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

February 6, 2018

MEMORANDUM

TO: **Fish and Wildlife Committee members**

FROM: **Tony Grover and Bryan Mercier**

SUBJECT: **Alternatives to implement Fish and Wildlife Program cost-savings language**

Presenters: Tony Grover and Bryan Mercier, Executive Manager, Fish and Wildlife, Bonneville Power Administration

Summary: The Cost Savings Workgroup (CWS) was authorized by the Council in 2015 to find cost savings within existing projects in order to fund new work. This was an effort to carry out the directive in the 2014 FW Program that "*Bonneville should fund any new fish and wildlife obligations from identifying savings within the current program and as necessary, from additional expenditures.*" The Council recognized that this would be an opportunity to coordinate with BPA to find savings, thus ensuring that emerging program priorities including long term maintenance of assets would be funded. This practice effectively ended the BPA practice of redirecting funds without Council input.

The Council approved a methodology to guide the CSW. The methodology was a way to establish a protocol, maintain consistency, and ensure candid communications within the group. The CSW was not a decision-making body, rather, it made recommendations to the committee and ultimately, the Council. Over time, however, some staff expressed concerns that the workgroup was not sufficiently open and transparent. Meetings were not advertised as "public" because of the need to protect and share sensitive information regarding the status of contract

performance and project deliverables. Given the sensitivity around funding decisions, the CSW worked to fully understand the complexities of any potential savings opportunity before bringing a recommendation forward.

In addition to staff concerns described above, the methodology is incomplete as it does not outline how cost savings are to be allocated. The Committee did approve the workgroup's consideration of new projects for funding, including O/M costs, so that the funds were utilized in the fiscal year they became available, but there was no formal mechanism in place.

Given these circumstances, there is a need to re-evaluate the cost savings process. Staff seeks input from the Committee regarding the future of the CSW and how it should function. Three potential alternatives are:

1. Update the current methodology to reflect the changes approved by the Committee and Council since July of 2015 and then reauthorize the CSW for an additional three years, or
2. Integrate the best practices and the lessons learned from the CSW into Council and BPA staff interactions. Retain the accounting tool (see Table 1, below) to track identified cost savings and Council decisions about the use of cost savings, or
3. Create a formal charter for the CSW and recruit workgroup members from around the region to implement the CSW functions.

Council and BPA staff **recommends alternative 2** and will discuss the advantages and disadvantages of each alternative with the Committee.

Relevance: The cost savings workgroup implements the language on page 116 of the 2014 Fish and Wildlife Program: '*Bonneville should fund any new fish and wildlife obligations from identifying savings within the current program…*'

Background:
Council member Anders chairs the CSW, which is composed of Bryan Mercier, Peter Cogswell, and Scott Donahue of BPA and Kerry Berg, Lynn Palensky, Laura Robinson and Tony Grover, of Council staff. The cost savings workgroup initially developed a cost savings methodology, which was approved by the Council at the regular July 2015 meeting in Spokane. Additional information about the cost savings workgroup and the methodology can be found on the Council's website, including a 'frequently asked questions' document that explains what the cost savings workgroup does and how it goes about identifying and vetting potential cost savings.

The CSW is not a decision-making body, and refers to the Fish and Wildlife Committee (Committee) and Council all recommendations about identified cost savings, opportunities to identify cost savings and potential uses for identified funds.

As previously described, BPA has created a reserve fund for cost savings beginning in FY 2017. The availability of funds is dependent on: 1) the spending trajectory within the rate period, and 2) developing a process to reallocate funds to other priorities. Experience gained over the last two years suggests a need to update the methodology to accurately reflect this joint BPA/Council initiative.

The CSW has functioned in two primary ways:

Mechanistic:
Twice per year BPA 'sweeps' through all the fish and wildlife projects to identify any project that is closing out or is anticipating a cost reduction greater than $50,000. In its first sweep through all fish and wildlife projects in FY2015 the CSW used a 'mechanistic' approach to finding projects that meet the criteria in the cost savings methodology. That effort netted two projects and around $183,000 in savings. Again in FY2016 the CSW used the mechanistic approach. That effort, presented to the Committee in March 2016, netted four projects and over $560,000 in savings. In FY2017, the CSW used both the mechanistic approach and a focused review (information provided below). That effort netted an additional three projects and the savings grew to roughly $1.1 million. Most of the projects identified for savings are in the process of a smart closeout, meaning that their funds will ramp down by approximately one-third each year for three years. Due to this process, the savings increases each year until the projects completely close out.

Focused Reviews:
Former-Committee Member Rockefeller requested the CSW members to explore other opportunities for cost savings that would be in addition to the 'mechanistic' cost savings approach. The CSW discussed this and developed three potential opportunity categories, which may or may not involve the cost savings workgroup. The three categories of potential cost savings include:

A. **Projects or components of projects identified through programmatic review:** Periodic review may result in identification of certain projects or groups of projects that are not providing the anticipated results, are no longer relevant, or are not scientifically sound.

B. **Projects with a common subject matter that may no longer meet program goals:** New scientific information or a change in policy direction may render projects within a particular subject matter of questionable value. This may be a cost savings opportunity, or an opportunity to adjust project focus to reflect the new information or policy direction. Either way, the effort results in more efficient and focused mitigation efforts.

