

Staff summary of Issues & Recommendations

Resident Fish

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

10/29/2013 10:07 AM

2009 Fish and Wildlife Program Section

Section D. 7 Title: Resident Fish Mitigation (pg 22-23)

Overview

Generally, entities recommend that the existing language in the program be maintained and implemented. Bonneville recommends that the Program support the processes needed for Bonneville to make final decisions in the resident fish artificial production facilities currently in the proposal or planning stages.

Many of the fish and wildlife agencies and tribes recommend that the Program address the threat of non native species as resident fish mitigation. They recommend that the Council support and Bonneville fund efforts to address primary limiting factors affecting resident fish including non-native species eradication and suppression. In addition they recommend that Bonneville fund the agencies and tribes to develop a methodology and complete resident fish loss assessments and suggest having framework in place for resident fish losses by 2015. Some are recommending that the Council direct Bonneville to fund perpetual land protection which includes conservation easements, land purchases and other long term measures to combat climate change impacts on resident fish. Some also recommend the the Council continue to maintain and implement existing Program language regarding settlement agreements, crediting and long term operation and maintenance funding.

The Council also received recommendations to support resident fish projects in the Fish Accords and that the Program should provide for passage of bull trout at Albeni Falls Dam and should identify and implement conservation measures to reduce the likelihood of harm to bull trout prior to the construction of fish passage at the dam.

I. Summary

1. Resident Fish Loss Assessment

- MFWP (2) , ODFW (3), WDFW (4) CSKT (16) CTGR (18) Cowlitz I.T. (22) USRTF (28) recommends completing loss statements for resident fish in the Basin.
- MFWP (2) recommends using loss statements as benchmark for assessing progress toward site-specific goals
- ODFW (3), WDFW (4) , BPT (12) CSKT (16) CTGR (18) Cowlitz I.T. (22) USRTF (28) recommends developing a methodology to complete loss assessments by working with a workgroup of resident fish managers, recognizing that selection of a method should be at the discretion of the entities involved in performing the survey; however, a standardizes process to ensure a consistent level of accuracy across the basin is needed.

- ODFW (3), WDFW (4) , BPT (12) CSKT (16) CTGR (18) Cowlitz I.T. (22) USRTF (28) recommends developing the loss assessment by building from the inundation methodology developed by the CBFWA Resident Fish Advisory Committee
- ODFW (3) , WDFW (4) , BPT (12) CSKT (16) CTGR (18) Cowlitz I.T. (22) USRTF (28) recommends having a framework for assessing resident fish losses in place by 2015 with assessments initiated that same year
- Cowlitz I.T. (22) USRTF (28) recommends that the process to develop and adopt a standard methodology include a public process and independent science review in addition to participation of the resident fish managers through the Columbia River Basin.

2. Non-natives and Resident fish

- ODFW (3) , WDFW (4) , BPT (12) CSKT (16) Cowlitz I.T. (22) NPT (25) USRTF (28) recommend BPA should fund efforts to address all primary limiting factors affecting resident fish including non-native species eradication and suppression and coordinate these efforts with companion efforts that protect anadromous fish from non-native species
- ODFW (3) , WDFW (4) , BPT (12) CSKT (16) Cowlitz I.T. (22) USRTF (28) recommend adding Program language to Section 2 and/or Section 7 under Basinwide Strategies about impacts of non-native species on resident fish, the need to fund actions that treat the problem including research, and where non-native species are the primary limiting factors for resident fish that funding should focus on eradicating or suppressing non-native and favorable habitat conditions.
- CSKT (16) recommends the Council should work cooperatively with NOAA Fisheries, USFWS, states, tribes to develop and implement system wide strategies to manage and reduce non-native fishes that compete and feed on native fish in mainstem and in tributaries ..[omitted text, list of non-native fish include] ... lake trout .., northern pike..., white crappie..., yellow perch..., walleye..., smallmouth bass.
- CSKT (16) recommends the Program should support, and BPA should fund, additional research into the overall magnitude of the impacts of non-native predators including studies on abundance, movement and habitat use, and food web interactions in order to help guide improved management of non-natives

3. White Sturgeon

- MFWP (2) USFWS (33) recommends incorporating in to the mainstem plan (Draft Columbia White Sturgeon Planning Framework v. Feb 2013) the strategic recommendations as a sturgeon chapter.
- MFWP (2), ODFW (3) WDFW (4) CRITFC (14) Cowlitz I.T. (22) USRTF (28) USFWS (33) USGS (38) recommends that the framework should be addressed within the Program either by being adopted into the Program, per MFWP (2) and CRITFC (14) Cowlitz I.T. (22) USRTF (28) USFWS (33), or by being identified as a program appendix, per ODFW (3), WDFW (4) USFWS (33).
- ODFW (3) , WDFW (4) Cowlitz I.T. (22) USRTF (28) recommends that BPA should fund sturgeon recovery and the recommendations in the Columbia White Sturgeon Planning Framework
- ODFW (3) , WDFW (4) , CRITFC (14) Cowlitz I.T. (22) USRTF (28) USFWS (33) consolidate measures intended to address sturgeon restoration, and ODFW (3) , WDFW

(4) Cowlitz I.T. (22) USRTF (28) USFWS (33) recommend accomplishing this by consolidating into set of strategies in the Mainstem Plan.

- ODFW (3) , WDFW (4) Cowlitz I.T. (22) USRTF (28) recommends inserting new text into the *Mainstem Plan as Strategies for White Sturgeon*
- ODFW (3) , WDFW (4) Cowlitz I.T. (22) USRTF (28) USFWS (33) recommends incorporating recommendations of Oregon’s Lower Columbia River and Oregon Coast White Sturgeon Conservation Plan (ODFW 2011) and the Council’s Columbia Basin White Sturgeon Planning Framework into the Program.
- ODFW (3) , WDFW (4) Cowlitz I.T. (22) USRTF (28) recommends incorporating ISAB recommendations for addressing hydrosystem impacts on Upper Columbia River White Sturgeon
 - Similarly to some of the ISAB recommendations, USGS (38) recommends that spatially explicit habitat models be developed for all life stages of white sturgeon to quantify habitat throughout the year. These models should incorporate the specific aspects of hydro system operations, such as duration of fluctuations in water releases that affect spawning, dispersal, growth, and survival of white sturgeon.
- USGS (38) recommends that the Council should provide a means to integrate information on sturgeon populations that can be used in an overall assessment of sturgeon population or demographic trends within the basin. The Fish and Wildlife Program should require the development of a method to store and quickly analyze information on sturgeon populations and restoration actions throughout the basin

