salmonids (predation by marine birds and piscivorous fish, and reduction in abundance of forage fishes as a buffer to predation), enable quantification of the current qualitative forecasts of adult salmon returns, and lead to an ecosystem-based model to help decouple the effects of various mitigation efforts in fresh water from the effects of a changing ocean environment.

The significance of this ongoing project to the region and to mitigation and management of Columbia River salmon and steelhead is widely recognized and cannot be overstated by the ISRP. Extending the 21-year dataset and addressing the new proposed objectives are critical to the understanding of factors affecting the growth and survival of Columbia River salmonids and how management actions in the Basin may increase salmonid survival at sea. The project has continued to adapt and change in response to scientific reviews by the ISRP and to management and evaluation needs in the Basin.

The description of the technical background is outstanding and provides a review of relevant past results and anticipated quantitative results, including strong supporting information from the primary literature.

2. Results and Adaptive Management

The ISRP reviewed the results and outcomes of this project in 2018. The ISRP views this "change of scope" proposal as an adaptive response to both the ISRP's review and lessons learned from past results. The project has an outstanding record of publication in the primary scientific literature (~130 publications), participation in scientific and management meetings, presentations to the Council including the Ocean Forum that provides outreach and interaction between scientists and managers in the Basin, and public outreach through electronic and print media. Underscoring the importance of the project, in February 2019, the Seattle Times

published a multi-page article that described the ongoing effort by this project to unravel factors affecting salmon survival and abundance. Another recent (March 2019) Seattle Times article discussed the project's June 2018 survey findings, indicating improved ocean survival of juvenile Chinook salmon.

3. Methods: Project Relationships, Work Types, and Deliverables

The proposal, including new objectives, is based on sound scientific principles and methods, and includes provisions for monitoring and evaluation of results. The relationships to projects both inside and outside of the Fish and Wildlife Program are clearly described. The project is well coordinated with similar projects that focus on the marine ecology and survival of salmonid populations from other regions of the USA and Canada, including collaborative data sharing, development of new and improved methods, and scientific publications. Work types and deliverables are clearly described and achievable based on past performance.

The proponents describe objectives, methods, and effort that are specific to three funding scenarios. They also provide a detailed description of how each of four objectives is dependent on each level of funding. Although NOAA Fisheries provides matching funds for this effort, project costs have increased while the overall operating budget has declined significantly since 2012. Additionally, BPA funding for two other ocean research projects (i.e., Canadian Department of Fisheries and Oceans; Pacific Ocean Shelf Tracking project) were eliminated in 2012. The current level of reduced funding for the NOAA Fisheries Program (Option A) would lead to reduced effort and scope (e.g., no May survey, thus missing steelhead and early migrating Chinook). Option B represents partial restoration of the budget. Option C represents full budget restoration that would include testing of hypotheses critical to understanding the top-down mechanisms (predation, predator-prey interactions) that control early ocean survival of juvenile salmonids (see [ISRP 2018-8](#)).

Predation

199007700 - Development of Systemwide Predator Control

- Background info in Taurus: [Project proposal](#)

Proponent: Pacific States Marine Fisheries Commission

Recommendation: Meets scientific review criteria (qualified)

Qualifications:

The ISRP recommends that the proponents describe their responses to the ISRP's comments and suggestions below in their upcoming annual report covering FY 2019 accomplishments.

1. This long-running project has fully developed annual objectives and well-established field and analytical tasks. However, project's methods were developed over twenty years ago. Consequently, the proponents should determine (a) if it is possible to use their extensive capture-recapture data in the Barker Model to estimate survival, recruitment, movement, and abundance; (b) if their estimators for abundance based on CPUE are still valid; and (c) how well those approximations align with potential estimates produced from capture-recapture data. Validation of the abundance estimator is important since it is linked to the project's predation index. The proponents should also determine whether current bioenergetic models could provide improved estimates of consumption of juvenile salmonids, instead of indices of consumption.
2. The ISRP asks the proponents to determine if direct measures of predation due to colonial waterbirds that have been developed can be applied to piscivorous fishes in the Basin. Although results from analyses on a variety of parameters including PSD, W_r , diet composition, and indices of abundance, consumption, and predation failed to detect signs of compensatory responses in northern pikeminnows, smallmouth bass, and walleye, their data suggest that localized compensatory responses may be occurring. The proponents should perform analyses to evaluate trends in locations that exhibit potential compensation by these predators. We also recommend that the proponents work with the Basin's avian researchers to see if their efforts to remove northern pikeminnow have prompted a compensatory effect in colonial waterbirds. Recently, direct measures of predation due to colonial waterbirds have been developed. The data collected by this project appear to be suitable for a similar analysis. We ask the proponents to explore this possibility with the avian researchers.
3. We encourage the proponents to work with others to publish peer-reviewed papers describing their work and findings. It appears that the most recent work published from this very large effort was published before the turn of the last century.

4. Although it is clear that the project is using adaptive management to change and refine its actions, a brief description of the process being used is needed. Is it a formal process or an ad hoc one prompted by an apparent need?

Comment:

1. Objectives, Significance to Regional Programs, and Technical Background

The northern pikeminnow management program (NPMP) has three major goals, to: (1) estimate rates of exploitation of northern pikeminnow and quantify predation reduction, (2) characterize population parameters of northern pikeminnow, smallmouth bass, and walleye in the Columbia and Snake rivers, and (3) assess evidence of intra- and inter-specific compensation due to the sustained removal of northern pikeminnow. These goals are addressed in the project's six overarching implementation objectives which are to (1) conduct a sport-reward fishery; (2) perform fisheries at the John Day and The Dalles dams; (3) evaluate the dam fisheries; (4) examine potential compensatory responses in northern pikeminnow, smallmouth bass, and walleye due to the continuous removal of northern pikeminnow; (5) estimate fishery exploitation rates; and (6) evaluate the overall effects of the NPMP on predation rates. Specific details on the tasks that are performed under each of these implementation objectives are presented in the project's 2017 Annual Report.

Pikeminnow control occurs annually. Quantitative objectives have been established for some objectives (e.g., annual exploitation rate of 10% to 20%), establishment of 19 sport fishery registration, and creel stations situated throughout the Basin. In most cases, however, specific quantitative objectives have not been set. However, they could be established if power analyses were used to help set yearly objectives for the number of diet samples, numbers of fish that should be tagged, and number to be collected for indices. Such objectives would need to be determined for each reservoir reach sampled by the project. For data analysis objectives, quantitative goals are not appropriate, other than their yearly completion.

2. Results and Adaptive Management

The proposal and 2017 Annual Report (Williams et al. 2018) indicate that annual sport-reward and dam fisheries have occurred as planned. Catch, effort, diet, and other biological data have been collected and analyzed. Additionally, a model developed in the 1990's is used to estimate the potential decrease in predation of juvenile salmonids due to the program's removal of northern pikeminnow. The proponents acknowledge that simply saving juvenile salmon from northern pikeminnow predation may not increase their overall survival. Compensatory responses (i.e., changes in abundance, diet, growth, or relative condition) in the northern pikeminnow population and in other potential predator populations may nullify any apparent gains in juvenile salmonid survival. Consequently, a portion of the project's work examines

possible compensatory responses in northern pikeminnow, smallmouth bass, and walleye. The project's CPUE estimation of abundance indices, however, should be reviewed and recalibrated. The population estimation methods were developed in 1995 and have not been reassessed or calibrated in more than 20 years. Local increases in smallmouth bass have been documented in several major sites. Compensation could be occurring locally and reducing the effectiveness of the pikeminnow control efforts, but the current averaging of abundance indices across the system will not reveal those impacts.

The project summary indicates the project has a long history of using adaptive management to change its methods and management actions. For example, changes were made on: (a) the lower size limit of the northern pikeminnow that should be harvested, (b) how sport fishers should be paid for harvested fish, (c) whether dam fisheries should occur and where these fisheries should take place, (d) where registration and creel check stations should be established, (e) tagging methods used to estimate tag loss, and (f) the number of agencies involved in program oversight. The results and lessons learned are largely applicable to the project. The overall approach of assessing potential survival benefits of predator removal on prey species, however, may have applicability beyond the Basin.

The project has consistently provided annual reports, helped organize a basinwide conference on predation, and made presentations to the Council. All these are useful for management. The project also produced peer reviewed journal articles before 2000, but the proposal does not report the publication of any journal articles in 20 years.

Since its inception in 1991, the program has harvested ~ 4.9 million northern pikeminnow, reached its desired exploitation rate of 10%-20% on northern pikeminnow > 25 cm in 24 out of 28 years, reduced potential consumption on juvenile salmonids (estimated from indices) by an average of 32% (range 17% - 49%), and detected no system-wide compensatory responses in sampled piscivores. There are several opportunities for the project to further its investigations on the effectiveness of its actions on juvenile salmon survival. For instance, the project could integrate its data with others (e.g., projects 1996-020-00 Comparative Survival Study and 1993-029-00 Survival estimates for passage through Snake and Columbia River dams and reservoirs) to estimate survival rates from one reservoir to the next. These rates could be correlated with exploitation and possibly SAR values. The project should also use its plentiful capture-recapture data to estimate abundance, survival, recruitment, and movement of fish throughout the river system. These estimates could be made by reservoir or location and compared to those the project makes on a systemwide basis.

Additionally, the project should investigate the possibility of using currently available DNA methods (including eDNA; see Sethi et al. 2018, Krehenwinkel et al. 2019) to help determine the diets of harvested northern pikeminnow by size, area, and time strata. Also, the current

model to evaluate improvements in survival of juvenile salmonids estimates how the removal of northern pikeminnow in year “*n*” has enhanced survival in the following year (year “*n + 1*”). Juvenile salmonid survival is also expected to increase during the year of removal (i.e., year “*n*”). The proponents collect data that could be used to estimate the number of juvenile salmonids “spared” due to the operation of their fisheries in the same year the fisheries are taking place.

The project’s proposal and annual reports conclude that compensatory responses in northern pikeminnow and other predatory resident fish have not been detected. This conclusion needs to be investigated further. Currently, abundance indices for northern pikeminnow, smallmouth bass, and walleye are based on catch-per-unit effort (CPUE) data. CPUE data have apparently not been calibrated with the project’s capture-recapture data since the early 1990s. Such an evaluation should be done as CPUE estimates of relative abundance likely vary among years and seasons. Also, the proposal reports that smallmouth bass have increased in several Snake River reservoirs and locations in the mainstem. This suggests that compensatory responses may be occurring in specific locations. This possibility should be investigated.

Finally, efforts to evaluate compensatory responses among predators has been restricted to fish species. The proponents should explore working closely with avian researchers in the Basin to see if reductions in northern pikeminnow abundance have led to compensatory responses in bird populations (e.g., numerical and migratory responses in gulls, pelicans, terns, cormorants, seabirds in the plume, etc.). Recently, for example, Real-Time Research scientists have developed methods that directly measure the predatory impacts of colonial waterbirds on juvenile salmonids. They discovered that bird predation was likely additive and varied from week to week. When asked, these scientists were confident that the data being collected by the northern pikeminnow project would be amenable to their approach. This would allow the project to make more robust assessments of additive or compensatory responses.

3. Methods: Project Relationships, Work Types, and Deliverables

The NPMP has developed and implemented its program based on sound scientific principles and initial empirical studies that modeled northern pikeminnow predation and produced indices of abundance, predation, and consumption. This foundational work continues to be the basis for the program and its continued focus on exploitation rates of northern pikeminnow. The approaches being used are appropriate. However, after more than 28 years, there are opportunities to:

- Re-evaluate estimators of abundance and predation rates. For instance, in 2017 more than 1400 northern pikeminnow were tagged with individual tags. About 170 were recaptured and used to estimate exploitation rates. It seems like much more could be done with these data. The Barker model, for analyzing capture-recapture data (an

extension of the CJS open-population model), could be used to estimate the survival of northern pikeminnow by size class and perhaps estimate their abundance (see Conner et al. 2015; Bouwes et al. 2016). If these estimates were calculated for different years, they may also provide information about compensatory responses of northern pikeminnow to the project's consistent removal program.

- Take advantage of the PIT-tagging program to create alternative estimates of abundance as well as measure the distribution and habitat use of northern pikeminnow across seasons.
- Conduct focused northern pikeminnow population estimates in the upper Columbia and use the survival studies of the PUDs and CSS study to evaluate the effects of pikeminnow predation on juvenile salmonid survival.
- Examine to what degree is the project's systemwide sport fishing harvest more efficient than focused intensive harvest activities by state and federal agencies or contractors in areas where elevated predation is likely occurring. For instance, dams, tailraces, and habitats upstream and downstream of passage routes are areas where predators can congregate. Salmonid prey are concentrated, and may be injured or impaired, as they pass through these locations. Predator management is warranted in such areas as it may increase the survival of juvenile salmonids as they navigate through the mainstem.
- Perform power analyses to determine appropriate numbers of tagged fish to release in each of the reservoirs being evaluated by the project.
- Use current bioenergetic models to estimate total consumption of salmonids by pikeminnow across reservoirs.
- Develop local and systemwide assessments of compensation to see if patchy compensatory responses are occurring, increasing, or simply represent interannual variation.

The NPMP has a long record of timely reporting to BPA and the states and has developed a public website where its reports and data on fishing results can be found. After more than 20 years of sampling and analysis, publication of their findings in peer-reviewed journals would increase their education and technical transfer efforts.

Literature cited:

Bouwes, N., N. Weber, C.E. Jordan, W.C. Saunders, I.A. Tattam, C. Volk, J.M. Wheaton, and M.M. Pollock. 2016. Ecosystem experiment reveals benefits of natural and simulated beaver dams to a threatened population of steelhead (*Oncorhynchus mykiss*). *Nature Scientific Reports* 6:28581.

- Conner, M.M., S.N. Bennett, W.C. Saunders, and N. Bouwes. 2015. Comparison of tributary survival estimates of steelhead using Cormack–Jolly–Seber and Barker models: implications for sampling efforts and designs. *Transactions of the American Fisheries Society* 144:34–47.
- Krehenwinkel, H., S.R. Kennedy, S.A. Adams, G.T. Stephenson, K. Roy, R.G. Gillespie. 2019. Multiplex PCR targeting lineage specific SNPs – a highly efficient and simple approach to block out predator sequences in molecular gut content analysis. *Methods in Ecology and Evolution* <https://doi.org/10.1111/2041-210X.13183>.
- Sethi S.A., W. Larson, K. Turnquist, and D. Isermann. 2018. Estimating the number of contributors to DNA mixtures provides a novel tool for ecology. *Methods in Ecology and Evolution*. 00:1–11. <https://doi.org/10.1111/2041-210X.13079>.

199702400 - Avian Predation on Juvenile Salmonids

- Background info in Taurus: [Project proposal](#)

Proponent: Oregon State University, Real Time Research

Recommendation: Meets scientific review criteria

Comment:

This is a well-developed and well-designed proposal with obvious benefits for salmonids in the Basin. Avian predation continues to be one of greatest sources of smolt mortality for some ESA-listed salmonid populations, particularly those that must migrate through the foraging ranges of multiple breeding colonies of piscivorous water birds. However, it is important to recognize that the continuing problem of avian predation appears to be a response to widespread human-driven changes in the Basin. These changes include hatcheries that release juveniles within a consistent and limited temporal period, artificially created habitat that is ideal for bird nesting, and dam operations and configuration that slow water flows at a critical time during smolt emigration. Acknowledging that causality, further research, monitoring, and evaluation studies are warranted to more fully understand the ecosystem level effects of avian predation, to quantify changes in predator abundance and predation impacts, and to continue to evaluate, manage, and develop management plans to improve survival of ESA-listed salmonids by reducing avian predation.

The program has been successful in estimating salmonid mortality from local avian predation (e.g., from a single colony) but less successful in estimating basinwide impacts. This is especially true when actions may succeed in reducing bird numbers at a single colony but fail to reduce the total number of birds eating salmonids in the Basin. For example, perhaps birds simply

move elsewhere in the Basin and total predation remains unchanged. Perhaps moving birds from the estuary (where non-salmonid prey are also abundant) to upstream sites (dominated by salmonids) leads to worse outcomes. This project has made the first steps in addressing the additive or compensatory nature of bird predation. This question, however, needs much more work for all fish predators throughout the Columbia River Basin.

1. Objectives, Significance to Regional Programs, and Technical Background

The project has two primary objectives, with several sub-objectives. These are not stated in quantitative terms and with timelines and milestones, but many are inherently quantitative. The proponents have demonstrated through their results from past efforts that the information collected is empirical and well-analyzed. This project has largely achieved past objectives by quantifying the abundance and distribution of piscivorous colonial water birds in the Basin and estimating their predation rate on juvenile salmonids migrating downstream. This knowledge is documented in over 50 peer-reviewed publications and has been used to develop multiple management plans to cost-effectively reduce localized avian predation on salmon smolts.

2. Results and Adaptive Management

Though the project has no explicitly stated adaptive management process, it has a history of rapid adaptation to unanticipated changes in avian predator abundance, behavior, distribution, or responses to management. The project has responded rapidly to cooperating agencies such as USACE, BPA, USFWS, NMFS, state agencies, and PUDs. Several of the project sub-objectives are RPAs in the current Biological Opinion. The proponents have responded thoughtfully to several questions raised by the ISRP in our last review ([ISRP 2018-8](#)) and plan to further address these issues through new research described in the current proposal.

3. Methods: Project Relationships, Work Types, and Deliverables

The proposed research is based on sound scientific principles and rigorous methods. Most of these were developed by researchers who have been world leaders in methods for monitoring bird colonies and measuring avian predation. The proposal describes the measurements used for each sub-objective and the products that will be produced. Exact timelines for each sub-objective are not reported, and it is unclear whether all research elements will be conducted simultaneously or phased through the funding period. The latest Annual Report (for work done in 2017) provides an excellent synthesis of sophisticated modeling to predict Caspian tern population status under alternative management scenarios.

Efforts to collect the data necessary to evaluate avian predation have been achieved through funding from multiple agencies. The proponents are concerned that USACE is no longer funding

avian predation studies upstream of Bonneville Dam and that other funding for avian predation studies in the Columbia River estuary is being drastically reduced. Sufficient funding must be provided if this project is required to adequately address the issues and concerns raised by the Council and the ISRP.

200800400 - Sea Lion Non-Lethal Hazing

- Background info in Taurus: [Project proposal](#)

Proponent: Columbia River Inter-Tribal Fish Commission (CRITFC)

Recommendation: Meets scientific review criteria

Final review comment:

The proponent provided thorough and informative answers to all questions. The ISRP notes that while hazing may be a legal requirement at this time, it is not scientifically warranted for California sea lions because the proponent's studies indicate it is not effective. The proponents are aware of the advantages of some of the alternative approaches suggested by the ISRP. They are willing to implement them if funds and regulatory restrictions allow or if research needs make them a higher priority. The general description of their adaptive management cycle is adequate. However, expected actions and the decision process for triggering the actions should be made more explicit. This will strengthen the process and increase clarity for reviewers and funders.

The proponents may find the following questions and comments helpful in refining activities as their project proceeds:

1. Could the tandem boat counts be validated at some point using side-scanning sonar? This might provide information on how many sea lions are not seen by either boat, leading to underestimates.
2. Might drones eventually be used to assess aggregations at certain tributary mouths? Could another person or team be deployed to gather these data?
3. Is there a reason that the tandem boat survey must be done in one day, rather than two? Would there be any advantage of traveling at a slower speed in producing more accurate estimates? Obviously, this would require more funding.
4. If lethal removal of sea lions has the goal of reducing habituation for certain locations, such as Bonneville Dam, and of reducing the number of naive sea lions that follow

repeat offenders, then these are assumptions that can and should be tested to improve program efficiency.

5. At some point in the near future, comparison of the abundance indices of the different pinniped investigation groups would be informative. Though the groups differ in the geographic locations of their studies, coherence in the temporal trends in abundance indices would be likely. Several publications that apply coherence analysis in aquatic systems are listed below for the proponents' reference.

Useful references on ecological coherence:

Freshwater, C., B.J. Burke, M.D. Scheuerell, S.C.H. Grant, M. Trudel, and F. Juanes. 2017. Coherent population dynamics associated with sockeye salmon juvenile life history strategies. *Canadian Journal of Fisheries & Aquatic Sciences* 75: 1346–1356.

Moore, J. W., M. McClure, L. A. Rogers, and D. E. Schindler. 2010. Synchronization and portfolio performance of threatened salmon. *Conservation Letters* 3 (5): 340–348.

Ohlberger, J., M. D. Scheuerell, and D. E. Schindler. 2016. Population coherence and environmental impacts across spatial scales: a case study of Chinook Salmon. *Ecosphere* 7 (4): e01333.

Ruff, C.P., J.H. Anderson, I.M. Kemp, N.W. Kendall, P.A. McHugh, A. Velez-Espino, C.M. Greene, M. Trudel, C.A. Holt, K.E. Ryding, and K. Rawson. 2017. Salish Sea Chinook salmon exhibit weaker coherence in early marine survival trends than coastal populations. *Fisheries Oceanography* 26:625-637.

Stewart, I.J., R. Hilborn, and T.P. Quinn. 2003. Coherence of observed adult sockeye salmon abundance within and among spawning habitats in the Kvichak River watershed. *Alaska Fishery Research Bulletin* 10(1): 28-41.

Preliminary review response request:

This project has been changed and has made significant progress since its inception. The proponents appear poised to develop better methods to determine sea lion predation using accelerometer tags and to collect useful data on distribution and abundance of sea lions using boat surveys. Estimation of sea lion abundances admittedly is a challenging task, but additional efforts to characterize the variance of these estimates would strengthen the research. More information is needed about the statistical analyses of the functional responses and abundance estimates from the tandem boat surveys. Additionally, better goals and criteria are needed for the lethal removal effort. The ISRP requests responses to the following:

1. More detail is needed about the statistical methods used for the conditional Lincoln-Peterson estimators of sea lion abundance from the tandem boat surveys. How would

abundance estimates differ if a sequence of additional observation boats were used (e.g., 2, 3, 4 or more) for a reach? Might drones be used?

2. The estimation of abundance, distribution, and predation of sea lions is described as a continuation of the previous measurements with tandem boat observation and accelerometers. Additional information should be provided to describe how these two measurements or their analyses will be changed or improved by the proposed research. How will these results be synthesized and reported? How will they evaluate their methods with comparisons to measures by other research groups or modifications of their protocols? More detail is needed about the functional responses fit to the predation data.
3. How will culling of sea lions be evaluated? What criteria will be used to assess whether it is effective at reducing sea lion abundance and predation on adult salmonids? What factors will be considered when determining how many animals will be culled?
4. Although lethal removal has been controversial to date, it is likely going to get much more so with increased culling. Is there a CRITFC or NOAA public relations plan in place to address a public response to the culling program?
5. What are the culling techniques and what do they plan to do with the carcasses? Will the meat, hides, and bones be used? If so, is there concern about possible contaminants in the meat?
6. A brief description of how adaptive management occurs is needed.

Comment:

1. Objectives, Significance to Regional Programs, and Technical Background

The proposal identifies three objectives: (1) continue boat-based hazing below Bonneville Dam, (2) estimate abundance, distribution, and predation of salmon by sea lions in the lower Columbia River, and (3) remove nuisance sea lions from the Columbia River. The only objective that is quantifiable is the second objective. The boat hazing and lethal removal objectives describe only implementation of the measures and do not provide quantifiable outcomes of anticipated results. The proposal simply indicates that these activities will occur. The ISRP has questioned the continuation of boat hazing in previous reviews because the proponent's studies indicated it was not effective. The hazing objective will be discontinued if CRITFC is authorized to lethally remove sea lions from the lower Columbia River, assuming that hazing is not a condition for removal under a new NOAA authorization.

The investigators propose to continue surveying sea lion occurrences below Bonneville Dam using tandem boat observation. These observations will be used to estimate abundance of sea lions from Bonneville Dam to Astoria (RM 12) and estimate predation based on a functional

response model. They also will use accelerometer tags attached to the heads of sea lions to estimate individual predation rates, but this method is still in the early stages of development and has been applied successfully to only seven individual sea lions.

2. Results and Adaptive Management

The description of objectives, deliverables, and timelines is brief and largely a continuation of previous work. Overall, the project objectives were met in most cases. Non-lethal hazing is not that effective and only temporary. Tandem boat surveys are relatively efficient for estimating abundance and distribution. Acoustic telemetry of individual sea lions gives information on differences in behavior of California versus Stellar sea lions in the lower river. Functional responses give estimates of predation by California sea lions below Bonneville. No obvious trend of increasing or decreasing predation was observed.

It appears that the main benefit of non-lethal hazing is deterring sea lions from areas around the entrance to the Bonneville fish ladder (Tidwell et al. 2019). The estimates of sea lion abundance from 2013-2016 were reported in a table, but the results were not discussed or interpreted. Abundances tended to be greatest in mid to late March but varied greatly between years and zones with no obvious trends.

The section on adaptive management identifies only changes that have been made over the course of the project. It does not identify a decision-making process for adaptive management of the overall project.

3. Methods: Project Relationships, Work Types, and Deliverables

The field observation methods and statistical analyses are described only briefly in the proposal but were described in more detail in their 2017 Annual Report to BPA. The estimates are based on observed animals only but do not include sea lions in areas that are not surveyed. The researchers plan to develop spatial analyses to adjust their estimates for areas surveyed, but the proposal does not describe these plans.

The proponents state the project is complementary to other sea lion interaction work that is currently being conducted, but they only described hazing or lethal removal activities of USACE and the states of Oregon, Washington, and Idaho. No collaborations on estimation of sea lion abundance and predation rates with other agencies or researchers are described. Such collaboration would be beneficial and improve synthesis of the results of these different studies. It is possible such collaborations are occurring, but the proposal provides no information about them. No information was presented on how lethal removals will be evaluated, in terms of whether they are effective at reducing sea lion abundance and predation on adult salmonids. It should be determined if the project's actions led to shifts in sea lion

distribution patterns (numerical responses) and feeding habits. For example, will remaining sea lions switch to eating more salmon per capita?

The description of data management does not indicate the project provides open or online access to the summary data and research products. QA/QC appears to be limited to proofed field data sheets prior to entry into Excel spreadsheets. Data potentially are shared if requested, but policies and criteria for sharing are not described. Key findings were shared via project reports, but peer-reviewed publications reporting results of boat surveys of abundance and functional response models have not been completed yet would be highly useful to other investigators and managers.

Literature cited:

Tidwell, K.S., B.A. Carrothers, K.N. Bayley, L.N. Magill, and B.K. van der Leeuw 2019. Evaluation of pinniped predation on adult salmonids and other fish in the Bonneville Dam tailrace, 2018. U.S. Army Corps of Engineers, Portland District, Fisheries Field Unit. Cascade Locks, OR. 65pp.

Climate Change

200900800 - Climate Change Impacts

- Background info in Taurus: [Project proposal](#)

Proponent: Columbia River Inter-Tribal Fish Commission (CRITFC)

Recommendation: Meets scientific review criteria

Final review comment:

The ISRP recognizes the importance of this project and encourages the proponents to continue working towards a focused program of activities that have the potential to help recover species and promote resiliency to climate change.

The detailed response includes revised objectives and more detail on methods, desired outcomes, and impacts of the program. It represents an important improvement over the original proposal and increased the ISRP's confidence in the project. Most informative were the discussion on strategic vision and the Gantt chart, which provided more information about specific objectives and when they will be met. Future outcomes can be compared to this chart to track progress.

While the ISRP is recommending that the proposal meets scientific review criteria, some concerns remain about the ability of the project to deliver specific products of the highest usefulness. The ISRP appreciated the background on the strategic vision, but we are not yet convinced that a focus on modifying operations at the Basin scale is realistic. If redefining Basin-scale operations is the primary goal, and it is not achieved for reasons beyond the proponents' control, then will the project still have produced important benefits?

For example, there is still a great need to understand how to prioritize habitat restoration actions across the landscape, and the ISRP considers this to be a more realistic and impactful focus for the climate change modeling that the proponent is undertaking. This objective supports the Tribes' ability to "incorporate climate change information into the design and implementation of restoration activities in tributary watersheds and tribal climate adaptation plans." It is not clear why the response includes analysis of past restoration actions on the landscape. What information would be produced from this analysis or how would it be used for guiding future restoration activities? The ISRP's feedback is that the climate change analysis should inform restoration moving forward. One appropriate process for this is the current effort to update the new salmon restoration plan, which the proponents indicate will be an outlet for results of the CRITFC Information System (CIS). A related contribution could include prioritization of projects on the landscape that are likely to persist and provide the greatest benefit as hydrology and temperature change. However, details on how the CIS work would inform the new restoration plan are scarce. Which subbasins/areas are likely to be most affected by climate change? How can CIS modeling be applied to help focus projects in locations where restoration will be most effective and resilient given climate change forecasts? There is a growing body of literature on this topic (Beechie et al. 2013, Lawrence et al. 2014, Perry et al. 2015), to which the proponents can contribute both within tribal lands and beyond.

In summary, the Gantt chart is an ambitious list, and the proponents will need to strategically focus on tangible outcomes for this project to produce its greatest impact. Rather than attempting to be all things to all people, a work plan that focuses on a few key projects, such as River Management Joint Operating Committee and restoration prioritization, will likely produce the greatest impact. In addition, strong leadership and detailed project management will be required to execute the plan.

The response also includes an adaptive management plan that appears reasonable on the surface, applying a Likert scale for impact of deliverables (i.e., from little impact to significant impact). Some details are missing though. For example, it was not clear how often individual deliverables or the broader program would be assessed or by whom. In addition, Figure 1 (Project Strategy for Informing Adaptation Actions) appears to be missing.

- T. Beechie, H. Imaki, J. Greene, A. Wade, H. Wu, G. Pess, P. Roni, J. Kimball, J. Stanford, and P. Kiffney. 2013. Restoring salmon habitat for a changing climate. *River Res. Appl.*, 29(8), 939–960.
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- Perry, L.G., L.V. Reynolds, T.J. Beechie, M.J. Collins, P.B. Shafroth. 2015. Incorporating climate change projections into riparian restoration planning and design. *Ecohydrology*, 10.1002/eco.1645

Preliminary review response request:

The ISRP requests responses to the following issues. We anticipate that some topics (e.g., 2, 4, and 6) will likely take more time to address than provided in the month-long response period. For those issues, the response should indicate how these questions will be addressed in the future.

1. The project’s objectives need to be modified with inclusion of measurable metrics and timelines. The use of SMART goals and a Gantt chart for achieving them would greatly strengthen the value and feasibility of project outcomes.
2. A strategic plan is needed to ensure that the modeling and coordination efforts are effective. Important questions that should be addressed include: What is the long-term vision for the program, and what are the intermediate steps that need to be completed to get there?
3. Over the short term (next three-year cycle), more detail is needed on project deliverables and on the work plan to achieve them. The proposal does not include anticipated quantitative results and benefits or any timeline of when outcomes may be achieved. A primary weakness of this proposal is the lack of clarity of specific outcomes so one can identify when the project will be complete. The proponents are clearly active, especially with model development and coordination of data and model sharing, but it is not clear what activities are occurring, or why, or that it is organized strategically.
4. Details are needed on how the modeling informs decision-making, including the design and prioritization of restoration. It is not clear how information from the modeling efforts will be used to make decisions about how the tribes will manage their First Foods

resources or interact with other co-managers to better manage flows, temperatures, water quality, and habitat to benefit these First Foods.

5. Communication about the program and its benefits needs to be improved. The website, for instance should be modified to elevate the profile of the project and improve access to information produced by the project.
6. Environmental change within the Basin is affected by climate change, land use changes, and modifications to the flow regime. Will the project evaluate the relative impact of these factors on environmental conditions in the Basin?

This program has the potential to be highly valuable for the tribes' and the region. It offers an important opportunity to examine restoration actions in the context of climate change and provides the Tribes with the expertise and tools to be an informed voice in policy-level discussions and decisions. However, the ISRP is concerned that a lack of strategic planning has led to a program whose full potential has not been realized.

The ISRP welcomes further dialogue with the project proponents as they develop their response. The response should address the qualifications listed above as well as several qualifications (numbers 1 and 3) from the 2012 ISRP review ([ISRP 2012-6](#)) that have not yet been addressed.

Comment:

1. Objectives, Significance to Regional Programs, and Technical Background

The key objectives of the project are not clearly or consistently stated. They generally center on: (1) reproducing and enhancing models for simulating the impacts of climate change, (2) allowing CRITFC personnel to represent tribal interest and expertise in regional technical workshops, and (3) providing opportunities for the tribes to exchange information about the impacts of climate change on flow regimes, water temperature, water quality, and hence on First Foods (salmon, lamprey, and eulachon, as examples) with other regional experts.

The project's stated objectives need to be quantitative and include timelines with milestones for achieving them. As stated, they are only general work statements; consequently, in the future, there will be no way to tell if they have been achieved. Details on the activities needed to accomplish the objectives are too general, making it difficult to conduct a scientific evaluation of the program. For example, the program is missing details regarding how the first two objectives (e.g., database and tributary analysis of flows and temperature) will inform future restoration strategies and planning for climate change. This issue was raised in [ISRP 2012-6](#).

Near the end of the proposal, a specific objective stated is: “The ultimate objective of CRITFC’s Climate Change Impacts Project is to develop and integrate various physical hydrological/river operational model outputs (CIS; CMOP) with water quality models outputs (RBM-10 Yearsley 2012 with updates) and fish spatial habitat models (Hatten et al. 2009) and fish survival models (Zabel et al. 2008; McCann et al. 2018).” However, it is not clear how the development and integration of this model will inform adaptation strategies for climate change.

Other activities are missing clear objectives. For example, what are the objectives of the technical review and information transfer, and how will the proponents know if those efforts are successful?

Finally, the proposed dissemination plan to make some data available through their website and flyers may not produce the greatest impact. It would be useful to provide details of the program’s dissemination plan, since this is essential to Objective 3. For instance, who are the target audiences, and how effective are the dissemination activities at reaching those audiences? Also, the model produced by this project appears to be valuable to many groups conducting restoration in the Basin. Is it available in the public domain? A strategic dissemination plan is needed to elevate the profile and impact of this work.

2. Results and Adaptive Management

The proponents are clearly busy, working on a range of topics that include Pacific lamprey and eulachon, benthic macroinvertebrates, and food webs. However, the ISRP was unable to understand who produced what results and how the results contribute strategically toward project objectives and/or informing adaptation.

In addition to the proposal lacking information on the key results of program to date, the list of deliverables in the “Contracted Deliverables and Quantitative Metrics” report was not detailed enough to evaluate progress of the project. It repeats the same items year to year and does not indicate what progress was made on them. For example, “Analytical Framework to Develop and Enhance Regional Climate Change Assessments” and “Estimate Changes in Mainstem Hydrology and Water Quality due to Climate Change Impacts” were repeated between years without any indication of what was actually accomplished. There were four topics listed under “Summary of Main Deliverables” (e.g., updates to HYDSIM, including daily time step, residence, time, ecosystem rule curves, etc.), but it is not clear when those deliverables were completed or how they relate to the ultimate needs/deliverables for the project.