The Council has sponsored topic-specific science/policy workshops in the past with the intention of clarifying policy direction related to the topic. The workshops are often used to discuss the new information or policy direction, how funded projects fit within the new direction, and what should happen next. The information gathered from these workshops, or any regular project review process, could result in cost savings to be considered by the Committee/Council and could involve the cost savings workgroup. For example, as we update the

research plan, the Council may find opportunities to streamline RM&E projects, which may also result in cost savings benefits.

C. **Project specific scrutiny:** The CSW recognizes that individual projects may be perceived to have specific problems that arise outside of project/programmatic review. An example might be a project conducting work outside the scope of work or project proposal. If the Committee desires, the CSW could serve to pre-screen/review these individual projects to inform the Committee on whether to look more deeply into the project or to keep the project within the normal category review cycle.

CSW recommended Policy Review of focus areas within BPA's Fish and Wildlife Program.

At the May 2016 Committee meeting the CSW requested and received Committee support to try finding additional cost savings within a small, discrete group of similar projects (category B, above). The CSW proposed to explore how to examine a category of projects in an open, fair and unbiased manner.

The purpose was to conduct targeted reviews to help inform the Committee of strategic opportunities to improve project or Program efficiency and effectiveness. The CSW identified the following attributes of program areas to consider for the initial topic area review:

a. Program area with a narrow focus and a limited number of projects,
b. Program area with projects that have (or had) discrete timelines and scope,
c. Program area consistent with the principles of the Cost Savings Methodology

Based on these considerations, the CSW suggested to the Committee that *Relative Reproductive Success* studies would be a potential candidate for a programmatic review. A year later, the CSW recommended a similar review of BPA funded *rotary screw traps*. The Committee supported both reviews.

The CSW has focused on two policy reviews at the behest of the Council:

- Review of all relative reproductive success projects funded by BPA (complete).
- Inventory and review of all Bonneville funded rotary screw traps (in-progress, nearly complete).

How does the Council and BPA use Cost Savings for fish and wildlife work?

As part of fish and wildlife division's annual work plan, Council staff tracks what is happening within each emerging priority area at a high level. Staff made an initial assessment of the current status and progress in the emerging priority and other programs areas to understand where there might be opportunities to expand existing work or fund new work in. Some considerations included the likelihood of expending funds in one year from time of contracting and 'readiness' to proceed. The Committee feels it important to start with program areas that can be implemented immediately.

Unsolicited proposals: While the CSW has not solicited untargeted project proposals, a few short project proposal summaries have been submitted to the CSW to consider for

near-term funding. The topic areas include hatchery effectiveness and habitat work related to climate change. At this point the CSW will keep those in a dynamic list of potential opportunities for consideration should the Council provide direction to prioritize work in those program areas at a later date.

BUDGETARY/ECONOMIC IMPACTS
No increase in overall program spending since the funds came from within savings in the current program budget.

Note: Decisions for the use of cost savings have usually stimulated the use of accord funds prior to the funds identified in the table 1 below.

Considerations for the use of cost savings
Cost savings (Table 1) have been allocated to emerging priorities as identified by the Council in the 2014 Fish and Wildlife Program Investment Strategy or, if implementation ready fish and wildlife work has not been identified within a fiscal year, then returned to the BPA reserves. As previously described, BPA has created a reserve fund for cost savings. The availability of funds is dependent on: (1) the spending trajectory within the current BPA rate period, and (2) developing a process to reallocate funds to other priorities.

At the May and October 2016 Fish and Wildlife Committee meetings the CSW requested and received committee support to explore approaches to identifying potential projects or program functions to apply identified cost savings. Staff recommended and the Committee agreed that projects that could be completed in one or two years are preferred, so as to maintain the capacity of the cost savings into the future for emerging priority work. Approaches that have been explored include:

1. Allocating funds directly to existing projects to implement elements of the 2014 program's emerging priorities as identified on page 116 of the program and
2. Soliciting proposals (targeted) to implement emerging priorities and other measures in the 2014 program.

Direct Allocation
This approach worked well for allocating cost savings funds for priority O&M work. Depending on the facilities and the need, Bonneville has the flexibility to develop direct contracts with existing project implementers or with contractors who are best suited to complete the repairs or replacements of infrastructure. The work to address operation and maintenance of mission critical components of BPA-funded fish hatcheries and fish screens has been through direct allocations.

Targeted Solicitation (RFI or RFP)
The Council and BPA have recent experience with the successful completion of just this kind of a targeted request for proposals (RFP) process in the Lake Rufus Woods and Lake Roosevelt Habitat Assessment work and with requests for information (RFIs) to identify white sturgeon work. This approach, while a longer time commitment for staff, might work well to identify additional priority work for program priorities. After Committee and Council approval, staff works to maintain the benefits and attributes of a targeted

solicitation, while compressing the timeline as much as possible for a near term one or two year implementation window.

After the CSW obtains the committee's preference for solicitation topics, the CSW will bring all successful proposals, following ISRP review, to the committee for a decision. The proposed project(s) are then brought to the Council for a decision whether or not to make an implementation recommendation to BPA.