4. Bull Trout

- USFWS (33) revised the first paragraph under Resident Fish Losses on page 12 to include ... such as bull trout (listed as threatened under the ESA), cutthroat ...
- USFWS (33) Modify the second paragraph under C. Biological Objectives, 1. Overarching Objectives and Priorities for the mainstem, paragraph page 36 to convey importance of Bull Trout but including this additional text Performance standards and fulfilling the relevant RPAs and RPMs set forth ...
- USFWS (33) Add this sub-bullett to the second bullet under C.2.a on page 36. Evaluate how projects, reservoir conditions and operations impact connectivity among basins for bull trout
- USFWS (33) Revise the fifth bullet under c. Resident fish and wildlife, page 39,by addition this text to the end of this bullet: Additionally, on September 30, 2010, the U.S. Fish and Wildlife Service designated critical habitat for bull trout throughout their U.S. range. This listing included the entire mainstem reaches of the Columbia and lower Snake Rivers. The Council’s Program and this mainstem plan recognize the importance of this critical habitat for bull trout and support needed efforts to maintain and/or improve this critical habitat where needed.
- USFWS (33) recommends adding the following bullet after the revised bullet in Recommendation 4 (page 39). Evaluate mainstem project specific impacts to migrating bull trout
- USFWS (33) recommends revising the first bullet on page 43 by replacing “mainstem habitat’ with “critical mainstem habitat”:

- USFWS (33) recommends adding the following bullet after the revised bullet in Recommendation 6 (page 43). Evaluate reservoir conditions and operations on foraging, overwintering, and migrating bull trout.

5. Freshwater mussel

- CRITFC (14) CTUIR (19) recommends including language in the Fish and Wildlife Program to recognize the importance of freshwater mussels regarding ecosystem diversity, function, and traditional cultural opportunities in the basin
- CRITFC (14) CTUIR (19) recommends that the pilot freshwater mussel project should continue and move from a research phase into a restoration and monitoring phase that will provide critical information regarding reintroduction and restoration that can be later applied to a larger scale.
- STI (26) Assess current status of freshwater mussels in the Spokane Arm and Columbia River adjacent to the Spokane Indian Reservation

6. Burbot

- Kootenai T. I. (24) recommends fully funding needs of the Tribe's integrated fish and wildlife program for genetics and culture

7. Maintain / modify existing Resident Fish Mitigation language

- MFWP (2) recommends, [under the Resident Fish Mitigation and Crediting subsection,] maintaining the resident fish goal of mitigating construction, inundation and operational impacts to resident fish populations by “preserving, enhancing, restoring and/or creating fish and wildlife habitat equal to the quantity and quality of habitat lost . . . through the acquisition of appropriate interests in real property at a minimum ratio of 1:1 mitigation to lost distance or area”
- CSKT (16) STI (26) recommends maintaining the existing language for the Resident Fish Mitigation Strategy
- CSKT (16) recommends modifying the title and introductory paragraph under the Resident Fish Mitigation Settlement Agreements subsection to include multi-year agreements
- CSKT (16) recommends modifying the 6th bullet under the Resident Fish Mitigation Settlement Agreements subsection to : Provisions [add: **to assure**] for long-term maintenance of the habitat adequate to sustain the [delete: ~~credited~~] habitat values for the life of the project. BPA shall increase base funding proportionate to the stream miles/acres protected

8. Fish Passage

- ODFW (3) Modify the lamprey and sturgeon passage section (page 47) to include bull trout and resident fish

9. Wildlife Loss Assessment

- MFWP (2) Terrestrial wildlife losses caused by dam operation should be based on the functionality of riparian and riverine ecosystems assessment tools similar to those developed by the Kootenai River Operational Loss Assessment, Protection, Mitigation, and Rehabilitation project (BPA Project 200201100).;

10. Climate change

- CSKT (16) Cowlitz I.T. (22) NPT (25) recommends BPA should fund perpetual land protection which includes conservation easements, land purchases, or other long term measures to combat climate change impacts on resident fish.
- CSKT (16) CTUIR (19) Cowlitz I.T. (22) USRTF (28) recommends adding language to Section 7 of Basinwide Strategies on Page 22 about climate change and native resident fish.

11. Funding prioritization

12. MFWP (2) recommends prioritizing permanent or long-term funding agreements between BPA and state and federal agencies and tribes who implement mitigation for completing this operational mitigation, including all the key points outlined in the current program.
- CdA (13) recommends allocating all resident fish funding to the habitats above Chief Joseph and Grand Coulee dams and other blocked areas until resident fish harvest opportunities in these areas are commensurate with the combined anadromous and resident fish harvest allowed elsewhere in the Basin,
 - CdA (13) recommends funding anadromous fish substitution projects from the anadromous allocation below Wells dam.
 - RFEG (63) Very little money appears to be available for resident fish restoration. We recommend increasing awareness and funding to native resident fish recovery in the Columbia Basin.

13. Include actions from Biological Opinions

- Kalispel T.I (23) recommends the actions required by the U.S. Fish and Wildlife Service's 2000 Biological Opinion entitled "Effects to Listed Species from Operations of the Federal Columbia River Power System" ("2000 BiOp"), including any modifications to this BiOp resulting from consultation due to the 2010 designation of bull trout critical habitat. See additional clarifications related to bull trout passage at Albeni Falls Dam, including ACOE timeline of tasks and milestones, language to be added about fish passage at Albeni Falls dam.
- BPA (35) recommends the Program should adopt and support on-going efforts to protect and enhance sturgeon populations through implementation of the USFWS Kootenai River White Sturgeon biological opinion; ...[omitted text].

14. Include actions from agreements with BPA

- Kalispel T.I (23) recommends incorporating the actions required by the July 2012 Memorandum of Agreement between the Kalispel Tribe, the Bonneville Power Administration, the U.S. Army Corps of Engineers, and the U.S. Bureau of Reclamation ("Kalispel Fish Accord"). See additional clarifications related to bull trout passage at Albeni Falls Dam, including ACOE timeline of tasks and milestones, language to be added about fish passage at Albeni Falls dam.
- BPA (35) recommends the Program should adopt and support on-going efforts to protect and enhance sturgeon populations through implementation of the [omitted text]...; Accord projects related to sturgeon; and [omitted text]....

15. Include actions from Projects

- BPA (35) recommends the Program should adopt and support on-going efforts to protect and enhance sturgeon populations through implementation of the [omitted text] ... and habitat improvement projects by the Kootenai Tribe of Idaho and others.

16. Partnerships to expand Conservation Benefits

- MFWP (2) recommends a greater use of partnerships to expand conservation benefits and reduce mitigation and long-term management costs to the ratepayers

17. Species in quick fact box in the planning assumption section

- MFWP (2) recommends adding Kootenai white sturgeon, mountain whitefish and redband trout in the box

18. Toxics

- USEPA (37) recommends that the Council to provide a review and assessment of how hydroelectric projects affect toxic contaminants in the Columbia River Basin and how toxic contaminants can impact the fish that are impounded behind dams.