A strength of the project is the facilitation of communication among research and technical groups who are modeling climate change impacts to the ecosystems and tribes, so that tribal interests in preserving traditional foods and culture can be represented in future management. The project has led to the proponents’ participation on a number of regional technical forums

and review processes. It has also resulted in the development of datasets and the CIS modeling tool that can be applied regionally to inform resilient river restoration. In particular, the two-way exchange of information between CRITFC and the wide range of stakeholders is a strength of this project. However, the project would have a greater impact if it was better organized around a coherent long-term strategy and near-term work plans and how technical details are leading to better adaptation actions (Goal 2 and Objective 3).

Some progress has been made in collaborating with groups who are modeling climate change impacts to adapt these results to scenarios of interest to the tribes, such as ecosystem function (although this has not been sufficiently defined). An important outcome is that the development of CIS has provided CRITFC the technical expertise and tools to contribute to major regional planning efforts (e.g., CRT, RMJOC II) and insert ecological objectives into planning and prioritization processes. Some of those efforts have ended, and CRITFC will need to continue to advocate for their seat at these planning forums, an issue that highlights the need for CRITFC to elevate the profile of their expertise and tools.

It would be helpful in the proposal to see some results of the project's analyses. For example, what were the results of the habitat modeling that USGS did with CIS outputs under different operational scenarios? Or what were the results of the collaborative project to study salmon survival and smolt-to-adult survival using CIS? And how were those results disseminated? The ISRP was unable to find much discussion of key results on the website, in the annual reports, or in this proposal. Results of at least one set of analyses are published (e.g., Justice et al. 2017) in peer-reviewed journals, which is commendable.

While the philosophical approach to adaptive management (AM) proposed by Rieman et al. (2015) is a good framework, the details of how AM is used in this project are not thoroughly described in the proposal. The ISRP would appreciate learning about the internal mechanisms being used to achieve an effective AM program and an effective project, as well as learning about any problems being encountered in its application. Even outside of a formal AM framework, the proposal does not describe lessons learned or how the project has adapted over time. The proposal discusses adaptive measures in response to climate change such as modified pumping to increase releases of cool water pool at Lake Roosevelt, selective withdrawal at Grand Coulee, and so forth. However, there was no discussion of adaptive management for this project or how the adaptive measures being analyzed improve management decisions on the ground. In addition, the ISRP would appreciate learning more about the barriers that led to the conclusion (p. 23) that "The development (proposed previously) of an overarching decision support system was found to be an unrealistic and ineffective approach so is no longer included as an objective." Rather than dropping it as an objective, since it is such an important outcome of this project, could the work activities be adapted towards translating model results into information that could be used by decision makers?

3. Methods: Project Relationships, Work Types, and Deliverables

The ISRP was not able to adequately evaluate project relationships without more detailed information on the mechanisms for cooperation and, specifically, the activities for which this project is responsible. In one of several examples, it was difficult to understand the synergy and/or overlap with the Monitoring and Recovery Trends work (BPA project #2009-004-00), which should be capitalized upon to examine the effects of restoration and climate change on fish populations. It was indicated in the proposal (page 28) that this capacity would be available at some point, but it was not clear what tasks remain to achieve this, who would complete those tasks, and by when. Given the critical importance of this type of analysis for the proposed framework, more details on how this work will be completed is needed to evaluate its feasibility and the merit of the approach.

Likewise, it is not always clear what CRITFC's contribution is to some of the technical forums in which they are participating. For example, for the proposal to NOAA with the University of Washington (UW), it appears that the CIS will be integrated with UW's forecasting models to develop some real time forecasting (of temperatures?). The workplan is not explicit enough to know if UW is just using CRITFC's CIS or if CRITFC actually plays a role in the study design, analysis, or dissemination of results. In other cases, such as the regional workshops, the proposal explicitly identifies how CRITFC contributed (e.g., assisted in workshop sessions, contributed to writing a report, and so forth), which was helpful in understanding their role and relationship to the other programs, even though it still was not always clear how it related to the objectives of this project.

There was also some question about how the work products relate to similar products being produced by others in the Basin. For example, how does the projection of stream temperatures relate to or duplicate the work of NorWeST?

Regarding the work types, the proposal's work plan was not detailed enough to evaluate the past and proposed activities. For example, the proposal notes several tasks with similarly vague details such as: "Further work to improve the RBM-10 model integration with CIS is proposed for 2019 and outyears as is exploration of CIS data collaboration with CE Qual W2 two dimensional and other water quality models." This concern about lack of clarity in the work plan was also raised by the ISRP in the 2012 review.

Finally, while four deliverables are discussed, they are worded in a way makes it hard to understand when they are completed and the objectives have been achieved. It is not always clear exactly what the final deliverables will be or what tasks are needed to produce those deliverables.

201600100 - BPA Project Action Effectiveness Monitoring (AEM) Programmatic

- Background info in Taurus: [Project proposal](#)

Proponent: Cramer Fish Sciences, Natural Systems Design

Recommendation: Meets scientific review criteria

Final review comment:

The proponents' response adequately addresses the ISRP's questions and concerns. The ISRP recognizes that some aspects of the research cannot be changed at this stage, and some of the limitations were created before the current proponents took over the study. Remaining research concerns can be addressed in their final years of data collection, final analyses, and documentation of the project history and design, which is expected to improve the application of project findings and design of future monitoring efforts.

However, the ISRP encourages the AEM project to continue this dialogue by presenting updated results to the ISRP in the coming year and again in a couple of years in more detail before the Category Review of Tributary Habitat and Artificial Production Projects in the Anadromous Fish Area. The exchange of information and perspectives in the review process increases our understanding of the history and design of the AEM project and strengthens the project's analyses and interpretation of the data. For example, a future presentation could include the final metrics that will be used to determine project success for riparian planting projects, a topic not addressed in their response. The ISRP looks forward to future presentations with more information on the AEM project's perspectives on the major issues discussed below.

In the following paragraphs, the ISRP provides additional feedback on several aspects of the proponents' response, so these critical issues can be considered in the dissemination of their results in annual and final reports, conferences, and peer-reviewed journals. Rather than respond to each of the proponents' points, we highlight four major themes for the proponent to consider and incorporate in their future analyses, reports, and publications.

Bias in site selection and representation

The proponents should clearly describe the criteria used for selecting or rejecting randomly selected candidate sites and report the characteristics of sites that were selected. These facts affect the scope of inference from the results. Publications and presentations should clearly indicate that the results are influenced by those characteristics and valid only for sites with similar characteristics. Additionally, the results from habitat projects can be influenced by other

variables such as slope, width, discharge, or watershed condition, and these might be included as covariates in analyses to improve the precision of models and hypothesis tests.

The proponents are aware of the potential biases in site selection, as indicated in the statement that “It is likely that restoration occurs first at sites with access, landowner willingness, lower cost are higher priority in a given watershed or for a given organization, but we have no way of quantifying or knowing that (nor is it a goal of AEM to do that).” These and other biases do not invalidate the AEM studies, but potential biases must be described clearly. For example, control sites chosen after the fact may not be similar to treatment sites originally chosen for habitat work unless the proponents are able to address this based on pre-project measurements. We urge the proponents to address this potential bias in their future site selection, analyses, reports, and publications.

Confounding factors and experimental design

It is not clear how the final analysis of floodplain restoration projects will be able to distinguish the effects of different combinations of restoration actions in the final analysis. The proponents note, “In 2014, we had originally proposed to stratify floodplain projects by up to four categories (remove levees, re-meander channels, reconnect or construct floodplain/side channels). However, since then it has become clear that many projects implemented included all these elements (techniques) together, and while it was historically (prior to ~2010) possible to categorize projects like this, it is not feasible at most projects because they typically incorporate two or more of these techniques.” These confounding factors and limitations for understanding and applying the final results should be described thoroughly when presenting conclusions.

It also seems likely that the analysis of the floodplain restoration actions will be hampered by small sample sizes (9 per ESU) so only large effects could be detected, and there is high risk that no significant effects will be found given the range of activities conducted in floodplain projects. A likely scenario is that a subset of individual projects will have large differences, and these may become case studies from which to develop hypotheses about features of projects that could contribute to success and be tested in future research.

Given the relatively low cost to complete the three studies of partial barrier removal, it is reasonable to complete the measurements. Regardless of the research costs, interpretation of the results of the three sites will be limited by the small sample size and different methods of measuring fish abundance. As a result, this component may serve largely as three case studies to inform future work.

Watershed conditions

The proponents acknowledge a willingness to incorporate watershed condition and asked the ISRP if a “consistent classification of watershed impairment across the basin” is available. One such classification system for a portion of the subbasins in the Columbia Basin is the Watershed

Condition Framework, which has been used to describe watershed condition on National Forest lands in the Columbia Basin since about 2012. The Framework is applied nationally and provides a standard set of variables and consistent methods to rate watersheds as fully functioning, at risk, or impaired. The Framework was updated in 2017 to address attributes/indicators that changed due to disturbance and/or management or restoration. Scoring is available for watersheds in the Columbia Basin that include some National Forest Service lands. Information on this system and interactive maps are located on the [Forest Service Watershed Program website](#). Additional information can be obtained by contacting leaders of the USDA Forest Service Watershed Program in each Region (1, 4, and 6 for the Columbia Basin). The Program Lead for Region 6 (Oregon and Washington) is Brian Staab (brian.staab@usda.gov).

Treatment-control differences will help account for effects of different watershed conditions, if we assume that the treatment-control difference is consistent across the potential range of watershed conditions. It is likely that habitat restoration will not be effective if watershed condition is poor (e.g., there is excessive sediment, temperatures are high even in reference sites), which is an interaction between watershed condition and the treatment-control response. Therefore, it will be important to include watershed condition as a covariate. However, without large sample sizes, effects of restoration likely will not be detected unless they are large. The proponents' response that they did not exclude sites because of quality of restoration or site conditions should be documented in reports and future publications.

Future directions and context for habitat monitoring

The ISRP recognizes the fixed funding limitations for the AEM project and understands that some changes in the program are not possible at this point in their contract. The proponents should identify future approaches that could build constructively on their findings. Such information would be useful in the ongoing development of a regional approach to habitat RM&E by the Council, BPA, and NOAA.

The reach-level focus to measure restoration effectiveness using paired sites in AEM addresses important questions in the Basin, but it also creates limits for extrapolating the findings to entire watersheds, subbasins, or ESUs. The proponents can improve the interpretation and implementation of their products by clearly identifying the appropriate scales for application of their results and providing contexts for applying their results at different locations and spatial scales. Great care should be taken when extrapolating results to entire watersheds, given that the original experimental design was not set up to make such an extrapolation and the study assumes that increases in abundance can be extrapolated to increases in production. The proponents could identify future research and approaches to address these issues and highlight areas where different types of sampling could be considered in the future (e.g., winter sampling).

It is reassuring to see that the ISRP and the proponents agree on the importance of acknowledging constraints for making conclusions on multiple projects. The proponents note that it is “important to highlight that this approach assumes a basic additive effect and there could be synergies among project or fish movement or migration that are overlooked by this approach.” Both of these possibilities seem likely for many projects.

Preliminary review response request:

The ISRP requests responses to the following issues with the understanding that some of the issues may take more time to fully address than provided in the month-long response loop (e.g., issues 4 and 5). In those cases, the response should discuss an approach to address the issues in the near future.

1. Explain the process for selecting the additional 39 sites for the riparian planting study to be sampled in 2019. Develop the framework for a randomized, stratified selection of study sites that accounts for major factors anticipated to influence restoration success (e.g., stand age, site history and land use). What are the final metrics for project success?
2. Explain the process for selecting additional sites for the floodplain restoration study. Clarify the range of practices included in the floodplain restoration projects category (e.g., levee removal or setback, channel reconnections, floodplain elevation modification, large wood placement, vegetation planting, hyporheic reconnection). What is the primary set of actions required before a site can be considered for inclusion in the floodplain restoration study? How will the analyses adjust for the variability in types of practices included?
3. Explain why the AEM project will complete the study of partial barrier removals with only three sites. The three sites will not address the full range of treatment types (road removal, open bottom arch, bridge) or provide the needed statistical power to draw strong conclusions. Why would the three case studies warrant an additional four years of field measurements?
4. The effect sizes measured are potentially biased by (a) the original practitioners selecting the highest-quality sites for restoration and (b) the proponents selecting the most tractable sites and controls for comparison. Each of these could result in the benefits of restoration being overestimated. How can these potential biases be addressed with the data that are available or could be collected?
5. Explain the types of restoration actions that are included and excluded in each of the five types of restoration actions being studied. Discuss how differences in watershed conditions (fully functional, intermediate, severely impaired), which can alter the observed responses to restoration actions, are addressed in the analysis. Are the types of watershed conditions evenly distributed across the projects or can the analyses

stratify by these covariates? Explain how the criteria for reference and treatment sites potentially influences the effect sizes observed. In general, sites with best M&E are accompanied by the best design. Does the elimination of sites with more variable or mixed site conditions and practices increase effect size?

6. Develop an informative regional context for understanding the strengths and limitations of the AEM studies and for effectively applying findings. Describe both the appropriate regional applications and the limitations of the AEM findings. How will basinwide impacts be analyzed? Will the regional analysis be able to measure the cumulative impacts of several projects on a stream (e.g., 20 projects vs 200 projects)? Explain biases inherent in the sizes of streams and fish communities represented within the regions, the lack of study of responses in winter, the way practitioners chose sites for restoration, and the effect of excluding sites where commonly used restoration practices did not meet implementation criteria. Address variations in treatment design and implementation important in influencing project success. Also, discuss the potential effects of combinations of restoration treatments in a given area (riparian planting, floodplain restoration, LWD placement) on the performance of an individual treatment type. Discuss lessons learned for both restoration and monitoring from the types of sites excluded from the study as well as those that were included. Provide a context to assist practitioners and decision makers to implement more effective restoration practices and identify gaps in our understanding for future study.

Comment:

The AEM Project is well organized and focused on assessment of the effectiveness of reach and local-scale restoration actions. The proponents are on schedule for completing their deliverables. The AEM Project provided thorough and thoughtful responses to the Research Review in 2018. They have published their protocols and research results and are working to increase their outreach to on-the-ground practitioners in the region.

The project has an opportunity to adjust two study elements (e.g., riparian plantings and partial barrier removal) at this midpoint. ISRP review prior to additional field work would provide beneficial coordination (see Issues 1-3).

The AEM Project is likely to produce a product that meets their first goal: (1) what are the effects of different action categories on fish and habitat at the reach scale? They will have difficulty with the second and third goals: (2) why some projects within an action type are more effective than others and (3) whether there are differences in project effectiveness among regions (see Issues 4 and 5).

The AEM Project faced many challenges in sites it inherited from other programs and sites it selected. The range of stream sizes and characteristics, river network locations, aquatic community composition, terrestrial plant communities, geology, land forms, land uses, land

types, designs, and intensities of restoration creates biases inherent in any study of this spatial extent within the constraints of funding and logistics. The sampling design leaves open the possibility that the results are biased, to an unknown extent, leading to either a false sense of security that effects are more positive than is true, or a false sense that there are not effects. The leaders of the AEM Project have extensive experience in these types of analyses and are well qualified to develop a framework for interpreting and applying their results, but caution is needed in communicating about the results to practitioners who may not understand potential biases and limitations in the study design and datasets.

1. Objectives, Significance to Regional Programs, and Technical Background

The proponents lay out timelines and clear objectives to measure (a) the effects of five types of habitat restoration on habitat and fish at the local (reach scale), (b) to determine why some projects are more effective than others, and (c) to measure whether these effects are different across regions (ESUs of salmonids in the Columbia River Basin). The proposal includes an update of quantitative and qualitative results and describes the time frames for completion of planned activities. It would be beneficial to have guiding hypotheses for individual components of the AEM analyses.

The measured fish and habitat responses are local (site and reach scale) and are not designed to answer the global question of the long-term watershed-scale impacts of improved habitat, such as possible bottlenecks later in the life-cycle.

The proponents have the technical training to conduct the analyses. The ISRP would like to learn more about efforts being made for the ongoing training and retention of staff. This would benefit the ISRP in understanding a potential widespread issue in the Basin.

2. Results and Adaptive Management

Results to date are well articulated. The ISRP looks forward to seeing the complete set of results and analyses when the project is finished. Lessons learned are summarized in the proposal and in an impressive number of publications. However, the potential to guide future habitat improvement and restoration efforts is hampered by several factors that limit the ability to generalize the results so that they can be applied in other locations.

For example, the results presented show that anadromous salmon ascended upstream of barriers after they were treated. However, the effect sizes measured are not likely to be accurate because the sites were not sampled with a statistically valid randomized sampling design.

There are similar limitations for the estimates of effects caused by large woody debris (LWD) placements. They may be less than the project predicts because sites deemed unsuitable are

less likely to be sampled than when a rigorous random (or stratified random) sampling design is used. Other studies in the region have found that LWD was not as effective as anticipated, possibly reflecting the influence of the study site selection on effect size.

An additional bias that is likely to result from EPT designs is that LWD placement is more likely at sites where effects will be greater and less likely at the sites chosen for controls, making the results more favorable. This is avoided in a true experiment where treatments are assigned randomly after pairs of sites are chosen.

Given these potential biases, the results are most appropriately viewed as providing evidence for what CAN happen under best-case scenarios of habitat restoration, but not what WILL happen, on average, when sites are subjected to these habitat actions. As such, simulations that roll up these results to the basin-scale are likely too optimistic.

The lack of detail describing initial conditions limits the use of the results for guiding the planning and implementation of future restoration work. Examples of additional detail include watershed and stream settings, past disturbance history at the sample sites (flood, wind and fire) and design and treatment details for restoration treatments at sampled projects. Given the relatively small sample size in each treatment category, this detail could be provided without a great deal of additional effort.

No formal adaptive management strategy is provided (a request from past ISRP reviews). There is, however, a lengthy discussion of various lessons learned and resulting project and activity adjustments that resulted. The proponents have shared their results with the scientific community and recognized the need to share the results with non-academic managers in the Basin. The ISRP agrees this type of outreach is an important use of resources for this project.

The ISRP strongly agrees (see p. 20) that “limiting factors that occur during winter may have stronger effects on ultimate smolt production than summer habitat. More detail on this relationship in final reports and publications would be highly useful for managers and researchers.” Perhaps this can be highlighted in reports to the Council/BPA so that winter monitoring and restoration actions can be prioritized for future activities.

We reviewed the AEM website but found it hard to figure out how to access the AEM data. Are the primary and summary data available online? If not, why not? The ISRP believes that these data should be freely available to the public.

3. Methods: Project Relationships, Work Types, and Deliverables

The mBACI and EPT designs are appropriate analyses for these projects. The analysis methods are well described. However, given the range of constraints, the results can be best used as a case example of the results for a specific set of sites but cannot be used to generalize results

across sites in the Columbia River Basin as managers are expecting. For example, the results for LWD placement likely represent a best-case scenario, owing to unknown biases of (a) practitioners selecting the best sites in which to do the work and (b) the proponents selecting the most tractable sites for measuring the results.

Several questions need to be addressed, including: Can (or should) estimates of the benefits of these types of restoration be extrapolated to estimate basinwide benefit? Can the authors suggest a wide-scale monitoring plan to evaluate effectiveness at larger scales? What type of data would be needed to accomplish this?

The riparian planting study is not complete, and 39 more sites will be measured in 2019. Preliminary results indicate that shrub abundances increase but not tree abundances. The results did not include important covariates for the projects, such as the ages of the stocks used for riparian plantings nor the planting techniques, so it is difficult to discern whether a response in tree cover would have been expected. Results will be more informative if the relevant context of other factors that influence restoration success is analyzed and provided.

Analysis of partial barrier removal was initiated by another project, and AEM took over the study in 2018. Only nine sites were identified originally, and six were dropped because of lack of implementation. The project plans to continue monitoring the three sites through 2022. It is not clear why this study is continuing when the number of sites is so small. This number of sites cannot even include the number of basic treatment types (crossing removal, open bottom arch, bridge, and multi-plate culvert) most often used in passage restoration. This assessment of three case studies does not seem consistent with the statistical approach of the AEM Program.

Similar and additional challenges are associated with the study of floodplain restoration, which was taken over by AEM in 2018. Only six sites meet the study criteria. In this case, AEM is going to supplement the analysis with 20 sites using EPT analysis by 2022. However, floodplain restoration activities are not defined. Typically, this treatment category includes a number of treatments including vegetation planting, increasing floodplain roughness, re-accessing of side channels and off channel ponds/wetlands, levee removal or setback, etc. Currently there does not appear to be a clear description of the treatments that are included in this category.

Bias in the responses to restoration is likely at several levels:

Level 1: Practitioners select sites at which to remove barriers, install LWD, or enhance floodplains, which are not a random subset of all such sites. For example, sites selected to install LWD are likely to be among the most suitable sites for such treatments with watersheds and stream segments, not average sites. Given this, the control sites selected post-hoc in and EPT design are not likely to be similar to the treatment sites originally chosen and may have

lower fish abundance pre-treatment. If so, the estimated effect of the treatment will be overestimated. Randomization of treatment locations is required to estimate this effect.

Level 2: From the set of sites that practitioners treated, the proponents selected a subset of sites to measure effects. Sites were rejected where adequate data did not exist. Given this, the effect of habitat treatments could be overestimated so that the results represent the best-case scenario rather than the average effects that managers are interested in knowing. A statistically valid randomized (or stratified random) sampling design is needed to avoid bias.

A related problem is that a statistically valid sampling design was not used to account for different regions (strata), and sample sizes of several types of habitat restoration were small. This means that the question of whether effects differ by region or ESU cannot be answered with confidence.

Given these potential biases, the ISRP requests that the project proponents carefully consider how they can be addressed with the data that are available or could be collected.

200725200 - Hyporheic Flow Assessment in Columbia River Tributaries

- Background info in Taurus: [Project proposal](#)

Proponent: Umatilla Confederated Tribes (CTUIR)

Recommendation: Meets scientific review criteria

Comment:

The project continues to make impressive progress toward meeting its primary goals. The proponents have responded to the majority of past ISRP recommendations with new and revised project components and approaches. The project provides valuable information, analytical models, landscape applications, and restoration approaches for conservation efforts both within and outside the Columbia River Basin.

1. Objectives, Significance to Regional Programs, and Technical Background

The project proponents responded constructively to the 2018 ISRP Research Review and, as well, developed explicit hypotheses, quantifiable objectives, and explicit timelines. This strengthens the research and provides a useful example for other projects. Timing of research components and objectives are clearly identified in the project timeline.

Important components for the project's technical foundations include (1) past project results that show that heat exchange between the channel and alluvial aquifer can influence main

channel temperature regimes, (2) results supporting the conclusion that “stream restorations in alluvial valleys that consider the hyporheic zone have shown significant increases in juvenile salmonid use, including Meacham Creek, Rock Creek and Catherine Creek restoration efforts” and (3) that future modeling and land classification will provide tools to restore lost hyporheic potential across the Columbia Basin.

The technical foundation of the proponents’ research is well documented and supported by their peer-reviewed publications.

The proposal not only describes benefits to habitat restoration programs but also identifies a link between their hyporheic research and the First Foods management approach of the CTUIR River Vision. This link between habitat restoration and the First Foods concept is extremely important and should be highlighted in the future.

2. Results and Adaptive Management

While there has been progress in quantifying the important components of the technical foundations of the project (summarized above), the ISRP notes limited confirmation-to-date through research and monitoring. The project attempts to confirm these relationships in the proposed activities. The five central activities for this project are logical extensions of ongoing activities (i.e., assessing salmon spawning locations with respect to thermal regimes indicative of hyporheic upwelling; the importance of floodplain shade in influencing hyporheic water temperatures; verifying and improving the TempTool model against empirical observations of hyporheic and channel water temperature; exploring the use of continuously logged temperature data; developing remote sensing classification and mapping methods to identify areas with high potential for hyporheic influence on stream temperature). Collectively, these activities address thermal issues that remain major challenges for conservation efforts in the Columbia Basin and provide tools that are potentially beneficial throughout the region and world.

The proponents describe a complex series of processes to provide adaptive management (AM). They have a regularly scheduled sequence of meetings both within the program and outside the research program with other decision-making processes of the CTUIR. Though it is not a strictly defined series of adaptive management steps, the identification of regularly scheduled coordination efforts and planned decisions provide the guidance and anticipated opportunities to adjust plans, consistent with a more formal adaptive management process.

3. Methods: Project Relationships, Work Types, and Deliverables

The ISRP greatly appreciates use of the SMART framework for the deliverables. This project was one of few proposals in this review to do so, and it illustrates a high level of expertise and strategic thinking for this project.

The ISRP found the proposal provided a clear outline of project activities. The detailed technical background and justification, as well as a clear set of proposed activities for the next phase, gave the ISRP confidence that the project has strong leadership and vision. The Gantt chart was also helpful in understanding the project's sequencing of the five activities.

The proponents are commended for their significant partnering with numerous and diverse groups, including other Tribes, USGS, USEPA, university researchers, and so forth, which expands the scope, impact, and dissemination of knowledge generated from this work.

The research methods and models are documented in peer-reviewed publications, past annual reports, and technical documents. The methods are well-suited for the research questions and field applications. The linkages between research components and on-the-ground restoration actions, both past and future, are a major strength of this project.

201700300 - Yakama Action Effectiveness Monitoring

- Background info in Taurus: [Project proposal](#)

Proponent: Yakama Confederated Tribes

Recommendation: Meets scientific review criteria (qualified)

Qualifications:

The ISRP recommends that the proponents address the ISRP's concerns in their next annual report and present to the ISRP within a year an overview of progress and challenges. The presentation could be either a face-to-face meeting or a teleconference. The ISRP believes that a thorough review is needed before the proponents apply results from the pilot/case study to evaluate other projects. Accordingly, the ISRP requests that the proponents:

1. Provide details on how results of the Project Annual Review (PAR) will be documented and used in the adaptive management process.
2. Clarify the details of how information from the project objectives (response to question 1), the monitoring activities, and the evaluation of various activities (accomplishments

and outcomes) will feed into the adaptive management program (response to question 5). What are the mechanisms for doing this?

3. Address the issue of how results of a case study will be used (if that is the intention) to prioritize landscape scale needs.

Final review comment:

The proponents' response provides a better understanding of this new project. The ISRP appreciates the time and effort that was required to provide this additional information. It appears that activities are underway to significantly improve project organization and planning.

The proponents' responses to ISRP concerns are generally satisfactory. This pilot investigation is designed to determine if the protocols, sampling design, statistical analysis, and logistics are feasible for a spatially extensive and longer-term investigation of the effectiveness of restoration actions. The ISRP anticipates learning more about the initial results, challenges and successes as the project progresses. It is expected that the proponents will need to modify the project using their adaptive management process, and this should be documented in the annual reports.

The annual report and the meeting with the ISRP should directly address the concern that project-scale monitoring will measure the effects of only one specific project at a specific site (essentially a case study), which cannot be generalized to other sites or be used to develop strategies or for prioritization. The ISRP feels this is a fundamental weakness in the project's rationale, indicating a need for improvement in understanding the basic design and monitoring of restoration effectiveness. That said, the ISRP views this type of project as a learning experience to test methods, gather pilot data, and allow the proponents to become better restoration practitioners. Also, it is not clear if the proponents have considered an alternative approach that would use a number of basic metrics to monitor restoration effectiveness at a landscape scale.

Preliminary review response request:

The ISRP felt that the proposal lacked adequate detail to evaluate the validity or feasibility of the project to meet its objectives. Key elements of the workflow are missing, as articulated below. Equally important, the proposal does not describe how the data will be used to inform restoration prioritization or design, as well as how the program will be evaluated and adaptively managed. Therefore, the proponents are asked to respond to the following issues. The ISRP understands that some of the issues may take more time to fully address than provided in the month-long response loop. In those cases, the response should discuss an approach to address the questions in the future.

1. Provide quantitative objectives and hypotheses to guide the monitoring, and set realistic timelines. The ISRP does note, however, that many of the deliverables provide for quantitative measurements.
2. Identify regional monitoring programs with which this program has relevance and relationships. For instance, describe the significance and relationship of this project to the basin-scale AEM project and to other databases in the region.
3. Provide adequate detail on project relationships and costs. For instance, the proposal identifies several related projects and offers some examples of how this project could support those efforts. If these relationships are to be realized they should be formalized before being presented as project benefits and the work plan should accurately reflect the personnel FTEs required to complete the work.
4. Provide an adaptive management (AM) plan, one that addresses internal processes as well as external influences.
5. Provide details on the workflow as it relates to the broad goal of examining project-scale effectiveness at a resolution allowing one to adaptively manage the habitat program (e.g., site selection, site design, prioritization). There are three broad categories of details that are needed.
 - a. What specific activities are planned under this phase of the project? SMART goals with a supporting Gantt chart would help articulate what will be completed by whom and when.
 - b. The monitoring and sampling plans need further detail. The proponents should consider consulting with experts to design the monitoring plan so that data contribute to informing restoration design by establishing causality, providing consistency across sites, addressing statistical power in detecting effects on fish, etc., as detailed below.
 - c. How will the project-scale effectiveness translate into improvements in the habitat program (prioritization, site selection, site design, etc.)? Several examples of those details are provided below.
6. Describe how the anticipated results (e.g., doubling of fish) will inform future projects. As well, assist the ISRP in understanding how the use of existing resources (e.g., restoration design and monitoring literature, other monitoring programs) are informing the process of establishing an action effectiveness monitoring project.
7. Provide details of the project roll out. These were not explained in the proposal or the presentation. How long into the future before the proposed 4-5 projects per year are implemented?

8. Identify threats to program investments and eventual success. This was not done in the proposal.

It will be advantageous for the proponents to discuss the content of the response with the ISRP before submitting it. Once the final version is received, the ISRP will reevaluate the proposal for scientific validity.

Comment:

1. Objectives, Significance to Regional Programs, and Technical Background

The proposal provides an overarching goal and three clearly stated objectives around tracking the fish response to restoration actions. While these objectives are clearly stated, the proposal does not provide adequate detail to understand if these objectives can be achieved (i.e., the objectives are too general). The proponents need to provide quantitative objectives, and hypotheses to guide monitoring efforts and set realistic timelines. The ISRP does note, however, that many of the Deliverables will be quantitative measurements.

Regarding significance to regional programs, the proposal lists some regional plans to which this project is relevant. However, perhaps more importantly, the proposal does not identify regional monitoring programs with which this program has relevance and relationships. For example, what is the significance and relationship of this project to the basin-scale AEM project or other databases in the region? Is there overlap with other monitoring programs that could result in a greater efficiency and scope with a little additional coordination? Are there opportunities to collaborate on sharing data repositories and dissemination?

The focus on biological sampling in winter (in addition to other seasons) is a positive feature of the proposed activities. Few other projects consider winter conditions, which the ISRP believes are critical in shaping fish population dynamics and habitat characteristics.

2. Results and Adaptive Management

The project currently does not have any results since it was launched only last year. More importantly, the project does not have an adaptive management (AM) process. An AM plan should be developed now, in advance of any issues that may arise. Having such a plan will allow the proponents to proactively identify and respond to issues in a timely manner.

3. Methods: Project Relationships, Work Types, and Deliverables

Is it not clear that the workflow, as presented, will lead to the broad goal of examining project-scale effectiveness at a resolution allowing the proponents to adaptively manage the habitat program (site selection, site design, prioritization). Based on the workflow presented in the

proposal and the presentation, the ability to actually inform project prioritization and design is low. Broadly, it is not clear how the results (e.g., doubling of fish) will inform future projects. Data from a case study posted on a database do not lead to better projects. There are several key steps in a workflow needed for the data to actually inform a longitudinal improvement in project design. For example:

- Establish a site selection and a sampling plan that represents the range of conditions and project types
- Provide an explicit definition of success and failure, and failure modes
- Field data collection – specifically, identify characteristics that can be used to evaluate drivers of project success (e.g., volume of large wood below active channel?)
- Data processing – QA/QC, metrics
- Since the description of the analysis of the BACI design does not appear to account for the multiple pre- and post-treatment measurements, a more sophisticated model will be needed.
- Database interfacing and management – The plan needs to be more comprehensive than only posting it to a dashboard.
- Data analysis and interpretation – In addition to analyses of fish data, identify the habitat data to be collected and articulate how they will be used to examine relationships between project design and fish response.
- Establish a plan for creating institution experience and memory. Identify how data are used to inform revisions to projects.

Related to this, the ISRP would like to understand how the proponents are using existing resources (e.g., restoration design and monitoring literature, other monitoring programs) to inform their process.

Outside of fish data development, adding a peer-review process for individual projects and data is likely to be very useful in adapting restoration designs. The Upper Columbia Salmon Recovery Board supports several projects in the region. The ISRP suggests that consulting these experts would be helpful, if it hasn't occurred already.

Regarding project relationships, the proposal identifies several related projects and offers some examples of how this project could support those efforts. For instance, the proposal notes that PIT-tag data could be used to estimate overwinter survival rates, which could be applied to the Upper Columbia LCM. However, as written, the proposal does not commit to this or the other identified projects. By using words like “may” or “could,” it suggests that this is not really part of the work plan. These relationships should be solidified and articulated before they can be

reported as benefits. And if such relationships do become established, the work plan will need to reflect the FTEs required to complete the work. In the LCM example above, who will be analyzing the PIT tag data to produce the overwintering rates? Also, who will be coordinating with developers of the LCM to exchange these data in a format that is needed/useful? These tasks take time, so if this is an expected outcome of this project, personnel needed to complete the work will need to be included and budgeted for in the work plan.

The timeline for rolling out the project indicates a long period before the project will actually benefit restoration designs. For instance, with one project implemented in 2021, this would mean that the project will not inform other projects until 2022 or later, and that there would be only one type of project that is investigated until some unknown future date. When does the project begin monitoring subsequent projects? That is, how long into the future before the proposed 4-5 projects per year is implemented? The details of the roll out were not explained in the proposal or the presentation.

The project would possibly benefit from assistance from the University of Washington group (i.e., J. Skalski), specifically to optimize the design, sampling, and analysis so that the data generated and analyses conducted are of the highest quality and aimed at questions that can be answered with confidence.

For instance, details of how the sampling plan would be designed at individual sites was not provided. Such a plan is needed to ensure that monitoring contributes to restoration design. What spatial design and resolution will be used? How does the temporal frequency of sampling align with key ecological processes? How will control sites be selected to avoid bias (See Bouwes et al. 2016)? Monitoring at sites should be carefully designed to help establish causality across sites in order to advance restoration design.

Use of the Barker model is ideal for estimating survival, but density estimates from snorkel surveys are likely not adequate to achieve an estimate of true density. Other methods should be explored, such as capture-recapture methods, or electrofishing or seining removal methods. The assumption of closure of the population must also be addressed.

Estimates of growth and condition will likely not be able to account for the effects of immigration and emigration. For example, changes in condition may be caused by emigration (fish in better condition emigrate between samples). Growth and condition measured for marked fish that one presumes remained as residents still leaves open the question about the growth and condition of those that emigrated or immigrated.