Leveraging existing processes:
At this Committee meeting, staff will present yet another approach to identifying lamprey projects for possible use of cost savings. Staff will present the results of an ISRP review of the *Pacific Lamprey Conservation Initiative Columbia River Basin Projects,* which may result in a recommendation to fund 'shovel ready' projects within the Columbia Basin. If this work is supported by the Committee, staff will bring it to the Council the following month for a decision to recommend.

More Info:

Table 1. Current status of Cost Savings identified by source and allocations to new work.

	Cost Savings Budget Tracking				updated 1/8/2018	
Credit		FY2016	FY2017	FY2018	FY2019	FY2020
2007-404-00	Captive Brood		$355,007	$355,007	$355,007	$355,007
2007-404-00	Captive Brood			$77,773	$77,773	$77,773
1982-013-03	CWT-USFWS		$29,162	$29,162	$29,162	$29,162
2006-006-00	HEP	$90,502	$90,502	$90,502	$90,502	$90,502
2010-076-00	Snake River	$92,244	$92,244	$92,244	$92,244	$92,244
2010-033-00	RRS-Methow		$85,000	$85,000	$85,000	$85,000
2003-063-00	RRS-Abernathy			$196,670	$393,340	$590,010
2007-299-00	RRS-Deschutes			$110,000	$220,000	$330,000
2010-034-00	WDFW - LCM			$75,000	$75,000	$75,000
Total savings found		$182,746	$651,915	$1,111,358	$1,343,028	$1,649,698
Debit		FY2016	FY2017	FY2018	FY2019	FY2020
2016-003-00	Blocked area		$100,000			
1994-043-00	N. Pike		$40,000			
	Sturgeon RFI			$283,000	$233,000	
	O&M - Hatcheries		$115,000	$238,000		
	O&M - Fish screens			$236,000		
Total savings utilized		$182,746	$255,000	$757,000	$233,000	$0
Unspent savings		$182,746	$396,915	$354,358	$1,110,028	$1,649,698

* Unspent funds will be moved to BPA reserves at the end of each fiscal year.

Results of focused Reviews:

Relative Reproductive Success Projects
The RRS workshop was well-attended and participants actively engaged throughout the entire day. The level of interest and participation demonstrated the value of a policy level review of projects, as well as regular coordination among projects of similar scope and subject matter. See **Attachment 1**, below, for a full report on the RRS workshop, which was presented to the Committee in December 2016. Two projects were put on a course toward close-out as a result of information gained at the workshop or in a subsequent follow-up meeting. The savings identified are listed in **table 1** above.

Bonneville funded Rotary Screw Traps
The cost savings workgroup recommended staff and Bonneville conduct a policy review on the location, number, and utility of BPA funded rotary screw traps for juvenile salmonid monitoring.

The policy review of the screw traps component of the smolt monitoring program may include:

a) Locate, confirm basic data (years of operation, objectives, methodologies employed by the operators, etc.), conduct a policy level review of all screw traps funded by BPA, and examine for geographic efficiencies based on identified needs.
b) Consider the ability of the trap to meet its objectives. For example, many screw traps are operated to estimate outmigrant abundance, but the confidence in the abundance estimates are routinely as large or larger than the estimate itself (due to low or variable trapping efficiency), thereby rendering the outmigrant estimate of limited value.
c) Consider the data management aspect of the program(s) – is the operator exercising best practices for data management (i.e. strong data management plan, timely flow of data into an identified data repository, etc.)

Staff recommended this policy review be conducted in a manner similar to the Relative Reproductive Success project review, which consisted of gathering basic information, developing questions for project managers, compiling the information received in response to questions, a day-long meeting in Portland with the project leads that use screw traps and then a final set of recommendations by the cost savings workgroup to the Committee and the Council. The recommendations may suggest an ISRP review in some instances.

Results to date of the Rotary Screw Trap review:
Rotary screw traps: Council and Bonneville staff agreed to look closely at the array of rotary screw traps funded through the BPA fish and wildlife funds. Council member Norman is leading the screw trap review. An updated inventory of screw traps was compiled by Bonneville Staff. Sponsors were sent the inventory and a letter with a list of questions compiled by Council and Bonneville staff with responses due by the end of October. Staff summarized responses in November and scheduled a series of phone call with sponsors on December 14 to ask follow up questions.

General observations regarding the conversations with project sponsors on December 14th:

- More than 100 screw traps are fully funded or funded in part by BPA within the Columbia River Basin. Information obtained through this review will provide a clearer sense of what O&M requirements are for these important assets.

- The majority of the sponsors are deploying the screw traps efficiently and successfully. Challenges such as ice, high flows, low flows, streams changing course and vandalism are being appropriately managed.

- Trap efficiencies are being tested routinely. In a few situations with few fish and flashy streams, innovative statistical techniques are required to calculate out-migrant abundance estimates.

- Most sponsors have close working relationships with hatcheries, and are well informed of any upstream hatchery release, and take appropriate actions to avoid overwhelming the trap.

- For the most part the fish data gathered from the screw traps is being properly reported and the data are being used to make appropriate management decisions.