19. Artificial Production

- BPA (35) recommends that the Program should support the processes needed for BPA to make final decisions in the resident fish artificial production facilities currently in the proposal or planning stages. Those facilities include only Black Canyon (red band trout), Crystal Springs (Yellowstone cutthroat trout), Kootenai (sturgeon and burbot), and the Columbia River Inter Tribal Fish Commission (CRTFC) (sturgeon) hatcheries.

II. Framework Recommendations

State F&W Agencies/other state agencies/state supported agencies

1. Montana Fish Wildlife and Parks, MFWP (2) (submitted by Brian Marotz)

- Page 7. Quick facts box : We recommend adding Kootenai white sturgeon and mountain whitefish, and change rainbow trout to redband trout.
- Page 12. Resident Fish and Wildlife Losses: Our previous comments urged completing loss statements elsewhere in the basin. Loss statements provide a measure of the negative impacts at each site, so can be used as a benchmark for assessing progress toward site-specific goals. This effort began, but faded over time, perhaps because the process became more complex and expensive than intended. Rationale: Our intent was to apply a quick and inexpensive method to examine construction and inundation losses sustained at each federal dam. The techniques used to develop loss statements for Hungry Horse and Libby reservoirs can be applied as a rapid assessment tool at other reservoirs. These loss statements can be used to measure progress toward offsetting construction and inundation losses. This is especially important now because BPA is requesting credits (i.e. credit for each kilometer of stream protected by their investments in fisheries mitigation) to provide accountability for the program.
- Pages 22-23. Resident fish mitigation and crediting: The program should maintain the resident fish goal of mitigating construction, inundation and operational impacts to resident fish populations by “preserving, enhancing, restoring and/or creating fish and wildlife habitat equal to the quantity and quality of habitat lost . . . through the acquisition of appropriate interests in real property at a minimum ratio of 1:1 mitigation to

lost distance or area”. We acknowledge that the 1:1 ratio does not replace habitat that was permanently lost due to inundation as the reservoirs filled, but instead prevents the loss of additional habitat, and after the habitat is protected, investments in habitat restoration are also secured. Terrestrial wildlife losses caused by dam operation should be based on the functionality of riparian and riverine ecosystems as determined from scientifically defensible, repeatable, and comprehensive assessment tools similar to those developed by the Kootenai River Operational Loss Assessment, Protection, Mitigation, and Rehabilitation project (BPA Project 200201100). The outcome of these efforts would be the overall protection and restoration of ecosystem integrity through coordinated implementation of BPA-sponsored projects, partnerships, and a variety of other leveraging opportunities. Projects funded by BPA would meet this purpose and outcome and need to be implemented in a clear, predictable, timely, cost-effective and efficient manner with benefits for fish and wildlife as well as credits clearly defined. Permanent or long-term funding agreements between BPA and state and federal agencies and tribes who implement mitigation should also remain a priority for completing this operational mitigation, including all the key points outlined in the current program. However, we believe that it would benefit the program and the ecological integrity of fish and wildlife habitats of the region if Council also encouraged a greater use of partnerships to expand conservation benefits and reduce mitigation and long-term management costs to the ratepayers.

- Adopt Strategic Recommendations for White Sturgeon : White sturgeon have declined in abundance throughout most of the Columbia Basin, and distinct population segments are in dire condition. Only the population downstream of Bonneville Dam continues to have substantial natural recruitment, and predation on adult sturgeon by Steller sea lions just below the Bonneville Dam may threaten that population (ISAB 2013). Reduced natural recruitment will likely be a major factor influencing sturgeon the status and sustainability of harvest fisheries. The Kootenai River population is being supported by conservation aquaculture while researchers work to restore natural reproduction. Roughly 4% (\$9.5 million) of annual direct Fish and Wildlife Program expenditures of \$246 million in 2012 were dedicated to white sturgeon restoration. Recommendation: The recently completed basin-wide framework plan for white sturgeon synthesizes existing information and recommends actions to address limiting factors and information gaps. After the draft basin-wide framework incorporates the edits and comments provided by the managers, strategic recommendations should be incorporated in to the mainstem plan as a sturgeon chapter. After ISRP review, the framework should be adopted into the Program (See Reference Section at the end of this document for these recommendations).

2. Oregon Department of Fish and Wildlife , ODFW, (3) (submitted by Tom Rien)

- **4.2 Address Management of Non-natives as Resident Fish Mitigation** (Attachment 2, Section 4.2) Current Program: Page 22-23, Resident Fish Mitigation Measure: BPA should fund efforts to address all primary limiting factors affecting resident fish including non-native species eradication and suppression and coordinate these efforts with companion efforts that protect anadromous fish from non-native species. **Recommendation:** Add Program language to Section 2 and/or Section 7 under Basinwide Strategies: *“The threat of non-native species increasingly complicates the protection, restoration, and enhancement of resident fish species throughout the basin. Competition, predation and hybridization by non-natives often reduces the effectiveness of habitat protection and restoration efforts for native fish populations. Funding should be directed to treat the problem, not the symptoms, including research to better understand food-web interactions. Where non-native species have been identified as a primary limiting factor in subbasin plans, increased effort and funding should be directed to eradicate or suppress non-native species in conjunction with the proven methods that benefit their habitats.”*
- **4.4 Resident Fish Loss Assessments** (Attachment 2, Section 4.4) Current Program: Page 22-23, Resident Fish Mitigation and Crediting, Measure: BPA should fund the Agencies and Tribes to develop a methodology and complete resident fish loss assessments. The selection of a method should be at the discretion of the entities involved in performing the survey; however, to standardize the process and ensure a consistent level of accuracy across the basin the Council should form a workgroup of resident fish managers to address this issue. A framework for assessing resident fish losses shall be in place by 2015 with assessments initiated that same year. Rationale: The Northwest Power and Conservation Council’s (Council) amended Fish and Wildlife Program (Program) provides for resident fish mitigation “where construction and inundation losses have been assessed and quantified by the appropriate agencies and tribes, mitigation should occur through the acquisition of appropriate interests in real property at a minimum ratio of 1:1 mitigation to lost distance or area.” Despite the mitigation provisions, the Program does not prescribe specific methodology for the calculation of lost

resident fish habitat due to construction and inundation. Because of this omission, resident fish managers (i.e., Columbia Basin Fish and Wildlife Authority's (CBFWA) members and non-members) in the Columbia River Basin, working through the CBFWA Resident Fish Advisory Committee (RFAC), developed a methodology to allow for the consistent quantification of inundated resident fish habitat (CBFWA Members Action Notes, October 7, 2009 [NPCC staff leonard downloaded a copy of these documents]). The CBFWA sent a letter on October 8, 2009 to the Council suggesting a recommended methodology to calculate the amount of resident fish habitat that has been inundated by the construction of the Federal Columbia River Power System. The inundation methodology could serve as the foundation for future identification of operational losses. The Council should develop and adopt a standard methodology through a public process that includes independent science review and the participation of the resident fish managers throughout the Columbia River Basin.