As described in [ISAB 2018-1](#) Review of Spring Chinook in the Upper Columbia River (Section 4.2.4; p. 129-130), long periods of pre-treatment sampling (five years or more) are needed to have hope of detecting changes such as a doubling or halving of fish abundance. This is due to

habitat restoration experiencing the normal levels of annual variation (i.e., process variation). How will the investigators address this issue when the data are analyzed and presented to the funding agencies and managers? Will this level of precision be acceptable? If not, how can the power be increased? Given only two years of pre-treatment data, the precision is likely to be less, requiring even a greater change (e.g., more than doubling of fish abundance) to be detected.

The most comprehensive measure of habitat effects is changes in smolts produced per redd. This requires measurements at the scale of subbasins, some of which is occurring for tributaries like the Twisp River in the Methow basin. How will this project be integrated with these larger efforts to collect data that can provide treatment versus control comparisons of these ultimate metrics of fish performance at the subbasin scale?

Finally, threats to program investments and eventual success are not identified. The proponents need to identify them and evaluate their potential for project disruption.

Water Transactions

200201301 - Water Entity - CBWTP

- Background info in Taurus: [Project proposal](#)

Proponent: National Fish and Wildlife Foundation

Recommendation: Meets scientific review criteria

Comment:

This is a well-written proposal and a well-conceived program that provides important benefits to fish. The CBWTP has shown impressive results in addressing the very contentious issue of water rights. It is being accomplished through an innovative partnership where work is strategically focused on priority subbasins and stream reaches. The proponents have been responsive to ISRP feedback, implementing a tiered monitoring program that effectively utilizes scarce monitoring resources. Prioritization of projects within the CBWTP is established locally but linked to broader subbasin and recovery plan efforts. The proponents also have a strong dissemination plan. They hold two conferences per year where they share information and approaches among the Qualified Local Entities (QLEs).

The ISRP has two concerns. First, it is not clear when the program will be complete or how the proponents will know if they have achieved their objective. Second, the CBWTP needs to be more specific about project benefits. Is the scale of the recovered instream flows measurable

relative to the overall flow and the scale of habitat loss and other issues in the basin? Given the large budget, simply reporting million-acre feet (MAF) does not effectively communicate the impact of the program. Water alone is likely not the best metric to describe the full suite of beneficial outcomes associated with the work. One alternative could include stream miles re-watered. Monitoring data and/or models could also be used to estimate changes in the numbers of redds, spawning fish, or smolts produced. The ISRP is aware that this monitoring is being conducted at some sites but found it difficult to use that information to discuss impacts of the program. The proponents need to do a better job at using that information to communicate tangible outcomes of flow restoration. In addition, it would be useful if the proponents could track any increase in efficiency in water transactions associated with program activities? Finally, the website could be improved to more effectively communicate benefits and elevate the profile of the program.

The ISRP welcomes the opportunity to continue a dialogue with the proponents on the new resiliency criterion that the proponents are developing for projects, particularly with respect to understanding the impacts of climate change. Related to this, it may be worthwhile to ask if the CBWTP should be focusing efforts in subbasins with strongholds of healthy fish populations. Climate change and human development will impact subbasins in different ways and with different effects. Are efforts prioritized to maintain subbasins that will remain in reasonably good condition for the long term? It appears that funds are spent opportunistically (to some degree) depending on willing water owners/sellers

1. Objectives, Significance to Regional Programs, and Technical Background

The objective for the program—restored stream flows to ecologically significant Columbia Basin tributaries—needs to be more quantifiable. While the work is clearly and compellingly justified, the objective (and goal) are not written in such a way that success in meeting the objective can be measured and assessed. Apparently, the proponents had more specific and ecologically oriented objectives when they were reviewed as a RM&E program (listed on page 5), and they consolidated them in the current proposal. How will they know if individual projects are significantly contributing to the program's overall objective? Are very small amounts of restored stream flows in a priority reach expected to contribute to ecological significance? Having a more clearly defined objective would help the proponents assess progress toward their objective and communicate benefits of the project. The seven deliverables provide more detail regarding project activities and expected results, but the linkage to an overarching flow restoration objective makes it hard to determine the significance of these activities.

Generally, the program is well conceived and certainly has relevance to regional programs. The collaboration with and support of QLEs makes a lot of sense. The work seems to be the right mix of actual transactions, capacity building, and monitoring. Using local recovery and

restoration plans for prioritization is both efficient and appropriate. The development and implementation of the Flow Restoration Accounting Framework (FRAF) is a strength of the program. The four tiers make logical sense and use resources as effectively as possible and represent a reasonable attempt to link results to the program objective, once it is more quantitatively defined.

The proposal directly addresses relevance to regional programs, including specific RPAs under the BiOp, Fish and Wildlife Program, as well as several more local scale plans.

2. Results and Adaptive Management

Despite the lack of a quantitative project scale objective, the CBWTP has achieved important results and the proposal is prepared in a way that those results are clearly documented. The proposal included plots of results over the program overall, as well as a handful of specific case studies with data (e.g., redd counts, redd distributions, WUA estimates, max temp data) to provide evidence of ecological benefit. The ISRP is grateful to the proponents for preparing such a professional proposal that was easy to read and included data. Key results of the program to date include over 540 water rights transactions and 1.6MAF of water returned to priority reaches. Another noteworthy achievement is that the distribution of projects is evenly distributed across the Columbia Basin, with a total of 232 active projects in thirty-two HUC-8 subbasins. Also noteworthy is the contribution of the program to fostering the improvement of state and QLE administrative rules and policies for allocating acquired water to instream use more effectively. A number of informative, stream specific accomplishment reports were provided which described good examples of work accomplished and results observed. The ISRP also recognizes the importance of providing transactional and capacity building support to the QLEs, including providing training and workshops to QLE project management staff in all aspects of water transactions.

While there is not a formal adaptive management strategy, the proposal provides details of the lessons learned and how it has improved and responded to ISRP feedback over the years. In this regard, the program represents the type of strategic feedback loop that is likely to be effective across other projects in the program. Grounded in science, responsive to feedback, and with a clear sense of reflection, this program has made important improvements since its initiation in 2003. Changes made to improve the project include developing and launching the FRAF and improvements in the tracking and management of transaction costs including a new database system launched in 2018. In addition, the proponents launched a water temperature logger “network” in 2019 to help collate temperature data that is being collected, though there were limited details on what this network will physically look like or how results will be analyzed to provide statistically valid findings. Also, the proponents note that QLEs are responding to climate change by prioritizing instream flow for headwater reaches. Taken together, even

though it is not through a formal adaptive management program, these changes indicate the program is doing the self-reflection needed to adapt the program and that the adaptations are tangibly improving the program over time.

Regarding sharing of program results, the proponents report that the data are available by request, but that there is not a great demand for it. However, the ISRP emphasizes that better access to the project accomplishments and data are needed. The website is only marginally informative and could provide a more appealing and useful documentation of program results. Their FRAF is available on monitoringmethods.org, and there is a good deal of accomplishments in project reporting, some, but not all, of which is found on their website. While the proponents are clearly working hard to develop relationships that secure more water, the nature and extent of public outreach that is happening with the scientific community or other audiences is not clear. More emphasis on this could help elevate the profile of the program.

3. Methods: Project Relationships, Work Types, and Deliverables

Project relationships appear to be numerous and working well. A major function of this project is building relationships. Some of the benefits of these relationships are demonstrated by the significant level of cost share for this program. The work types are clearly defined and appropriate.

The outcomes (33,650 acre-feet and over 165 cubic feet per second to low flow tributaries in new/renewed transactions annually) and seven deliverables are explicitly described. Some of these deliverables (DEV 3, DEV 6) are measurable, while others represent important activities but for which it will be hard to measure the level of success or quality as a deliverable. The ISRP appreciated that the proponents identified factors that will limit success in producing each of the deliverables. In addition, the ISRP agrees with the proponents that a third-party evaluation of the program is a valuable use of resources that is likely to benefit the program. The ISRP agrees with the proponents that deliverables directed to increase the skills and knowledge of QLE staff should be a priority.

Based on how the objectives are written, it is easy to conclude that they are meeting the objective of restoring instream flows, but the causal linkages to ecological benefits are not always clear. It may not be necessary to demonstrate that their flows result in a measurable change in biological outcomes, via post-project monitoring or by modeling, given all the other stressors in these systems.

The ISRP is supportive of the logical and efficient approach for tiered monitoring (FRAF) and shares the proponents' concerns regarding the current 5% cap on monitoring by BPA. This seemingly arbitrary restriction makes it difficult for proponents to demonstrate compliance and effectiveness for individual projects, so they can show they are meeting their objectives and

providing a broader benefit to the Fish and Wildlife Program. The proponents note that the cost of monitoring is rising and are requesting that BPA raise the 5% limit on monitoring to 15%. This appears reasonable given their prior experience and formal monitoring strategy.

Freshwater Mussels

200203700 - Freshwater Mussel Research and Restoration

- Background info in Taurus: [Project proposal](#)

Proponent: Umatilla Confederated Tribes (CTUIR)

Recommendation: Meets scientific review criteria (qualified)

Response loop qualifications:

The ISRP recommends that the proponents (1) meet by teleconference or in person with the ISRP within three months to discuss the following qualifications and (2) satisfactorily address the qualifications and any other ISRP concerns in their next annual report. The ISRP will review the annual report to determine if the responses to qualifications are acceptable. In addition, the ISRP would like to comment on an early draft of the Master Plan by the end of 2019, well before it is finalized and formally submitted.

1. Provide satisfactory responses to qualifications from the previous ISRP review ([ISRP 2018-8](#), page 69). This includes establishing quantitative restoration objectives and specific timelines, establishing testable hypotheses, and formulating a plan to provide empirical information on factors causing population declines. Prior to the official release of the Master Plan, these objectives, hypotheses, and plans can be labeled as “provisional.”
2. Provide an adequate description of an adaptive management (AM) process, either for the current activities or the Master Plan to be developed in 2019. The use of SMART objectives, a Gantt chart, or another decision-making process would be especially helpful in illustrating the project’s quantitative objectives, deliverables and timelines. The AM process should include explicit stages for actions and decisions and, as well, explicit schedules and decision processes for each stage.
3. It remains unclear to the ISRP if the proponents have an approach for integrating the research components. Therefore, the ISRP reiterates its suggestion that the development of population models and landscape analyses of habitat suitability would provide a context for integrating results from investigations of population trends,

reintroduction success, host specificity, and artificial propagation. The ISRP requests direct responses to these suggestions. If population models and landscape analysis of habitat suitability are not appropriate or other approaches are more appropriate, the proponents should inform the ISRP and provide adequate description of their approach for integration.

4. Provide a response to the following ISRP concern and suggestion: Much of the effort on restoring mussels to the Columbia River Basin appears to rest on developing laboratory culture methods, which to date have not been successful. Other methods such as field inoculation of host fish and translocating adult mussels are discussed as options if mussel culture proves unsuccessful. The ISRP feels that it would be prudent to develop all possible methods concurrently and to use an adaptive management framework to assess them in tandem and further develop those that are successful, while phasing out or making major modifications to those that are not.
5. Identify specific publications, authors, intended journals, and timelines for analysis, writing, and submission of peer-reviewed publications as well as for agency reports (e.g., technical bulletins) and other significant grey literature. Indicate how each planned publication is linked to specific objectives and work areas.
6. The third goal of incorporating mussel monitoring in other monitoring efforts remains vague and weakly linked to the subsequent eight objectives. Explain how observations about mussels based on other monitoring efforts (building on their training of other programs) will be recorded, verified, incorporated into a spatially explicit database, and used in a landscape analysis of mussels (i.e., presence/absence, abundance, diversity, recolonization, extirpation, trends). As well, the proponents should devise ways to be sure that mussel and environmental monitoring are conducted in tandem.

Preliminary review response request:

The research and monitoring of freshwater mussels by the CTUIR provide an important element in regional conservation for the Fish and Wildlife Program. The program has developed a useful database for understanding status and trends in mussel populations, which should be expanded and continued. Several improvements in integration and adaptive management (AM) would strengthen the program. The ISRP requests responses to the following:

1. Satisfactory responses to the Qualifications from the previous ISRP review ([ISRP 2018-8](#), page 69). This includes establishing quantitative restoration objectives and specific timelines, establishing testable hypotheses, and formulating a plan to provide empirical information on factors causing population declines. For example, what course of action will be taken if culturing mussels is not successful in the next phase?

2. Description of an AM process, either for the current activities or the Master Plan to be developed in 2019. The ISRP views AM as an essential component of research and monitoring; one that should be incorporated into the Master Plan.
3. More information on the approach used by the proponents for integrating the research components. The ISRP suggests that the development of population models and landscape analyses of habitat suitability would provide a context for integrating the results from investigations of population trends, reintroduction success, host specificity, and artificial propagation.
4. A workable plan and schedule for preparing peer-reviewed publications. This is essential as the project morphs from a discovery phase to one emphasizing the integration of research and restoration.

There are two additional, related issues the ISRP would like the proponents to address in their response:

5. The proponents identified eight objectives but do not link them to the four major work areas. The proposal simply identifies time periods for conducting the studies and reintroduction efforts, but it does not provide quantitative objectives and specific timelines for accomplishing them.
6. The third goal of incorporating mussel monitoring in other monitoring efforts is vague and weakly linked to the subsequent eight objectives.

1. Objectives, Significance to Regional Programs, and Technical Background

Since 2002, the goal has been to use project findings for development and implementation of restoration actions for freshwater mussels in the Umatilla River and other mid-Columbia basins on ceded lands. As the ISRP stated in previous reviews, this is a project with outstanding potential to provide essential information on the ecological status and health of the Basin's rivers. Unfortunately, the proponents have not responded to previous ISRP encouragements and comments, especially those for establishing quantitative objectives and timelines or for publication of their results. Perhaps it is indicative that a Master Plan for mussels is only now being developed and will not be finished before 2020. It is imperative that the project move beyond the "discovery" phase of the research and monitoring activities to syntheses and applications as soon as possible.

The significance to regional programs is potentially huge if the proponents develop a comprehensive and integrated set of activities. The program has been on the cusp of this potential for several years and needs to firmly enter that realm.

The ISRP has no issues with the technical background. The proponents appear to have a strong understanding of their subject.

2. Results and Adaptive Management

The proponents have made substantial progress in several areas of their research and restoration efforts. Their monitoring has revealed areas of population increases as well as locations that continue to show declines or failure of adult mussel reintroductions. Their studies of genetics and host relationships have added critical knowledge for regional understanding of mussel systematics, identification, and biology. Their framework for guiding reintroduction and the best management practices together provide valuable tools to guide restoration efforts, which may benefit other conservation efforts in the Pacific Northwest.

The 2018 ISRP review recommended incorporating an analysis of population dynamics in their queries of population status and trends. The proposal assesses temporal trends in abundance of juvenile and adult mussels, but there is no evidence this analysis will be based on an understanding of the population dynamics (e.g., fecundity, recruitment, stage-specific survival, immigration and emigration). Their efforts to protect and restore populations of the three mussel genera would be strengthened substantially by more rigorous analysis of population dynamics and the factors responsible for rates of change. This would allow the proponents to integrate results from their research on host relationships and factors related to survival in artificial propagation with their analyses of population trends.

The proposal describes the implications of climate change, non-native fish, non-native bivalves, and contaminants for mussel populations. Non-native mussels and fish are identified in their monitoring program, and their propagation studies examine thermal effects. To date, the program has not addressed contaminants other than sediment. The ISRP believes that this latter issue should be more fully addressed in the future either by the proponents or with collaborators.

The proposed development of a Master Plan for Reintroductions/Restoration is a positive step forward. The proposal states that the Master Plan will include an "integrated phased approach for artificial production that emphasizes adaptive management," but the elements or processes anticipated for AM are not provided (see below). The ISRP looks forward to reviewing the Master Plan and the adaptive management process in the near future.

In our previous review, the ISRP praised the proponents but recommended a qualification including several questions that were not addressed in the current proposal. Basically, the ISRP was greatly impressed by the project, believing it had the potential to make substantial contributions to conservation and restoration in the study area, as well as in the Columbia River Basin. That said, the ISRP was not sure how the mussel project would share information with the Biomonitoring Project and other restoration and lamprey projects and asked for a discussion of this with the proponents. The ISRP felt that there were several questions to be addressed: Would salmon and mussel restoration be beneficial in similar areas? Are there risks?

Mussels can also provide a retrospective look at past environmental conditions; are the proponents thinking along these lines? The ISRP urged the proponents to work with the EPA, departments of health, and others on contaminants, as well as on other factors implicated in population declines. Finally, and most importantly, the ISRP urged the project to move from the discovery phase to one that had quantitative restoration objectives, as well as one that identified concrete information on factors causing population declines. The ISRP feels that the proponents need to respond in a satisfactory manner to these qualifications in the immediate future.

The section on adaptive management (AM) describes changes made over the last decade, but it does not indicate that there is an explicit AM process. The changes appear to be iterative adjustments as information becomes available or as major problems are encountered. The ISRP strongly believes that the program would be strengthened by a cohesive overall research and monitoring plan, an explicit process for review and assessment of new information, and by adaptive adjustments, all of which follow a clear process.

The ISRP was very pleased that the habitat work culminated in development of a decision framework to identify potential suitable outplanting habitat specific to genera (Figure 2 on p. 14). This is a positive step forward.

3. Methods: Project Relationships, Work Types, and Deliverables

As recommended in the previous review, the ISRP encourages the proponents to prepare peer-reviewed publications and to expend effort on public/professional outreach. Publications are not addressed in the current proposal whereas the Education and Outreach efforts appear to be sustained and conducted with appropriate groups (e.g., Xerces Society). The ISRP notes that one publication is used in the proposal (p. 12) but not listed in the Literature Cited: O'Brien et al. (in press). Is this person a member of the project research team? Where will the article be published?

The ISRP is pleased that the monitoring program has worked with Xerces and other researchers to develop technically sound methods for identifying mussel species, examining genetic relationships, monitoring populations, and determining the success of reintroductions. The collaboration with Xerces has been especially productive and contributes to conservation efforts beyond the CTUIR.

Data and Information Sharing

200400200 - Pacific Northwest Aquatic Monitoring Program (PNAMP) Coordination

- Background info in Taurus: [Project proposal](#)

Proponent: US Geological Survey (USGS)

Recommendation: Meets scientific review criteria

Final review comment:

The response is very well written and informative. The extra effort that the proponents invested in providing a comprehensive and thoughtful response to the ISRP's questions is appreciated. The proponents provide good examples of two quantitative, implementation objectives and describe a comprehensive approach for strategic planning. The proponents' response expanded the ISRP's understanding of PNAMP's scope, complexity, accomplishments, and future directions. This is a very active and highly effective program.

Some areas remain where improvements would be particularly useful. The program should continue to develop a full suite of quantitative project objectives that incorporate sample metrics into objective statements. The program also should develop a more complete adaptive management program that includes increased documentation of lessons learned, changes in the program, and improvements to [MonitoringResources.org](#). With a record of continued improvements, it is anticipated that the project will continue the leadership role it has played for many years.

Discussion of response comments:

1. Development of quantitative objectives/deliverables and metrics that can be used to measure and evaluate project accomplishments and outcomes.

The proponents provide four examples of improved objective statements. In general, these objectives are a major step forward from those in the original proposal. The Proposal Objectives and Proposal Deliverable statements are generally qualitative goal statements while the Implementation Objectives 1 and 3 provide more explicit quantitative statements:

- "Organize and facilitate one to four workshops over the next five years on topics of interest as identified by PNAMP partners" (Example 1) and
- "Organize and facilitate Data Visualization Work Group meetings every other month for two years." (Example 3)

These are well written objectives and should serve as a basis for re-crafting other project objectives.

Examples of potential changes include:

Objective 2: “Increase data sharing of habitat-related metrics and indicators among federal, state, and tribal entities by summarizing recommendations from the Regional Habitat Indicator Project Phase 2 pilot effort.” Initially, as a deliverable, this summary could explore how to improve data access and reporting for two indicators: the 7-day Average of the Daily Maximum Temperature (7-DADMAX) and Median Average Daily Discharge.

The proponents also provide a list of potential metrics to gauge accomplishments and outcomes. These are well conceived and could be coupled with objectives that are currently qualitative statements to create more measurable, time bound objectives. For example, Objective 4 (“Improve user interface and improved data documentation process to meet the FAIR data principles based on user feedback and management needs.”) could be reframed as “Complete an average of at least 25 backlog data documentations by 2023.”

All in all, the proponents are moving in the right direction and, with a few additional modifications, will be able to provide truly quantitative objectives that can be objectively evaluated in future reviews. The ISRP urges the proponents to continue to refine the quantitative objectives.

2. Description of a more formal process for adaptive management. This is particularly important for long term project success given PNAMP'S expanding geographic scope and increased user base.

The proponents note that adaptive management (AM) is largely driven by interactions with the PNAMP Steering Committee and periodic development and update of a 5-year strategic plan. This plan lays out key work objectives that are assigned relative priorities. Also included are requirements for user assessments and various evaluations. As an example of adaptive management of project web resources, PNAMP is currently conducting an extensive user feedback process targeting streamlining and improving the user interface of MonitoringResources.org. This type of systematic effort to evaluate and redefine program direction is the type of feedback loop that underlies effective adaptive management. While the current adaptive management approach is not structured as a formal AM process, there is a clear explanation of how proponents seek external feedback on the project and their products. The assessment and feedback loop articulated at the end of this section generally meets the intent of our request for self-evaluation and the ability for mid-project correction.

It appears that the 2019 Five-Year Strategy provides a broad framework to guide the program. However, it is not clear how the recently updated 2019 Strategy used past experience (lessons

learned from project monitoring and evaluation of effectiveness and accomplishments) from the 2014 Strategy to guide the update/revision. For example, were lessons learned from project monitoring and evaluation of effectiveness and accomplishments used? Also, while “Staff and steering committee regularly discuss what issues are looming on the horizon so that tasks can be identified or adapted to support partners’ needs,” the program may benefit from including analysis of new opportunities and threats in the longer-range and strategic thinking about the program. For example, given that “Over the last five years, as funding has declined, we have cut back on the time we spend surveying PNAMP participants,” proponents may need to identify and discuss strategic approaches to address declining funding in the 5-year strategy. The ISRP was unable to find any such discussion in the 5-year strategy. Such discussions are valuable, but an explicit AM process with scheduled decision stages would increase the likelihood of effective responses.

A more complete documentation and summarization of strategic assessments and evaluations would be useful to provide a history of decisions and improve understanding of the strategic process and how it links to AM. This additional effort would provide benefits to the program in tracking the evolution of changes over time and providing a context for new employees or external audiences.

3. A strategic vision for PNAMP outlining where the project is headed in the next 5 years. This should include a brief description of how the collection of current activities help move the project towards that vision. Also, it would be helpful to see how these activities are part of broader, long term thinking about future PNAMP contributions, especially given expansion to the national arena.

The proponents adequately responded to request 3.

4. Provide an explanation of the reasons behind the lags in publishing methods and protocols, and how the issue will be remedied in the very near future (i.e., 1-2 years).

The proponents clearly answered request 4. They note that the primary reason lags exist in publishing methods and protocols is because “project sponsors are not completing their documentation in MonitoringResources.org. Of the 629 methods and 889 protocols in Draft state (as of April 30, 2019), 64% and 92% respectively have never been submitted for publication review; all the remaining drafts have been reviewed by PNAMP staff and are back in the hands of the owners to respond to review feedback ... PNAMP has little ability to influence project sponsors who are not willing to complete the documentation of their project’s metadata in MonitoringResources.org.” Lags in publishing methods and protocols are troubling from a programmatic perspective and inhibit the effectiveness of PNAMP. PNAMP’s lack of leverage appears to be another priority issue that should be identified and addressed by the 5-year strategic plan. As a starting point, PNAMP could meet with the ISRP/Council in the near future to explore the scope of this issue and how it could be resolved.

Preliminary review response request:

A response is requested to provide the following:

1. Development of quantitative objectives/deliverables and metrics that can be used to measure and evaluate project accomplishments and outcomes.
2. Description of a more formal process for adaptive management. This is particularly important for long term project success given PNAMP'S expanding geographic scope and increased user base.
3. A strategic vision for PNAMP outlining where the project is headed in the next 5 years. This should include a brief description of how the collection of current activities help move the project towards that vision. Also, it would be helpful to see how these activities are part of broader, long term thinking about future PNAMP contributions, especially given expansion to the national arena.
4. An explanation of the reasons behind the lags in publishing methods and protocols, and how the issue will be remedied in the very near future (i.e., 1-2 years).

Comment:

This project has a long history of impressive accomplishments. It continues to provide a wide range of technical tools and services, and it acts as a forum to bring a wide range of agencies, tribes, and other entities together for improved coordination, consistency, and collaboration in aquatic monitoring. There are project areas where improvements are desirable, and they are primarily included in the categories where a response is requested. They include developing quantitative objectives; gauging user needs and satisfaction/project effectiveness; developing metrics for measuring the impact of the PNAMP program, including major accomplishments and outcomes and the development of long-term project goals for PNAMP and a strategic framework to help move towards them. The number of reports and workshops, while impressive, is not a clear measure of whether the program is actually increasing the quality or efficiency of monitoring or producing new knowledge to support decision making. Finally, it should be noted that the topics, where a response is requested, are all discussed in the programmatic section of this ISRP report and apply to most data management projects reviewed.

1. Objectives, Significance to Regional Programs, and Technical Background

The PNAMP project plays an important role in coordinating aquatic monitoring efforts in the Pacific Northwest (PNW), from Canada to Northern California. It has broad significance to regional programs and has provided sustained leadership to support effective monitoring and

data sharing efforts across the Pacific Northwest. The PNAMP group has the technical expertise to guide a successful endeavor.

The project has four primary objectives; all are qualitative and broadly stated with no dates for accomplishment. This makes it very difficult to evaluate actual accomplishments and outcomes. Some additional details were provided under each of the 11 deliverables, but many are still vague. Current descriptions leave many questions unanswered. Some include: How do the proponents know if the workshops and coordination are having an impact? Being able to describe more quantitative results would help answer this question. The proposal discusses workshop reports, white papers, annual reports, website and tools, etc., but is there some way to track the impact of these activities? Or are they just available online but underutilized? The ISRP recognizes that the impacts of coordination can be hard to measure. However, the objectives and deliverables could be written to be more specific to facilitate quantitative evaluation to determine if an objective was met or a deliverable was produced and what the associated outcomes were.

2. Results and Adaptive Management

Overall results appear to be outstanding. The number of activities reported in the proposal is admirable. PNAMP has provided regular annual reports describing an impressive array of products and accomplishments. Some of these include assistance in development of study and sample designs for charter members' monitoring projects; outreach and training including workshops to webinars; assistance in the development of regional high-level habitat indicators; coordination of effectiveness monitoring and data management; sharing of "best practices"; and operation and maintenance of the MonitoringResources.org website. It is apparent that impressive and important enhancements have been made to MonitoringResources.org, despite the relatively low number of protocols and methods that have been published.

Although the project does not appear to have a formal adaptive management (AM) process, it can point to several changes in work and organization that are a result of past lessons learned. Proponents describe PNAMP collaboration and coordination functions as responsive to the needs of partners. This is an indication of the adaptive management philosophy of PNAMP, and it seems to be implementing it reasonably well with numerous meetings and information feedback loops. Currently, the primary tool for assessment of overall project effectiveness is the PNAMP Steering Committee (SC). The proponents note that there are also periodic strategic planning retreats and annual user surveys. A summary of findings/results of these efforts and how they informed decisions on project design and operation was not provided and would have been helpful.

There are no metrics provided that can be used to gauge project outcomes/impacts for key activities nor is there any strategic vision or framework to guide longer term program

development. In a 2007-2009 solicitation review, it was noted in discussing PNAMP'S effectiveness that, "To assess the effectiveness of this facilitation an audit or poll of participating agencies should be conducted within two years. Adaptive management and course corrections within the PNAMP framework could be realized if direct feedback from the participating agencies were obtained." The proposal would be improved by documentation of this feedback as well as by a better description of whether a particular model of coordination is being used." Although user feedback is provided by the Executive Committee, it does not appear that a formal audit or poll has been completed or has there been a summary of findings and description of how they have been incorporated into the current project. This feedback information would clarify, for example, how practitioners in the basin become aware of PNAMP and its resources, the effectiveness of dissemination of information about various training opportunities, MonitoringResources.org, and such. Articulating a strategic dissemination plan, if it does not already exist, could be useful in informing this audit and increasing the impact of the program.

Another ISRP concern, especially with the expansion of PNAMP activities outside the Pacific Northwest, is that there continues to be prioritization of activities to ensure continued service to the Fish and Wildlife Program and Tribes. While expansion can bring great opportunities, there is a need to remain focused on the important tasks within the region. The ISRP assumes that the expansion will enhance programmatic functions and analyses, but, if so, the proponents need to describe in what ways this will happen and what the possible positive outcomes might be.

A final concern relates to publishing monitoring protocols (p. 22). Only 219 of the 1,166 are published. Methods have a better rate of publication, but there are still several hundred waiting. Please explain why the lags are occurring. The ISRP hopes that the efforts expended toward project expansion are not delaying the publications.

3. Methods: Project Relationships, Work Types, and Deliverables

There is a wide range of work types and services provided by the project. These range from data management, operation and maintenance of a website, public outreach, and user training sessions and webinars. A general description of project methods, in key project areas, is provided. All provide good examples of how a project should function and how to prepare a well written proposal.

There are 11 deliverables listed. They are described in some detail but do not provide quantitative measures or metrics to measure activity completion or effectiveness. An example would be tracking the activities organized under the fourth objective of "develop and maintain web resources." This type of description is very general and makes the actual assessment of what activities were completed and their outcomes nearly impossible to evaluate. Also, while

the proposal indicates that PNAMP participants and administrators will show responsiveness to the needs of partners by identifying the tools that are most technically appropriate and durable over the long term, it would have been particularly helpful to have a strategic vision and framework for the future that establishes the broad project direction and provide a general description of expected results. Given the changes in project scope, this vision is particularly relevant. Having this information will assist the ISRP and the Council/BPA to understand how needs will be met in the future. It is acknowledged that the proponents have reported that such a strategic document is in preparation and a review draft ready soon. The ISRP is interested in participating in a review of this document to provide feedback on PNAMP's vision and strategy going forward.

198810804 - StreamNet - Coordinated Information System (CIS)/ Northwest Environmental Database (NED)

- Background info in Taurus: [Project proposal](#)

Proponent: Pacific States Marine Fisheries Commission

Recommendation: Meets scientific review criteria

Final review comments:

The ISRP greatly appreciates the proponents' efforts in providing comprehensive responses to the request for additional information. As a result, our understanding of StreamNet's scope, complexity, accomplishments, and future directions has been greatly expanded. This is a very active and highly effective program.

It is understandable that the request for quantitative objectives and timelines will be delayed. It is important that these elements are well crafted and accepted by both the proponents and the Executive Committee. If useful, the ISRP would be pleased to review these objectives via a teleconference or face-to-face meeting, followed by a review of them in the proponent's annual report for 2019.

The proponents provide a satisfactory response to our request for more information on their adaptive management (AM) process, as well as their data quality assurance and quality control (QA/QC) procedures. The ISRP appreciates being well-informed of the details associated with these components. There are, however, limitations to the current AM approach which include a lack of quantitative objectives and timelines to provide a framework for program performance and efficiency evaluations. That said, the proponent's annual reports provide information on an adaptive management process by tracking issues and articulating proposed changes, as well as

various evaluations of overall use and user needs and the effectiveness of various project components.

At the direction of BPA, StreamNet has focused their collection, curation, and sharing of data through the Coordinated Assessments Project on salmonids. StreamNet has been effective and efficient at completing this work and has highlighted its importance to managers. The impact of the project has also highlighted the need for similar activities focused on other vulnerable species in the basin, including lamprey, sturgeon, eulachon, resident species, and potentially wildlife and hatchery origin salmon and steelhead. The ISRP suggests that the proponents, the Council, and BPA explore the possibility of expanding StreamNet's efforts to include these other species, if they wish to do so.

The proponents provide a good deal of information that demonstrates general attention to examining program effectiveness and user satisfaction, especially from the state and federal agency participants. As well, there is a large amount of excellent information provided which summarizes level of use and major users over the last five years. Collectively, this appears to provide a solid base of information for additional evaluation of project effectiveness and user satisfaction.

The ISRP suggests that StreamNet request funds from BPA for archiving photographs. Collecting visual records of habitat changes in one place, where they are readily available, is essential for a vibrant restoration program. StreamNet is the logical place for establishing this important archive.

Preliminary review response request:

StreamNet is a long-standing project that has evolved into a key component of the Basin's anadromous fish management and reporting program. It has provided data management and dissemination for more than 20 years. Although there appears to be room for continued improvement and efficiency, the project is well organized and effective at meeting an increasing array of goods and services to its users. With continued focus on reducing expenditures for most projects and given the importance of the project to basinwide management and reporting, it appears careful review of future work plans and approaches will be needed to effectively address increasing demands for data management and dissemination.

The proponents are asked to respond to the following issues as well as additional issues identified in the review comments.

1. The ISRP requests that the proponents develop an adaptive management (AM) plan, one that encompasses both internal and external AM. This plan was also requested in past ISRP project reviews. The ISRP notes that while an internal AM process is not described in

the proposal, the proponents do provide internal goals and objectives. However, these are only part of an AM process. Please present the internal AM process for ISRP review.

2. As described in the 2006 ISRP Review, “The project should have in place a system for monitoring and evaluating its performance. The program still needs to develop more in-depth measures of monitoring effectiveness and assess its impact in terms of user satisfaction. Use of the services should be documented, and more focus should be placed on outputs rather than inputs. A systematic way of evaluating effectiveness is needed. Who are the users? Were these users satisfied? Is tracking software used (e.g., Web Trends)? The sponsors should provide some evaluative performance information to address these questions.”

The proponents still need to respond to a previous qualification from the 2012 ISRP review, specifically:

3. That the proponents: “Provide a report describing in detail the data quality assurance and quality control (QA/QC) procedures used by StreamNet.” If this is in another StreamNet publication, please provide the link. Otherwise, please provide a response detailing the QA/QC procedures.

1. Objectives, Significance to Regional Programs, and Technical Background

There are three primary objectives listed in the 2019 proposal that address priority work items identified in the Five-Year Plan for Coordinated Assessments. These objectives are qualitative and do not lend themselves to tracking accomplishments with given timelines. The ISRP believes that the StreamNet project needs to establish quantitative objectives and timelines as well as interim milestones for meeting them.

The ISRP recognizes that the StreamNet Project is an important component among regional agencies and programs, especially its role in providing web-based, standardized, and comprehensive information for anadromous fish in the Basin. The need for regionally coordinated and readily accessible data has been consistently identified by the Northwest Power and Conservation Council (NPCC), the Bonneville Power Administration (BPA), and the National Oceanic and Atmospheric Administration Fisheries Program (NOAA). StreamNet began in 1995 and is now the primary data source for a number of agencies. A five-year Strategic Plan is in place and the current priority is identified as the Coordinated Assessments Project. StreamNet helps lead implementation of the Coordinated Assessments Project, in partnership with the Pacific Northwest Aquatic Monitoring Partnership (PNAMP).