- BPA staff will follow-up with individual sponsors to work through any remaining screw trap deployment or data reporting issues.

Council and Bonneville staff will continue to coordinate on a summary of this effort which will be completed in the spring of 2018.

Potential future policy reviews:
CSW members have discussed additional topics for consideration for potential policy reviews of a discrete group of related projects:

- Location, number, and utility of Bonneville funded PIT tag detection arrays.

- Review of the use of genetics tools and methods

- Stream temperature monitoring

- Nutrient enhancement studies

- Other

More information:
In October 2017, staff compiled a draft history of the CSW, which can be accessed here.

Attachment 1:

Cost Savings Workgroup Report: Relative Reproductive Success Projects

Background

On October 13, 2016, the Northwest Power and Conservation Council (Council) and the Bonneville Power Administration (BPA) held an all-day public workshop on Relative Reproductive Success (RRS) projects within the Fish and Wildlife Program. RRS projects are studies used to evaluate the potential effects of hatchery fish on the ability of wild populations to spawn successfully if genetic intermingling occurs. Studies for both chinook and steelhead are underway. The RRS workshop had two purposes:

- Knowledge sharing and retention as some of the RRS projects close out;
- Cost savings that can be identified and repurposed for other emerging priorities in the future.

A letter was sent to all project sponsors of RRS projects on September 15, in preparation for the October workshop. Summaries of each RRS project were compiled by the workgroup and attached to the letter. The summaries were written in a common format and included project-specific questions identified by the workgroup. The project sponsors were asked to consider their responses to the questions common to all RRS project that the workgroup proposed in the letter, as well as their project-specific question in the project summary. The questions that all project sponsors were asked to consider are:

- How does this project inform (1) the Council's Research Plan and (2) the Council's Fish and Wildlife Program objectives?
- Can any results from this study be extrapolated to other geographic locations or other populations?
- How does the Idaho Supplementation Study (1989-098-00) inform this project?
- Please provide the following information relative to this project:
  (a) A scientific question;
  (b) A hypothesis;
  (c) A specific time frame within which to answer the question posed.
- How did you determine which species or geographic area to study?
- How are you working or collaborating with other RRS projects on aspects of your study (methodology, data and conclusions)?
- How does *density dependence* factor into your studies moving forward?

The RRS workshop provided time for introductory comments from the Council, BPA, and a representative of the Columbia River Inter-Tribal Fish Commission (CRITFC); ten 25-minute slots for each project starting with the project sponsor(s) providing an overview presentation on the project followed by questions from the workgroup and other workshop attendees; and wrapped up with a lengthy group discussion addressing what was heard in the workshop and what seem like the logical next steps for this group of work. The workshop was well-attended with over 30 project sponsors and others in the room, and many on the phone, from the Council (central and state offices), BPA, NOAA Fisheries, US Fish and Wildlife Service, Washington Department of Fish and Wildlife, Oregon Department of Fish and Wildlife (ODFW), Idaho Department of Fish

and Game, Yakama Nation, Nez Perce Tribe, CRITFC, Upper Columbia Salmon Recovery Board, University of Washington, and Oregon State University. Brief notes were taken at the workshop, primarily focused on the discussion. The notes can be found below, and the presentations can be found on the Council's website.

The ten BPA-funded RRS projects form a discrete group, some of which are closed, or are heading towards closure. Those RRS projects closing out are generating identifiable cost savings. With the RRS workshop, the workgroup gained a better understanding of each of the ten RRS projects and facilitated knowledge and expertise sharing among the sponsors. The workgroup felt this was important to do before any of the RRS knowledge and expertise is irretrievably lost as principal researchers move on once the project is closed.

At the close of the meeting, the workgroup committed to composing a report to share with the Council's Fish and Wildlife Committee that would put forth recommendations on the RRS body of work. Since the workshop, the workgroup compiled staff notes and created this report for Committee consideration. Additionally, the workgroup is meeting one-on-one with RRS project sponsors to further discuss their projects. The workgroup will follow up with the Fish and Wildlife Committee if any further action is necessary.

Additional Information
In 2016, the Independent Science Advisory Board (ISAB) and the Independent Scientific Review Panel (ISRP) produced the report *Critical Uncertainties for the Columbia River Basin Fish and Wildlife Program* (ISAB/ISRP 2016-1), which contains background text that summarizes and expands on the information shared at the RRS workshop. This excerpt from the ISAB/ISRP report provides a general overview of the Basin's RRS studies and gives reviews of the recent annual reports produced by each RRS project. This excerpt from the report discusses the current status and progress made on the seven critical artificial propagation uncertainties that were listed in the Council's 2006 Research Plan.