- **5.4 White Sturgeon** (Attachment 2, Section 5.4) Current Program: Page 12, 39, 41, 43, 47-49, 53, and 55 Measure: BPA should adequately fund sturgeon recovery and the recommendations from the Council's Columbia Basin White Sturgeon Planning Framework (NPCC 2013). **Recommendation 1:** The Program should consolidate measures intended to address sturgeon restoration into set of strategies in the Mainstem Plan. Incorporate recommendations of Oregon's Lower Columbia River and Oregon Coast White Sturgeon Conservation Plan (ODFW 2011) and the Council's Columbia Basin White Sturgeon Planning Framework into the Program. The Framework should be identified as a Program appendix on White Sturgeon. **Rationale:** White sturgeon are widely recognized as iconic mainstem fish species severely affected by construction and operation of the hydrosystem (ISAB 2013, NPCC 2013, ISAB programmatic review, Kootenai and select Zone 6 sturgeon reports 1995 and 2012). About "4% (\$9.5 million) of annual direct Fish and Wildlife Program expenditures of \$246 million in 2012 were dedicated to white sturgeon. Kootenai sturgeon projects account for the majority of sturgeon-related expenditures (\$6.5 million). The remainder is distributed among one general and six accord projects" (NPCC 2013). The Council's Fish and Wildlife Program accounts for just a portion of total expenditures within the basin to restore white sturgeon populations. Four non-FCRPS hydropower entities, Idaho Power Company, Grant PUD, Chelan PUD, and Douglas PUD, fund substantial white sturgeon restoration programs within the reaches impacted by their hydropower projects. "Of all fish species in the Basin, the status of white sturgeon is most strongly tied to conditions in the mainstem, which are directly affected by the hydrosystem. The white sturgeon has declined greatly in abundance throughout most of the Columbia Basin. Only the population segment below Bonneville Dam still shows substantial natural recruitment, despite the fact that it is affected by hydrosystem operations at all dams upstream. It is anticipated that diminished natural recruitment will be a major factor influencing sturgeon status and the sustainability of harvest fisheries. Natural recruitment of sturgeon is potentially affected by hydrosystem operations directly, through blocked passage or inundation of preferred spawning areas, and indirectly, through the effects of water flow and sediment release on spawning success. In addition, recently documented predation on adult sturgeon by Steller sea lions just below the Bonneville Dam may threaten that population (ISAB 2013)" In response to a Council request, sturgeon project sponsors recently completed a basin-wide framework plan for white sturgeon that synthesizes existing information and recommends actions to address limiting factors and information gaps. Strategic recommendations should be incorporated in to the mainstem plan as a sturgeon chapter. After ISRP review, the framework should be adopted into the Program.
- Recommended Draft Language: Insert the following text into the *Mainstem Plan as Strategies for White Sturgeon*: *"The Program supports a vision of abundant and diverse white sturgeon populations and optimum sustainable fisheries throughout the historical range, achieved by a combination of natural production and careful supplementation, and supported through an adaptive, collaborative, coordinated, science-based mitigation, management, monitoring, and evaluation program to be achieved over the coming 50 years. Seven basic elements are incorporated into this vision: sustainability; natural production; biological characteristics; an inclusive program scope; effective monitoring, research, and evaluation; and rebuilding/mitigation. To date, the Council has supported sturgeon program efforts that have effectively documented biology, status and limiting factors throughout the region. White sturgeon distribution, abundance, and productivity throughout the Columbia and Snake river basins are severely limited by habitat changes, particularly those associated with hydropower system construction and operation. Large areas of suitable sturgeon habitat remain throughout most of the historical range upstream from Bonneville Dam but use is currently limited by widespread passage limitations and natural recruitment problems that are the direct and/or indirect result of the development and operation of the Columbia River hydrosystem. The Council endorses additional work that contributes to conservation, recovery or mitigation goals identified in the Columbia Basin White Sturgeon Planning Framework (NPCC 2013). Strategies to achieve the sturgeon vision include: • Operate the FCRPS to provide operations consistent with normative river conditions, including increased spring and summer flows and spill.*

Recruitment in many impounded areas has been positively correlated with high annual discharge April—July. Sturgeon are expected to benefit from court-ordered dam operational measures being implemented for salmon and steelhead. • Continue to utilize and adaptively manage conservation hatchery programs as interim measures to avoid extinction of unique sturgeon populations. • Hatchery production of sturgeon can be an appropriate mitigation strategy to supplement populations where natural recruitment is currently limited. This strategy should: (1) Be conservative and responsible in establishing protocols for source populations and numbers of hatchery fish released; (2) Build on knowledge gained from ongoing hatchery efforts in other areas; (3) Utilize experimental hatchery releases and monitoring to assess ecological factors and population productivity limitations; and (4) Optimize hatchery production and practices consistent with monitoring natural production and environmental carrying capacity which will most effectively be identified using an experimentally adaptive approach. • Some opportunities for sturgeon passage improvements exist but benefits are likely to be limited by habitat-related natural recruitment problems in most areas. Passage strategies for white sturgeon should include: (1) Detailed evaluations of costs, benefits and risks of passage improvements relative to other potential strategies; (2) Consideration of opportunities to incorporate sturgeon-friendly features in existing fish ladders during future ladder designs and planned modification where consistent with sturgeon population goals and objectives; (3) Opportunities for non-volitional passage by taking advantage of fish trapped in dewater draft tubes or fish ladders during maintenance; and (4) Continued review of protocols used to prevent fish stranding/mortality during planned maintenance activities at passage facilities. • Investigate the use of site-specific habitat measures such as substrate enhancement and channel restoration as viable alternatives for improving natural recruitment in some areas. • Support fishery monitoring and management in combination with the suite of other restoration options to mitigate for lost productivity and contribute to population rebuilding efforts in areas where harvest is warranted, but where natural recruitment is currently limited and the subpopulation does not represent a unique component of the historical diversity. • Manage marine mammals to reduce predation of white sturgeon downstream of Bonneville Dam. • Operate the hydrosystem to reduce mortality on white sturgeon. Develop an operational protocol to block access to turbine draft tubes during turbine dewatering and other maintenance operations to minimize white sturgeon entrainment, dewatering, and mortality. • Conduct dredging operations in a manner minimizing operation-related mortality on white sturgeon. • Conduct research that addresses critical white sturgeon uncertainties identified in the Columbia Basin White Sturgeon Planning Framework. • Monitor and evaluate mitigative white sturgeon restoration actions, and population responses to environmental condition consistent with the Columbia Basin White Sturgeon Planning Framework.” • Assess the effects of climate change on basin sturgeon populations and develop adaptation strategies to address these impacts.