The technical background of personnel involved appears to be strong.

2. Results and Adaptive Management

The project has been very effective in developing a data management and dissemination system focused primarily on anadromous fish. It provides consistent and transparent data-sharing among formal members as well as other cooperators and partners. Due to past and current work priorities and limited funding, StreamNet does not provide much organization or support for resident fish or wildlife data.

The use of supported technical staff located and working within member agencies is a useful way of developing ownership and technical expertise. However, the ISRP acknowledges that supervision and oversight of quality and work timelines may be difficult with a dispersed work group. According to the proponents, these technical staff work to develop the data management infrastructure within specific agencies to first satisfy the internal need for this information, and secondly to standardize and coordinate sharing of this information across state and agency boundaries.

The ISRP is impressed by the proponent's contributions to the development of database systems and approaches for improving the efficiency of data management and dissemination, their work enhancing agencies' capacities for data management, and their participation in a variety of teams of data management professionals from states, tribes, and agencies that coordinate regional data sharing.

There is no formal plan or discussion of adaptive management (AM). It is noted that a new organizational structure was put in place in 2014 to help improve project direction and performance. An Executive Committee was formed to direct the project, and it is comprised of policy level members of the StreamNet group as well as representatives of regional management agencies that fund the program and/or use the information. However, how the Executive Committee addresses AM issues is not discussed, and the ISRP would like more information on the mechanics of how AM is implemented.

An activity that helped drive adaptive changes to the project was the development and implementation of an online survey involving fisheries data management professionals in spring 2015. The survey asked respondents for opinions on data management questions. Discussions were then held with the StreamNet Steering Committee, BPA, NPCC, and others. One result was adoption of a five-year plan to guide activities. The plan was reviewed and updated by the Committee again on September 2017 and November 2018.

Some specific comments:

1. The recommendation on pages 4-5 of the latest annual report represented a thoughtful level of synthesis and strategic thinking.

2. The ISRP notes that many projects generate data in diverse formats and StreamNet brings them together nicely. This is a vitally important aspect of the project.
3. The ISRP was surprised that photographs are no-longer stored. For habitat restoration work, photographs provide visual evidence of changes over time. Are these superseded by other formats? StreamNet seems like a logical place to store images from photo-points recorded over time.

3. Methods: Project Relationships, Work Types, and Deliverables

Well-developed database methods are used by StreamNet. There is a comprehensive description of project relationships, work types, and deliverables. Given declining funding it appears that maintaining the current mix of work types and level of activity will be increasingly challenging. The StreamNet Steering Committee and other partners will need to engage in a careful review of future work plans and approaches to ensure that the project is able to maintain its important basin-wide management and reporting responsibilities.

The proponents rightfully recognize that “Threats and limiting factors for StreamNet are primarily related to leadership, direction, and the data management capabilities within the data source agencies, rather than biological or ecological factors.” Do the proponents have suggestions on how the Fish and Wildlife Program could assist in addressing these important threats and limiting factors?

200850500 - StreamNet Regional Library

- Background info in Taurus: [Project proposal](#)

Proponent: Columbia River Inter-Tribal Fish Commission (CRITFC), Idaho Department of Fish and Game (IDFG), Montana Fish, Wildlife and Parks (MFWP), Northwest Power and Conservation Council, Oregon Department of Fish and Wildlife, Pacific States Marine Fisheries Commission

Recommendation: Meets scientific review criteria

Comment:

The ISRP believes the hiring of a professional librarian is a positive development. Ms. Wilkerson demonstrated a comprehensive knowledge of library resources during her presentation as well as during the follow-up Q&A with the ISRP.

The proponents need a multi-year plan as soon as possible, and the ISRP is looking forward to being able to comment on it.

1. Objectives, Significance to Regional Programs, and Technical Background

This proposal requests continued funding of a 23-year-old, regional project that stores, manages, organizes, and provides access to fish and wildlife literature on the Columbia River Basin and region. Such a library is vitally important for researchers and technicians, particularly for those not having access to the diverse informational resources provided by academic/university libraries.

A particularly useful aspect is the focus on grey literature (i.e., academic theses and dissertations, consultant reports, government documents, conference and meeting proceedings, working papers, and organizational development documents) which is rarely published and often not readily accessible to most users. The library is also an important regional resource providing ready access to a wide range of publications.

The project has a comprehensive set of five objectives. These are described in detail but are qualitative, with no projected completion dates, making tracking of implementation and effectiveness difficult. The ISRP strongly urges the proponents to develop quantitative, time-bound objectives as part of the multi-year plan.

2. Results and Adaptive Management

The ISRP was surprised to read that “The greatest stumbling blocks in the first three months has been the disorganization of the physical and virtual spaces. While there is a wealth of materials, the systems to receive and prioritize them remain somewhat of a mystery. The staff have been forced to reconstruct and reintegrate the current actions with past knowledge and systems.” From the presentation to the ISRP, progress appears to have been made on this issue, though details on the strategy were not discussed. Could a steering committee be assembled to assist with these efforts moving forward?

The ISRP assumes that the proponents are aware that the need to store grey literature seems to be diminishing as many organizations now routinely publish such documents digitally. This was a general issue identified in the 2012 ISRP Review—the need for increased coordination to minimize duplication of efforts with other data and information management projects. The ISRP acknowledges that there has been an effort by the proponents to improve coordination, which should continue to ensure the library is prioritizing and making the best use of declining resources.

The project has generally met all work items and deliverables in a timely and competent manner. Nevertheless, as with many other data and information sharing projects, there is no adaptive management (AM) plan and the elements needed to support it. This was a qualification in the 2012 ISRP Review ([ISRP 2012-6](#)), “A greater project emphasis on scientific

components, measurement of outcomes, and development of an adaptive management framework for designing, implementing, evaluating, and revising data management activities would help to resolve such issues and to identify scientific components of planned future growth.” There is little evidence that this is being meaningfully addressed as the project moves forward.

Some recent progress on project evaluation and adaptation is underway. In 2018, the project began collecting and analyzing baseline metrics to examine how the Library collection is used. These metrics will drive future library services. Additionally, internal and external assessments by the library team have identified a number of needed changes and developed initial elements of an outreach strategy. The proposal notes, “The Library will embark on a robust User Assessment in 2019 and 2020 to better define user groups, field and research needs, technological and access concerns, and gather input on direct improvement.” The ISRP looks forward to learning about the survey’s outcomes and about the resulting changes to library operations.

However, with the development of a multi-year plan, the ISRP expects to see a formal AM process that is responsive to both internal and external issues.

3. Methods: Project Relationships, Work Types, and Deliverables

The library’s professional staff appears to take pride in a well-run operation and to proactively search for ways to improve the scope and quality of services. Despite growing demands for expanded services, it appears that potential budget constraints may limit future operations, which would not be helpful to the Fish and Wildlife Program. The ISRP continues to urge researchers and managers to publish project results in the professional literature; having a vibrant library is central to this goal.

Finally, the ISRP supports the movement toward evaluating the feasibility and cost-effectiveness of moving the Library catalog into the Cloud. Cloud computing would allow a reduction in hardware and IT expertise necessary to “hold the collection details.” Please keep the ISRP informed of progress as well as any issues that might arise.

200850700 - CRITFC Inter-Tribal Monitoring Data

- Background info in Taurus: [Project proposal](#)

Proponent: Columbia River Inter-Tribal Fish Commission (CRITFC)

Recommendation: Meets scientific review criteria (qualified)

Qualifications:

The ISRP recommends that the proponents describe their responses to the ISRP's comments and suggestions below in their upcoming annual report covering FY 2019 accomplishments.

1. Objectives need to be quantitative with specific timelines for attaining clearly stated milestones and criteria for success.
2. Provide an Adaptive Management (AM) process description for ISRP review.
3. Provide the ISRP documentation on the project mission and out-year work plan, i.e., the plan developed to guide future activities. The documentation needs to include the strategic approach or activity list, as well as the timeline to support multi-year implementation.
4. The proponents adequately addressed some qualifications from the previous ISRP review ([2012-6](#)), but some were not addressed. The ISRP would like to discuss Qualifications No. 1 and No. 3 (and possibly Qualifications 2 and 4) from the previous ([2012-6](#)) review in a face-to-face meeting. No. 1 relates to objectives being restated in terms of desired outcomes rather than tasks and No. 3 relates to defining the success criteria used to determine whether each of the five project objectives will have been met specified milestones. The ISRP believes that these can be accomplished as long as there is a common understanding of what is expected.

Comment:

This project is challenging in that it provides support for upgrading and enhancing data management for a group of tribes with varying degrees of support and enthusiasm for the effort. It appears that there has been major progress and that it has resulted in tribal members' active participation and data sharing with broader regional efforts. The broader efforts include implementation of the Columbia Basin Fish Accords, recovery planning under the ESA, tribal co-management needs regarding U.S. v. Oregon and the Pacific Salmon Treaty. Although designed as an interim project, funding reductions are likely to extend the time needed for full

implementation. The ISRP notes that that data management is a full-time effort and requires an appropriate level of financial support.

1. Objectives, Significance to Regional Programs, and Technical Background

The proposal includes a strong and clearly stated goal that centers around effective data management, and the text has a comprehensive and explicit explanation of what effective data management means. The proponents appear to have the technical expertise and appropriate leadership to execute the activities to achieve the goal. However, some objectives are not written in a way that progress toward them can be evaluated. Simple changes from words like “ensure” or “enhance” toward more measurable goals could help. With that said, some of the text beneath the objectives did provide measurable objectives, so it may just be a proposal structure issue. For instance, “Facilitate routine (e.g.; 6 times per year) ITMD coordination phone calls between tribal data stewards and attend occasional (e.g.; once per year) site visits to share information and transfer technology.” Nevertheless, as stated, the objectives (p. 5) are very general and lack timelines for completion. They are really work statements rather than quantifiable objectives.

The text on significance to regional programs clearly defines that the project is a resource to help the Tribes manage and share data. The proposal does indicate that the project is responsive to some other efforts in the basin (e.g., BiOp), but (appropriately) does not attempt to extend project significance more broadly to all efforts across the basin.

Overall, the ISRP believes that the project is highly relevant to member tribes as well as to other regional data management programs. The proponents have the technical skills to be successful. Nevertheless, the ISRP is concerned whether the project is threatened by personnel issues (p. 16) without having adequate funding to acquire and retain skilled staff, to train and educate staff (continuing education and conferences), and to overcome the difficulties in recruiting skilled professionals to remote tribal locations.

2. Results and Adaptive Management

The project has provided important support and encouragement for improving member Tribes’ data management and information sharing capabilities. It has resulted in a wide range of deliverables ranging from increased infrastructure development, improved coordination and communication, and enhanced data transfer support. A major accomplishment occurred in 2018. With the help of an EPA grant, the tribes were able to install centralized data management systems and load a limited number of data sets.

The project has enabled data sharing for important regional projects including recovery plans and U.S. v. Oregon. Although the project is intended as an interim effort, it is limited by the

need for improved data management staffing. Two tribes now have full time data stewards who are rapidly acquiring data management skills. The remaining tribes have identified individuals for the role of a part time data steward despite the proponent's observation that a part-time steward is not sufficient to fully support tribal fisheries programs.

The ISRP notes that a project mission and out-year work plan has been developed to guide future activities. However, there is no mention of any documentation of a strategic approach or activity list and timeline to support multi-year implementation. The ISRP mentions this because the proponents do not feel that this project needs an adaptive management (AM) process. The proposal states, "The ITMD project is not the type of project that requires an adaptive management plan of its own per the specific definition." It does acknowledge that the "project does adapt to ever changing policy guidance on data management from the tribes, CRITFC, and Columbia Basin fish and wildlife resource management programs." Despite lacking an AM process, there is an excellent discussion of lessons learned and recommendations for change contained in the 2018 Annual Report. Nevertheless, the ISRP feels that the project could improve efficiency by having a clearly articulated AM process for both internal and external issues.

The ISRP was pleased to see that "At the close of 2018, all the tribes and CRITFC possess the required infrastructure to be able to share data regionally. Experiments in uploading and downloading data have taken place to several regional repositories. The expectation is that by the close of 2019 some tribal and CRITFC data will be available across the region." This is a very positive development.

As well, the ISRP supports the continued efforts made toward training personnel and seeing that each tribe has the technology and skills to successfully participate in the data management project. The proponents understand that a serious threat to project success (p. 17) is not having adequately trained personnel and have established a process for maintaining that expertise over time.

While the proponents provided honest responses to previous ([2012-6](#)) ISRP qualifications, it would be good to discuss Qualifications No. 1 and No. 3 (and perhaps Nos. 2 and 4) in a face-to-face meeting. No. 1 relates to objectives being restated in terms of desired outcomes rather than tasks and No. 3 relates to defining the success criteria used to determine whether each of the five project objectives will have met specified milestones. The ISRP believes that these can be accomplished if there is a common understanding of what is expected.

The ISRP agrees only in part with the statement (p. 13) that "Good decisions are based on quality of data, quantity of data (over space and time), and on real-time data flowing quickly through data management systems (for those decisions that require a quick turn-around time)." We also believe that good decisions are based on appropriate analyses of good

information and having the experience to interpret the results accurately (wisdom). The overall impression is that abundant data are being collected by each Tribe and processed through the project, but less emphasis is given to analyses and interpretations. In the future, the proponents should add analysis and interpretation to the training of skill sets.

3. Methods: Project Relationships, Work Types, and Deliverables

The project is guided by the overall data management strategies developed for each of the Tribes and CRITFC. The ISRP notes that “Since the last ISRP review, the project has been gradually transitioning from supporting individual project data systems to more common data systems to support tribe-wide and regional data sharing and reporting. This is linked to the demand for broader data sharing on a regional scale. Work types include infrastructure development, skills and technical capacity development for tribal staff, information sharing and review and application of new technical developments, most recently to support field data entry.”

While the nine deliverables are quite detailed, they are generally qualitative in describing activities but not outcomes, as recommended by the 2012 ISRP review

The ISRP is concerned that several data stewards are only part-time positions. A discussion with the proponents and the Council/BPA is warranted to see if the positions can become full-time. Part-time positions, ones that have responsibilities elsewhere, do not bode well for long-term success. That said, could these positions also include responsibilities for advanced data analyses and interpretation?

The ISRP is still not completely clear on how the proposed data management activities are related to data management activities of other programs in the Basin, for example, the AEM activities proposed by the Yakama Tribe, PNAMP, StreamNet, and others. The ISRP would appreciate understanding how much database sharing and overlap occurs.

Objective 1 and Deliverable 2 (p. 24) are seriously hampered by current BPA funding rules for travel for meetings and conferences, which restrict access to continuing education opportunities. Additional support and funding for continuing education, information sharing, and outreach appears justified for this project.

201102000 - Data Management Project

- Background info in Taurus: [Project proposal](#)

Proponent: Kalispel Tribe

Recommendation: Meets scientific review criteria (qualified)

Qualifications:

The ISRP recommends that the proponents describe their responses to the ISRP's comments and suggestions below in their upcoming annual report covering FY 2019 accomplishments.

1. Establish quantitative objectives, guiding hypotheses and timelines for meeting key activities that can be reviewed by the ISRP.
2. Provide an Adaptive Management (AM) process description for ISRP review. The AM process should include quantitative, time bound objectives and a more comprehensive description of how implementation and effectiveness monitoring will be aligned to improve project use and efficiency.
3. Develop a strategic framework to guide project direction and priorities to move toward longer term project goals and, as well, a description of the major activities and skills required.
4. Provide evidence regarding the database's level of use. The ISRP would like to be confident that the project is being widely used and that it is improving restoration actions and outcomes.

Comment:

The project appears to be well focused on providing comprehensive and efficient data management. The primary user is the Kalispel Tribe, but there are a number of partner agencies providing funding to support their use of the data. The proponents describe long term goals as well as information on who and how it will be used, but the information is not supported by a strategic plan or a list of major activities that should occur over the next several years.

1. Objectives, Significance to Regional Programs, and Technical Background

The primary goal is to assist in coordinating resource management strategies by addressing the status of resident fish, wildlife, and their habitats using a centralized data repository. There is a desire to publicly disseminate project and resource information, so that independent parties can "rapidly access primary or secondary data types, research metadata, and download reports related to data sets." Also, a long-term goal is identified as the project functioning as "a decision support system, to guide natural resource management managers in their strategies

and activities.” Unfortunately, the latter goal statement was confusing to the ISRP because it was not clear how the database addresses it, especially since there is no long-term strategy or action plan in place to guide actions or decisions over the long term.

There are six detailed and quite clearly stated objectives. They are qualitative and have no specific time frames for completion. A major plus is that each objective has a description describing metrics/criteria for measuring successful accomplishment. As previously noted, there are no objectives linked to longer term goals for the project. An example is that there is a stated desire to have the data system “be a place to disseminate natural resource information to the public and act as a data repository for future wildlife and fisheries managers,” but there are no objectives focused on user recruitment, marketing of services to potential partner agencies or publics, or measuring current user satisfaction and desires for specific products and services. There has been tracking of actual use, but no description of how that information is used to guide management or decision-making.

Regarding regional significance, the proponents list a number of programs for which the database has relevance, but the details of how it contributes to the programs are more assumed and not clearly documented. Regional significance appears limited to the non-anadromous areas of the Basin. That is not necessarily a problem, but the ISRP is curious if some of the data sets housed within the database have wider utility. If so, linkages to other Columbia Basin databases (e.g., StreamNet, PNAMP, and so forth) are not readily apparent.

2. Results and Adaptive Management

The project appears to be meeting the near term needs of the Kalispel Tribe, yet there is only a limited description of actual accomplishments over the last four to five-years. Also, there is no summary of major accomplishments from inception to the present, which would be useful for evaluating the project. There are biannual accomplishment reports provided but they are narrowly focused on the accomplishment of specific objectives.

Although there is some tracking of project effectiveness, there is no evaluation or identification of lessons learned to guide future project direction and operations. As well, there is no mention of adaptive management (AM) or that it is an important project component. The proponents portray that project effectiveness is measured in several ways and that the range of users, including the public, that submit and maintain data sets will reflect project effectiveness through operational usage. Currently there is tracking of “the volume of data sets uploaded by licensed users, the number of data sets downloaded by the general public and added a hit counter at the web interface level.” There is no discussion as to trends in use over the last few years or whether this use appears to be meeting user needs. Further, how are data on number of users and dataset volumes downloaded being used to improve the project? The proponents

note that they receive and respond to feedback, but it is not clear from whom or that this feedback process is structured in a way that leads to more than an ad hoc set of edits.

Based on the Explanation of Financial History, it appears that the project has made some minor additions to the functionality of the website. Have any additional modifications been made? For instance, the proponents state that they were tracking project effectiveness as the number of users and the volume of datasets uploaded and downloaded. However, none of those results was presented aside from stating that the database is the repository for 60 datasets. Are these tracking data being used to modify the website? Who is using these data and how? What new insights or restoration plans/actions have been developed as a result?

Based on the workflow for submitting and providing QA/QC of datasets, it seems that substantial personnel time is required to get datasets verified and uploaded. The database would benefit from implementing algorithms that require less human attention to have datasets formatted, documented, and uploaded. Related to this, what is the long-term outlook for the database? Will it need this level of support in perpetuity?

Some of the issues mentioned above suggest the proponents need to pause and carefully think about the design and function of their database. The proponents were honest about their lack of success with the former database (JSAP DB), which was scrapped in 2009. However, the design of the current database also seems to have some inefficiencies, and the ISRP feels that more thought could be given to database design and longevity. For instance, no threats to program investments and the project are mentioned. For this database to have the maximum utility and impact, especially given its ambitious goals, the objectives for and design of the database need to be strategic.

3. Methods: Project Relationships, Work Types, and Deliverables

The proponents list many projects for which this database provides an information repository, 60% of which are BPA-funded projects.

The proposed work and deliverables include some relatively minor modifications to the database, as well as the ongoing activities needed to maintain it. The proposal states that, “Future versions will incorporate field survey report documents, data analysis tools, and summary statistics information.” While this functionality is potentially useful, it is not explained well enough for the ISRP to understand its merit or limitations, or even if it will be incorporated in this project.

The ISRP would like to understand why the work under Deliverable 1 (Provide templates for downloading primary datasets into the Intermountain Province GEDMS) needs to be subcontracted rather than done “in-house.”

The ISRP has a concern about Deliverable 2 (p. 15). Will the public care about primary data? If resource managers want to share what they are learning about the environment, habitat, and focal species progress within their jurisdiction, the ISRP suspects that they will probably find that analyzed (and interpreted) results are more useful. Are there provisions to see that these are done and provided to the public? Perhaps some links to published analyses using these data would be helpful to the public, especially those wondering what has been learned or accomplished?

The proponents anticipate (p. 16) that within the FY 2019-2023 timeframe additional equipment needs to be acquired. This likely will include a data server, desktop or laptop computers, and additional software. This may also include having to rent facilities for housing the equipment. Were these potential expenditures in the proposed budget?

199800401 - Columbia Basin Bulletin

- Background info in Taurus: [Project proposal](#)

Proponent: Intermountain Communications

Recommendation: Not applicable

Comment:

The Columbia Basin Bulletin (CBB) is a unique source for information sharing in the Basin. It is designed to “provide information about fish and wildlife issues important to Columbia River Basin fish and wildlife policy development” and receives broad use that is reportedly increasing steadily. It is a major outlet for dissemination of information about restoration and environmental developments in the Basin.

Currently the CBB is scheduled to be terminated in FY 2020. Funding for FY 2019 is about 50% of the level of previous years. Because there are no other similar information/technical transfer products with the timeliness, public accessibility, and range of subjects provided by the CBB, its termination of the CBB will have adverse effects on program users and the general effectiveness of information sharing in the Basin. The ISRP strongly recommends that policy makers consider either (1) abandoning current plans that call for the dissolution of the CBB, or (2) developing replacement tools for comprehensive and timely, basinwide information sharing before terminating the current project.

1. Objectives, Significance to Regional Programs, and Technical Background

No specific objectives were listed or apparently required for the 2018 project contract. Nevertheless, the CBB is described in the proposal narrative as a tool for use in information sharing and technical transfer of a wide range of information relevant to the Fish and Wildlife Program and other recovery programs for fish and wildlife in the Basin. This description is quite broad and makes it difficult to measure completion or outcomes. Nevertheless, it is clear that the overriding objective of this weekly bulletin is to find and publish online articles that are of interest to Fish and Wildlife stakeholders in the Columbia Basin. The proposal does not provide metrics that describe anticipated results or benefits beyond the reference to having 9500+ current subscribers. Given the many ways that people access information these days, the proponents need to be able to demonstrate that it is “stakeholders’ key source for objective, complete, timely information about Columbia Basin Fish and Wildlife issues.”

The significance to regional programs appears to be strong, and much information is provided to demonstrate many of the ways that the CBB aligns with various priorities for the Fish and Wildlife Program and the Basin. To maintain and strengthen this strong linkage, the ISRP suggested in the 2012 review ([ISRP 2012-6](#)), that the Council might consider using an independent scientific survey of members/users to evaluate the CBB in terms of regional coordination of outreach and education. It is important to understand how users view the CBB. This was not addressed in the proposal.

The discussion on Technical Background is satisfactory. However, the CBB should be actively considering new and emerging techniques for communication as ways to improve its readership and usefulness (if it is not already being done).

2. Results and Adaptive Management

Overall the results are outstanding. The CBB has been produced on a weekly schedule for more than 20 years and has provided information summaries to a wide range of users. It has served as a unique information sharing resource for the Fish and Wildlife Program, its participants and other interested parties and publics. It has been a useful tool to disseminate up-to-date information across the entire region. Unfortunately, the proposal does not include additional information that attempts to describe specific outcomes from CBB or any metrics to gauge efficiency in information transfer of the newsletter and website. It is reported by the proponents that the subscriber base and website visits have steadily grown over the years, but the reported number of subscribers has remained constant in proposal documents.

The proposal does not present lessons learned or indication of how the program has evolved. The proposal would be improved by a discussion of factors that might limit the project's success at meeting project objectives. Since there does not appear to be a requirement for the project

to provide annual reports, it is difficult to track any adaptive management that has occurred. It was noted in the 2012 ISRP review that “No significant changes in project direction have occurred, although based on requests from a reader survey conducted by the CBB, the sponsors have included more articles on research in the Columbia Basin or relevant research conducted outside the Basin.” It was also suggested in the 2012 review that there be: a future, independent scientific survey of members/users to evaluate the CBB in terms of regional coordination of outreach and education; a greater emphasis on trying to measure outcomes; and including in the proposal an adaptive management framework for designing, implementing, evaluating, and revising coordination activities and a discussion of the factors that might limit the project's success at meeting coordination objectives. There is no evidence that any of this has occurred.

It seems like the impact of the project could be substantially larger. The basin and technology have changed significantly since 1998, but it is not clear that the Bulletin has done the same. There are a number of questions regarding change. These include:

- Are email blasts the most effective way to disseminate the information? Given how many list serves people receive every day, it is likely that some of the emails are going directly to the trash. What other mechanisms (e.g., Twitter, others) could be used to increase the effectiveness of sharing information?
- Who exactly is the audience? Under a limited budget, it may help to identify who is reading the emails and how content could be focused.
- It sounds like readership survey was conducted before the 2012 review, but it may be useful to revisit that survey. For example, it seems like they would need to know how many of the 9500+ subscribers actually read the emails, better understand how the subscribers navigate the information (what broad themes are they interested in? How do they search for/reach those themes, etc), and get feedback on how the newsletter impacts their work and decisions. It sounds like the project has some website analytics, but it is not clear how those results are being used to improve the dissemination of the information. For example, those analytics could be used to better understand how subscribers are accessing the information, which should lead to improvements of the emails and website.

3. Methods: Project Relationships, Work Types, and Deliverables

Producing the CBB requires considerable coordination and interaction with a wide range of individuals and agencies across the basin. The proponents provide a comprehensive list; however, it did not appear to include any political offices (e.g., governors or state legislators), an important audience.

Lamprey

199402600 - Pacific Lamprey Research and Restoration Project

- Background info in Taurus: [Project proposal](#)

Proponent: National Oceanic and Atmospheric Administration, Umatilla Confederated Tribes (CTUIR)

Recommendation: Meets scientific review criteria (qualified)

Qualifications:

The Council, BPA, and project proponents should address the following qualifications when developing and reviewing the project's Statement of Work and annual reports. The qualifications reflect two persistent concerns with many projects that are discussed more generally in section III (programmatic comments) of this ISRP review.

1. Provide SMART objectives with quantitative targets and timelines that can be used to evaluate progress.
2. Develop and describe an adaptive management process (i.e., review cycles) by which progress toward restoration will be assessed and decisions to alter course will be made.

Final review comment:

The ISRP asked the proponents to (1) clarify the 6 major objectives for 2020-2024 with inclusion of specific quantitative objectives and timelines, (2) describe an adaptive management process, and (3) describe a monitoring program to assess progress. Their response adequately addresses request 3 but only partially addresses requests 1 and 2. The additional detail provided on metrics and monitoring methods has improved the ISRP's understanding of the proponents' capacity to evaluate progress. However, the proposal still lacks: numerical targets and/or expected benefits against which progress can be judged; and an adequate description of the internal adaptive management process (e.g., 1-yr and 5-yr review cycles) by which progress will be assessed and decisions could be made to alter tactics or objectives.

Specific comments:

Request 1 is only partially addressed. Objective 1 (reintroduction and translocation of spawners) includes a numerical target (i.e., <350 adults) but it appears to be incorrect; presumably, the proponents intended to define a minimum target (i.e., >350 adults). The other five objectives still lack quantitative targets. That said, the proponents have made a good start by clarifying timelines for all objectives and identifying quantitative tasks for 12 of the 26

deliverables (1, 2, 3, 4, 10, 12, 13, 14, 17, 18, 20, and 21). We recommend that further details be linked to the other deliverables. In general, the deliverables provide a good overview of the work and research being proposed.

Request 2 is only partially addressed. The proponents indicate that the project has four phases. Results from work performed in each phase are expected to inform or lead to modifications of work planned in subsequent phases. The response briefly sketches an adaptive management process by describing actions that will be, or have been, undertaken in each phase along with anticipated management responses. However, this description lacks important details about how actions will be reviewed and evaluated. How frequently will actions be reviewed? Is there a formal process and schedule for reviewing progress? Are contingency plans with decision criteria being developed? A more complete description is needed to explain how the proponents will review progress and alter course as necessary to achieve their objectives.

Request 3 is adequately addressed. The 26 deliverables now include considerable detail on how monitoring data will be used to monitor the success of proposed restoration actions. For instance, parentage-based tagging (PBT) will be used to track the distribution and reproductive success of individual adults following translocation and supplementation. Progeny of translocated adults will be detected by standardized sampling for eDNA and juveniles in tributaries. Juvenile survival will be determined by sampling from 30 days to one year after release to gain knowledge about when, where and how hatchery fish should be released. PIT tags and acoustic tags in juveniles together with radio tags in adults will be used to evaluate the effectiveness of lamprey passage structures and to identify problem sites. PIT tags in juveniles will also provide information on migration and survival rates, as well as entrainment and impingement at irrigation diversions. Radio tags in adults will help to identify key over-wintering and spawning areas.

Preliminary review response request:

This long-running lamprey recovery and conservation project has helped to restore lamprey to the Umatilla and Grande Ronde subbasins by translocating adults and improving passage for adults and juveniles. These efforts appear to have substantially increased the distribution and abundance of juvenile lamprey. Introductions of hatchery juveniles into the Walla Walla and Tucannon subbasins are also planned. The project is credited with developing methods that are now used elsewhere in the Basin to improve artificial propagation and passage for lamprey. Project personnel are participating in regional planning committees and have helped develop documents that are being used to guide lamprey research and recovery efforts throughout the Basin.

To complete our review, however, we request that the proponents:

1. Clarify each of the six major objectives for 2020-2024 by adding quantitative detail and timelines.
2. Describe the adaptive management process (i.e., review cycles) by which decisions to alter course are being made.
3. Provide information on how monitoring data will be used to assess progress toward restoration.

Comment:

1. Objectives, Significance to Regional Programs, and Technical Background

The proposal clearly explains why this project was initiated and how it addresses biological objectives identified in the Pacific Lamprey Restoration Initiative and other agreements, as well as critical uncertainties identified in the Fish and Wildlife Program. The primary goal is to restore Pacific lamprey to self-sustaining and harvestable levels in the Umatilla, Walla Walla, Grande Ronde, and Tucannon subbasins. In 1994, when the project began, Pacific lamprey were at risk of being extirpated from the ceded lands of the CTUIR. Additionally, little was known about the biology of Pacific lamprey or about the many factors constraining their abundance. Work being performed by the project addresses all four major themes in the Council's Fish and Wildlife Program.

The proposal includes six general objectives which lack quantitative elements that could be used to measure progress. (We also note an apparent inconsistency in the Executive Summary which mentions eight "future objectives"). Anticipated benefits to lamprey recovery are not described quantitatively. Twenty-six deliverables are clearly linked to the six objectives, but only a few of the deliverables include quantitative details. Most deliverables are expected annually from 2020 to 2024. Deliverable #21 appears to be misnamed; its current descriptor suggests that genetic samples will be obtained from the hatchery lamprey being released into nature. Yet, the true objective of this task is to mark/tag a portion of these fish using non-genetic methods. A desired tagging/marking rate should be indicated.

2. Results and Adaptive Management

The latest Annual Report provides extensive summaries of activities and cumulative progress from 1995 to 2014, and a table in the proposal provides a summary of annual accomplishments to 2018. The project has contributed to Pacific lamprey conservation and recovery plans through successful collaboration with other tribal, federal, and state agencies. Notable examples include the 2017 Synthesis Report (CRITFC 2017a), which was reviewed favorably by

the ISRP (ISRP 2018-02), and the 2018 Pacific Lamprey Supplementation Master Plan Step Review, also reviewed favorably by the ISRP at step 2 (ISRP-2018-05).

Adult translocation efforts associated with this project have increased juvenile Pacific lamprey abundance in the Umatilla subbasin. Moreover, pheromones from these juveniles appear to have attracted a steadily increasing number of adults into the Umatilla subbasin. Genetic samples were collected from all translocated adults to determine if progeny are returning to spawn in the Umatilla subbasin. Adult lamprey were also equipped with radio telemetry tags to identify and mitigate barriers to lamprey passage.

The project provides new knowledge on methodological issues and status and trends that are broadly applicable to Pacific lamprey populations throughout the Columbia Basin. For example, the proponents are credited with developing a method for PIT-tagging juvenile lamprey that is used throughout the Basin to provide insights about juvenile movements and passage success. The proponents are now (1) using acoustic tags in juvenile lamprey to increase knowledge of the threats during downstream migration and (2) investigating the use of eDNA to assess lamprey distribution.

The Adaptive Management section of the proposal includes good examples of lessons that have shifted the focus of the project moving forward. For example, the proposal mentions that the project has evolved from mostly research to mostly applied restoration and monitoring. However, neither the proposal nor the annual report describes the process (i.e., review cycles) by which such decisions to alter course are being made. A description of the process for adaptive management, and examples of how the project has used it to modify recovery actions and monitoring would be useful.

Annual reporting is behind schedule—the most recent annual report is for 2013-14. However, that report is well written and provides detailed information on objectives, methods, and results, as well as a discussion of cumulative results to date. Some project results have been published in the peer-review literature, presented at conferences and to the Council, and shared through public education and outreach.

3. Methods: Project Relationships, Work Types, and Deliverables

The proposal provides a good overview of activities and methods, and the 2013-14 annual report provides sufficient detail for a rigorous review of methods. Methods seem appropriate and both reports use the published literature to justify assertions and support procedures.

This project aims to serve a long-term monitoring and assessment function. The proposal and 2013-14 Annual Report together provide appropriate detail about the types of monitoring activities that have been conducted or planned. However, it is not clear how the monitoring

data are being used to assess progress toward restoration. Research has been an important component of this project, but hypothesis testing is not described.

The proposal would be strengthened by including additional information on how juvenile abundance and distribution data will be estimated. The current description is limited to determining larval abundance at individual sampling sites. The proposal should also describe the procedures that will be used to choose the number and location of juvenile lamprey index sites, as well as the criteria that will be used to identify adult and juvenile passage problems. More details are also needed on the methods that will be used to transfer and release hatchery larvae into the Walla Walla and Tucannon subbasins.

200830800 - Willamette Falls Lamprey Escapement Estimate

- Background info in Taurus: [Project proposal](#)

Proponent: Confederated Tribes of Warm Springs

Recommendation: Meets scientific review criteria

Comment:

This proposal describes impressive progress since 2010 in developing, testing, and refining alternative methods to achieve the lamprey abundance estimation objectives. A power analysis (requested by the ISRP in a previous review) determined that at least 2,000 Pacific lamprey must be tagged to obtain reliable estimates of abundance with the Lincoln-Peterson mark-recapture model. Fieldwork confirmed that PIT-tagged Pacific lamprey could be detected reliably, and that Pacific lamprey could be counted reliably from video recordings; both uncertainties had been identified by the ISRP in a previous review. Based on these results, the proponents expanded the PIT-tag antenna arrays and contracted Oregon State University statisticians to develop an alternative Bayesian model for estimating abundance that does not require tagged fish; this model can be used when low abundance makes it difficult to catch and mark enough fish for capture-recapture estimation. Thus, despite some recent challenges with low abundance, the project remains on track and continues to provide important data for assessing the status of Pacific lamprey.