Staff Analysis and Cost Savings Workgroup Recommendations
The Council and BPA have funded a number of important RRS studies, and these studies are leading the way on this complex topic. Significant progress has been made, but progress also leads to new questions. For example, RRS studies have shown some genetic effects on wild fish due to artificial propagation, reduced productivity of hatchery fish in the wild, some density effects on steelhead populations, higher RRS for wild Chinook than hatchery Chinook, geographic and species differences in RRS results, and more; however, the more that is learned, the more uncertainties are raised.
A considerable amount has been learned and the ongoing studies that were presented at the RRS workshop are set to provide the region with additional valuable information. It is important to note that project sponsors stressed that not all RRS studies can be applied elsewhere, as there are various geographic, watershed conditions, species, and study differences at each location. Topics and questions that appear to Council staff to be the most pertinent to explore at this time are:

a) Examine further the RRS of Chinook and other species, and how they relate or differ from the RRS of steelhead;

b) Identify the long-term effects of supplementation on the relative fitness, abundance, productivity, and capacity of wild stocks;
c) Evaluate if better hatchery management practices could result in reduced genetic impacts, and determine if and how the results of RRS studies inform and improve hatchery practices;
d) Identify and tease apart environmental effects from genetic effects;
e) Examine whether surplus hatchery fish could be harvested to benefit both the wild population and fisherman.

Based on the information gathered prior to the workshop and the discussion held at the workshop, the workgroup developed the following recommendations for the Council's Fish and Wildlife Committee to consider as recommendations to the Council.

- The Council will coordinate an annual RRS meeting to facilitate further knowledge sharing between RRS project sponsors in order to improve and advance this body of work. The ISAB/ISRP 2005-15 report *Monitoring and Evaluation of Supplementation Projects* proposed that such a meeting should occur to develop a Basin-wide plan to evaluate the effects of supplementation, and could be used to coordinate efforts among researchers in the Basin to answer outstanding questions about supplementation. The RRS project sponsors also requested at the RRS workshop that similar meetings be planned for the future.
- The workgroup found that the initial study design for the US Fish and Wildlife Service's project (#2003-063-00) *Natural Reproductive Success and Demographic Effects of Hatchery-origin Steelhead in Abernathy Creek, Washington* was unable to be met in the time that the work has been conducted. Considering this, the project sponsors began to rescope the project, which they shared at the RRS workshop. The workgroup recommends that the Fish and Wildlife Committee recommend a smart close-out for this project, and that the funds be allocated to the cost savings budget for future use on a new project or research.

Meeting Notes

The following are brief meeting notes pertaining to the discussion portions of the October 13 RRS workshop. These notes are intended to summarize comments from the RRS project sponsors and workshop participants and do not reflect any views of the Council or BPA.

RRS Workshop Notes
October 13, 2016
Northwest Power and Conservation Council central office – large and small conference rooms

Cost Savings Workgroup members present: Jennifer Anders, Tony Grover, Bryan Mercier, Kerry Berg, Lynn Palensky, and Laura Robinson

Agencies represented in the room and/or on the phone: The Council (central and state offices), BPA, NOAA Fisheries, US Fish and Wildlife Service, Washington Department

of Fish and Wildlife, Oregon Department of Fish and Wildlife, Idaho Department of Fish and Game, Yakama Nation, Nez Perce Tribe, CRITFC, Upper Columbia Salmon Recovery Board, University of Washington, and Oregon State University

Opening comments provided by Jay Hesse on behalf of the Columbia River Inter-Tribal Fish Commission:

- Hatchery effectiveness assessments are complex and being implemented for varying reasons, but generally are designed to assess if mitigation targets are being met.
- Urge the Council and BPA to gather multiple perspectives at the technical level and mold that into a policy decision rather than just focusing on policy. The review for the RRS Workshop was not technically comprehensive, nor were all parties presented, therefore judgement of the projects should be reserved for a more comprehensive technical and policy review with all parties involved.

Project 2003-050-00: Evaluate the Reproductive Success of Wild and Hatchery Steelhead in Natural and Hatchery Environments

- This project focuses on Forks Creek hatchery in Willapa Bay and is conducted by the University of Washington.
- The RRS of hatchery and wild fish in the wild could not be measures. According to presenter, Todd Seamons, they were an “utter failure” at meeting their objective. The weir was not effective, only catching a tiny fraction of fish. When they realized that their primary objective was not achievable, they withdrew from BPA funding. They re-thought their hypothesis and went for a different objective and research plan that did not have a nexus to the hydrosystem and they therefore sought funding elsewhere.
- As Tony stated, negative results are as good as positive results in information sharing and understanding of RRS projects.

Project 2003-063-00: Natural Reproductive Success and Demographic Effects of Hatchery-Origin Steelhead in Abernathy Creek, Washington

- Much has been learned about conservation hatchery practices over the two decades of this project.
- A minimum of four years is needed to finish their current research which focuses on how to minimize domestication selection.
- Density dependence has been difficult to assess due to its complexity, and the sponsors are uncertain how habitat restoration efforts nearby will or have effected their study.
- Steelhead were chosen for this study given that they can get over barriers quickly and have a diversity of life history. Dan Rawding added that the mid- to late-90s saw a significant drop in natural-origin steelhead returning to this area so it was seen as a location to test how supplementation would impact the population numbers.
- There is a need to understand steelhead population dynamics and structures to effectively assess RRS.