- **Recommendation 2:** The Council should incorporate ISAB recommendations for addressing hydrosystem impacts on Upper Columbia River White Sturgeon: • Develop a credible white sturgeon habitat model for the UCR to quantify habitat throughout the year in conjunction with mainstem hydrosystem operations • Identify the specific aspects of hydrosystem operations, such as duration of fluctuations in water releases and of water levels, that affect natural spawning, reproduction, growth and survival of larval and juvenile fishes, and overall recruitment success of white sturgeon in the UCR • Investigate the potential impacts of trace element contamination of UCR sediments on the quality of critical white sturgeon habitat throughout the UCR from Lake Roosevelt upstream to the International Border. **Rationale:** White Sturgeon in the Upper Columbia River (UCR) are a considered a ‘Species at Risk’ by the Canadian federal government, are a species of active research for the Washington Department of Fish and Wildlife (WDFW), and are the focus of a recent UCR White Sturgeon Recovery Plan developed by US and Canada entities. That plan highlights a number of issues as contributing to poor white sturgeon populations and greatly diminished natural recruitment, including but not limited to, habitat diversity, flow regulation, water temperature, water clarity, total dissolved gas (TDG), contaminants, food availability, fish community alteration, predation, exploitation and incidental catch. Selected topics have benefited from recent studies by USGS, US EPA, WDFW, and the Colville and Spokane Tribes, but issues such as habitat diversity, flow regulation effects, temperature and elevated trace-element concentrations in bed sediments are in need of research. Specific to the UCR, the physical habitat for various life stages of white sturgeon have not been characterized or quantified, nor has the potential for trace-element contaminants to compromise critical habitats. The amount, distribution and complexity of benthic substrates in Lake Roosevelt are currently unknown. Various life stages of white sturgeon are known to utilize and benefit from particular habitat types in the Lower Columbia River, but similar understanding is not available for the UCR. Proper characterization of habitat availability would benefit fisheries managers in estimating what a sustainable population size should be. Substrate size, location and complexity (as substrate diversity) are key variables currently lacking characterization. Recent additions of detailed bathymetry of the Lake Roosevelt pool and

lower portions of the UCR provided by US Bureau of Reclamation, and LiDAR (light detection and ranging) are key tools ready for application in developing a white sturgeon habitat model. Superimposed on a habitat model for the UCR are the multiple lines of evidence that indicate trace element contamination in the sediments of the UCR may be a critical habitat stressor to the reproductive success of white sturgeon in the reach between Lake Roosevelt and the International Border. Preliminary evidence suggest that hydrosystem controlled conditions in the mainstem river play a controlling factor on exposure of white sturgeon to dissolved trace elements mobilized from river bed sediments.

- **5.8 Bull Trout** Current Program: Lamprey and Sturgeon Passage (Page 47) Recommendation: Revise the section header to read “Lamprey, sturgeon and resident fish passage.” **Recommendation:** Include the following language addressing sturgeon bull trout and resident fish passage. *Provide upstream and downstream passage for white sturgeon, bull trout and resident fish species in conjunction with anadromous passage solutions at the federal hydropower/flood control facilities.*
- 3. **Washington Department of Fish and Wildlife, WDFW, (4) (submitted by Amy Windrope)**
 - **6. Resident Fish 6.1 Address Management of Non-natives as Resident Fish Mitigation** Current Program: Page 22-23, Resident Fish Mitigation Measure: BPA should fund efforts to address all primary limiting factors affecting resident fish including non-native species eradication and suppression and coordinate these efforts with companion efforts that protect anadromous fish from non-native species. **Rationale and proposed Program language** to be added to Section 2 and/or Section 7 under Basinwide Strategies: *“The threat of non-native species increasingly complicates the protection, restoration, and enhancement of resident fish species throughout the basin. Competition, predation and hybridization by non-natives often reduces the effectiveness of habitat protection and restoration efforts for native fish populations. Funding should be directed to treat the problem, not the symptoms, including research to better understand food-web interactions. Where non-native species have been identified as a primary limiting factor in subbasin plans, increased effort and funding should be directed to eradicate or suppress non-native species in conjunction with the proven methods that benefit their habitats.”*
 - **6.3 Resident Fish Loss Assessments** Current Program: Page 22-23, Resident Fish Mitigation and Crediting **Measure:** BPA should fund the Agencies and Tribes to develop a methodology and complete resident fish loss assessments. The selection of a method should be at the discretion of the entities involved in performing the survey; however, to standardize the process and ensure a consistent level of accuracy across the basin the Council should form a workgroup of resident fish managers to address this issue. A framework for assessing resident fish losses shall be in place by 2015 with assessments initiated that same year. **Rationale:** The Northwest Power and Conservation Council’s (Council) amended Fish and Wildlife Program (Program) provides for resident fish mitigation “where construction and inundation losses have been assessed and quantified by the appropriate agencies and tribes, mitigation should occur through the acquisition of appropriate interests in real property at a minimum ratio of 1:1 mitigation to lost distance or area.” Despite the mitigation provisions, the Program does not prescribe specific methodology for the calculation of lost resident fish habitat due to construction and inundation. Because of this omission, resident fish managers (i.e., Columbia Basin Fish and Wildlife Authority’s (CBFWA) members and non-members) in the Columbia River Basin, working through the CBFWA Resident Fish Advisory Committee (RFAC), developed a methodology to allow for the consistent quantification of inundated resident fish habitat (CBFWA Members Action Notes, October 7, 2009). The CBFWA sent a letter on October 8, 2009 to the Council suggesting a recommended methodology to calculate the amount of resident fish habitat that has been inundated by the construction of the Federal Columbia River Power System. The inundation methodology could serve as the foundation for future identification of operational losses. The Council should develop and adopt a standard methodology through a public process that includes independent science review and the participation of the resident fish managers throughout the Columbia River Basin.
 - **5.4 White Sturgeon** (Attachment 2, Section 5.4) Current Program: Page 12, 39, 41, 43, 47-49, 53, and 55 **Measure:** BPA should adequately fund sturgeon recovery and the recommendations from the Council’s Columbia Basin White Sturgeon Planning Framework (NPCC 2013).
 - **Recommendation 1:** The Program should consolidate measures intended to address sturgeon restoration into set of strategies in the Mainstem Plan. Incorporate recommendations of Oregon’s Lower Columbia River and Oregon Coast White Sturgeon Conservation Plan (ODFW 2011) and the Council’s Columbia Basin White Sturgeon Planning Framework into the Program. The Framework should be identified as a Program appendix on White Sturgeon. **Rationale:** White sturgeon are widely recognized as iconic mainstem fish species severely affected by construction and operation of the hydrosystem (ISAB 2013, NPCC 2013, ISAB programmatic