1. Objectives, Significance to Regional Programs, and Technical Background

The objectives are clearly stated and justified. The proposal clearly explains why this project was initiated and how it addresses biological objectives identified in the Pacific Lamprey Restoration Initiative, as well as critical uncertainties identified in the Fish and Wildlife Program. Anticipated benefits and opportunities for further research are described, but they are not

expressed quantitatively. This is primarily a monitoring project that will require long-term continuity to fully describe escapement trends.

Obtaining and tracking changes in the abundance and status of Pacific Lamprey returning to the Willamette River is an important conservation task. Additionally, genetic samples collected by the project and analyzed by CRITFC have shown that regional differences occur in the Basin's Pacific lamprey populations. This information is particularly important because it will help inform ongoing translocation efforts.

2. Results and Adaptive Management

Good progress has been made since 2010 in developing, testing, and refining alternative methods to achieve the abundance estimation objectives.

The major challenge is that declining catches in the fish ladder (HDX pool) since 2016 have compromised the precision (and feasibility in 2018) of capture-recapture estimates of Pacific lamprey escapement passing the falls through the fish ladders. An additional challenge is that these escapement estimates are expanded further to determine the total abundance that arrive at Willamette Falls in a given year. The expansion factor is the estimated proportion of fish (marked and unmarked) that do not pass the falls, which in turn is inferred from the proportion of marked fish that return through the fish ladders after being collected in the HDX pool, anesthetized, sampled, PIT-tagged, and released below the falls. One concern is error propagation—the percentage of marked fish returning to the fish ladder is low (averaging only 33%) and quite variable. A larger concern is bias because the return rate of marked fish appears to be estimated reliably from detections of PIT tags, but it remains unclear if the return rate for the marked fish accurately represents the passage rate of unmarked fish. Moreover, the fate of the fish that do not return is unknown. The proponents hypothesize that Pacific lamprey have been increasingly deterred from entering the fish ladders by a growing presence of California sea lions. This hypothesis could also explain the greatly reduced (since 2015) correlation between Willamette and Bonneville abundance indices for Pacific lamprey. If the proponents are correct, efforts in 2019 to reduce California sea lion presence should ameliorate these issues.

Other project objectives, such as obtaining genetic samples, determining harvest rates, collecting biological data (length, weight), and ascertaining use of various passage routes over the falls have largely been met. Progress in assessing the fate of Pacific lamprey that remain below the falls is difficult to evaluate because not enough detail is provided in the proposal about the objectives and methods. Similarly, the genetics component of the project is not described in enough detail to evaluate results to date. This limitation arises partly because results for 2018 were not available for this review.

The proponents are to be commended for their continuing efforts to develop, test, and refine alternative technological and analytical procedures in the face of daunting challenges posed by physical logistics at Willamette Falls and the paucity of knowledge about Pacific lamprey. The credibility of the project has been greatly enhanced by comparing and validating results obtained by alternative approaches. Examples include the corroboration of capture-recapture estimates by video counts in 2011 and development of different statistical models (with OSU) that are less reliant on having access to an adequate sample of marked fish.

The proposal also indicates that the project's objectives are evolving steadily and creatively as information is gained, challenges are discovered, and new hypotheses are developed. However, neither the proposal nor the annual report describes an adaptive management process (i.e., review cycles) by which adjustments are made. For example, it is not clear who within or outside the project evaluates data and makes decisions to alter course. For completeness, the adaptive management process being used by the project will need to be described in the project's next annual report.

The monitoring data from the project are specific to the Willamette River and Falls. However, the project is also providing new knowledge on methodological issues and status and trends that are broadly applicable throughout the Columbia Basin. The genetic sampling in this project is directly linked to a study of population structure, adaptation, and migration that spans the lower Columbia and Snake rivers.

Results for 2018 were not available for this review. The proposal referred to "Other Project Documents on the web" but these documents were not apparent in Taurus. Moreover, the (draft?) 2018 Annual Report seemed to be the 2017 Annual Report with an updated title page. That said, the 2017 and earlier annual reports provide appropriately detailed discussion of objectives, methods, and results.

Findings have been shared as summary data in annual reports and similar documents. No peer-reviewed publications are listed.

The proponents mention that they may collect samples of juvenile and adult Pacific lamprey for contaminant evaluation by USGS scientists. They note that Pacific lamprey appear to be accumulating high levels of flame retardants, pesticides, and mercury. Such levels may be harmful to the fish and could represent a health threat to human consumers. The ISRP feels strongly that this partnership should be established as soon as possible. It is critically important to ascertain whether contaminants are hampering lamprey recovery. If contaminants are a major issue, then no amount of habitat restoration or other measures will restore populations until their effects can be ameliorated.

The conceptual approach is logically valid for estimating the escapement passing the Falls through the fish ladders and for expanding that estimate to determine the total abundance arriving at the Falls, but it seems quite susceptible to errors in estimating the passage rate for unmarked fish. Confidence in the expansion procedure would be increased if it were possible to demonstrate that the low return rate of marked fish is mostly unrelated to factors associated with their capture and tagging.

3. Methods: Project Relationships, Work Types, and Deliverables

The proposal describes activities and methods in appropriate detail and makes good use of the published literature to justify assertions and to support procedures. Unfortunately, the online file in “Other Project Documents” with tables and figures that was cited to explain the 2018 methods and results could not be found for this review. Previous methods and results are documented clearly and adequately in the 2017 Annual Report. Many of their protocols have been posted on the PNAMP web site.

This project primarily serves a long-term monitoring and data sharing function. The proposal generally provides appropriate detail about the types of monitoring activities that have been conducted or planned. An exception is the discussion on page 10 of how *“the sensitivity analysis of sea lions on lamprey indicated dramatic negative effect on below-falls estimates causing them to be unreliable.”* This discussion is difficult to understand and warrants more explanation. The genetics research component of the proposal lacks clear hypotheses; plans for future sampling are not described in the documents provided.

200847000 - Yakama Nation Ceded Lands Lamprey Evaluation and Restoration

- Background info in Taurus: [Project proposal](#)

Proponent: Yakama Confederated Tribes

Recommendation: Meets scientific review criteria (qualified)

Qualifications:

The ISRP recommends that the proponents describe their responses to the ISRP’s comments and suggestions below in their upcoming annual report covering FY 2019 accomplishments.

1. Include quantitative objectives that are clearly linked to deliverables with specified timelines.
2. Provide additional information about procedures for inferring the availability of suitable habitat and the average density of larval Pacific lamprey in tributaries. Estimating the

overall availability of suitable habitat and the average density of larval Pacific lamprey would require a random (or stratified random) sampling design throughout accessible tributaries. It is not sufficiently clear how the individual 50-m electrofishing sites are chosen, or how the presence/absence data are used to determine accessible reaches.

3. Describe the adaptive management process (i.e., review cycles) by which decisions to alter course of the project are being made.
4. Develop a formal management plan to refine procedures for sharing methods and data.

Comment:

The proposal and the 2017 Annual Report provide good evidence of progress since 2008 toward achieving stated objectives. Indeed, the knowledge obtained and management actions instituted through this project are very impressive. It is time to summarize these accomplishments in a comprehensive report, perhaps a peer-reviewed monograph that demonstrates the progress made by the Yakama Nation.

1. Objectives, Significance to Regional Programs, and Technical Background

This project is large and diverse. The proposal provides insight about the overall direction but does not clearly describe the specific research and management activities for the next few years. Objectives are mentioned frequently, but the proposal becomes confusing, partly because the objectives are diverse and evolving over time, and partly because objectives are not labeled and described consistently throughout the proposal. The four broad objectives in the objectives section (page 9) are not quantitative, although they do include some consideration of timelines.

The Problem Statement section describes (on page 8 under “New Objectives (2018-2028)”) 7 restoration activities, 8 RME activities, and 5 deliverables. The proposal does not explain how these activities and deliverables relate to the 12 deliverables listed in the Project Deliverables section (pages 62-65) or how the 12 deliverables address the 4 objectives (stating only “to be developed” on pages 66-67).

The Problem Statement section also describes 8 original objectives for the period 2008 to 2018, which help to evaluate progress over that period, but these objectives do not correspond with 13 primary goals listed in the latest annual report (for 2017).

The extensive discussion about objectives and deliverables suggests a lot of planning and diverse activity within the project, but the inconsistent framework obscures the proponent’s strategy and complicates evaluation of progress. For completeness, the proposal should provide descriptions of the specific work tasks to be completed over the next four-year funding period (i.e., specific quantitative time bound objectives). For example, how many larval index

sites will be surveyed annually? How many adults will be translocated annually into the Yakima, Methow, Wenatchee, and Entiat subbasins? How many public outreach presentations will occur annually?

The proposal clearly explains why this project was initiated and how it addresses biological objectives identified in the Pacific Lamprey Restoration Initiative, as well as critical uncertainties identified in the Fish and Wildlife Program.

This project will require annual funding and long-term continuity to achieve the diverse objectives.

2. Results and Adaptive Management

The proposal and latest annual report (for 2017) provide extensive summaries of activities and progress since 2008. These results contributed to the recent synthesis report (CRITFC 2017a) that was reviewed favorably by the ISRP ([ISRP 2018-2](#)). The project is on track and continues to generate new approaches and data necessary for assessing and improving the status of Pacific lamprey in the study area.

The proponents are commended for their commitment to adaptive management. The Adaptive Management section of the proposal is nicely organized and includes many good examples of lessons learned and self-evaluation of progress to date. However, neither the proposal nor the 2017 Annual Report describes the actual process (i.e., review cycles) by which decisions to adjust course will be made. Developing more specific objectives and protocols to assess compliance and effectiveness will help in refining the adaptive management process.

This project provides new knowledge on methodological issues and status and trends that are broadly applicable to Pacific lamprey populations throughout the Columbia Basin. The proposal indicates that the project is evolving steadily and creatively as information is gained, limiting factors are discovered, and new approaches for restoration are developed. Examples of results that will have broad utility include new tagging methods, hatchery methods to propagate juvenile larvae and macropthalmia, and field keys to distinguish the larvae of Pacific lamprey, brook lamprey, and river lamprey.

The annual reports provide an appropriately detailed discussion of objectives, methods, and results. In the Data Management section of the proposal (pages 58-59), the proponents acknowledge a continuing need for a formal management plan to refine procedures for sharing methods and data. This concern was raised by the ISRP in our 2009 review and has yet to be addressed.

Project findings have been shared with regional partners, presented at regional and national meetings, and documented in at least 73 publicly accessible documents and annual reports, and

numerous peer-reviewed publications. The reports cover many topics including juvenile surveys, adult collections and translocations, juvenile PIT tagging, juvenile entrainment, public outreach, and other topics related to the objectives and primary deliverables. A full evaluation of these reports is beyond the scope of this review, but a partial reading of a few reports indicates that they are well-written scientific documents.

3. Methods: Project Relationships, Work Types, and Deliverables

The proposal provides a good overview of activities and methods, and the 2017 Annual Report provides sufficient detail for a rigorous review of methods. Both reports use the published literature to justify assertions and support procedures. Methods generally seem appropriate.

An exception is the description of survey procedures for estimating the availability of suitable habitat and the density of larval Pacific lamprey. Estimating the overall availability of suitable habitat and average density would require a random (or stratified random) sampling design throughout accessible tributaries. It is not clear how the individual 50-m electrofishing sites are chosen or how the presence/absence data are used to determine accessible reaches. The larval Pacific lamprey surveys are intended to provide information on presence/absence at selected sites as well as average density by size category in Type 1 and 2 habitats within the selected sites. The methods should provide additional explanation of how the 50-m electrofishing sites were selected because that process will determine the statistical validity of inferences about density at larger spatial scales. With more sophisticated statistical analysis of density distributions from stratified random survey data, it might be possible to distinguish among three different factors that could limit the density of lamprey observed in a particular site and habitat type: (1) accessibility of the site to larval Pacific lamprey; (2) the number of larval Pacific lamprey that have access to the site (e.g., “seeding” level in the tributary); and (3) habitat preference by larval Pacific lamprey that are able to reach the site. Such an analysis could look for spatial and habitat correlates in deviations from the density distributions that would be expected under the null hypothesis of unrestricted access to sites and random occupation within sites.

Some specific methods employed by the project have not yet been documented for PNAMP. The proposal summary states that an effort will be made to upload methods into PNAMP in the future. Most research objectives are stated as anticipated outcomes rather than explicit hypotheses.

This project aims to serve a long-term monitoring and assessment function. The proposal and 2017 Annual Report together provide appropriate detail about the types of monitoring activities that have been conducted or planned. More detail regarding methods and outcomes for monitoring efforts can be gleaned from the array of documents and reports.

200852400 - Implement Tribal Pacific Lamprey Restoration Plan

- Background info in Taurus: [Project proposal](#)

Proponent: Columbia River Inter-Tribal Fish Commission (CRITFC)

Recommendation: Meets scientific review criteria (qualified)

The Council, BPA, and project proponents should address the following qualifications when developing and reviewing the project's Statement of Work and annual reports. These qualifications reflect two persistent concerns with many projects that are discussed more generally in section III (programmatic comments) of this ISRP review.

1. Provide SMART objectives with quantitative targets and timelines that can be used to evaluate progress.
2. Develop and describe an adaptive management process (i.e., review cycles) by which progress toward restoration will be assessed and decisions to alter course will be made.

Final review comment:

The ISRP requested a response to the following points:

1. Explain how this umbrella project links with other Pacific lamprey recovery efforts in the Basin. What work is being done by CRITFC staff and how much work is subcontracted to other entities? To what extent does this project duplicate or complement the umbrella role of the Lamprey Conservation Initiative (2017-005-00)?
2. Provide quantifiable biological or physical objectives with timelines (i.e., SMART objectives) to support or replace the qualitative objectives (i.e., goals) provided in the current proposal. The quantitative elements could be measurable tasks or deliverables associated with the qualitative objectives. Additional quantitative objectives (or deliverables) and timelines should be provided for each of the component projects. Those objectives will be needed for the proponents (or ISRP) to evaluate the performance of the component projects.
3. Describe the process by which component projects are prioritized and selected for funding.
4. Describe the procedures by which the effectiveness of each component project will be monitored and evaluated.

5. Describe the adaptive management process (i.e., review cycles) for assessing progress toward achieving the overall objectives, for adjusting the suite of component projects based on observed outcomes, and for revising objectives.

We commend the proponents for their well-organized and significant effort to address our requests. Their response adequately addresses requests 1, 3 and 4 but only partially addresses requests 2 and 5. Requests 2 and 5 focus on Qualifications 1 and 2 (above) and are consistent with the ISRP's persistent concerns regarding quantitative objectives, timelines, and adaptive management. The proposal still lacks: quantitative objectives (i.e., numerical targets and/or expected benefits) against which progress can be judged; and an adequate description of the internal adaptive management process (e.g., review cycles) by which progress will be assessed and decisions could be made to alter tactics or objectives.

Specific comments

Request 1 (Linkages with other projects) is fully addressed. The response provides comprehensive answers to all three components of this request.

Request 2 (SMART objectives) is only partially addressed. The ISRP had expected more precise (i.e., numerical) targets or expected benefits. However, we recognize that developing more precise statements is particularly challenging in this case and might require more time and deliberation given that the proponents must do this in collaboration with other parties.

The ISRP urges the proponents to quantify their objectives and to use a Gantt chart to delineate the milestones and timelines needed to reach desired endpoints. Objective 6 stands out as a case in which appropriate milestones and timelines associated with genetic analyses are already included. In contrast, objective 1 (Improve lamprey mainstem passage, survival, and habitat) is a large and complicated goal that should be expressed as a series of quantitative milestones. The SMART objective listed for this and other objectives is to attend meetings, but obviously just attending meetings is not enough. Appropriate quantitative milestones for objective 1 might include: identify potential passage issues by measuring adult and juvenile passage at dam X for years 1, 2, 3, and 4; improve passage by planning, designing, and installing x lamprey passage structures at Dam X in year 5; evaluate effectiveness by measuring passage success of adults and juveniles at Dam X in year 5, and so on. Establishing similarly explicit milestones and timelines for the other objectives is essential to developing an adaptive management process to track progress and facilitate course corrections.

The metrics associated with objectives 1, 2, 4, 5, and 6 measure activities rather than biological or physical impacts of those activities. Expected benefits such as possible actions to be taken based on attending meetings, results expected from research projects initiated, and effect of

website updates should also be specified. Many of the deliverables are aspirational goals or desired endpoints much like the objectives and should be quantified with suitable metrics.

Request 3 (Prioritization) is adequately addressed. The response lacks detail about the actual prioritization process but confirms that selection and funding is consistent with regional efforts and objectives documented in the Tribal Pacific Lamprey Restoration Plan. The proponents point out that information from the Inter-Tribal Lamprey Technical Workgroup, CRITFC Lamprey Task Force, and their Commission is also used in this process.

Request 4 (Monitoring and evaluation) is adequately addressed.

Request 5 (Adaptive management) is only partially addressed. The response provides a reasonable overview of an adaptive management process, but more detail is required to demonstrate effective implementation. Again, the ISRP recognizes that the proponents must collaborate with other parties, and that implementing this process will be challenging and require more time.

The brief description and schematic of the adaptive management plan indicate the following sequence: workplans will be developed, projects will be implemented, multiple check-ins each year will provide information to produce progress reports with lessons learned, and workplans will then be modified accordingly. These are all reasonable steps in an adaptive management process, but more detail is needed as to how each step will be conducted and specifically when each step will occur. Importantly, quantitative objectives and timelines (see Request 2) are needed to “Evaluate progress.”

One portion of the plan (“Attend local, regional, and range-wide coordination and passage improvement forums”) might be out of place. Currently it follows the quarterly check-in box, apparently because results would be shared with other restoration practitioners. However, this activity might be more effective at the beginning of the cycle if the meetings are likely to identify problems that could improve development of prospective workplans.

Preliminary review response request:

It is evident that good progress has been made since 2008 in developing cost-effective genetic methods for assessing parentage, demonstrating successful production of progeny from adult translocations, and identifying species, sex, and population structure in both neutral and adaptive genes. To date, the project appears to have been very effective at both enabling and conducting research to support the conservation of Pacific lamprey.

However, the project is complicated to review because it has effectively become an “umbrella” project requesting funding for a diversity of component projects. Even during the 2010 Category Review, the ISRP noted *“the information in the proposal describing the methodology*

to undertake the remaining sub-objectives (and associated tasks) is too general to serve as a basis for scientific review. These sub-objectives need a response with additional details. ... As the proposal now stands, it is simply too general. It lacks specific, detailed methodology and study design to be considered scientifically justifiable. The proponents should give serious consideration to prioritizing (with rationale) the myriad of conceivable projects that could fall under the broad “plan” as outlined in the present proposal. It would be helpful if the proponents culled those sub-objectives that would not be funded directly by this project and provided more details on the methods that will be used to address lamprey passage and distribution questions.” This situation has not yet been addressed.

Given the information and time available for the 2019 Category Review, it is infeasible for the ISRP to review all the component projects listed in this proposal; and it is infeasible for the proponents to have included in a single proposal all the information needed for rigorous scientific review of this complex project. Accordingly, our review focuses on the extent to which the proponents are providing leadership and scientific expertise to achieve the stated objectives. In particular, we are examining how the component projects are prioritized for funding, how their effectiveness will be monitored and evaluated, and how overall progress toward achieving the objectives of the umbrella project will be assessed. In short, the ISRP is looking for evidence of a process for adaptive management and reassurance that the umbrella role is cost effective. In the future, it may also be useful for the ISRP to undertake a rigorous scientific review of some or all the component projects.

To complete this review, the ISRP requests a response to address the following concerns:

1. Explain how this umbrella project links with other Pacific lamprey recovery efforts in the Basin. What work is being done by CRITFC staff and how much work is subcontracted to other entities? To what extent does this project duplicate or complement the umbrella role of the Lamprey Conservation Initiative (2017-005-00)?
2. Provide quantifiable biological or physical objectives with timelines (i.e., SMART objectives) to support or replace the qualitative objectives (i.e., goals) provided in the current proposal. The quantitative elements could be measurable tasks or deliverables associated with the qualitative objectives. Additional quantitative objectives (or deliverables) and timelines should be provided for each of the component projects. Those objectives will be needed for the proponents (or ISRP) to evaluate the performance of the component projects.
3. Describe the process by which component projects are prioritized and selected for funding.

4. Describe the procedures by which the effectiveness of each component project will be monitored and evaluated.
5. Describe the adaptive management process (i.e., review cycles) for assessing progress toward achieving the overall objectives, for adjusting the suite of component projects based on observed outcomes, and for revising objectives.

Comment:

1. Objectives, Significance to Regional Programs, and Technical Background

Each objective states a commitment to engage with appropriate regional forums or working groups to contribute to one of six range-wide themes for restoration identified in the Lamprey Conservation Agreement. These qualitative objectives are expanded into more specific statements of actions and tasks within Table 4.4, Objectives and associated actions, and Project Deliverable Sections. Although some of the deliverables refer to specific activities, they are also vague, not quantifiable, and lack expected benefits or timelines. In the section "Objectives and Deliverables" (pages 20-22/30), the response to the prompt "How the project deliverables help meet this objective" is "to be developed" in every case.

The most recent annual report (for 2016) provides different, more specific and somewhat quantitative objectives for each of 12 "work elements," but time lines are not stated.

Anticipated outcomes are not expressed quantitatively. Explicit timelines for completion are not provided for any of the objectives. The ISRP recognizes that specific outcomes and completion dates may be difficult to predict for this project because they depend on decisions to be made collaboratively with other partners.

The proposal clearly explains why this project was initiated and how it is strategically consistent with biological objectives identified in the Pacific Lamprey Restoration Initiative, as well as critical uncertainties identified in the Fish and Wildlife Program. Even so, it is difficult to understand how this diverse project stands in relation to other more specific projects that are also being reviewed by the ISRP in this Category Review.

2. Results and Adaptive Management

Participation in regional Pacific lamprey forums and working groups has enabled research that is producing a diverse suite of impressive results (listed and summarized in the proposal and annual reports). These results were generated by a collection of focused component projects, some of which are also being reviewed individually, at least in part, elsewhere in this Category Review (e.g., the Willamette Falls Lamprey Project, 2008-308-00). The component studies are

too diverse, with too little detail provided in the proposal and annual reports, to enable a rigorous scientific review by the ISRP.

Despite the impressive list of research results, the proposal does not describe progress toward achieving the objectives. The latest report available in Taurus that includes reviewable details about activities associated with this project is the Annual Report for 2016; at that time, results were not yet available for many of the activities supported by this proposal. Still, it is clear that good progress has been made on specific topics such as developing cost-effective genetic methods for assessing parentage, demonstrating successful production of progeny from adult translocations, and identifying species, sex, and population structure in both neutral and adaptive genes. The project proponents have a good record of producing peer-reviewed publications and sharing information with Basin partners. They have also been diligent in their efforts to educate and reach out to the public about the ecological and cultural importance of Pacific lamprey.

Neither the proposal nor the annual reports describe “lessons learned” or any adaptive management process (i.e., review cycles) by which decisions to alter course would be made. That said, the diversity and time course of results described within this proposal provide some reassurance that the project activities are evolving steadily and creatively as new information is gained and new opportunities are discovered with various partners.

In sum, this project continues to provide new knowledge on methodological issues and status and trends that will benefit the conservation of Pacific lamprey populations throughout the Columbia Basin and Pacific coast. The development and application of novel genetic methods described in this project are broadly applicable for resolving uncertainties about population structure and the success of adult translocation efforts.

3. Methods: Project Relationships, Work Types, and Deliverables

Together, the proposal and annual reports provide an appropriate overview of methods for the diversity of studies undertaken and cite published literature to justify assertions and support procedures. However, the methods are not described in sufficient detail for a rigorous review, nor is this practical given the large number of different activities subsumed by this project. The project has developed important protocols that are being applied across the Basin; thirteen have been uploaded to the PNAMP web site.

The proposal contains few details about methods or plans for monitoring and evaluation activities. Many activities supported by this project relate at least indirectly to status and trends monitoring. However, given the diversity of activities associated with this project, it would have been impractical to provide sufficient detail to support a rigorous review of M&E.

201101400 - Evaluate Status & Limiting Factors of Pacific Lamprey in the lower Deschutes River, Fifteenmile Creek and Hood River Subbasins

- Background info in Taurus: [Project proposal](#)

Proponent: Confederated Tribes of Warm Springs

Recommendation: Meets scientific review criteria (qualified)

Qualifications:

The ISRP recommends that the proponents describe their responses to the ISRP's comments and suggestions below in their upcoming annual report covering FY 2019 accomplishments.

1. Provide quantitative objectives with timelines.
2. Explain more clearly how this project meshes with recovery efforts in other subbasins.
3. Describe the adaptive management process (i.e., review cycles) by which decisions to alter course are being made.
4. Provide additional information about the sampling design and procedures for inferring the density of ammocoetes in study streams. It is not clear how the individual electrofishing locations were chosen.

Comment:

This is an ambitious project that continues to provide important data for assessing status and trends of Pacific lamprey in three subbasins: Hood River, Deschutes River, and Fifteenmile Creek. The proponents propose to expand their Pacific lamprey surveys into the John Day subbasin. Together, the proposal and 2017 Annual Report provide a useful synthesis of activities since 2011 and general progress toward achieving stated objectives. The proponents have established workable protocols that are being used to track changes in the distributions and abundances of lamprey in these subbasins. Surveys are providing information on habitat characteristics that adult and juvenile lamprey prefer. Testing for contaminant levels in lamprey will begin in 2019. All this information is useful. Conservation and restoration of Pacific lamprey depend on obtaining knowledge about population structure and factors that currently limit distribution and productivity.

1. Objectives, Significance to Regional Programs, and Technical Background

The objectives are clearly stated and justified. Objectives 1 to 3 are implicitly quantitative (i.e., estimating parameters for population assessment). Objectives 4-7 are not expressed quantitatively.

The proposal clearly explains why this project was initiated and how it addresses biological objectives identified in the Pacific Lamprey Restoration Initiative, as well as critical uncertainties identified in the Fish and Wildlife Program. Anticipated benefits and opportunities for further research are described, but they are not expressed quantitatively. The seven deliverables mirror the objectives (although numbered differently) and lack quantitative details and timelines. This is primarily a monitoring project that will require long-term continuity. There is no discussion of when conservation or enhancement actions based on findings from the monitoring might occur.

2. Results and Adaptive Management

The proposal and latest annual report (for 2017) provide a useful synthesis of activities since 2011. The proponents have made substantial progress in establishing monitoring protocols for abundance, harvest, and escapement, as well as describing the distributions and densities of larvae in the subbasins. Habitat conditions are being assessed to help identify limiting factors (e.g., water temperature regimes, deficiencies of larval habitat, and potential passage barriers). Despite some unexpected challenges in 2017 caused by personnel changes, high water levels, and new detection equipment, the project appears to be on schedule and continues to provide important data for assessing status and trends of Pacific lamprey in this study area.

The proponents are also collecting tissue samples for analysis by contractors to estimate population genetics parameters (e.g., effective population size) and to investigate contaminant loads; however, it is difficult to evaluate progress on these objectives with the information provided. Movement patterns are being assessed using both PIT and acoustic tags, and water temperature is being monitored at several sites within the lower Deschutes subbasin. The information provided about these activities is insufficient to evaluate progress.

The proposal and 2017 Annual Report indicate that the project is evolving steadily and creatively as information is gained, challenges are discovered, and new hypotheses are developed. M&E has led to changes in project operations and prompted the development of new initiatives. For example, recapture rates were increased by using PIT tags instead of Floy tags in the capture-recapture studies and adding additional PIT tag antennas at Sherars Falls. New initiatives include: (1) a recent effort to work collaboratively with ODFW and CRITFC to develop ways to extend lamprey assessment activities into the John Day subbasin; and (2) success in convincing management biologists to remove the “headworks” barrier on Shitike Creek based on inferences from juvenile surveys.

However, neither the proposal nor the 2017 Annual Report describe the adaptive management process (i.e., review cycles) by which decisions to alter course are being made. The data being collected during this project are primarily monitoring data to assess progress toward recovery,

but the proposal does not adequately describe management objectives and activities, or the process by which data from this project will be analyzed to influence future management decisions.

This project provides new knowledge on methodological issues and status and trends that are broadly applicable throughout the Columbia Basin. The genetic sampling in this project is directly linked to a study of population structure, adaptation, and migration that spans the lower Columbia and Snake river basins.

The 2017 and earlier annual reports provide an appropriately detailed discussion of objectives, methods, and results. The proponents have completed annual reports in a timely fashion and have published twelve of their protocols in the PNAMP web site. There does not appear to have been any sharing of findings in peer-reviewed literature.

A next step for the project is to use the information that is being gathered to develop restoration or conservation plans for Pacific lamprey in the subbasins they have been monitoring. Are there plans to do so? Further explanation of what is being planned for the John Day subbasin would be useful. Given that this project now involves four different subbasins, the proponents are urged to consider ways to improve coordination and data sharing with managers responsible for Pacific lamprey conservation in other subbasins.

In discussing the estimates of "effective population size" based on genetic data (page 8 of the proposal), the proponents state that the estimates of 206 individuals in 2016 and 291 in 2017 are much lower than the escapement estimates (1,897 and 3,357 individuals, respectively), and that they are "*still trying to determine if one of the estimation methods is flawed, or perhaps there is a high level of pre-spawn mortality occurring.*" Neither of these explanations may be necessary—it is important to recognize that the *genetically effective* population size of a naturally spawning fish population is typically much smaller than its *census* population size (i.e., 10% is not extreme). A discrepancy is expected because the genetically effective population size indicates the number of individuals in an idealized population (characterized by a standard set of assumptions about sex ratio, probability of mating and variation in productivity among families) that would give rise to the same genetic diversity indices seen in the natural population being studied. Most natural populations deviate substantially from the idealized population. On the other hand, it is not clear in the text if the proponents actually mean *genetically effective* population size or instead are referring to the maximum number of parents detected by parentage analysis, which would depend on the number of fish that survived to spawn and the proportion of spawning fish whose progeny were represented in the samples for genetic analysis.

3. Methods: Project Relationships, Work Types, and Deliverables

The proposal provides a good overview of activities and methods, and the 2017 Annual Report provides sufficient detail for a rigorous review of methods. Methods seem appropriate and both reports cite published literature to justify assertions and support procedures.

An exception is the description of procedures for estimating the density of ammocoetes in study streams. More detail is needed to explain the survey design and how the individual electrofishing sites were chosen. The sites seem to comprise an unspecified mix of previously sampled sites and new sites that are easily accessible and look suitable for ammocoetes. For this reason, it is not clear what the density statistics actually represent—it seems like they would represent just the collection of selected sampling sites, perhaps reflecting something like average density in the best habitat stratum in each stream. In the text they seem to be reported as representing the average density in each stream. Estimating the average density over all habitat types would require a random (or stratified random) sampling design. It's not clear if this was done.

We agree with the proponents in expressing concern (page 22 of 2017 Annual Report) that capture-recapture estimates of escapement to the Warm Springs River might be biased by releasing marked fish on the same bank as the WSNFH fish ladder in which they were trapped. Releasing fish on both banks to ensure proper mixing seems like an appropriate precaution to take in future.

This project aims to serve a long-term monitoring and assessment function. The proposal and 2017 Annual Report, together with links to the PNAMP site, provide appropriate detail about the types of monitoring activities that have been conducted or planned. Continued assessment of status and trends will be needed to evaluate the sustainability of current harvest rates (~20%) and to decide if harvest regulations are required.

201700500 - Lamprey Conservation Initiative

- Background info in Taurus: [Project proposal](#)

Proponent: Bonneville Power Administration, Pacific States Marine Fisheries Commission, US Fish and Wildlife Service (USFWS)

Recommendation: Meets scientific review criteria (qualified)

Qualifications:

The ISRP recommends that the proponents describe their responses to the ISRP's comments and suggestions below in their upcoming annual report covering FY 2019 accomplishments.

1. Objective #1 in the proposal is to evaluate population structure, yet none of the 13 deliverables addresses objective #1. The ISRP believes this is a key objective, as there is uncertainty about how local adaptation in fitness traits may be jeopardized by translocation efforts. Consequently, we ask the proponents to describe how ongoing project activities will be used to elucidate regional population structure and the spatial scale of adaptations in Pacific lamprey.
2. Explain how the Strategic Habitat Conservation (SHC) approach, described in the Adaptive Management section of the proposal, could be applied to individual Regional Management Unit (RMU) projects. The ISRP suggests that critical requirements of an adaptive management process are needed at the project level. A first step in any adaptive management approach is the formulation of quantitative and time explicit objectives. A section in each project proposal should be dedicated to listing these objectives. Additionally, each proposal should include an explanation of how project implementation and effectiveness will be evaluated. Combining quantitative objectives with appropriate monitoring and evaluation is an essential feature of adaptive management that should be strengthened at the project level.
3. Strengthen processes to reduce conflicts of interest and ensure the scientific objectivity of the Conservation Team during the proposal review process. Research and assessment projects selected for funding through this proposal should also be reviewed individually by the ISRP to ensure sound study designs and to alleviate concerns about potential conflicts of interest.
4. Provide an empirical assessment of how individual projects are contributing to accomplishment of the overall objectives of the Initiative. The Lamprey Conservation Initiative has been functioning since 2007 and BPA-funded since 2017, but it is unclear if projects supported by the Initiative are making progress “to achieve long-term persistence of Pacific Lamprey and support traditional tribal cultural use over the U.S. range.”

Comment:

This umbrella project proposal is intended to facilitate funding for high priority, but currently unfunded, opportunities to restore, monitor, and evaluate lamprey abundance and distribution within the Columbia Basin. It uses a process developed by the Pacific Lamprey Conservation Initiative to address the declines in abundance and distribution of Pacific lamprey, and continuing threats to their existence in freshwater habitats throughout their U.S. range (Alaska, Washington, Oregon, Idaho, and California).

We commend the proponents (particularly the co-chairs of the Conservation Team) and the signatories to the Cooperative Agreement for their collaborative efforts. However, some elements of the Initiative remain to be addressed and are listed as Qualifications. It would have been useful to demonstrate how component projects are addressing the hypotheses and threats listed, and to describe in more detail the metrics and M&E procedures being used by the component projects.

1. Objectives, Significance to Regional Programs, and Technical Background:

The overarching goals of this umbrella project are to facilitate, coordinate, and prioritize Pacific lamprey recovery actions throughout the states of Alaska, Washington, Oregon, California, and Idaho. Secondly the proponents seek funding for prioritized actions. Currently, the conservation agreement has 33 signatories that represent tribal, state, and federal natural resource agencies.