- While there has been no focused coordination of this project with other RRS projects, the sponsors do learn from the other project sponsors.
- The focus of any future research would be conservation nutrition, measures that reduce the potential for negative interactions between hatchery and wild fish, and spawning and rearing protocols to reduce disturbance.
- WDFW works within this broad research question: *how can we make hatchery fish more like wild fish?*

Project 2007-299-00: Investigation of Relative Reproductive Success of Stray Hatchery & Wild Steelhead & Influence of Hatchery Strays on Productivity in the Deschutes

- This project chose steelhead as the species of interest because the Deschutes steelhead population was considered at-risk for extinction due to straying out-of-basin Snake River hatchery fish.
- This project uses a BACI design with Bakeoven Creek as the treatment site and Buck Hollow as the control. Hatchery fish are blocked from accessing Bakeoven, while in Buck Hollow hatchery fish are counted and allowed upstream. After five years, hatchery fish will be blocked from both streams, so they will both be treatment streams. This approach is taken to determine where stray steelhead are spawning, track parentage, and understand the population dynamics.
- Complete brood years are needed before the study questions can be answered. Those steelhead will not be returning until at least next year and so this study is considered on-going and incomplete at this point. Two to three more years is needed to complete the study.
- 60% of the hatchery fish can be assigned to their hatchery of origin.
- The project sponsors have addressed the Council recommendations in their reports to BPA. The project sponsors have committed to working with BPA on a report responsive to the ISRP request, and the Cost Savings Workgroup has agreed to meet with the project sponsors to go over this project in further detail.

Project 2003-054-00: Evaluate the Relative Reproductive Success of Hatchery-Origin and Wild-Origin Steelhead Spawning Naturally in the Hood River

- This 19-year study has shown that hatchery fish have much lower fitness than wild fish and that there is evidence of rapid adaptation to captivity. The project sponsors found that a fish born from two hatchery parents performs worse in the wild and better in the hatchery.
- The cause of RRS is different between species, and different RRS has only been shown to have a genetic component in steelhead.

Project 1996-043-00: Johnson Creek Artificial Propagation Enhancement

- The methods used to estimate RRS in this study are different that all other RRS studies. At Johnson Creek only parents that had offspring were included. When the more common method for studying RRS was used, the RRS of hatchery fish was lower than the RRS of wild fish.
- A total of 25 years of funding is expected for this study, with eight years remaining. What happens after the study is complete? The limiting factors have not been mitigated for so it is unlikely that artificial production would cease for this area. Additionally, given that no populations in the Snake Basin have

achieved recovery or been delisted, it is unlikely that this population will, so supplementation is likely in the long-term plan.

- Johnson Creek does not have a density dependence issue, though when jacks are present the spawning success is poor.
- The Idaho Supplementation Studies (ISS) used Johnson Creek data to inform results.
- Information from this study can be applied to others so long as the same impacts/effects are applied such as weir use, study design, etc.
- The project sponsors emphasized that the perception of the RRS workshop was to find funds to cut, so the sponsors are feeling defensive. They also expressed interest in the Council continuing these workshops with the intent for sponsors to continue to share information and learn from one another.

Project 2003-039-00: Monitoring the Reproductive Success of Naturally Spawning Hatchery and Natural Spring Chinook Salmon in the Wenatchee River

- NOAA has several RRS studies in the Basin – the others are not funded by BPA.
- This project uses a BACI design and has run from 2004 continuing to 2018 to examine a total of 3 generations of spawners.
- They have found that male fitness is lower than female fitness.
- Not much has been seen of genetic effects on RRS but the project sponsors would like to keep studying this.
- This project is concurrent with a steelhead RRS study in the basin, though this project focuses only on spring Chinook.
- This study replicates the Hood River study looking at broodstock makeup, and almost exactly replicates those results.
- The project sponsors are hoping to nail down the genetic effects difference between steelhead and spring Chinook before wrapping up the study in 2018.

Project 1989-096-00: Genetic Monitoring and Evaluation (M&E) Program for Salmon and Steelhead

- This is a long-term monitoring project with an RRS component. RRS is studied at various geographic scales.
- Year-to-year variation is seen based on in-basin and out-of-basin factors.
- The longer the stock is exposed to the hatchery, the more effect seen.
- At Sheep Creek, the RRS of steelhead has shown to be lower than wild since 2000. At Catherine Creek, the RRS has been equal when examining adults to juveniles, and slightly less in adult to adult.
- There is a good relationship between the sponsors of this project and the other RRS studies in the basin. Additionally, this project received a lot of input from the state FW managers doing similar work.

Project 2010-033-00: Study Reproductive Success of Hatchery and Natural Origin Steelhead in the Methow

- This study has examined RRS at multiple life history stages to see which is most effected and has found that all life stages show differences.
- Project sponsors plan to continue to evaluate:
    - RRS of Wells broodstock;

    - the effects of density and pHOS on RRS; and
    - RRS of local broostock program.
- Juveniles will be collected through 2025 for this study.

1995-063-25: Yakima River Monitoring and Evaluation – Yakima/Klickitat Fisheries Project (YKFP)

- RRS measurements in the spawning channel is complete, but measurements of RRS in the river is ongoing until 2018 with a few additional years of analysis and writing to follow.
- There have been four generations of adult returns from Roza Dam that have been used in this study. Differences were seen in traits and morphology. Project sponsors are now looking at jacks and so far the findings are consistent with the ISS studies.
- This project is providing information for CRITFC's project examining Basinwide genetic effects from supplementation.
- Fast et al 2015 has a summary of program findings, specifically:
    - Spawner abundance, Spatial distribution, and harvest increased;
    - Natural-origin returns were maintained;
    - Managed gene flow reduced genetic divergence;
    - Ecological Interactions parameters were maintained within established guidelines;
    - Habitat and water management factors continue to limit natural productivity; supplementation likely necessary until these factors are fully addressed;
    - Results very consistent with Venditti et al. ISS final report.