review, Kootenai and select Zone 6 sturgeon reports 1995 and 2012). About “4% (\$9.5 million) of annual direct Fish and Wildlife Program expenditures of \$246 million in 2012 were dedicated to white sturgeon. Kootenai sturgeon projects account for the majority of sturgeon-related expenditures (\$6.5 million). The remainder is distributed among one general and six accord projects” (NPCC 2013). The Council’s Fish and Wildlife Program accounts for just a portion of total expenditures within the basin to restore white sturgeon populations. Four non-FCRPS hydropower entities, Idaho Power Company, Grant PUD, Chelan PUD, and Douglas PUD, fund substantial white sturgeon restoration programs within the reaches impacted by their hydropower projects. “Of all fish species in the Basin, the status of white sturgeon is most strongly tied to conditions in the mainstem, which are directly affected by the hydrosystem. The white sturgeon has declined greatly in abundance throughout most of the Columbia Basin. Only the population segment below Bonneville Dam still shows substantial natural recruitment, despite the fact that it is affected by hydrosystem operations at all dams upstream. It is anticipated that diminished natural recruitment will be a major factor influencing sturgeon status and the sustainability of harvest fisheries. Natural recruitment of sturgeon is potentially affected by hydrosystem operations directly, through blocked passage or inundation of preferred spawning areas, and indirectly, through the effects of water flow and sediment release on spawning success. In addition, recently documented predation on adult sturgeon by Steller sea lions just below the Bonneville Dam may threaten that population (ISAB 2013)” In response to a Council request, sturgeon project sponsors recently completed a basin-wide framework plan for white sturgeon that synthesizes existing information and recommends actions to address limiting factors and information gaps. Strategic recommendations should be incorporated in to the mainstem plan as a sturgeon chapter. After ISRP review, the framework should be adopted into the Program.

- Recommended Draft Language: Insert the following text into the *Mainstem Plan as Strategies for White Sturgeon*: “*The Program supports a vision of abundant and diverse white sturgeon populations and optimum sustainable fisheries throughout the historical range, achieved by a combination of natural production and careful supplementation, and supported through an adaptive, collaborative, coordinated, science-based mitigation, management, monitoring, and evaluation program to be achieved over the coming 50 years. Seven basic elements are incorporated into this vision: sustainability; natural production; biological characteristics; an inclusive program scope; effective monitoring, research, and evaluation; and rebuilding/mitigation. To date, the Council has supported sturgeon program efforts that have effectively documented biology, status and limiting factors throughout the region. White sturgeon distribution, abundance, and productivity throughout the Columbia and Snake river basins are severely limited by habitat changes, particularly those associated with hydropower system construction and operation. Large areas of suitable sturgeon habitat remain throughout most of the historical range upstream from Bonneville Dam but use is currently limited by widespread passage limitations and natural recruitment problems that are the direct and/or indirect result of the development and operation of the Columbia River hydrosystem. The Council endorses additional work that contributes to conservation, recovery or mitigation goals identified in the Columbia Basin White Sturgeon Planning Framework (NPCC 2013). Strategies to achieve the sturgeon vision include:*

 - *Operate the FCRPS to provide operations consistent with normative river conditions, including increased spring and summer flows and spill. Recruitment in many impounded areas has been positively correlated with high annual discharge April—July. Sturgeon are expected to benefit from court-ordered dam operational measures being implemented for salmon and steelhead.*
 - *Continue to utilize and adaptively manage conservation hatchery programs as interim measures to avoid extinction of unique sturgeon populations.*
 - *Hatchery production of sturgeon can be an appropriate mitigation strategy to supplement populations where natural recruitment is currently limited. This strategy should:*
 - (1) Be conservative and responsible in establishing protocols for source populations and numbers of hatchery fish released;*
 - (2) Build on knowledge gained from ongoing hatchery efforts in other areas;*
 - (3) Utilize experimental hatchery releases and monitoring to assess ecological factors and population productivity limitations; and*
 - (4) Optimize hatchery production and practices consistent with monitoring natural production and environmental carrying capacity which will most effectively be identified using an experimentally adaptive approach.*
 - *Some opportunities for sturgeon passage improvements exist but benefits are likely to be limited by habitat-related natural recruitment problems in most areas. Passage strategies for white sturgeon should include:*
 - (1) Detailed evaluations of costs, benefits and risks of passage improvements relative to other potential strategies;*
 - (2) Consideration of opportunities to incorporate sturgeon-friendly features in existing fish ladders during future ladder designs and planned modification where consistent with sturgeon population goals and objectives;*
 - (3) Opportunities for non-volitional passage by taking advantage of fish trapped in dewater draft tubes or fish ladders during maintenance; and*
 - (4) Continued review of protocols used to prevent fish stranding/mortality during planned maintenance activities at passage facilities.*
 - *Investigate the use of site-specific habitat measures such as substrate enhancement and channel restoration as*

viable alternatives for improving natural recruitment in some areas. • Support fishery monitoring and management in combination with the suite of other restoration options to mitigate for lost productivity and contribute to population rebuilding efforts in areas where harvest is warranted, but where natural recruitment is currently limited and the subpopulation does not represent a unique component of the historical diversity. • Manage marine mammals to reduce predation of white sturgeon downstream of Bonneville Dam. • Operate the hydrosystem to reduce mortality on white sturgeon. Develop an operational protocol to block access to turbine draft tubes during turbine dewatering and other maintenance operations to minimize white sturgeon entrainment, dewatering, and mortality. • Conduct dredging operations in a manner minimizing operation-related mortality on white sturgeon. • Conduct research that addresses critical white sturgeon uncertainties identified in the Columbia Basin White Sturgeon Planning Framework. • Monitor and evaluate mitigative white sturgeon restoration actions, and population responses to environmental condition consistent with the Columbia Basin White Sturgeon Planning Framework.” • Assess the effects of climate change on basin sturgeon populations and develop adaptation strategies to address these impacts.