The proposal lists seven qualitative “objectives”: (1) evaluate Pacific lamprey population structure; (2) identify global issues that are impacting Pacific lamprey; (3) provide public outreach; (4) facilitate data sharing; (5) identify and characterize Pacific Lamprey for the RMUs; (6) identify, secure, and enhance watershed conditions contained in the RMUs; and (7) restore Pacific lamprey to the RMUs. The ISRP considers these to be goal statements rather than quantifiable objectives with timelines, ones that could be used to measure progress. (Note also that these objectives have not been modified to address the same concern in our previous review, [ISRP 2017-13](#)). Given the broad scope of this initiative, it will likely be necessary to develop multiple quantitative objectives for each goal. Within that format, biological metrics could be incorporated into the objectives to address population-scale effects of management efforts.

The proposal clearly explains why this project was initiated and how it is strategically consistent with biological objectives identified in the Pacific Lamprey Restoration Initiative, as well as critical uncertainties identified in the Fish and Wildlife Program. However, as noted above, for the purposes of this review, it is difficult to understand how this umbrella project stands in

relation to other more specific projects that are also being reviewed, and a similar umbrella proposal from CRITFC (2008-524-00 “Implement Tribal Pacific Lamprey Restoration Plan”).

Thirteen deliverables are described. None addresses objectives 1, 3, or 4. The deliverables represent individual projects that have been prioritized for funding in 2019. Each of these projects should have its own quantitative objectives with anticipated completion dates.

2. Results and Adaptive Management

The project appears to have been successful in initiating and maintaining a process to address the objectives. All three components—the Assessment, Conservation Agreement, and Regional Implementation Plans (RIP)—have now been created. Numerous cost sharing and collaborative agreements have been signed among federal, regional, state, and tribal entities involved in the Initiative. A structured prioritization of proposed projects is operating within the framework of an adaptive management process.

The Initiative began in 2007. Since that time the project has gained signatories, helped establish RIPs, established a formal process for evaluating submitted proposals, and funded lamprey recovery actions. Projects wholly or partially funded by the Initiative have the potential to answer questions in the following categories of the Council’s 2017 Research Plan: Tributary Habitat, Mainstem Habitat, Fish Propagation, Hydrosystem Flow and Passage Operations, Estuary, Plume and Ocean, Population Structure and Diversity, Predation, Contaminants, and Climate Change.

The Initiative’s five-year assessment provides the proponents with an opportunity to see the effects that sponsored projects may have had on the status and trends of Pacific lamprey. It is unclear, however, how results of the project’s assessment process will be used by the RMUs to modify or adjust their RIPs if that proves to be necessary.

The RIP development and project selection process of the Pacific Lamprey Initiative is expected to identify and fill gaps that are not being addressed by current Columbia River Basin projects. It is expected to foster the development of new methods and to provide additional knowledge on status and limiting factors that will help to restore Pacific lamprey abundance throughout the Columbia River Basin.

Project results will be reported in annual RIPs and the Initiative is currently developing a Pacific Lamprey Data Clearinghouse. Additionally, GIS support is available to display lamprey distribution patterns, abundance, and threat data. These tools, plus the organizational structure of the Initiative, make it likely that lessons learned by individual projects will be widely shared among the RMUs.

Annual reports for 2018, the first year of funding for this project under the Fish and Wildlife Program, are not expected until April 2019, and were not available for this review. This proposal does not acknowledge our previous review ([ISRP 2017-13](#)) nor does it include any response to qualifications and concerns expressed in that review.

The Initiative has released a number of other reports and documents, including a description of the Pacific Lamprey Conservation Agreement, regional implementation plans, best management practices to minimize impacts on Pacific lamprey, and practical guidelines for lamprey passage at fishways. The proponents suggest that these reports and other products from component projects helped the Council develop aspects of its 2014 Fish and Wildlife plan that were related to producing self-sustaining populations of Pacific lamprey. The project is also working closely with CRITFC, USACE, BOR, the mid-Columbia PUDs, and state fish and wildlife agencies on how to maintain, recover, and supplement Pacific lamprey in the Columbia Basin.

Surprisingly, only one report was included in the Taurus database for this review. It is unclear if reports and publications from projects supported by the Initiative are accumulated and available through the Initiative's office. There is no mention in the proposal of a repository for data obtained through projects supported by the Initiative.

It is also disappointing that no projects have been selected to focus on genetic identification of populations and population structure. It seems that insufficient research is being conducted to investigate the spatial scale of genetic adaptations within the Basin (a previous concern and qualification from our previous review ([ISRP 2017-13](#))).

While the project contains a process for selecting projects, it lacks a process for monitoring and evaluating projects to determine the extent to which they are helping to achieve the goals and objectives listed in the 2012 Cooperative Agreement. A lack of quantification of the objectives in the Cooperative Agreement will complicate assessment of individual projects and overall success of the Initiative.

The proposal does not contain any discussion of lessons learned. There is a need to assimilate and share information on lessons learned through implementation of the component projects. The program should develop and apply an adaptive management process where lessons learned by researchers in each RMU can be broadly shared with all the Initiative's partners.

3. Methods: Project Relationships, Work Types, and Deliverables

The proposal describes how the Pacific Lamprey Conservation Initiative develops and prioritizes proposals for conservation action or research for each of 17 RMUs within the United States. Four of these RMUs are in the Columbia River Basin. RIPs are developed for each RMU and updated annually to document the status of, threats to, and opportunities for lamprey restoration. The RIPs in turn guide development of RMU project proposals. The RIPs are

submitted to a Conservation Team comprising representatives of the Initiative from throughout the Columbia River Basin. The Conservation Team prioritizes and submits prospective RMU projects to the Policy Committee for approval. The Policy Committee suggests where funding for approved projects may be obtained.

A more formal description of the process for proposal development and selection within RMUs would be of value to participants in the Initiative. There is a need to enhance assurances of scientific objectivity during proposal development within RMUs and subsequent assessment by the Conservation Team.

In the 2017 review, the ISRP asked a series of questions about this process:

1. What is the process for composing and updating the RIP within each RMU?
2. Who develops the RIP for each RMU?
3. Do representatives from all signatories to the Initiative participate for each RMU?
4. Do organizations that are not signatories to the Initiative participate in the development of RIPs?
5. Are organizations that contribute to composing and updating RIPs also potential recipients of funds for projects proposed based on the RIP for that RMU?
6. How are potential conflicts of interest addressed in the process?
7. How is scientific objectivity assured within the process of composing and updating RIPs?

and about the process within the Conservation Team:

1. How is the Conservation Team composed?
2. Are all signatories to the Initiative represented within the Conservation Team?
3. Do all signatories to the Initiative participate equally (1 signatory, 1 vote) on the Conservation Team?
4. Are participants on the Conservation Team also potential recipients of project funds? If so, how are potential conflicts of interest addressed?

These questions should be answered in the Initiative's next annual report.

The first level of M&E mentioned (the Strategic Habitat Conservation approach) is relevant to the overall Initiative and to periodic revision of the RIPs. However, it does not appear to provide an M&E framework for the individual projects selected. The ISRP does not understand how M&E and adaptive management would be conducted within the individual projects (deliverables 1-13). Methods for assessing the success of projects supported by the Initiative are not described in the proposal. The proposal does not provide links to proposals or reports from individual projects to enable scientific review of the projects. Hypotheses being addressed by individual projects are not described in the proposal.

Fall Chinook RM&E

199102900 - Research, monitoring, and evaluation of emerging issues and measures to recover the Snake River fall Chinook salmon ESU

- Background info in Taurus: [Project proposal](#)

Proponent: University of Idaho, US Fish and Wildlife Service (USFWS), US Geological Survey (USGS)

Recommendation: Meets scientific review criteria

Comment:

The ISRP was impressed by the proposal, results-to-date, and the project review presentation. There are, however, several items that the proponents should consider (these are detailed below). Most importantly, the ISRP would appreciate knowing the topics and timelines for completing the multi-part synthesis (i.e., peer-reviewed publications) over the next year or two.

1. Objectives, Significance to Regional Programs, and Technical Background

Project objectives are to (1) inform recovery actions taken to increase the abundance, productivity, and spawning distribution of natural-origin adults, and (2) inform recovery actions taken to increase the abundance and diversity of natural-origin subyearlings during early freshwater rearing and migration. The project objectives are well aligned with the Snake River fall Chinook salmon recovery plan, the current biological opinion, and the Council's 2014 Fish and Wildlife Program and 2017 Research Plan.

However, the proponents should establish quantitative objectives, specific timelines, and hypotheses to guide the research/monitoring. The stated objectives are actually work elements described in vague terms as to what is expected to be accomplished. Although the project objectives are not quantitative, the text associated with each objective identified criteria for success. That said, the ISRP would like to see a long-range vision articulated for the project, as well as criteria for success identified for that vision.

The proponents mention that several regional programs use the data that are generated by the project. However, it is not clear to the ISRP that these regional programs require those data. Please consider adding letters of support from those programs to future proposals.

2. Results and Adaptive Management

Status and trend monitoring of juvenile and adult fall Chinook are described and provide important information on the recovery of this ESU. The project's monitoring program revealed

strong density dependence in fall Chinook salmon recruitment. The mechanism leading to this is unknown. The ISRP also notes that millions of hatchery fish are released with a large portion (20% or more) unmarked, leading to less certainty about the status of the natural population. The proponents and decision-makers associated with this project should carefully consider these issues in crafting future project actions.

The proponents make a few statements that would benefit from further explanation:

- Density dependence (p. 6): “Although it is not likely that the capacity of the spawning habitat is a large factor for the density dependent population response being observed (Groves et al. 2013*), we have observed large-scale redd superimposition at some spawning areas that could explain this.” The ISRP is curious as to why other possible factors (e.g., juvenile growth) were not considered.
- Is there a publication or document showing how the life-cycle and passage models are linked (see p. 16)? And how are the outputs from that linkage effective in improving population status and management?
- The proponents state that they account for climate change, predation, and potential food web changes (p. 16) “by fitting stock-recruitment functions to predict changes in adult and juvenile abundance from covariates derived from empirical data collected on stream flow, temperature, and ocean conditions.” This is confusing to the ISRP since the proponents do not collect data on these important factors. What is the origin of these data?
- Budget (p. 22): It would be useful to know the amounts devoted to data synthesis and preparation of professional publications in each year, as well as for public outreach.

3. Methods: Project Relationships, Work Types, and Deliverables

Although specific methodology was not described in the proposal, annual reports provided more details. The reports noted that more accurate identification of redds is needed.

Deliverables noted in the proposal included redd counts, spawner origin determination based on PBT (300 fish), stock-recruitment analysis, juvenile PIT tagging, juvenile run reconstruction, the life cycle model, and associated information. The project uses standard statistical methods.

Project relationships are described at several places in the proposal. However, the mechanisms underlying these relationships are not always clearly described. Are there any problems or issues associated with project relationships that ISRP could assist with in the near future?

Chum and Fall Chinook in the Lower Columbia

200871000 - Chum Salmon Restoration in the tributaries below Bonneville Dam

- Background info in Taurus: [Project proposal](#)

Proponent: Washington Department of Fish and Wildlife (WDFW)

Recommendation: Meets scientific review criteria

Comment:

This is an ambitious, well-conceived restoration project that covers a broad geographical area in the lower Columbia River. The project includes habitat, fish propagation, and monitoring components and it addresses the critical conservation need to protect and recover lower Columbia River chum salmon populations, which are ESA-listed. Recovery actions have been prioritized by the proponents and their regional partners. Monitoring and evaluation has been adequate to demonstrate that life cycle productivity (adult returns per spawner, R/S) is typically higher for fish spawning in constructed channels than for fish collected as hatchery broodstock to produce progeny for release as fed-fry, and intermediate for fish that spawn naturally in Duncan Creek. However, productivity is highly variable from year to year, and greater than 1 in only ~50% of brood years, indicating the population may not yet be self-sustainable. Overall chum salmon abundance in the ESU is variable but generally increasing since the low in 2008. The proponents have made good progress toward the overall goal of chum salmon recovery and are working with ODFW to develop a coordinated recovery effort for chum salmon in both Washington and Oregon tributary populations.

1. Objectives, Significance to Regional Programs, and Technical Background

In 1999, chum salmon in the lower Columbia River were listed as threatened under the ESA, leading to the recovery plan for chum salmon and the efforts by this restoration project. Three broad/general objectives are clearly stated and partially quantitative: (1) provide habitat restoration and chum salmon spawning channel development in Washington State tributaries of the lower Columbia River, (2) create multiple self-sustaining spawning populations (>1,000 adult returns annually) in each of three strata (Coastal, Cascade, Gorge) in the lower Columbia River and its Washington tributaries, (3) implement monitoring that provides accurate and precise estimates of data for viable salmon population (VSP) analyses and data for managing and evaluating enhancement projects. Project objectives and anticipated results closely follow applicable goals presented in the Council's Fish and Wildlife Program. Anticipated outcomes for biological objectives are not specified explicitly in the proposal, but one general expectation is to follow FCRPS prioritization criteria and HSRG guidelines to establish self-sustaining populations in each of the three strata. The proposal states that abundance targets for each

population were included in Table 5 of the original proposal, but they were not shown in the current proposal. Results from ongoing chum salmon recovery efforts indicate that environmental conditions during spawning, incubation, fry migration and ocean residence can have substantial effects on productivity (R/S values), and this makes it difficult to predict when desired abundances might be achieved.

2. Results and Adaptive Management

The proposal provides a comprehensive listing of recent habitat actions. These include design and construction or rehabilitation of spawning channels, removal of non-native vegetation, inventories and assessments of prospective restoration sites, and groundwater investigations. Reintroduction efforts and the use of hatchery programs to augment natural chum populations were also described and are ongoing activities. Additionally, M&E activities are being employed to evaluate the project's habitat restoration, hatchery, reintroduction, and enhancement actions. Run reconstruction of the chum salmon populations is especially important for evaluating VSP criteria. Some objectives have already been achieved, while others are on track to be met. Results from the project will have direct applicability to the Council's 2017 Research Plan as project results directly address questions in the Tributary Habitat, Mainstem, Fish Propagation, Population Structure and Diversity, Climate Change, Human Development, and Monitoring and Evaluation Methods categories of the plan.

A number of improvements in methods have occurred in response to the project's M&E efforts. New procedures are being used to estimate population abundances in tributary and mainstem spawning locations. Methods used to collect and tag adults were changed to reduce stress and enhance the retention of tags used in capture-recapture studies. Methods to mark juveniles produced from the project were changed from strontium and otolith thermal marking to Parentage-Based Tagging (PBT) to increase sample sizes and reduce uncertainty in estimates. Additionally, environmental changes were made to the Duncan spawning channels to increase egg-to-fry survival rates. Changes to broodstock collection locations, fry release numbers, and rearing locations were made in response to project data. All these changes indicate that the program is using adaptive management to refine its actions. For completeness, the program should provide a description of its adaptive management process in its next annual report.

The lessons learned are generally specific to the project. However, the general recovery approach of identifying extant stock structure, determining the limiting factors faced by each population segment, assessing habitat and prioritizing recovery actions has broad application throughout the Basin and beyond.

Annual reports are routinely produced and made available. Project data are made available on many web-based sites, including Coordinated Assessments, Fish Passage Center, Fish Books, NOAA's Salmon Population Summary (SPS) Database, StreamNet, WDFW-JMX, WDFW Hatchery

Future Brood, WDFW Salmonid Stock Inventory & SalmonScope, WDFW’s Fish Ageing Database, and WDFW’s website.

One of the identified threats to the success of this effort is further human development in key chum salmon spawning areas. If not already occurring, we encourage the proponents to work with others in the Basin to establish conservation easements or to use other suitable methods to protect such areas from further development.

3. Methods: Project Relationships, Work Types, and Deliverables

Given the numerous activities in the project, methods are only briefly described in the proposal and readers are referred to more detailed reports and to procedures at the Pacific Northwest Aquatic Monitoring Partnership (PNAMP) web site. Methods seem appropriate to evaluate success of the chum salmon recovery actions, but the methods were not reviewed by the ISRP in detail. The current monitoring plan is briefly described. Summaries of results to date show that monitoring has been adequate to compare trends in productivity among natural, channel, and hatchery spawners in several core populations.

The genetic identity of broodstock collected at local donor sites outside the target rivers and rationale for their use are not well explained. On the other hand, the decision to translocate all “volunteer adult returns” captured in Duncan Creek to the spawning channel seems sensible as a way to encourage local adaptation within the population.

The project includes one research project to compare the benefits of using adult spawners, releases of fed-fry, and natural straying to maintain, reintroduce, or enhance lower Columbia River chum salmon populations. Formal hypotheses and expected time lines for when this comparison might be completed should be described. However, given the high variation the proponents have documented in R/S values it seems reasonable to assume that it will take three or more generations for this assessment to be concluded.

199900301 - Evaluate Spawning of Fall Chinook and Chum Salmon Just Below the Four Lowermost Mainstem Dams

- Background info in Taurus: [Project proposal](#)

Proponent: Oregon Department of Fish and Wildlife, Pacific Northwest National Laboratory, Pacific States Marine Fisheries Commission, Washington Department of Fish and Wildlife (WDFW)

Recommendation: Meets scientific review criteria (qualified)

Qualifications:

The proponents should address the following qualifications in their Statement of Work and next annual report.

1. Develop and describe an adaptive management process (i.e., internal review cycles) by which progress will be assessed and decisions to alter course will be made. This qualification reflects a persistent concern with many projects and is discussed more generally in section III (programmatic comments) of this ISRP review.
2. Attempt to quantify how effective this project has been in avoiding dewatering of chum salmon redds. How many salmon redds were dewatered? How many more redds would have been dewatered without information from this project? If this determination is beyond the scope of this project, then explain why, and discuss how effectiveness could be determined.

Final review comment:

The ISRP asked the proponents to provide responses on three primary issues summarized here and provided in full in the “Preliminary response review request” comments below:

1. Provide a synthesis of the overall approach and methodology used to achieve project objectives.
2. Describe lessons learned and adaptive management resulting from past and ongoing research and monitoring.
3. Describe the extent to which FCRPS operators use information from this project to alter hydropower operations, as emphasized in the overall project goals.

The proponents’ response adequately addresses request 1 but only partially addresses requests 2 and 3. The additional information provided in the response should be included in the next annual report.

Specific comments

Request 1 is adequately addressed. The response provides details on the periodicity of redd surveys, the methods used, and the types of biological samples and metrics collected. This information is helpful for understanding the scope of the overall effort and should be included in the next annual report. The proponents also explain how spawner abundance and the likelihood of redd de-watering were estimated. According to the response, spawner abundances were recently re-estimated and the previous point estimates lie within the 95% confidence intervals of the revised values. This statement indicates that variance measures are

being calculated, as requested. However, the confidence intervals were not reported in materials provided for review; they should be included in the next annual report.

Request 2 is only partially addressed. The response includes several examples of lessons learned, indicating that the proponents have an internal process to test and modify methods to meet their objectives. Key improvements include the development of real time data collection using a buoy system to help identify emergence timing of chum salmon, a new method for estimating the spawning abundance of Chinook salmon, and refinements to how water temperature and water height data are collected. However, the response does not describe the internal review process. The proponents should develop a more formal adaptive management process and describe it in the next annual report.

Request 3 is only partially addressed. The proponents explain in general terms how project findings about chum salmon spawning locations and emergence timing is provided to an interagency Technical Management Team (TMT) which attempts to regulate dam operations to limit redd dewatering and to protect the fish from high levels of total dissolved gas. The proponents also note that water elevation data from this project are used by BPA in Real-Time-Kinematic surveys to help determine the probability of redds dewatering. However, the response does not indicate the extent to which dewatering of redds has been avoided when it would otherwise have occurred. Consequently, the ISRP is unable to judge the effectiveness of the overall project. We recommend that the proponents attempt to quantify these benefits, although we recognize that the proponents do not have direct control over TMT recommendations for spill and flow.

Preliminary review response request:

1. Provide a synthesis of the overall approach and methodology used to achieve project objectives. Please include additional information on how the fall Chinook surveys are conducted. How often do they occur, how are redd locations identified and marked, are genetic samples being collected, are egg retention counts being made, are otoliths being collected for possible microchemistry analyses, and what type of length data are collected (e.g., FL, MEHP)? Provide variance measures of the spawning population estimates, as previously requested by the ISRP.
2. Describe lessons learned and adaptive management resulting from past and ongoing research and monitoring. It is possible that the project consistently reviews its operations and methods on a regular basis to determine if anything might be improved. If this is the case, this procedure should be described in future reports. On the other hand, if a formal or quasi-formal adaptive management process is not yet in place, the proponents should establish one. This will provide them opportunities to discuss and possibly implement changes to existing procedures.

3. Describe the extent to which FCRPS operators use information from this project to alter hydropower operations, as emphasized in the overall project goals. The ultimate goal of this project is to collect data that can be used to reduce potential impacts of hydropower operations on salmon spawning below the dams. The effectiveness of this effort should be reported in the proposal and annual reports. As part of this analysis, the proponents should describe and discuss the extent to which salmon redds were dewatered, if at all.

Comment:

1. Objectives, Significance to Regional Programs, and Technical Background

The purpose of this ongoing research and monitoring project is two-fold: (1) to assess the extent of spawning by ESA-listed fall Chinook salmon in the mainstem Columbia River so that the Federal Columbia River Power System (FCRPS) can be managed to protect and enhance these populations, and (2) to collect riverbed temperature data so that the emergence timing of ESA-listed chum salmon can be estimated. This allows managers to know when chum salmon emergence is complete and FCRPS operations can shift from protecting incubating chum salmon to supporting spring spill operations to aid other species.

Real-time water temperature and water surface elevation data supplied by the project, for example, are used by managers to prevent redd dewatering and estimate when chum salmon fry emergence has ended. Additionally, field surveys are used to count fall Chinook adults, carcasses, and redds, as well as collect biological information (scales, gender, length, fin clips, CWT retrieval etc.) from carcasses. This information is passed on weekly to another project for use in run-reconstruction, abundance forecasting, and VSP monitoring. The project seems to be well-integrated with other regional programs that use these data, and it addresses BiOp RPA Action 17.

2. Results and Adaptive Management

The project has routinely supplied environmental data to hydrosystem managers. This information has been used by managers to regulate hydrosystem flows to protect ESA-listed chum salmon spawning immediately below Bonneville Dam. Additionally, biological information on ESA-listed fall Chinook has consistently been sent to personnel supported by project 2010-036-00 who use it to track the status and trends of fall Chinook spawning below Bonneville Dam. Data from the project are helping to address questions in the Mainstem Habitat, Hydrosystem Flow, and Passage Operations, Population Structure and Diversity, and Climate Change categories of the Council's 2017 Research Plan. It is also directly linked to the Council's Fish and Wildlife Program which calls for sustaining abundant, productive, and diverse communities of fish and wildlife. Although the project reportedly collects and shares these data, the proposal and annual reports do not describe the extent to which this information was

used to shift FCRPS operations as stated in its goals, nor do they discuss the extent to which salmon redds were dewatered.

Although an example of external adaptive management is described, no direct examples are provided on how the project has used adaptive management internally to modify or improve its objectives or methods. The proposal states that data supplied by the project are used by hydrosystem managers to adaptively manage flows to protect chum and Chinook using spawning and incubation habitats below Bonneville Dam. This is an important use of project's data for external adaptive management, but it does not address how or if the project has an internal process to refine its own operations. Clearly some changes in methods have occurred. The development of the real-time data system that is being used to convey hourly temperature and water height data would be one example how the project has changed. There are likely others as well.

In general, the results produced by the project are largely applicable to the project and its end users. However, the development and use of its "real time" data system to gather and send hourly water temperature and water height information could be a valuable tool for others examining the possible effects of dam operations on fish and wildlife populations.

Project reports have been produced on a timely basis, data has been provided to end users on a regular basis, and peer-reviewed publications on some of the project's results have been published.

While the information provided by this project are undoubtedly useful, there are some shortcomings that need more discussion in the annual reports and proposal. For example, annual reports should describe the extent to which salmon redds were dewatered, if at all in response to water elevation fluctuations. To what extent were data from this project used to shift FCRPS operations as a means to protect salmon redds, as stated in its goals? To what extent has the project addressed previous ISRP qualifications, including the development of confidence intervals for spawning Chinook salmon? Specific information on lessons learned and adaptive management are needed.

3. Methods: Project Relationships, Work Types, and Deliverables

Methods seem appropriate but are not described in sufficient detail (or linked adequately via ~10 protocols) in the proposal. Methods for monitoring water temperature and elevation at chum spawning sites are described in detail in previous annual reports. Methods for estimating fall Chinook abundance below McNary, John Day and The Dalles dams were well documented in the Annual Report for 2001-2006, but no comparable documentation has been provided for surveys below Bonneville Dam. A qualification of the ISRP ([2010-44b](#)) review was to provide more detail on methods. For example, how often are boat and foot surveys conducted, how are

redd locations identified and marked, are genetic samples being collected, are egg retention counts being made, are otoliths being collected for possible microchemistry analyses, and what type of length data are collected (e.g., FL, MEHP)?

No formal description is provided on how the project monitors whether it is meeting its objectives. However, the expected hourly delivery of environmental information and weekly submission of biological data to end users likely serves this purpose. Because of the immediate need for some of the project's data, any interruptions in data flow would be quickly recognized and corrected if possible. Nevertheless, the proposal and annual report should discuss these issues.

Artificial Production RM&E

198909600 - Genetic Monitoring and Evaluation (M&E) Program for Salmon and Steelhead

- Background info in Taurus: [Project proposal](#)

Proponent: National Oceanic and Atmospheric Administration

Recommendation: Meets scientific review criteria

Comment:

This is a well-developed and well-designed proposal to increase our understanding of the effects of artificial propagation on salmonid populations. The project is credited with pioneering many of the genetic monitoring tools now widely used by salmon researchers. It has consistently provided valuable information to regional managers and helped others within and outside of the Basin to address issues raised in FCRPS BiOp RPAs and the Fish and Wildlife Program.

The proponents have responded thoughtfully to questions raised by the ISRP in the last review ([ISRP 2018-8](#)), and plan to continue to address these issues through ambitious new research described in the current proposal. We continue to encourage the proponents to find ways to: (1) evaluate the contingent historical effects of low initial population sizes and low proportionate natural influence (PNI) in the study populations; (2) identify the genetic versus environmental causes of reduced relative reproductive success (RRS) in steelhead; and (3) move the acclimation site in Little Sheep Creek to control for environmental effects on RRS which are now understood.

1. Objectives, Significance to Regional Programs, and Technical Background

The proposal includes 15 clearly defined objectives that are implicitly quantitative (i.e., include metrics). Of these, 12 were added, in part to address a qualification arising from the previous ISRP review ([ISRP 2018-8](#)). The ISRP's concerns have now been addressed.

The proposal clearly explains why this project was initiated and how it addresses two biological objectives identified in previous FCRPS Biological Opinions and four critical uncertainties in the Fish and Wildlife Program.

Nine deliverables all involve quantitative assessments, and each is linked to at least one objective. Seven of the new objectives are not associated with any deliverable, but these cases, the objective is itself a very specific task that could be considered as a deliverable.

No specific timelines are provided but should be included in work plans, annual reports, and future proposals. The proponents point to the continuing need to monitor genetic changes, to extend time series to improve statistical power to detect differences in reproductive success, and to identify heritable effects in the second generation. In some cases, the tasks are expected to occur annually (e.g., genetic monitoring of reference populations and evaluations of RRS). In other cases, specific endpoints could not be established without some preliminary results (e.g., objectives 11 -15 to develop new genetically based monitoring tools).

Results will aid in understanding and mitigating the genetic risks of using artificial propagation in salmon and steelhead recovery. A particularly important issue, to be addressed in part by Objectives 6 and 8, is to understand how the history of hatchery supplementation affects RRS. RRS values measured in the study populations might be misleading (biased high relative to more natural populations) if the natural origin population had historically experienced significant domestication and/or bottlenecks of low effective population size.

2. Results and Adaptive Management

The project has consistently met its objectives and provided tribal, state, and federal agencies with genetic monitoring information. It has clarified evolutionary relationships among salmon populations in the Snake River and provided new insights on demographic, ecological, and evolutionary processes in these populations. Results from the project are being used within the region to make management decisions.

This type of monitoring work is now an essential part of hatchery reform and the goal of using widespread hatchery propagation in recovery of natural populations. Overall, these projects illustrate that hatchery origin and natural origin interactions can be similar in some locations and species, yet strikingly different in others. The ultimate goal of these studies is to investigate the causal mechanisms behind any observed deficits in RRS. The more that can be learned

about factors determining RRS, the more managers will understand the effects of supplementation, and the more they will be able to achieve the stated goals of sustainably increasing natural production. A key research issue is the extent to which hatchery supplementation limits the ability of small wild salmon and steelhead populations to adapt over time to local environments.

Some findings from these RRS studies raise questions that might be possible to answer in subsequent reports. Why did RRS of male Chinook in Catherine Creek (adult to juvenile stage) continually increase over time (Fig. 6)? More generally, how does cumulative low PNI and low population size influence RRS results? How should we expect RRS to differ among supplemented streams given contingent historical differences in the initial abundance of natural spawners and cumulative PNI? It would be useful to consider how the history of PNI and bottlenecks in natural population size varies among the RRS study populations.

Collaboration and sharing of information among partners seem excellent. Sampling efforts are coordinated closely with other BPA-funded projects to best leverage the available resources and incur the least disturbance possible to the fish being sampled. The project has created a valuable long-term genetic database of broad interest to managers and researchers throughout the Basin and elsewhere. Project results have been presented through 43 peer-reviewed publications, conference presentations, and presentations to the Council.

Besides supplying information that will inform regional policies and management actions, the proponents have exhibited adaptive management in meeting their own objectives. For instance, since the project began in 1989, it has benefited from two major decisions to change the types of genetic variation being surveyed—from metabolic proteins encoded by DNA (allozymes) which required lethal sampling, to selectively neutral mutations in microsatellite DNA which could be assayed non-lethally, and recently to Single Nucleotide Polymorphisms (SNP) which include both neutral and adaptive genes.

The current proposal continues the quest to explore, develop, and implement genetically based monitoring tools. Warm temperatures in some streams have reduced opportunities to collect DNA samples. The proponents are now testing the possibility of obtaining allele frequency data for population profiles directly from eDNA in water samples, in lieu of using individual fish when environmental conditions prevent field sampling. Additionally, the proponents plan to look for microhaplotypes associated with the SNPs currently being assayed as a way to increase the statistical power of pedigree assessments for RRS studies.

3. Methods: Project Relationships, Work Types, and Deliverables

A time-series approach is being used to study general trends in genetic diversity, population structure, and effective population sizes of Chinook salmon and steelhead in the Snake River

basin, together with more focused studies of RRS of hatchery and wild origin fish at three study locations. Sampling and analytical protocols are clearly documented in the annual reports through links to the PNAMP website. Standard methods are being used, and statistically reliable results are being produced.

A notable strength of this project is the deliberate effort to replicate RRS studies in different locations with different species. However, two complications are the small initial population size of the study populations and the high level of interbreeding that has occurred prior to and during the investigation. These complicating factors might reduce the power to detect differences in reproductive success between hatchery and natural origin spawners. The proponents acknowledge this concern from our previous review ([ISRP 2018-8](#)) and have added new objectives to clarify their intentions to investigate the issue.

The proponents also recognize the limitations imposed by continued use of the existing juvenile acclimation site, which results in hatchery steelhead homing to the lower river and disproportionately spawning in poor quality substrate. This known environmental cause of reduced RRS (poor spawning habitat) must be eliminated or controlled to better elucidate genetic mechanisms causing reduced RRS. It is not clear why stakeholders are reportedly reluctant to move the Little Sheep Creek acclimation site to areas in the upper watershed with better spawning habitat. One potential solution might be to release study steelhead from a new acclimation site in the upper watershed while continuing to release non-study steelhead at the existing site to maintain fishing opportunities for stakeholders.

199305600 - Advance Hatchery Reform Research

- Background info in Taurus: [Project proposal](#)

Proponent: National Oceanic and Atmospheric Administration

Recommendation: Meets scientific review criteria

Comment:

A long-standing challenge in the Basin and elsewhere in the Pacific Northwest has been how to best use hatcheries in steelhead conservation and supplementation programs. Results from numerous studies have indicated that steelhead exposed to standard hatchery practices experience morphological, behavioral, physiological, and genetic changes. This inadvertent domestication has reduced the value of using hatcheries as a conservation tool for steelhead recovery. Mainly, this is because when allowed to spawn under natural conditions, hatchery-origin fish and their offspring have reduced fitness when compared with natural counterparts.

This project is designed to provide information on whether hatchery culture coupled with natural steelhead growth patterns, behavior, and physiology, can limit domestication effects. The central approach presented in the proposal (i.e., the separation of slow-growing and fast-growing juveniles at an early age into age-2 and age-1 smolts) represents a substantial shift from standard practices. The comprehensive assessments and experiments described in the proposal will help determine the usefulness of this approach. Importantly too, the project will help elucidate the mechanisms responsible for domestication and provide insights into how or whether inadvertent domestication can be alleviated when steelhead are artificially reared.

1. Objectives, Significance to Regional Programs, and Technical Background

This project has three clearly described implementation objectives: (1) improve survival and reduce fitness loss, (2) reduce domestication selection, and (3) optimize hatchery steelhead programs through the use of natural origin broodstock.

The proponents are examining ways to reduce the effects of domestication by altering rearing procedures and choice of broodstock. Current investigations are evaluating the benefits and risks associated with rearing and releasing age-1 and age-2 steelhead smolts. Splitting of juveniles into these two rearing trajectories is based on broodstock maturation timing, hatchery thermal regimes, and the early growth patterns of juveniles. It is hypothesized that such splits will reduce residualism, precocious maturation, and generally reduce inadvertent domestication. A suite of laboratory and field studies are proposed to identify the underlying causes of domestication and help determine whether it can be reduced by management actions. If these approaches are shown to be effective, that could substantially change how steelhead are bred, reared, and released from the Basin's hatcheries and elsewhere.

Timelines for completion of studies, evaluations, and results are provided. Results will become available over the next several years. A production-scale study that releases age-1 and age-2 steelhead smolts began in 2018 at the Winthrop National Fish Hatchery. Rates of smoltification, precocious development, and survival through the Columbia River will be compared in release years 2020-2023. SARs and an examination of the effects of smolt age on fecundity will be assessed as adults from the rearing treatments return to the hatchery.

The objectives and anticipated results of the project coincide with a number of the goals presented in the Council's Fish and Wildlife Program.

2. Results and Adaptive Management

Investigations carried out by the project have been successfully completed. Results to date have shown that: (a) natural-origin steelhead can be used as broodstock in hatchery programs, (b) a hatchery can rear and release age-2 steelhead smolts on a production basis, and (c)

differences exist in the post-release survival, behavior, physiology, and marine age, in age-1 and age-2 smolts and the adults produced from these fish. The proponents have linked their proposed studies directly to uncertainties in the Fish Propagation (uncertainties 1.1., 1.2, 1.3, and 1.5) and indirectly to uncertainties in the Population Structure and Diversity (1.1, 1.2., and 3.6) categories in the Council's 2017 Research Plan.