2009-009-00: Basinwide Supplementation Evaluation

- This is a multi-faceted project measuring the RRS of reintroduction Chinook in the Hood River.
- Natural-origin fish have shown greater productivity and higher fitness.
- Using genetic testing components for lamprey translocation work, enough is known to start understanding parentage for lamprey. You should be able to assess successful spawning by watching the juveniles.
- CRITFC is working with member tribes to do RRS studies in various locations in the basin.
- The tribes significantly rely on CRITFC for the genetics lab work, which is a portion of the Haggerman Genetics Laboratory.

Discussion – lessons learned, future implementation directions, policy implications, and follow-up needed

- Before any decisions are made by the Council and BPA on the RRS projects, project sponsors asked that the question, "where are we at with hatchery evaluations?" be considered, and then from there examine, "where are we at with the RRS process?"
- The region has been working very hard to standardize technical information from the bottom up and the top down. The technical folks have people working on the data and the Council has the dashboards – some additional work to clarify common metrics for common decision points is still needed. It was suggested by

a meeting attendee that an opportunity is needed to create an integrated hatchery evaluation strategy and study design along with a plan for information sharing.

- There was enthusiasm in the group to continue a similar workshop to facilitate discussions like what was heard at this meeting, and to brainstorm standardization of information. Both AFS and PSMFC meetings have provided opportunities for RRS sponsors to come together and have technical discussions but common metrics have not been determined and decided on. It is going to take effort to come to an agreement on standardized metrics and multiple perspectives will be needed from the technical group to policy folks.
- The longer the projects continue their work, the more information is found between species and across basins. There are many factors that affect RRS, there is no one thing. A forum like this, on a regular basis, could help answer a lot of the questions that projects sponsors have by facilitating open communication and information sharing.
- Species differences in RRS are clear and fall Chinook should be considered in an RRS study. Additionally, it is unclear what causes jack rates in Chinook.
- Steelhead are challenging and intriguing. The group knows a fair amount on effects of hatchery fish on steelhead, but we don't know the casual mechanisms which should be understood better.
- What is a heritable effect vs an environmental effect? The heritable long term effects are probably relatively small. Coho are highly adaptable to their environments. Opportunity equates to natural selection. Hatcheries were brought in because the fish populations were/are depressed. If the hatcheries help to alleviate that, then it's a matter of habitat suitability and availability. The concern is that hatcheries are leading to long-term effects on natural fish.
- BPA would like to ensure that the project portfolio for RRS, within the RME budget, is the right mix in order to optimize investments of the $85 million RME budget. Meeting attendees expressed that since this is the second largest category of spending in the program, it needs to be better understood. Many of these projects are separate in the basin; they need to be more integrated from a study design perspective and from an information sharing basis. Also, project sponsors feel that they receive mixed signals from the Council – first they are told that the Council wants to hear what is needed from the project sponsors but then the Council says they do not want to spend any more money on RME.
- What are the effects of density on relative fitness? Fitness is exacerbated at higher densities – is this a competition problem and is there anything we can do about this?
- Is fitness loss genetic for Chinook? If not HSRG recommendations may be detrimental.
- Member Karier expressed concern that the group could be going backwards and that the region should be focusing on examining the hatcheries for practices that affect success.
- How do we retrofit current hatcheries to fix the issues that we know? First there would be small changes but we would need to be prepared for larger changes.

More natural areas, more feeding. How do we implement changes in a practical way?

- Member Norman said it would be good to know the long-term and short-term effects that hatchery fish have on natural populations. Can any of that be un-done? Are there ways that we can change the hatchery practices to reduce the negative traits?

Additional feedback and thoughts from Council representatives attending the workshop:

Hatchery management practices:

- How does data from the RRS studies inform/improve hatchery management practices for both mitigation and conservation focused programs?
    - Best broodstock management approach by species and watershed?
    - Supplementation-when, where, how much, how long?
    - Best rearing and release strategies for mitigation and supplementation programs?
- Future research data that would put a finer point on the HSRG guidelines, specific to particular programs in particular watersheds, would be a significant benefit with regard to developing future hatchery strategies.
- Certainly the answers to the hatchery management questions are specific to the conditions in each watershed with regard to habitat productivity and capacity (and the ability to improve and expand), the status of the population, other limiting factors outside of the tributary of origin, and other legal/social factors such as treaty fishing rights.
- We generally know enough to make many precautionary management decisions. For example, we should harvest segregated hatchery fish in order to minimize interbreeding with natural fish (especially important for steelhead), as recommended by the HSRG. This will require additional discussions by stakeholders and changes in the current fishing approach.

Density effects:

- Density effects have been shown to influence steelhead success in at least one hatchery. A couple of projects discussed density dependence, but density has not been part of many RRS studies of salmon in the wild. In Catherine Creek males were found to be more affected than females regarding density; enough to consider moving the females higher up in the basin.