- **Recommendation 2:** The Council should incorporate ISAB recommendations for addressing hydrosystem impacts on Upper Columbia River White Sturgeon: • Develop a credible white sturgeon habitat model for the UCR to quantify habitat throughout the year in conjunction with mainstem hydrosystem operations • Identify the specific aspects of hydrosystem operations, such as duration of fluctuations in water releases and of water levels, that affect natural spawning, reproduction, growth and survival of larval and juvenile fishes, and overall recruitment success of white sturgeon in the UCR • Investigate the potential impacts of trace element contamination of UCR sediments on the quality of critical white sturgeon habitat throughout the UCR from Lake Roosevelt upstream to the International Border. Rationale: White Sturgeon in the Upper Columbia River (UCR) are considered a ‘Species at Risk’ by the Canadian federal government, are a species of active research for the Washington Department of Fish and Wildlife (WDFW), and are the focus of a recent UCR White Sturgeon Recovery Plan developed by US and Canada entities. That plan highlights a number of issues as contributing to poor white sturgeon populations and greatly diminished natural recruitment, including but not limited to, habitat diversity, flow regulation, water temperature, water clarity, total dissolved gas (TDG), contaminants, food availability, fish community alteration, predation, exploitation and incidental catch. Selected topics have benefited from recent studies by USGS, US EPA, WDFW, and the Colville and Spokane Tribes, but issues such as habitat diversity, flow regulation effects, temperature and elevated trace-element concentrations in bed sediments are in need of research. Specific to the UCR, the physical habitat for various life stages of white sturgeon have not been characterized or quantified, nor has the potential for trace-element contaminants to compromise critical habitats. The amount, distribution and complexity of benthic substrates in Lake Roosevelt are currently unknown. Various life stages of white sturgeon are known to utilize and benefit from particular habitat types in the Lower Columbia River, but similar understanding is not available for the UCR. Proper characterization of habitat availability would benefit fisheries managers in estimating what a sustainable population size should be. Substrate size, location and complexity (as substrate diversity) are key variables currently lacking characterization. Recent additions of detailed bathymetry of the Lake Roosevelt pool and lower portions of the UCR provided by US Bureau of Reclamation, and LiDAR (light detection and ranging) are key tools ready for application in developing a white sturgeon habitat model. Superimposed on a habitat model for the UCR are the multiple lines of evidence that indicate trace element contamination in the sediments of the UCR may be a critical habitat stressor to the reproductive success of white sturgeon in the reach between Lake Roosevelt and the International Border. Preliminary evidence suggest that hydrosystem controlled conditions in the mainstem river play a controlling factor on exposure of white sturgeon to dissolved trace elements mobilized from river bed sediments. Flow regulation has likely contributed to poor spawning and early-rearing success of white sturgeon in the upper Columbia River. Increased storage in the upper basin and hydro system operation have generally eliminated floods, reduced spring flows, and increased late summer through winter discharges. Recruitment of juvenile sturgeon has been widely correlated with spring flow volume. White sturgeon depend on riverine habitats and seasonal floods to provide suitable spawning conditions. Flow for larval dispersal may be a limiting factor.

Tribes/ Tribal Organizations

4. Burns Paiute Tribe, BPT (12) (submitted by Jason Kesling)

- Address threat of non-natives as resident fish mitigation, current program page 22-23, resident fish mitigation. Measure: BPA should fund efforts to address all primary limiting factors affecting resident fish including non-native species eradication and suppression. Rationale: proposed program language to be added to section 2 and/or Section 7 under Basinwide Strategies: "The threat of non-native species increasingly complicates the protection, restoration, and enhancement of resident fish species throughout the Basin. Competition, predation, and hybridization by non-natives often reduces the effectiveness of habitat protection and restoration efforts for native fish populations. Funding should be directed to treat the problem, not the symptoms, including research to better understand food-web interactions. Where non-native species have been identified as a primary limiting factor in subbasin plans, increased effort and funding should be directed to eradicate or suppress non-native species in conjunction with the proven methods that benefit their habitats
- Resident Fish Loss Assessment Current Program: Page 22-23, Resident Fish Mitigation and Crediting Measure: BPA should fund the agencies and tribes to develop a methodology and complete resident fish loss assessments. The selection of a method should be at the discretion of the entities involved in performing the survey; however, to standardize the process and ensure a consistent level of accuracy across the Basin the Council should form a workgroup of resident fish managers to address this issue. A framework for assessing resident fish losses shall be in place by 2015 with assessments initiated that same year. Rationale: The NPCC's amended Program provides for resident fish mitigation "where construction and inundation losses have been assessed and quantified by the appropriate agencies and tribes, mitigation should occur through the acquisition of appropriate interests in real property at a minimum ratio of 1:1 mitigation to lost distance or area." Despite the mitigation provisions, the Program does not prescribe specific methodology for the calculation of lost resident fish habitat due to construction and inundation. Because of this omission, resident fish managers (i.e., Columbia Basin Fish and Wildlife Authority's (CBFWA) members and non-members) in the Columbia River Basin, working through the CBFWA Resident Fish Advisory Committee, developed a methodology to allow for the consistent quantification of inundated resident fish habitat (CBFWA Members Action Notes, October 7, 2009). CBFWA sent a letter on October 8, 2009, to the NPCC suggesting a recommended methodology to calculate the amount of resident fish habitat that has been inundated by the construction of the FCRPS. The inundation methodology could serve as the foundation for future identification of operational losses. The NPCC should develop and adopt a standard methodology through a public process that includes independent science review and the participation of the resident fish managers throughout the Columbia River Basin.

5. Coeur d'Alene Tribe, CdA (13) (submitted by Cameron Heusser)

- Set forth the following program funding priority : B. allocate all resident fish funding to the habitats above chief Joseph and Grand Coulee dams and other blocked areas until resident fish harvest opportunities in these areas are commensurate with the combined anadromous and resident fish harvest allowed elsewhere in the Basin, and fund anadromous fish substitution projects from the anadromous allocation below Wells Dam.

6. Columbia River Inter-Tribal Fish Commission, CRITFC (14) (submitted by Aja DeCoteau)

- **4.3 White Sturgeon** Current Program: Page 12, 39, 41, 43, 47-49, 53, and 55 Measure: The Council should build a sturgeon program of short-term and long-term measures based on the recommendations from the Draft 2013 Framework, "Columbia River Basin White Sturgeon Planning Framework." Recommendation 1: The Program should consolidate measures intended to address sturgeon restoration. Rationale: White sturgeon are widely recognized as iconic mainstem fish species severely affected by construction and operation of the hydrosystem (ISAB 2013, Draft framework 2013, ISAB programmatic review, Kootenai and select Zone 6 sturgeon reports 1995 and 2012). About "4% (\$9.5 million) of annual direct Fish and Wildlife Program expenditures of \$246 million in 2012 were dedicated to white sturgeon. Kootenai sturgeon projects account for the majority of sturgeon-related expenditures (\$6.5 million). The remainder is distributed among one general and six accord projects" (Draft Framework 2013). The Council's Fish and Wildlife Program accounts for just a portion of total expenditures within the basin to restore white sturgeon populations. Four non-FCRPS hydropower entities, Idaho Power Company, Grant PUD, Chelan PUD, and Douglas PUD, fund substantial white sturgeon restoration programs within the reaches impacted by their hydropower projects. "Of all fish species in the Basin, the status of white sturgeon is most strongly tied to conditions in the mainstem, which are directly affected by the hydrosystem. The white sturgeon has declined greatly in abundance throughout most of the Columbia Basin. Only the population segment below Bonneville Dam still shows substantial natural recruitment, despite the fact that it is affected by hydrosystem operations at all dams upstream. It is anticipated that diminished natural recruitment will be a major factor influencing sturgeon status and the sustainability of harvest fisheries. Natural recruitment of sturgeon is potentially affected by hydrosystem operations directly, through blocked passage or inundation of preferred spawning areas, and indirectly, through the effects of water

flow and sediment release on spawning success. In addition, recently documented predation on adult sturgeon by Steller sea lions just below the Bonneville Dam may threaten that population (ISAB 2013)” In response to a Council request, sturgeon project sponsors recently completed a basin-wide framework plan for white sturgeon that synthesizes existing information and recommends actions to address limiting factors and information gaps. Strategic recommendations should be incorporated in to the mainstem plan as a sturgeon chapter. After ISRP review, the framework should be adopted into the Program.