The project has revealed both biological benefits and costs associated with releasing age-1 versus age-2 smolts. Although migration speed and survival through the mainstem was higher, precocious maturation was more prevalent in age-2 than age-1 smolts. Age-2 smolts had substantially higher survival rates in sea-water challenge tests suggesting they were more highly smoltified than age-1 smolts. Consequently, it is likely that age-2 smolts achieve higher survivals during the freshwater/seawater transition period in the estuary. On the other hand, adult males produced from age-1 smolts were more aggressive and produced more offspring than males originating from age-2 smolts. The proposal provides a comprehensive overview of these and other project findings and indicates how project results and data have informed their future work plans.

The proponent's studies are directed toward upper Columbia summer steelhead. However, the methods and findings produced from the study will be of interest to all who culture and release steelhead, whether within or outside of the Columbia River Basin.

Results of the project have been presented at conferences, to the Council, and in the peer-reviewed literature.

3. Methods: Project Relationships, Work Types, and Deliverables

The proposal describes the studies and methods that will be used to complete the project's six deliverables. Linkages between the deliverables and the project's three overarching objectives are shown. Citations to the PNAMP methods that will be used to complete each deliverable are clearly delineated. Monitoring and evaluation protocols are in place to determine if the project is completing deliverables as planned.

Hypotheses directly linked to uncertainties in the Council's 2017 Research Plan are presented. Work that the project has completed relating to each of these hypotheses is described along with the future actions that will be used to test each hypothesis. Completion dates for when the work will be completed are generally described in the proposal. Peer-reviewed publications have been produced by the project and several are currently under review. It is anticipated that new findings from the project will be shared via presentations and additional publications.

200203100 - Growth Modulation in Salmon Supplementation

- Background info in Taurus: [Project proposal](#)

Proponent: National Oceanic and Atmospheric Administration, University of Washington

Recommendation: Meets scientific review criteria

Comment:

This is a highly relevant and practical research project that addresses key uncertainties involving survival and maturation rates of hatchery Chinook salmon and the potential effects of hatchery supplementation on natural and hatchery production. Results from this project may be used to help develop hatchery rearing regimes that minimize early male maturation rates and improve hatchery smolt-to-adult survival rates (SARs) while minimizing negative impacts to protected natural stocks, including resident fishes. The project has important implications for implementation of segregated versus integrated hatcheries, as the latter approach tends to produce earlier maturing minijacks. Based on the findings of this project, all Chinook salmon hatcheries in the Columbia Basin should test for and estimate the production of minijacks.

1. Objectives, Significance to Regional Programs, and Technical Background

Objectives are clearly stated and quantitative with implied time limits (one generation). The biological objectives have important implications for hatchery supplementation and management, including outcomes from segregated versus integrated hatcheries. The unintentional production of precocious salmon (“minijacks”) reduces the production of anadromous fish (i.e., large fish that are harvested in fisheries), may lead to deleterious ecological and genetic interactions with native fishes, and complicates (i.e., biases) the calculation of important demographic metrics such as SAR, SAS, and R/S values. The anticipated outcomes are expressed quantitatively as hypotheses to be tested. Timelines for achievement are approximately 5 years (to obtain results over one full generation).

2. Results and Adaptive Management

Some objectives have already been achieved in that hypotheses have been tested at the laboratory scale, and multiple studies have been published in journals. The project is on track to assess the feasibility and potential benefits from implementation of its findings at a larger hatchery-level scale.

The project has evolved from surveys to accurately determine the prevalence of minijacks in hatchery releases of yearling Chinook smolts, to experiments to identify the environmental and genetic factors responsible for early maturation in hatchery settings, to efforts to develop hatchery guidelines that can be used to reduce minijack production in a variety of different

settings. One of the most important and unexpected finding is that integrated hatcheries tend to produce more minijacks than segregated hatcheries because segregated hatcheries select against the use of minijacks in the broodstock. We expect the project team will continue to develop new hypotheses and conduct experiments that will provide direct benefits for hatchery management throughout the Basin.

3. Methods: Project Relationships, Work Types, and Deliverables

The numerous peer-reviewed publications indicate that the project includes appropriate experimental designs, methodology, and statistical methods. The proposal provides a good overview of the hypotheses tested, methods, findings, and relationships to key Fish and Wildlife Program issues throughout the Basin.

Harvest Monitoring and Mitigation

200852700 - Zone 6 Fisheries CRITFC Accord project

- Background info in Taurus: [Project proposal](#)

Proponent: Columbia River Inter-Tribal Fish Commission (CRITFC)

Recommendation: Not applicable

Comment:

The current proposal is not scientifically reviewable because it primarily involves planning activities. The proposal identifies three objectives with the overall goal of re-programming salmon hatchery production efforts to mitigate for salmon harvest losses associated with the construction of John Day and The Dalles dams. The Master Plan Step Review process has not begun for this hatchery re-programming effort. The ISRP will likely be asked to review the Master Plan after it is developed.

1. Objectives, Significance to Regional Programs, and Technical Background

The project aims to help adjust the current stock mix of fall Chinook from the current 50:50 Up River Brights (URB) to Tule ratio to the target 75:25 URB to Tule ratio, and to move fall Chinook releases to areas directly impacted by the construction of the two dams, thereby maximizing transit of returning adults through the Zone 6 Tribal fishery. The objectives involve (1) coordination activities to facilitate re-programming, (2) project design and step review process for the hatchery, and (3) hatchery coordination activities with other programs. Background information and significance of the effort is adequately addressed.

2. Results and Adaptive Management

The proposal identifies problems with the achieving the project goals, including the loss of key personnel. The current effort involves a decision to switch hatchery production to the Prosser Hatchery. A Step Review will be conducted at a later date for new hatchery salmon production. It is not clear how the mitigation estimates were developed, so this part of the proposal is not reviewable.

3. Methods: Project Relationships, Work Types, and Deliverables

Deliverables include a brief discussion of meetings to ensure the project aligns and integrates with tribal fishery management strategies and other issues.

200850200 - Expanded Tribal Catch Sampling

- Background info in Taurus: [Project proposal](#)

Proponent: Columbia River Inter-Tribal Fish Commission (CRITFC)

Recommendation: Meets scientific review criteria (qualified)

Qualifications:

The ISRP recommends that the proponents describe their responses to the ISRP's comments and suggestions below in their upcoming annual report covering FY 2019 accomplishments.

1. A detailed description of the creel survey methodology and/or an appropriate publicly available reference that provides details of the survey methodology.
2. Creel survey data for 2017 and 2018 integrated with prior data.
3. A description of how creel survey data are shared with co-managers so that timely management responses can be made if needed. The ISRP presumes that creel survey data are shared in-season with co-managers.
4. A description of the project's adaptive management process; i.e., how the proponents review and possibly alter their existing survey methods and other protocols.

Comment:

This project provides creel survey data in mainstem Tribal fisheries that are expanded by the Yakama Nation fisheries biologists and shared with co-managers. The project fulfills U.S. v. Oregon monitoring requirements, but little information was provided in the proposal and

survey reports about the survey design, standard procedures, dates, survey effort or extent of survey coverage.

More timely reporting of creel survey data is needed.

1. Objectives, Significance to Regional Programs, and Technical Background

The objectives of this catch monitoring project are to increase monitoring of Zone 6 tribal fisheries and tribal fisheries immediately below Bonneville Dam (all gear types and uses) and to recover PIT tags in captured salmon. Harvest data are used to expand and estimate total catch by tribal fisheries, which is needed for fisheries management and to ensure harvests are within the limits of the U.S. v. Oregon Management Agreement. Sufficient information is provided in the brief proposal and report regarding the significance and background of this basic fisheries monitoring effort.

2. Results and Adaptive Management

Project reports summarize expanded tribal harvests by species in relation to counts at Bonneville Dam and PIT tag recoveries for each species of salmon and steelhead. The most recent report describes harvests for 2016. No information was reported for 2017 and 2018 fisheries, but these data were presented in the PowerPoint presentation. Creel data are shared with the U.S. v. Oregon Technical Advisory Committee, and creel data are expanded to total catch by species. The potential role of PIT tag recoveries was considered in discussions of adaptive management. However, to date PIT tags are primarily collected and shared with agencies that released the tags rather than using them for harvest management. In its next annual report, the proponents should describe their adaptive management process; i.e., how they review and possibly alter their existing survey methods and other protocols.

3. Methods: Project Relationships, Work Types, and Deliverables

The Yakama Nation Fisheries Department runs the creel monitoring program for all four tribes. CRITFC assists in coordinating tribal fisheries and reporting catches to co-managers. The approach is briefly described, including creel (interview) surveys to estimate CPUE and weekly aerial surveys to estimate overall effort. The proposal indicates that the effort has successfully achieved its goal of surveying 20% of the fishers. This effort does not involve stock-specific estimates, which are covered by other projects, but it does document marked and unmarked harvests. The effort is integrated with state fisheries management. The proposal and recent reports do not provide details about the survey design, standard procedures, dates, survey effort or extent of survey coverage. Presumably this effort receives sufficient technical oversight from the U.S. vs Oregon Technical Advisory Committee, but there was no reference to

the creel survey methodology. The proponents assume that the creel data can be expanded to obtain accurate counts of total numbers of fish harvested in Tribal fisheries.

Conservation Enforcement

200739100 - Tribal Conservation Enforcement-Columbia River Inter-tribal Fish Commission (CRITFC)

- Background info in Taurus: [Project proposal](#)

Proponent: Columbia River Inter-Tribal Fish Commission (CRITFC)

Recommendation: Not applicable

Comment:

The ISRP has identified all tribal enforcement projects in this review as “not applicable” because scientific assessment of the enforcement activities to biological conservation objectives is not possible.

There is a need for proponents of this and other enforcement projects to coordinate with biologists from CRITFC and other agencies to obtain estimates of the biological metrics stated in the objectives and relate these estimates to enforcement activities.

All the tribal enforcement projects have documented their activities. A separate effort is needed to track trends in enforcement activities among tribes, quantify their cumulative enforcement actions, assess changes over time, and relate these activities to biological objectives.

1. Objectives, Significance to Regional Programs, and Technical Background

The goal of this project is to reduce illegal take of Columbia River Basin salmonids, lamprey, and native resident fishes in Zone 6 to help rebuild endemic fish populations within the basin. The need for effective enforcement is placed in the context of conserving fish species.

The four objectives are clear and reasonable. The first three are partially quantitative in that they include biological metrics (i.e., increased survival) for measuring success; however, the project proponents do not obtain estimates of these metrics.

Objectives specific to enforcement activities are not included. Objectives and expected outcomes relative to enforcement activities can be expressed quantitatively. This refinement would improve the ability to conduct adaptive management by allowing effective review of

objectives, methods, and performance outcomes; thus, enabling the proponents to identify and share lessons learned from enforcement actions, identify limiting factors, and recognize opportunities for adaptive responses.

2. Results and Adaptive Management

Enforcement actions are documented in annual reports, but outcomes are not evaluated in terms of the metrics identified in the objectives. It would be helpful to synthesize the tabular summaries of resource protection actions by year over the history of the project to facilitate evaluation of temporal trends by types of actions.

Annual reports list numbers of tribal fishery and sport fishery enforcement actions. A highly informative summary table in the 2017 Annual Report shows time patrolling commercial and ceremonial fisheries, time patrolling by boat and vehicle by day and night, numbers of fishing gears seized or recovered, numbers of salmon and sturgeon seized and released alive, and numbers of arrests. Summary tables provide data for each quarter and are useful. It would be helpful to develop additional tables providing annual summary data for these actions for each year of the project. Such a synthesis would facilitate basic analyses of activities (i.e., temporal trends illustrated graphically or in tables) and potentially reveal new challenges for enforcement.

There is opportunity to evaluate temporal and spatial trends in enforcement actions based on summaries in annual reports. Police activities beyond those associated with natural resource protection are also described in annual reports. It is unclear how much time is spent on these activities. Summary tables similar to those for fishery enforcement actions would be useful.

Annual reports list public outreach and education events by date, as well as numbers of people attending events. Summary tables of these activities would be useful in evaluation of the project.

The ISRP 2010 review ([2010-44b](#)) pointed to opportunities to improve and coordinate data collection through spatial representation (i.e., GIS) to allow a more analytical, synthetic, and scientific representation of what is occurring in enforcement by CRITFC. Response to this suggestion is not evident in the proposal.

There are no descriptions of lessons learned through the enforcement actions. The 2010 ISRP review noted that, in addition to describing enforcement actions, lessons learned should be described.

3. Methods: Project Relationships, Work Types, and Deliverables

Four full time enforcement personnel are funded by this project: three officers and one dispatcher. The general approach used by CRITFC is appropriate: (1) maintain highly visible fish and wildlife conservation enforcement as a means to deter illegal fishing activities; (2) enhance enforcement activities through cooperation and assistance from federal, state, tribal, regional, and local entities; and (3) educate people about the need to protect species and cultural values.

Neither the proposal nor the most recent 2017 Annual Report describes methods in sufficient detail to enable scientific review. General overviews of police patrol procedures are provided, but there is not detail on patrol design, schedules, standard procedures, or temporal or spatial extent of patrol coverage.

Monitoring and evaluation of enforcement actions are not described.

200739000 - Tribal Conservation Enforcement-Umatilla Tribe

- Background info in Taurus: [Project proposal](#)

Proponent: Umatilla Confederated Tribes (CTUIR)

Recommendation: Not applicable

Comment:

The ISRP has identified all tribal enforcement projects in this review as “not applicable” because scientific assessment of the enforcement activities to biological conservation objectives is not possible.

There is a need for proponents of this and other enforcement projects to coordinate with biologists from CRITFC and other agencies to obtain estimates of the biological metrics and relate these estimates to enforcement activities.

All of the tribal enforcement projects have documented their activities. A separate effort is needed to track trends in enforcement activities among tribes, quantify their cumulative enforcement actions, assess changes over time, and relate these activities to biological conservation objectives.

1. Objectives, Significance to Regional Programs, and Technical Background

The proposal describes the overall goal of this salmon conservation enforcement effort within the Nez Perce Tribe 1855 Treaty Area, Zone 6 of the mainstem Columbia River and Usual and Accustomed fishing areas. A simple, general objective (i.e., statement of purpose) is stated, but

it is not possible to determine if or when such an objective is achieved. The objective does not refer to biological outcomes relevant to the Fish and Wildlife Program (e.g., increased survival of salmon). Specific quantitative objectives with timelines are needed.

There is no discussion of anticipated benefits. While it is accepted that law enforcement is necessary, benefits to be achieved by the proponents' law enforcement program are not explained.

2. Results and Adaptive Management

It is assumed that enforcement of resource protection regulations benefits salmon populations throughout the middle Columbia Basin. Benefits to the Council's Fish and Wildlife Program are not explained. There is no discussion of what has been achieved by the law enforcement program since its beginning in 2007. Simple statistics of enforcement activities (e.g., license checks, warnings, hours and miles patrolled, hours investigated, meetings) are documented in annual reports. There is no evaluation to identify whether these activities have improved compliance with the laws or how enforcement procedures could be improved. Lessons learned about enforcement strategies or tactics have not been documented.

Law enforcement activities are documented as statistics in annual reports. It would be useful to compile these statistics by year over the history of the project to examine temporal trends in legal infractions and patrol efforts. Such a synthesis would facilitate analyses to assess improvements in coverage and public compliance and help to reveal new challenges for the project.

No information was provided in the proposal on the use of results from law enforcement activities for adaptive management. Quantitative objectives with timelines coupled with monitoring and assessment of metrics stated in objectives would enable an adaptive management cycle. An adaptive management cycle would allow for more effective review of methods, evaluation of performance outcomes, and sharing of lessons learned.

In the ISRP 2010 review, the ISRP listed two qualifications that pointed to opportunities to improve and coordinate data collection through spatial representation (GIS) to allow a more analytical and scientific representation of what is occurring in enforcement across the Basin. These qualifications do not appear to have been addressed and are still pertinent.

The proposal does not describe public outreach activities or how such activities will be assessed.

3. Methods: Project Relationships, Work Types, and Deliverables

Methods need to be described in greater detail. Neither the proposal nor the most recent annual report (2017) documents methods in sufficient detail for scientific review. The documents provide a general overview of police patrol procedures, but they do not provide details about the survey design or standard procedures that determine patrol coverage.

Monitoring and evaluation (M&E) are not described. There is an opportunity to evaluate temporal and spatial trends in enforcement actions based on summaries in the annual reports. A useful first step would be to compile data in the annual summaries to facilitate statistical evaluation of trends.

200810600 - Tribal Conservation Enforcement-Colville Tribe

- Background info in Taurus: [Project proposal](#)

Proponent: Colville Confederated Tribes

Recommendation: Not applicable

Comment:

The ISRP has identified all tribal enforcement projects in this review as “not applicable” because scientific assessment of the enforcement activities to biological conservation objectives is not possible.

There is a need for proponents of this and other enforcement projects to coordinate with biologists from CRITFC and other agencies to obtain estimates of the biological metrics and relate these estimates to enforcement activities.

All the tribal enforcement projects have documented their activities. A separate effort is needed to track trends in enforcement activities among tribes, quantify their cumulative enforcement actions, assess changes over time, and relate these activities to biological conservation objectives.

We encourage the program to expand annual reports. Summary statistics as provided in the 2016 Annual Report should be provided each year so that the data can be used to document whether specific illegal activities are increasing or decreasing.

It is noted that the proposal states that more officers are needed to carry out all tasks including outreach and enforcement during night and day.

1. Objectives, Significance to Regional Programs, and Technical Background

The proposal describes five highly relevant objectives related to the overall goal of conservation enforcement on reservation and ceded lands. Concise background information is provided that includes the significance of enforcement to regional programs. The objectives are clear and reasonable but not quantitative. The overall goal and two objectives are explicitly linked to biological and physical outcomes. It is good that one of the objectives is to maximize accountability through monitoring and evaluation (M&E).

Quantitative outcomes are not provided despite the use of the terms “optimize” and “maximize” that imply a quantitative approach. Timelines are not provided. It is not possible to assess to what extent objectives have been met because of the lack of quantification of objectives and timelines.

The proposal seems incomplete in that only one deliverable is listed (i.e., assistance with Upper Columbia River steelhead recovery). No deliverables are associated with objectives 2, 4 or 5.

The ISRP 2010 ([2010-44b](#)) review comments are still relevant and should be addressed.

2. Results and Adaptive Management

Enforcement of resource protection regulations on Colville reservations and ceded lands is assumed to benefit salmon populations throughout the Upper Columbia Basin.

No results were provided in the proposal, but some results are provided in past annual reports. Enforcement actions are documented in most of the annual reports (excepting the most recent 2017 report), but outcomes have not been assessed as implied by the language in objectives 3 - 5. It would be useful to compile tables of resource protection actions by year over the history of the project to facilitate evaluation of temporal trends by type of action. Such a synthesis would facilitate assessment of success and may reveal challenges that face the project.

An adaptive management approach is not evident. For example, quantitative objectives with timelines, lessons learned, and project changes and reasons for them over time are not described.

Objectives and expected outcomes should be expressed quantitatively. Metrics and methods for evaluation of objectives should be documented in greater detail. These refinements would improve the adaptive management cycle by allowing for more effective review of methods, evaluation of performance outcomes, and sharing of lessons learned. Lessons learned about enforcement strategies or tactics have not been documented.

The proponents state that “new objectives/performance measures were established” and “a work plan has been developed.” It would be helpful in a review of the proposal if the

proponents described the objectives/performance measures and the work plan. The proponents state that they will do an evaluation and analysis of the project impacts, but no process for evaluation and analysis is described in the proposal.

3. Methods: Project Relationships, Work Types, and Deliverables

Neither the proposal nor most recent 2017 Annual Report describes methods to achieve the five objectives listed in the proposal in sufficient detail for review. The documents provide a general overview of police patrol procedures and actions, but they do not provide details about the survey design, standard procedures, dates, or extent of patrol coverage. The “work plan” mentioned in the proposal may contain details about methods. It would be useful if the proponents would provide details from the work plan. The need for a description of methods was identified as a qualification by the ISRP in 2010 ([2010-44b](#)), and this limitation persists.

Monitoring and evaluation (M&E) are not described. The proponents mention that they will evaluate the impact of the project. Information as to how this is to be done is not presented in the proposal and is needed to provide an effective review of the project. There is an opportunity to evaluate temporal and spatial trends in enforcement actions based on summaries in annual reports. A useful first step would be to compile data in the annual summaries to facilitate statistical evaluation of trends.

To facilitate adaptive management, quantifiable metrics with time lines are needed for each of the five objectives with a good description of deliverables for each.

Harvest – Selective Gear Evaluation

200810500 - Selective Gear Deployment

- Background info in Taurus: [Project proposal](#)

Proponent: Colville Confederated Tribes

Recommendation: Meets scientific review criteria (qualified)

Qualifications:

This selective fishing project is important because it evaluates how hatchery Chinook salmon can be selectively harvested in upper watershed tributaries for the benefit of Tribal members and for reducing interactions of hatchery and natural-origin Chinook salmon on the spawning grounds. This type of project was highlighted in the ISAB report on density dependence ([ISAB 2015-1](#)). The ISRP views this effort as a demonstration project that might stimulate similar

efforts in other parts of the Columbia Basin. Addressing the following ISRP comments will justify and highlight the utility of this effort.

In its review of this project in 2010, the ISRP listed six qualifications. Qualifications two through five are repeated here and need to be addressed by the project. *“(2) Explain how relationships among projects will be implemented, and provide a more detailed description of these related projects; 3) Explain methods used to evaluate which gear will be used for selective capture of hatchery fish (e.g., will CPUE, cost, or tradition (or some combination) be the deciding factor(s); 4) Explain statistical details of monitoring methods; 5) Explain methods for communal distribution of fish caught in experimental gear; and 6) Explain how the education and outreach components of objectives 4 and 5 will be performed and evaluated.”*

Three additional qualifications are identified by the ISRP for the current review: (1) Document the change in pHOS, PNI, and overall spawning escapement induced by the selective fishing effort; (2) Estimate the increase in harvest that the selective gear approach enabled compared with a non-selective fishing approach; and (3) A limited description of an annual adaptive management cycle for reviewing assumptions, decision-making, and data sharing is presented. A more complete description of this process is requested.

The proponents are asked to provide a written response to each of the 2010 ISRP qualifications and the two additional ones from this review, and submit the responses for the 2021 Category Review of Artificial Production Projects for anadromous fishes.

Comment:

A description of the major accomplishments of this project since its beginning in 2008 is needed. The project has produced a lot of data that should be placed in summary tables that cover the years that the program has been active.

The proponents should be commended on making a good effort to produce quantitative objectives. However, timelines are not provided. The next step is to see if the proponents are achieving the objectives. The selective gear project is important for the specific area and for potential application to other parts of the Columbia Basin. The reporting of results should be expanded as noted in the qualifications so that the full benefits of the effort can be evaluated and shared with others in the Columbia River Basin.

1. Objectives, Significance to Regional Programs, and Technical Background

It is hypothesized that selective fishing of hatchery origin salmon on Colville reservations and ceded lands will improve the survival and percent natural influence (PNI) of natural salmon populations and reduce mortality on other non-target species with benefits to salmon populations throughout the Upper Columbia Basin.

The four objectives are clearly stated and seem appropriate. The first two objectives are explicitly linked to biological outcomes (i.e., to increase the survival of natural-origin anadromous salmon [especially ESA listed ESUs] and to increase PNI of summer/fall Okanogan Chinook by selectively harvesting hatchery origin returns [HOR]).

All four objectives include quantitative targets, and the last objective includes expected benefits (i.e., expect annual harvest of >1000 HOR Chinook surplus to broodstock requirements). However, additional explanation is needed to reconcile three related but quantitatively different targets from the problem statement, *“these selective harvest techniques are expected to remove upwards of 80 percent of all surplus hatchery fish returning to the basin each year”*; from objective 4 (misabeled as 5?) – *“goal is to capture at least 50 percent of the terminal run of Chinook with minimum (<3%) mortality on natural origin fish”*; and from objective 3 (misabeled as 4?) – *“goal of the program is to be able to remove 10 percent of the HOR origin fall summer/fall Chinook passing the weir using these methods.”* Presumably the target percentages refer to different components of the run at different locations (i.e., all surplus hatchery fish, total terminal run, and hatchery fish passing the weir, respectively). However, clear explanations of these differences are needed to show that the different targets are coherent.

The significance of the program to regional programs is noted, but the presentation could be expanded given the importance of implementing selective fisheries as a means to provide harvests while reducing ecological and genetic impacts associated with hatchery fish spawning in the wild. However, the project proponents do not provide information on how their project is integrated with other restoration efforts in the Basin. For example, in the section on Project Relationships, they state that purse seining is conducted in a location to "prevent catching large numbers of Methow River summer/fall Chinook and summer steelhead." What kind of coordination is being conducted to assure that this project is not negatively impacting other restoration efforts?

Given that the project focuses on assessment of different gears, what is currently being done to assess the three current approaches to collecting and harvesting fish (i.e., purse seine, weir, and hatchery ladder)? What are the relative effectiveness, needed human resources, and cost of each collection/harvest approach? An objective focused on this element of the project appears to be lacking.

2. Results and Adaptive Management

There has been no rigorous assessment of results from this project. Selective fishing results for broodstock and harvest are tabulated for individual years in annual reports. However, the summary results for each year should be compiled across years to facilitate evaluations of year-to-year variability, temporal trends, and averages compared to targets. Such a synthesis is

needed to assess the success of the project to date and to reveal challenges that face the project.

The table format in annual reports requires more explanation. Tables are difficult to interpret, and some entries seem inconsistent with values mentioned in the text. It would help to show (as for previous years) the total number of natural origin returns (NOR) and to explain how the grand total handling mortality is calculated. The proposal does not present any results relating directly to the third objective (i.e., fostering the adoption of selective fishing methods by individual tribal fishermen).

The proposal does not provide evaluation of outcomes in terms of the targets or expected benefits listed in the objectives.

Although an increase in PNI is a goal of the project, the PNI value was not calculated for Chinook and steelhead as a means to evaluate the overall effectiveness of the program. The project report should evaluate the extent to which pHOS is reduced by the selective fishery efforts by documenting HOR and NOR fish in the escapement and among those removed by the selective fishery. It is unclear how many tribal fishers were instructed in the use of selective fishing gear.

Management targets for broodstock collection and HOR harvest are identified each spring at the Chief Joseph Hatchery Monitoring and Evaluation (CJHM&E) Annual Program Review. The Selective Gear Deployment Project is tied to the CJHM&E program which appears to include a systematic adaptive management process. However, an adaptive management process specific to the Selective Gear Deployment Project is not fully described. The Adaptive Management section of the proposal describes a step process, but the detail is insufficient to enable an understanding of the process. A limited description of an annual adaptive management cycle for reviewing assumptions, decision-making, and data sharing is presented. Some outcomes of adaptive management are evident. For example, the harvest target for HOR Chinook is now determined annually to achieve a five-year running average target for PNI based on annual calculations described in the CJHM&E Program. Similarly, tribal seining operations were insufficient on their own to remove the number of hatchery origin fish required to achieve HSRG conservation goals, so a weir is planned on the Okanogan River to supplement the purse seine removals and broodstock collection.

Lessons learned about ways to improve methods of selective fishing or to foster the use of selective fishing among tribal fishers are applicable but have not been documented.

3. Methods: Project Relationships, Work Types, and Deliverables

The proposal does not provide information on methods being used to achieve the stated objectives. The most recent 2015 Annual Report documents the selective fishing methods and

annual activities in considerable detail. However, it does not describe methods for evaluating the performance of alternative methods and for choosing which selective gear to use (ISRP 2010 qualifications 3 and 4; [2010-44b](#)). Neither the proposal nor the 2015 Annual Report describes methods for implementing or evaluating the outcomes for the last objective (i.e., fostering the adoption of selective fishing methods by individual tribal fishermen).

Education will continue to be an important focus for the project. Tribal members have reportedly embraced opportunities to learn about live-capture technique. Methods to evaluate this element of the project are needed.

Coded Wire Tags

198201301 - Coded Wire-Tag Pacific States Marine Fisheries Commission (PSMFC)

- Background info in Taurus: [Project proposal](#)

Proponent: Pacific States Marine Fisheries Commission

Recommendation: Meets scientific review criteria

Comment:

The coded-wire-tag (CWT) project is an ongoing critical effort for the management of fisheries and hatcheries in the Columbia Basin and along the entire West Coast. This proposal is clearly written and provides a detailed explanation of the structure and linkage of two long-term projects within the overall CWT program. The CWT program has clearly played an effective role in providing the data needed to manage harvest rates in fisheries, evaluate the status of endangered salmon populations, and monitor and compare trends in productivity of wild and hatchery salmon in the Columbia Basin. It would be worthwhile knowing more about how the CWT effort is coordinating with PIT-tagging efforts and emerging parentage-based tagging efforts.

Section 1.2 (on CWT sampling in ocean fisheries) contains a statement that recent reductions in funding from BPA for CWT support have resulted in undesirable sampling cutbacks in minor salmon-only fishery locations. The implications of these cutbacks need to be evaluated and discussed by the Basin's fisheries managers, the Council, and BPA.

1. Objectives, Significance to Regional Programs, and Technical Background

The goal and objectives of this ongoing coast-wide effort are clearly described: maintain the regional CWT databases used to manage data related to CWT release and recovery events as

well as catch and effort statistics for fisheries providing CWT recoveries. The centralized database and associated coordination of effort support international, state, federal, and tribal fisheries organizations using CWT data or marking anadromous salmonids throughout the Pacific region, including the Columbia River Basin. The database is needed for a variety of important ongoing issues, including status monitoring of ESA-listed salmonids and survival of hatchery salmonids. It would be worthwhile knowing more about how the CWT effort is coordinating with PIT-tagging efforts and emerging parentage-based tagging efforts, and whether new cost-effective methods are being developed to "read" CWTs.

2. Results and Adaptive Management

This project maintains the CWT database from which many analyses are based, but it does not test hypotheses or analyze data itself. Activities associated with this project are briefly described, including CWT sampling of Columbia River commercial fisheries, hatcheries, spawning grounds, observations of Bonneville and Priest Rapids dams, selective fisheries sampling, sampling of Oregon ocean fisheries, data management, and basic analyses. By its design, the project provides data that are broadly applicable to salmon populations throughout the Pacific Coast. Objectives have been achieved consistently over many years, and the project remains on track. The project has successfully adapted to challenges related to changes in management policy (e.g., mass marking of hatchery fish) and budgets. Adaptive management actions largely involve focusing sampling efforts each season and year on high priority fisheries to meet management needs.

Surprisingly, the proposal does not provide arguments (or cite relevant articles) to justify continuing the use of CWT instead of switching to genetic techniques for identifying individual fish (e.g., parent-based tagging) that have become increasingly powerful and cost effective and are now used widely throughout the Columbia Basin (e.g., by CRITFC).

3. Methods: Project Relationships, Work Types, and Deliverables

Project relationships are well documented for this ongoing coast-wide monitoring effort. Specific project deliverables include extraction of CWTs from salmonids and inputting data into the Regional Mark Information System, and coordination of the collection, reporting, and database management. The methods have been developed, reviewed, and fine-tuned over many years. The project is not responsible for evaluating the CWT data beyond validating their accuracy and maintaining a publicly accessible database. Most CWT fish are from hatcheries and managers generally assume that hatchery stocks are representative of natural stocks.

201003600 - Lower Columbia Coded Wire Tag (CWT) Recovery Project

- Background info in Taurus: [Project proposal](#)

Proponent: Washington Department of Fish and Wildlife (WDFW)

Recommendation: Meets scientific review criteria (qualified)

Qualifications:

The ISRP recommends that the proponents describe their responses to the ISRP's comments and suggestions below in their upcoming annual report covering FY 2019 accomplishments.

1. The proponents should perform the power analyses they suggest in their proposal to help guide their sampling efforts and to provide measures of precision for all estimates.
2. The project should begin to build a "brood table" for natural origin salmonids and show these values in annual reports, e.g., total adult recruitment produced by natural spawners. This information is needed for the evaluation of abundance and productivity, two key VSP parameters.
3. Describe any efforts being made to link fish identification from the CWT- and PIT-tagging programs with comparable data obtained by Parentage-Based Tagging.

Comment:

This proposal clearly explains why the project was initiated, how it relates to the overall coded-wire-tag (CWT) program, and why it remains a critical monitoring effort in the Columbia Basin. However, the Adaptive Management section contains statements that reductions in funding hampered WDFW's ability to achieve sample rates targets for some fisheries in 2013-2017, and that *"if additional funding is not identified, it will be necessary to prioritize fisheries and reduce or eliminate sampling of some fisheries. ... It may be possible to shift sampling effort among fisheries occurring simultaneously to come closer to sample rate targets, but this is often not possible as fisheries may occur on different days or large distances apart. Fishery sampling of the treaty Indian fishery (Zone 6) was especially challenging in recent years due to increased landings of dressed (i.e., gutted) fish and lack of access to sample some tribal fish buyers. The issues encountered by samplers in Zone 6 may result in a biased sample of the CWTs, PIT tags and individual fish weights even if sample rates met the targets due to the need to sample different stocks in proportion to the catch composition. These potential sources of bias in Zone 6 create issues for estimating harvest by stock and in general decrease precision in management by WDFW and co-managers in the Columbia River basin. WDFW is currently attempting to restructure sampling in Zone 6 to account for these potential sources of error, but difficulties may continue."* These concerns parallel concerns expressed in the PSMFC proposal involving CWT (1982-031-00). These funding issues and associated implications require further discussion

and evaluation by the Basin's fisheries managers, the Council, and BPA. To be effective, these discussions should occur now, prior to the Basin's fall fisheries.

1. Objectives, Significance to Regional Programs, and Technical Background

The goals and objectives of the monitoring project are well defined and justified, including (1) estimate the number of PIT tags in Columbia River fisheries, (2) estimate CWT Chinook and coho salmon contributions to escapement count in Washington's lower Columbia tributaries as a means to support VSP status, (3) Chinook salmon escapement monitoring for the Toutle River, Upper Gorge, and Upper Columbia populations (including Hanford Reach), and (4) monitoring spawning escapement of coho salmon in key Washington populations below Bonneville Dam. Anticipated outcomes are expressed quantitatively as sampling rates and data standards to be achieved and maintained over the longer-term. This is a monitoring project that requires long-term continuity to evaluate fish status in relation to fisheries.

2. Results and Adaptive Management

Results from 2013-2017 are briefly presented in the proposal for (1) Chinook and coho salmon spawning in specific tributaries, including hatchery origin (HOR) and natural origin (NOR) spawners, (2) sport fisheries, (3) commercial fisheries, and (4) fall Chinook counts at Bonneville Dam. Origin (hatchery versus natural) is identified in the recreational catches (unmarked fish are released) and commercial catches, and spawning escapements. Harvest rates based on PIT-tag data are calculated despite some logistical and technological challenges to achieving a 20% sampling rate in the mainstem fisheries. The proponents have identified a plan to overcome these hurdles; measures of precision about estimates and assumptions should be provided when possible. Ultimately, data generated by this effort are used in agency reports that describe basic salmon population trends and harvests. The proponents should begin to use the population data to create "brood tables" which are key to development of stock-recruitment relationships and assessing stock productivity. Data and evaluations produced by this project are uploaded to the publicly accessible CWT database (RMIS). A comprehensive report for the 2010 season provides many details on the methods and results. The proponents have produced a series of publications on methods and data standards in addition to their annual reports.