Genetic effects:

- An important issue is to tease apart genetic versus ecological/environmental effects associated with RRS of hatchery salmonids spawning in streams. Most RRS studies have not isolated genetic versus ecological effects, such as hatchery fish spawning in degraded habitat. However, adverse genetic effects have been shown for steelhead and these effects can appear rapidly, as shown in recent papers involving steelhead. More studies could be conducted with steelhead to determine if genetic effects occur in other steelhead populations, especially those that vary in the level of integration with the wild stock. But so far, the evidence indicates a clear genetic effect associated with steelhead in a

hatchery setting. Long rearing in fresh water by steelhead (compared with other salmonids) might contribute to the seemingly stronger RRS effect shown by steelhead versus other salmon. Hatcheries should examine approaches to increase RRS--both genetic and ecological factors--as discussed at the meeting.

- The goal of RRS is to evaluate whether or not hatchery fish spawning in the wild reduce the productivity of the natural stock. The mechanism of impact (genetic versus ecological) is important to know because adverse genetic effects are longer lasting. Nevertheless, lower RRS due to ecological issues (e.g., hatchery fish spawning in degraded areas) is important too because lower productivity of the population equates to lower potential harvest rate (sustainable harvest rates depend directly on life cycle productivity).
- Can alterations in breeding programs and rearing treatments reduce genetic changes in fish being reared in supplementation programs? Can changes in rearing protocols be applied in existing hatchery infrastructure? At the workshop we heard some very interesting ideas regarding changes in diets to reduce early maturation rates and the possible use of other physical changes, e.g., increasing currents in rearing vessels. Also, increasing the number of parent fish used as broodstock and controlling family sizes at ponding. Genetic tools are available to examine the effects of these and other possible treatments to control genetic differentiation due to hatchery conditions.

Long-term effects and uncertainties:

- The studies to date have shown reduced productivity of hatchery fish in the wild, but the long-term effects are uncertain. It seems that is a key question that would be of value in a benefit/risk analysis with regard to supplementation strategies.
- If the focus is to supplement wild populations to reduce risk due to low abundance until factors of decline are adequately addressed; those decisions (when, where, how much, how long?) would benefit from a better understanding of the long-term consequences with regard to fitness. For example: we would consider using hatcheries to address abundance risk more frequently if studies suggested long-term consequences were minimal.
    - This would require a longer-term (several generation) study and species specific info.
- The idea of expanding research on hatchery broodstock and rearing strategies to minimize productivity differences compared to wild fish is compelling.
- RRS of hatchery versus wild salmon has been a key uncertainty for many decades, though the assumption of many (but not all) scientists has been that hatchery fish have lower RRS when spawning in streams due to both genetic and ecological factors. New genetic tools are now allowing a more detailed examination of this important question.
- How long might it take for hatchery fish to re-adapt to natural conditions (i.e. for natural selection to act on hatchery fish)? How long should supplementation programs last and will this vary by species?

Species differences:

- Among the few studies conducted to date, RRS of hatchery Chinook appears to be lower than RRS of wild Chinook, but this may be due more to ecological than

genetic factors. The lower RRS of hatchery Chinook is not as strong as shown by hatchery steelhead. More research is needed to isolate genetic versus ecological influences on RRS of Chinook and other species of salmon.

Integrated versus segregated hatcheries:

- The PNI approach described by the HSRG is an important tool for managing hatcheries and fisheries. The approach is logical, but we do not have detailed studies showing the tradeoff between the PNI value and genetic fitness of the wild stock. This is a very tough question to address, as noted in the ISAB/ISRP Critical Uncertainties Report. But the PNI relationship and other recommendations by the HSRG provide the basis for a precautionary approach when balancing the desire of people to have more fish to harvest with the needs of maintaining productive and diverse wild populations.
- For hatcheries that use an integrated approach and where the intent is to encourage some natural spawning of these fish (supplementation), hatchery fish in excess of what is needed to fully seed the spawning grounds should be harvested. One reason for this is that an integrated approach, as described by HSRG, requires a self-sustaining population in the stream. However, as described in the ISAB report on density dependence, some stocks are not self-sustaining because spawning density is too high (i.e., return per spawner exceeds one when density is low but not when it is high). There is some evidence (see NOAA studies) that an integrated hatchery approach might cause a higher level of precocious maturation (mini-jacks) in Chinook salmon.

General thoughts:

- Is there a way to harvest surplus hatchery fish to benefit both the natural stock and fishermen? This is a very complex issue involving both fisheries science and social issues, as described in the ISAB report. Additional dialog in the Basin and new approaches might help move this idea forward.
- What are the effects of supplementation on the abundance, productivity, and capacity of natural populations & how are these effects linked to density dependent effects and by the species being supplemented? Looking at the effects of supplementation must be done in an ecological context.
- What factors are responsible for differences in RRS in hatchery and natural origin fish? How important are spawning locations, spawn timing, size & age at maturation (all factors that can be influenced by hatchery environmental conditions) on the reproductive success of hatchery fish vs. genetic effects caused by domestication?