WDFW recognizes the need to restructure sampling in Zone 6 to account for potential sources of error and bias because of increased landings of "dressed" fish and lack of access to sample some tribal fish buyers. WDFW is testing new methods of electronic data capture and transfer to databases. Stream surveys of coho salmon are being revised.

The proposal does not mention any effort directed toward linking fish identification data from the CWT- and PIT-tagging programs with data obtained by genetic (e.g., parentage-based tagging, PBT) or acoustic telemetry programs. A major recommendation from the Pacific

Salmon Commission’s expert panel review in 2005 (that motivated this project) was to develop a coordinated research and implementation plan, including integration of other genetic and electronic tagging tools/techniques. This integration could be particularly useful because, as noted in the proposal, exploitation rates of wild salmon in commercial fisheries stem from analysis of CWT hatchery salmon and the assumption that exploitation rates of wild salmon are the same as hatchery salmon.

3. Methods: Project Relationships, Work Types, and Deliverables

The proposal documents activities and methods in appropriate detail and makes good use of the published literature to justify assertions and support procedures. This project primarily serves a long-term monitoring and data sharing function. The proposal provides appropriate detail about the types of activities used to detect or recover CWT in samples of catches and escapements, and to estimate escapements and calculate harvest rate. There is a need to develop and describe integrated methods that can propagate uncertainty along the entire chain of computations to get final estimates with measures of uncertainty. On page 57 of the report, it states the need to *“Consider a power analysis for important fishery management groups to ensure sufficient PIT tagging and sampling to meet management precision goals.”* This analysis should be completed immediately. We could not verify whether the statistical methods used for CWT analyses were standard or something different.

Some typos were noted in the caption to Table 1 of the 2018 report (“do **NOT** provide accurate p_{HOS} estimates...”) and values in Table 14 (commas misplaced or extraneous digits).

Passage and Survival Monitoring and Support

198331900 - New Marking and Monitoring Technologies

- Background info in Taurus: [Project proposal](#)

Proponent: National Oceanic and Atmospheric Administration

Recommendation: Meets scientific review criteria

Comment:

The ISRP encourages continued efforts to respond to 2018 review qualifications ([ISRP 2018-8](#)). Specifically, the project proponents should continue efforts to provide more supporting data to back up detection efficiency test results for new systems. Details of methods for each deliverable including the PIT tag retention study and the PIT barge are encouraged.

The ISRP also encourages collaboration with NOAA's trawl efforts to increase sampling coverage. In addition, increased detection at Bonneville is needed because the current data from the corner collector are not adequate.

The ISRP does not need to review a response on these items.

1. Objectives, Significance to Regional Programs, and Technical Background

The project's overall objective is to continue to develop and implement technologies and infrastructure that can be used throughout the Basin to detect PIT-tagged fish. The project is tasked with solving specific issues that deal with tag detection, logging tag detections, PIT tag modifications, antenna modifications, and with designing, testing, and evaluating tag detection equipment that can be used at dams, large rivers and in small tributary systems. Consequently, project objectives are specific, clearly defined, measurable, and have proven to be testable and achievable as well as time-based.

Improvements in tag detection are relevant to the Council's Fish and Wildlife Program because of the wide use of PIT tags to measure survival and migration timing of the Basin's salmonids. Projects in the mainstem RM&E program rely on information gathered from PIT-tagged fish, so implementation of this project is important for increasing accuracy and precision of data that are necessary for monitoring and improving fish passage.

2. Results and Adaptive Management

The proposal provides a list of results produced by the project in the past. These results are used throughout the Columbia River Basin in projects that depend on PIT-tagged fish.

Adaptive management is described in terms of the effect of the new technologies the project develops on other projects in the RM&E program. The assumption is that the improved data collection has been instrumental in many management decisions made over many years. However, it is unclear how new developments inside and outside the Columbia Basin are monitored so that new technologies may be considered for use. Is there a group that is assigned this task?

3. Methods: Project Relationships, Work Types, and Deliverables

Projects in the mainstem RM&E program rely on information gathered from PIT-tagged fish. Success of these projects depends on implementation of this project. The methods are appropriate and appear able to deal with the realities of working in large river systems. Work types are 100% RM&E and Data Analysis. The proposal states that the proponents are working to publish protocols for various parts of this project. The ISRP encourages the proponents to do so.

200500200 - Lower Granite Dam Adult Trap Operations

- Background info in Taurus: [Project proposal](#)

Proponent: National Oceanic and Atmospheric Administration

Recommendation: Meets scientific review criteria

Comment:

The ISRP encourages the proponents to investigate (1) solutions to the problem of long holding times that increase prespawn mortality and (2) ways to minimize the impact of American shad at Lower Granite Dam.

1. Objectives, Significance to Regional Programs, and Technical Background

This project continues to make valuable contributions to the region. This proposal requests support to continue operating the Lower Granite Dam adult trap to provide information to managers on age class structure, wild/hatchery proportions, predator and harvest wounds and other data that are useful to manage restoration programs. Operating the adult trap also provides access to returning adult fall Chinook, coho, and sockeye to obtain adults for hatchery and recovery program needs. Data collected are used by several agencies and tribes. Data that benefit other projects are uploaded several times a day and available in near-real time.

The technical background describing how adults are diverted into the trap holding area is adequately explained. Improvements to the data collection system are briefly described in the proposal.

2. Results and Adaptive Management

Scales from returning PIT-tagged fall Chinook salmon are collected to better understand their life history diversity. These data indicate that a large percentage of returning adults each year are yearling or reservoir type migrants. These results have led to the design of other research projects such as transport studies, overwintering telemetry studies, and otolith microchemistry studies.

3. Methods: Project Relationships, Work Types, and Deliverables

Project relationships involving broodstock collection, transport studies, and run reconstruction are mentioned. The proposal mentions that the Lower Granite Dam is the best location for

examining the physical effects on adults resulting from passage through the downstream hydropower system. No mention is made of how these data are used. Similarly, adult passage times through the ladder are monitored for the effects of the trapping facility on passage, but it is not clear what is done with this information. More details are needed in future proposals.

The importance of the facility continues to increase with the focus on improved monitoring to better understand the impact of hydrosystem operations, or actions that impact fish, while also taking account of mainstem habitat research and the effects of climate change.

201800200 - Integrated In-stream PIT tag Detection System Operations and Maintenance

- Background info in Taurus: [Project proposal](#)

Proponent: Biomark, Inc.

Recommendation: Meet scientific review criteria

Comment:

The Integrated In-stream PIT tag Detection System (IPTDS) was designed as part of the Integrated Status and Effectiveness Monitoring Project (ISEMP) to estimate adult escapements and juvenile survival of Chinook and steelhead in high priority tributaries. This proposal describes encouraging results from two years of effort to develop and apply best management practices for the operation and maintenance of IPTDS. The proponents demonstrate that they have achieved considerable improvements in data reliability and cost savings. They also provide improved escapement estimates for Chinook and steelhead passing Lower Granite Dam as well as to tributaries of the Snake and upper Columbia rivers.

1. Objectives, Significance to Regional Programs, and Technical Background

This O&M project was developed to assume responsibility for a subset of the ISEMP-related IPTDS that has continuing utility for managers. The proponents clearly describe the importance of IPTDS to regional programs, including the Council's Fish and Wildlife Program and Research Plan, the Upper Columbia River Recovery Plan for steelhead and spring Chinook salmon, the Anadromous Salmonid Monitoring Strategy, and other regional programs. The primary goal of this project is to maintain the current set of PIT-tag arrays and to improve cost-effectiveness by automating many common labor-intensive tasks. A secondary goal is to develop operational standards to improve reliability and data quality. These goals offer hope that instream arrays can become more cost effective and might be installed more widely in the Basin to evaluate the cumulative impacts of restoration projects.

The two objectives listed in the proposal are not stated quantitatively. However, objective 1 (improve the reliability and consistency of data) is implicitly quantitative and will continue annually. Quantitative metrics have also been developed to evaluate performance in 2019. Objective 2 (data management) is vague in the proposal but somewhat clearer in the annual reports and manuals. To help evaluate project success, we encourage the proponents to develop quantitative objectives more explicitly in future proposals and reports.

The proposal states that responsibility for generating escapement estimates (as provided in the annual report for 2018) is now beyond the scope of this O&M project and will be transferred to another project in 2020. However, it is not clear if the proponents who will assume this responsibility will have the necessary expertise to maintain the code for these models and to continue to generalize their applicability to other sites. The ISRP notes that this project currently supports a valuable “repository” of highly qualified personnel with the experience to efficiently direct any future expansion of IPTDS and the models for estimating escapements.

2. Results and Adaptive Management

The proponents have improved the cost-effectiveness of the project and the reliability and consistency of IPTDS data by implementing remote communications at all project sites. Consolidating IPTDS within one project has substantially reduced the cost of remote communications and enabled near-real-time alerts when IPTDS diagnostics deviate from operational tolerances. Periods of inoperability have also been reduced with a corresponding improvement in data quality.

Sophisticated models developed by ISEMP were used to estimate adult escapements for 23 populations of Snake River Basin spring/summer Chinook salmon and 15 populations of steelhead.

Neither the proposal nor the annual reports describe an adaptive management process by which adjustments to infrastructure are being made. The proposal states “Development, implementation and routine updates to IPTDS site and infrastructure selection and O&M best management practices documents are the primary forms of internal adaptive management.” The proponents describe changes in methods to improve the reliability of counts while also reducing overall costs. For example, program improvements have reduced labor to repair corrupted data from 680 to 60 hours per year and reduced remote data transmission costs by 85%. The proponents also note that this project has triggered a number of cost-saving adaptive responses within the Nez Perce management process by confirming the effectiveness of IPTDS at several sites and by detecting unexpectedly high steelhead escapements at Big Sheep Creek. However, it is not clear how the project proponents receive and act on feedback from other investigators analyzing IPTDS data. How, for example, would the CSS team inform the

proponents of any changes needed in the location of the project's arrays or the need to add additional ones, e.g., at a critical junction of two streams?

In summary, this project provides new knowledge on methods for monitoring status and trends, and this knowledge is broadly applicable throughout the Columbia Basin. The project provides data needed for harvest management and evaluations of status of ESA-listed populations, as well as to assess the cumulative effectiveness of restoration efforts. Electronic data are shared directly with PTAGIS. Annual reporting is timely and includes appropriate detail.

3. Methods: Project Relationships, Work Types, and Deliverables

The proposal and annual reports include appropriate detail about the operation and maintenance of IPTDS. Project deliverables are described in detail, including (1) install fish monitoring equipment, (2) transfer and store IPTDS data, (3) IPTDS O&M Schedule, Checklist, and Troubleshooting Guide, (4) BiOp reports, (5) produce 2017/2018 steelhead escapement estimates, and (6) produce 2018 spring/summer Chinook salmon escapement estimates.

Sophisticated models are used to estimate escapements past Lower Granite Dam and into upper tributaries. The modeling approach was previously developed and used as part of ISEMP and appears reasonable. The models include: (1) an automated system (PITCleanR) is used to query interrogation data and identify the most likely final spawning destination for PIT-tagged individuals that adopt linear and non-linear migrations; (2) the State-Space Dam Escapement Model (STADEM) generates a single estimate of natural-origin escapement past Lower Granite Dam by combining data from window counts, historical estimates of nighttime passage, adult trap interceptions, and PIT tag interrogation; and (3) the Dam Branch Occupancy Model (DABOM) which expands upstream PIT tag interrogations to estimate escapement. The proposal includes links to reports that explain each of these methods in appropriate detail.

The proponents assessed the adequacy of adult abundance estimates from IPTDS data by comparing them to estimates from other methods (i.e., weirs and redd counts). The results are encouraging and have provided confidence to use IPTDS for long-term status and trend monitoring in locations not amenable to other methods and to replace more costly methods in at least two locations. However, the ISRP is concerned that DABOM is used to generate escapement estimates at very fine spatial scales such that escapement estimates to some tributaries are <50 fish (Tables 6 to 8 in the annual report). We wonder if these fine-scale estimates are precise enough to be useful. Precision improves as estimates are aggregated at larger scales (Table 9). At what scale have the modeling results been validated by fence counts? More formal review by a peer-reviewed journal and/or by the ISAB/ISRP seems warranted.

198712700 - Smolt Monitoring by Non-Federal Entities

- Background info in Taurus: [Project proposal](#)

Proponent: Fish Passage Center, Pacific States Marine Fisheries Commission

Recommendation: Meets scientific review criteria

Comment:

This is a high priority project that is called for in the Fish and Wildlife Program. The importance of this work is clear. The proposal includes the following statement, “The primary goal of the Smolt Monitoring Program (SMP) is to develop a consistent, continuous long term data time series of juvenile salmon, steelhead, lamprey passage characteristics through the mainstem Columbia and Snake River hydrosystem.” This sentence mentions lamprey and the proposal lists lamprey as a focal species, but lamprey are not discussed in the proposal. However, the Fish Passage Center provided extensive documentation of the monitoring protocols for lamprey.

The SMP has been collecting data on the emigration of salmonids and lamprey for over 30 years. They have adapted their methods in response to regional needs and the development of new technology. The data collected and transmitted daily is critical to the real-time management of the hydrosystem and the long-term evaluation of management actions.

1. Objectives, Significance to Regional Programs, and Technical Background

The proposal states the goal of the SMP is to build a long-term time series of passage characteristics for juvenile salmon, steelhead, and lamprey through the mainstem hydrosystem. To accomplish this goal, the project collects daily samples at seven mainstem hydroelectric projects as well as several trap sites that are used to provide juvenile passage index data by species. The project also marks fish with PIT tags at several sites to supplement available data.

The SMP data, which are available on the Fish Passage Center (FPC) and DART websites, provides a basis for fish passage management in real-time and for analyses to assess future fish passage management decisions. These data, for example flow and spill, are critical to the day-to-day operations of the hydrosystem and to subsequent analyses of the success of management actions via the Comparative Survival Study (CSS). The data collected are quantitative and of benefit to many in the Basin.

The technical background for the project was not presented in the proposal but is available on the FPC website. Specifically, sampling protocols and data reporting protocols for each sampling site are available.

2. Results and Adaptive Management

The SMP meets its objectives on a daily basis by collecting and submitting data. The daily data generated by the SMP are transmitted and posted immediately on the FPC website where the data are available to the region. The historical data are available for investigation of future hydrosystem fish passage mitigation measures.

The proposal does not mention a formal adaptive management strategy but rather mentions that data provided by the project may be used to identify problems in fish passage operations that require modifications. That is, the project enables others to adaptively manage the hydrosystem to the benefit of fish. In addition, during its 30+ years in place, the SMP has adapted its methods as needs and technology have changed. For example, monitoring for gas bubble trauma signs began in the late 1990s in response to the voluntary spill program.

3. Methods: Project Relationships, Work Types, and Deliverables

This project is integral to the CSS and FPC projects. The SMP-marked fish are used in the CSS analyses. The proposal and the additional materials supplied demonstrate that the scientific principles and methods are sound and are adequate to meet objectives. The SMP is reviewed annually by state, tribal, and federal agencies to ensure that the project meets objectives.

199008000 - Columbia Basin PIT-Tag Information

- Background info in Taurus: [Project proposal](#)

Proponent: Pacific States Marine Fisheries Commission

Recommendation: Meets scientific review criteria

Comment:

The ISRP appreciates the efforts of the proponents to obtain user feedback through surveys and conferences as well as from this project's steering committee and users like DART. The project would likely benefit from even more effort to obtain user feedback including developing an action plan for evaluating, collecting, and responding to user suggestions for improvement of the data management, interrogation system, and coordination of deliverables. This feedback should improve the valuable services provided the project.

1. Objectives, Significance to Regional Programs, and Technical Background

This project fills an essential need in the region by collecting and maintaining data. PTAGIS is used by all BPA-funded projects where PIT tags are a component of the research or monitoring,

and it also contains data from many projects not funded by BPA. The project has a rich data portal.

The overall objective of the PIT-tag information system is to provide a source of regional scale PIT tag data. These data are used to detect adult fish in ladders, evaluate adult survival, and monitor hatchery effectiveness. This system has now been in operation for many years and is well established. The project provides information as needed for various groups in the region. The measurable goal for the system is to collect 100% valid data and provide those data promptly with downtime of not more than one percent.

2. Results and Adaptive Management

The proposal states that the project does not perform RM&E but rather provides a reference data set that is used by others. Results are provided in terms of informing and guiding policy decisions through PIT-tag data management, installation and coordination of large scale interrogation systems, and coordination in support of PTAGIS software systems. Adaptive management is not apparent in the proposal, but creative adaptation to advances in equipment and scope of interrogation systems is evidenced.

3. Methods: Project Relationships, Work Types, and Deliverables

The proposal describes activities that are used to achieve the objectives in general terms. Deliverables are related to scope of work elements that are referenced in the FY19 contract report.

199403300 - Fish Passage Center

- Background info in Taurus: [Project proposal](#)

Proponent: Fish Passage Center, Pacific States Marine Fisheries Commission

Recommendation: Meets scientific review criteria

Comment:

1. Objectives, Significance to Regional Programs, and Technical Background

This project is responsible for implementation of the Smolt Monitoring Project and the Comparative Survival Study. The Fish Passage Center (FPC) provides the tags and funds the tagging. Objectives are clearly stated and related to important management issues involving fish passage. The project is beneficial to regional management applications through its activities

of coordinating and mobilizing data sets. Project efforts include working toward providing improvements to current scientific practices in fish passage management.

This project has been ongoing for many years. It is not clear if there is a technology planning group that looks to see if methods should be updated over time, both in the field and in data management.

2. Results and Adaptive Management

The project provides support to fisheries management related to juvenile and adult fish passage in mainstem systems. The project deliverables relate to critical uncertainties concerning the effects of hydrosystem operations on migrating fish.

The proposal addresses adaptive management by noting that its life-cycle monitoring program supports adaptive management experimentation. Also, in response to technical management questions from management agencies, an objective is for the project to have knowledge of issues and analytical methods relevant to contemporary fish passage issues.

3. Methods: Project Relationships, Work Types, and Deliverables

Methods used in the project are appropriate. The project employs experienced and stable tagging crews, especially at the remote sites. Fishery management entities in the region use the technical services and products of this project to facilitate fish passage management. The project maintains a long time-series of fish passage data in the Columbia River Basin.

It is not clear how this project interacts with other projects that use other fish tagging methods. Similarly, are PIT-tag data from avian predation investigations integrated into the database?

The proposal provides evidence of an excellent record of delivering products on time.

199602000 - Comparative Survival Study (CSS)

- Background info in Taurus: [Project proposal](#)

Proponent: Columbia Basin Fish and Wildlife Foundation, Fish Passage Center, Pacific States Marine Fisheries Commission, US Fish and Wildlife Service (USFWS)

Recommendation: Meets scientific review criteria

Comment:

The project produces high quality products, is responsive to feedback, and is a critical resource for the Basin. The ISRP encourages this project, which uses PIT tags, and the Statistical Support

for Salmonid Survival Studies project, which uses coded wire tags (CWT), to examine differences in SAR results (see Programmatic Comments).

1. Objectives, Significance to Regional Programs, and Technical Background

This is a long-running project to measure survival of smolts as they traverse the hydrosystem and subsequent SARs. Many projects in the basin rely on and coordinate with the CSS to provide tagged fish for specific projects. The overall objective is to link stages of salmon life cycle to factors influencing survival and to identify how these factors affect smolt-to-adult return rates. This project has an observational study design and the data are intended to apply to management questions including hydropower operations, hatchery evaluations, and habitat management

It is unclear how successful efforts have been to identify opportunities to coordinate marking activities. What are the barriers to more coordination and cooperation for tagging?

2. Results and Adaptive Management

Data and analyses from the project have influenced passage operations related to smolt transportation and spill for fish passage. Adaptive management is occurring in the sense that project life-cycle analyses are being used to compare EIS alternatives. It is not clear how the CSS is made aware of the data needs for adaptive management programs elsewhere in the basin. If there are data gaps that are critical for adaptive management, perhaps the CSS should be part of the planning group looking forward, if one does not already exist.

3. Methods: Project Relationships, Work Types, and Deliverables

The proposal mentions strengthening data and analyses on several fronts that could involve other projects related to delayed and latent mortality, hydropower effects on SARs, tributary productivity related to SARs, additional populations, density dependence in downstream passage, and more. The question of whether there are any plans to include lamprey and sturgeon in life cycle studies is of interest in the region.

Work products are reviewed on an annual basis by the ISAB and are high quality. The CSS is very responsive to the ISAB's suggestions for revisions to their project.

200851800 - Upstream Migration Timing

- Background info in Taurus: [Project proposal](#)

Proponent: Columbia River Inter-Tribal Fish Commission (CRITFC)

Recommendation: Meets scientific review criteria (qualified)

Qualifications:

The ISRP recommends that the proponents describe their responses to the ISRP's qualifications, information requests, and additional questions contained in this review in their upcoming annual report covering FY 2019 accomplishments.

The 2010 ISRP review ([2010-44b](#)) contained the following statement, "In future years the methodology should be used to address specific hypotheses, with detailed descriptions of study plans, statistical methods, desired levels of precision, and necessary sample sizes." These concerns have not been addressed in this proposal.

1. The proponents should identify a plan of action for incorporating suggestions from the 2010 ISRP review to use methodology to address specific hypotheses with detailed descriptions of study plans, statistical methods, desired levels of precision, and necessary sample sizes.
2. The proponents should identify a plan of action to determine if samples are representative, and if not, identify the impact of using information from these samples for decision making.
3. An explanation of the adaptive management process being used by the project to review and possibly modify its actions is also needed.

Comment:

The ISRP encourages the region to investigate the adequacy and likelihood for obtaining representative samples.

1. Objectives, Significance to Regional Programs, and Technical Background

This project tracks samples of returning adult salmon as they move up the hydrosystem above Bonneville Dam. The project helps address critical uncertainties listed in the 2017 Research Plan by collecting data that allow estimation of upstream mortality as fish move through the hydrosystem and into tributaries. Estimation of migration rates between sites and dam passage times helps to monitor fish reactions due to changing river conditions. The data collected by the

project also allow estimation of fallback at dams, stray rates, and the weekly portion of the steelhead run that is B-run. PIT tagged returning adults at Bonneville Dam allows comparison of these fish with data from fish tagged as juveniles.

Many projects use this information as the record of spawners returning to their native streams.

2. Results and Adaptive Management

The project reports seem a bit dated, but presumably the information is available in almost real time for use in the Basin by managers. More explanation is needed on this. An explanation of the adaptive management process being used by the project to review and possibly modify its actions is also needed.

Tracking adults PIT tagged at Bonneville Dam, when combined with use of GSI to identify origin of fish, allows determination of migration timing, stray rates, and upstream survival on a stock-specific basis. The proposal describes situations where the data from this project raised concerns about operations for detection of upstream migrants resulting in alterations in dam operations.

Approximately 48,000 fish have been tracked over the project's lifetime. Results have been summarized by year, species, and objective in annual reports from 2009 to 2018. The total number of fish tracked by year and the number by species are quite variable. An evaluation of the adequacy of the sample size is necessary to determine if the number of fish sampled per year and per species is appropriate. Without an evaluation, it is unknown if the number sampled is appropriate for the multiple objectives of the project. For example, the estimated minimum fallback rates for fall Chinook in 2016 are quite variable from dam to dam with Priest Rapids at 28% while some other dams had an estimated rate of 0%.

The proposal states that a "reasonably representative sample of the run" is obtained. Evidence of this assertion is required. Knowing the extent of bias in the sample is necessary if results are to be useful.

It is unclear if there are critical gaps in knowledge of upstream migration. For example, how is harvest information integrated into the findings? Also, are the impacts of technological change being anticipated? For example, if full parental genotypes can be tracked will the amount of data overwhelm this project? Responsibility for monitoring technological change should be identified.

3. Methods: Project Relationships, Work Types, and Deliverables

Methods are appropriate. The proposal clearly identifies the connection between objectives and deliverables.

It is stated in the proposal that the ability to obtain a representative sample is affected by regulations on the operation of Bonneville Dam Adult Fish Facility. Efforts to determine the effects of having non-representative samples should begin immediately, so the impact of these restrictions on conclusions arising from this project's data can be evaluated.

The project has a good publication record with many project references and citations presented. However, while the proposal states the contract has a good record of delivering annual reports it also states that reports are delivered within 18 months of the end of sampling which seems to be an excessive delay. The proponents are encouraged to provide results before beginning work the following year to provide an immediate opportunity for adaptive management.

199302900 - Survival Estimate for Passage through Snake and Columbia River Dams and Reservoirs

- Background info in Taurus: [Project proposal](#)

Proponent: National Oceanic and Atmospheric Administration

Recommendation: Meets scientific review criteria (qualified)

Qualifications:

The ISRP recommends that the proponents describe their responses to the ISRP's comments and suggestions below in their upcoming annual report covering FY 2019 accomplishments.

1. The project should address the effect of bias resulting from sampling constraints on recommendations for structural and operational changes at Snake and Columbia river dams.
2. The project should conduct an evaluation of bias resulting from missing summer migrants and inability to sample edge habitat in the estuary which may result in size selectivity.
3. The project should evaluate whether its resulting data are adequate to determine how best to operate the hydrosystem given the large impact that changing climate and ocean conditions have on survival.

Comment:

The project is commended for acknowledging the limitations of their data and the overlap of their data with CSS.

1. Objectives, Significance to Regional Programs, and Technical Background

The proposal clearly presents project objectives that are of significance to regional programs. Smolt travel and survival estimates from this study have been important in preparation of biological opinions, for operation of the FCRPS, and for tracking progress of regional fish and wildlife efforts in the Columbia Basin.

Objective 2, which is to detect smolts in the Columbia River estuary with the PIT-tag trawl, should be evaluated in terms of accuracy and precision of survival estimates to determine if the results obtained with current efforts are adequate for management purposes.

Objective 4, which is to relate estimates of smolt travel time and smolt survival with adult returns, should be evaluated to determine whether it is possible to have acceptable confidence in how best to operate the hydrosystem given the large impact that changing climate and ocean conditions have on survival.

2. Results and Adaptive Management

Results from this study are used to guide structural and operational changes at Snake and Columbia river dams to improve smolt travel time and survival.

Over the life of the project, results have been shared through a series of annual reports and peer-reviewed journal articles. Project reports are well written. In recent years, fewer journal articles have been published. An explanation of the adaptive management process being used by the project to review and possibly modify its actions is also needed.

3. Methods: Project Relationships, Work Types, and Deliverables

The project uses standard statistical methods. In response to past ISRP reviews the project proponents have satisfactorily considered the limitations of the data collected by the project. Past responses to ISRP reviews stated that the project is not designed to estimate SARs and does not have a sufficient number of smolts tagged to make extensive evaluations of adult returns. It is not clear from the current proposal if this limitation continues.

199105100 - Modeling and Evaluation Statistical Support for Life-Cycle Studies

- Background info in Taurus: [Project proposal](#)

Proponent: University of Washington (UW)

Recommendation: Meets scientific review criteria

Comment:

This proposal and project are models for how other projects could be described and conducted.

1. Objectives, Significance to Regional Programs, and Technical Background

This proposal clearly describes statistical analysis of fish tagging data and data from monitoring and evaluation projects that are critical for making management decisions for the Columbia River hydrosystem. The proposal clearly describes what analyses and results will be produced each year, as well as the type of other studies anticipated to aid in monitoring and evaluation. Overall, the objectives, significance, and technical background are clearly presented.

This project is important for regional programs that need to have the best available science for protecting, mitigating, and enhancing fish and wildlife management of the hydropower projects. This project helps address critical uncertainties such as how hydrosystem operations could be changed to benefit fish. The success of spill augmentation to enhance smolt outmigration depends on knowing smolt run timing in real time.

Monitoring methods developed by this project focus on collecting and using non-tagging data to make management decisions. The proposal clearly differentiates the focus of this project from that of project 1989-107-00, Statistical Support for Salmonid Survival Studies, that involves the design and analysis of tagging studies. Both projects emphasize that for data to be useful it must be both accurate and precise.

The Fish and Wildlife Program calls for status and trend monitoring for the hydrosystem, tributaries, estuary, and harvest. Dissemination of monitoring information is important and dissemination of in-season data via the internet is an effective way of providing access to useful data for management decisions. Forecasts of run timing are posted on the UW DART website.

BPA has requested that this project provide information to support BPA's ability to make independent decisions. The analytical support and technical skills provided by this project are highly useful.

2. Results and Adaptive Management

This project clearly met its objectives to provide real-time monitoring of smolt outmigration by stock and location for hundreds of stocks, and estimates of juvenile and adult survival needed to assess fish passage and life-cycle information for many salmonid stocks. The project also meets the objectives of increasing the rigor of sampling and analysis for monitoring and evaluation projects throughout the Columbia River Basin and of providing the best available scientific information on which management decisions, including adaptive management, depend. The lessons learned and results provided are broadly applicable inside and outside the Basin, and are routinely used to fine-tune or even alter management policies. Results are shared widely through easily accessible and easily understood websites. Evidence about the impact of the availability of results should be provided in future reports and publications.

Predictive performance of smolt migration is generally good; however, questions arise such as how could predictive performance be made better? Is the current performance adequate, inadequate, or better than needed for managing spill augmentation?

The project has an excellent record of producing peer reviewed publications. The project proponents note in the proposal that collaboration with field investigators has resulted in the joint publication of 28 journal articles and 82 technical reports over the life of this project.

3. Methods: Project Relationships, Work Types, and Deliverables

The proposal clearly describes the activities conducted and planned, and it has met its objectives. The proposal describes the research products produced, and the proponents have an excellent track record of producing peer-reviewed publications of the highest quality, in addition to timely technical reports and real-time information disseminated via websites.

This project uses statistical methods developed by Project 1989-107-00 for analyzing tagging data to produce status and trend performance measures. This project generates analyses of historical tagging data that is used in Project 1989-107-00 to improve the design and analysis of tagging studies. This project uses data from Project 1990-080-00 (PTAGIS) for PIT-tag data and from Project 1982-013-01 for CWT data.

The work type for this project is 100% RM&E and Data Management. Deliverables are closely aligned with the four main objectives of the project.

199601900 - Data Access in Real Time (DART)

- Background info in Taurus: [Project proposal](#)

Proponent: University of Washington

Recommendation: Meets scientific review criteria

Comment:

The project is to be commended for looking at ways to add value to the database. For example, the project plans to provide information to hatcheries that can be used for managing hatchery practices.

1. Objectives, Significance to Regional Programs, and Technical Background

Objectives are clear. The project provides support for the COMPASS life-cycle model.

The proposal identifies that this project's significance to regional programs is due to providing data integration, web-based information, and analytical services that help connect primary databases, monitoring programs, decision makers, and resource users.

2. Results and Adaptive Management

The proposal states that services provided by this project support critical uncertainties research themes (D) Hydrosystem flow and passage operations and (F) Population structures of diversity identified in the Council's 2017 Research Plan. This project also reports data availability, data anomalies, formatting, and accuracy issues to primary data sources. Evidence of the amount and utility of this feedback to primary sources would be useful for this and future ISRP reviews.

Adaptive management is mentioned in the proposal in the sense that this project generates products such as data tools, analysis methods, and predictive models that can be used to support all areas of Fish and Wildlife Program adaptive management. It appears that adaptive management per se is not applied within this project but could be of use to consider the impact of vastly more data from increased detections, more precise detections, and additional methods of tagging.

3. Methods: Project Relationships, Work Types, and Deliverables

The proposal documents relationships that this second-tier data base has with many data base projects in the region. This project is a data management work type with data management issues dealt with properly. The interactive web-based query system appears to work very well. Most of the sources for DART data are the entities that provide public access to primary data. This project provides access to its research database through a web-based interface and

through delivery of user-requested datasets and metadata. It is not clear how it is decided which data should be stored in DART.

The project develops procedures to ensure the quality of all integrated datasets. It also provides feedback to primary data sources on data quality issues.

198910700 - Statistical Support for Salmon

- Background info in Taurus: [Project proposal](#)

Proponent: University of Washington

Recommendation: Meets scientific review criteria

Comment:

The ISRP encourages this project, which uses coded wire tags (CWT), and the CSS project, which uses PIT-tags, to examine and explain the difference in SAR results (see Programmatic Comments).

1. Objectives, Significance to Regional Programs, and Technical Background

The overall objective is to design and analyze fish tagging studies using peer-reviewed statistical methods, so the best available information is obtained. The methodology will be shared with others involved with fish tagging through peer-reviewed publications, reports, workshops, and shared analysis software. The proposal provides details on the approach the proponents plan to use to improve the rigor, defensibility, and cost effectiveness of tagging studies.

The statistical services and products provided by this project make a major contribution to fish-tagging studies by state, federal, tribal, and academic entities throughout the region. The project has provided continuity of statistical support for both as-needed and anticipated needs to multiple parties in the region. The statistical software developed by project personnel is used throughout the region.

The project has direct significance to the 2014 Fish and Wildlife Program to use the best available science to protect, mitigate, and enhance fish and wildlife populations in the Columbia Basin. The proposal also connects the project objectives to critical uncertainties identified in the 2017 Research Plan.

The proposal explains the technical background in adequate detail and makes the point that the need for this ongoing project continues because tag technologies evolve as RM&E needs change over time.

2. Results and Adaptive Management

The proposal gives a summary of results that the project provides in support of regional tagging studies such as development of tagging models for new and complex investigations, publications on the design and analysis of tagging studies, development of statistical software for designing and analyzing tagging studies, participation in regional workshops, and providing statistical consulting for the design, analysis, and interpretation of tagging studies.

Adaptive management is discussed in terms of how advances in knowledge, new tagging technologies, and BiOp standards require changes in the design and analysis of tagging studies.

3. Methods: Project Relationships, Work Types, and Deliverables

Methods used are appropriate and up-to-date. The project has resulted in several peer-reviewed papers published in appropriate journals. The project provides support for tagging studies in the Basin and uses PIT-tag and CWT data from other projects. The project uses project DART as a repository for software and assorted materials.

This project is 100% RM&E work type.

Deliverables are clearly identified in the proposal as developing methods for the design and analysis of tagging studies, developing and maintaining statistical software for tagging studies, providing statistical consulting on the design and analysis of tagging studies, and providing BPA with technical assistance and peer review of tagging proposals and reports.

The ISRP appreciates the fact that in response to previous ISRP recommendations, project staff now keep ledgers and report time spent on consulting activities. In addition, surveys have been added to websites that allow user feedback, course evaluation forms are used for classes on software use, and records of unsolicited comments, acknowledgments, and suggestions are maintained.

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