- **4.5 Freshwater Mussels** Current Program: Freshwater Mussels not included Recommendation: Include language in the Fish and Wildlife Program to recognize the importance of freshwater mussels regarding ecosystem diversity, function, and traditional cultural opportunities in the basin: Rationale: Freshwater mussels are critically endangered world-wide. In western North America (genera Anodonta, Margaritifera, and Gonidea) are notoriously understudied, although they have historically been a major component of the biomass in western aquatic systems and likely have a disproportionately large impact on ecological stability and processes in these systems. Freshwater mussels were historically abundant in the Columbia Basin and can provide a myriad of ecosystem services that benefit other aquatic species, including salmonids. Recent studies suggest that freshwater mussels also benefit Pacific lamprey populations, in part by retaining organic matter in the system. Freshwater mussels have been harvested for food and shell material by Native Americans for over 10,000 years and are considered an important cultural resource. Recently BPA and CTUIR have funded pioneering work on the genetic composition, taxonomy, host fish, physiology and habitat associations of western freshwater mussels. Now that some of the basic questions (e.g., genetics, host fish) regarding western freshwater mussels have been answered, applied pilot actions and research can be appropriately designed and implemented to begin reintroduction and restoration efforts. Such studies and pilot efforts are critical for effective monitoring, conservation, and informing expanded restoration programs.
- Measures: The pilot freshwater mussel project should continue and move from a research phase into a restoration and monitoring phase that will provide critical information regarding reintroduction and restoration that can be later applied to a larger scale.

7. Confederated Salish and Kootenai Tribes, CSKT, (16) (submitted by Lynn DuCharme)

- RESIDENT FISH, Resident Fish Mitigation and crediting, Current Program: Pages 22-23, Resident Fish Mitigation and Crediting, Recommendation: The Council should continue to support and BPA shall fund the existing language in the 2009 Program regarding resident fish mitigation, on pages 22-23. In addition:
 - Maintain the existing language from the 2009 Program listed below with modifications shown in bold:
 - Resident Fish Mitigation Settlement [add: **and Multi-year**] Agreements Whenever possible, resident fish mitigation via habitat acquisitions should take place through long-term [add: **or multi-year**] agreements that, [delete: ~~as with wildlife mitigation agreements,~~], have clear objectives, a plan for action over time, a committed level of funding that provides a substantial likelihood of achieving and sustaining the stated [delete: ~~wildlife~~]-mitigation objectives, and provisions to ensure effective implementation with periodic monitoring and evaluation.
 - Provisions [add: **to assure**] for long-term maintenance of the habitat adequate to sustain the [delete: ~~credited~~] habitat values for the life of the project. BPA shall increase base funding proportionate to the stream miles/acres protected
- Address the Threat of Climate Change to Resident Fish Current Program: Page 22-23, Resident Fish Mitigation Measure: BPA should fund perpetual land protection which includes conservation easements, land purchases, or other long term measures to combat climate change impacts on resident fish. Rationale and proposed Program language to be added to Section 7 of Basinwide Strategies on Page 22: "*Climate change threatens the existence of native resident fish in the Columbia basin. The ISAB directs the Council to consider requiring project proposals and management plans to consider the potential impact on project outcomes of climate change and its associated variability and uncertainty. Perpetual land protection efforts are one of the most effective ways to combat climate change. By protecting and restoring key habitat features such as riparian shading, channel morphology and improved base flows, population resiliency increases. Targeting those parcels with the combination of connectivity and intact healthy riparian and stream habitat will give those systems more resiliency as climate change and variability take effect.*"
- Address Management of Non-natives as Resident Fish Mitigation Current Program: Page 22-23, Resident Fish Mitigation, Measure: BPA should fund efforts to address all primary limiting factors affecting resident fish including non-native species eradication and suppression and coordinate these efforts with companion efforts that protect anadromous fish from non-native species. Rationale and proposed Program language to be added to Section 2 and/or Section 7 under Basinwide Strategies: "*The threat of non-native species increasingly*

complicates the protection, restoration, and enhancement of resident fish species throughout the basin. Competition, predation and hybridization by non-natives often reduce the effectiveness of habitat protection and restoration efforts for native fish populations. Funding should be directed to treat the problem, not the symptoms, including research to better understand food-web interactions. Where non-native species have been identified as a primary limiting factor in subbasin plans, increased effort and funding should be directed to eradicate or suppress non-native species in conjunction with the proven methods that benefit their habitats."

- Resident Fish Loss Assessments Current Program: Page 22-23, Resident Fish Mitigation and Crediting , Measure: :BPA should fund the Agencies and Tribes to develop a methodology and complete resident fish loss assessments. The selection of a method should be at the discretion of the entities involved in performing the survey; however, to standardize the process and ensure a consistent level of accuracy across the basin the Council should form a workgroup of resident fish managers to address this issue. A framework for assessing resident fish losses shall be in place by 2015 with assessments initiated that same year. Rationale: The Northwest Power and Conservation Council's (Council) amended Fish and Wildlife Program (Program) provides for resident fish mitigation "where construction and inundation losses have been assessed and quantified by the appropriate agencies and tribes, mitigation should occur through the acquisition of appropriate interests in real property at a minimum ratio of 1:1 mitigation to lost distance or area." Despite the mitigation provisions, the Program does not prescribe specific methodology for the calculation of lost resident fish habitat due to construction and inundation. Because of this omission, resident fish managers (i.e., Columbia Basin Fish and Wildlife Authority's (CBFWA) members and non-members) in the Columbia River Basin, working through the CBFWA Resident Fish Advisory Committee (RFAC), developed a methodology to allow for the consistent quantification of inundated resident fish habitat (CBFWA Members Action Notes, October 7, 2009).The CBFWA sent a letter on October 8, 2009 to the Council suggesting a recommended methodology to calculate the amount of resident fish habitat that has been inundated by the construction of the Federal Columbia River Power System. The inundation methodology could serve as the foundation for future identification of operational losses. The Council should develop and adopt a standard methodology through a public process that includes independent science review and the participation of the resident fish managers throughout the Columbia River Basin
- Implement Predator Control Measure: BPA (and action agencies) should work cooperatively with NOAA Fisheries, USFWS, states, tribes and the Council to develop and implement system wide strategies to manage and reduce non-native fishes that compete and feed on native fish in mainstem and in tributaries. This also applies to section II.D.2 Non-Native Species Strategies, page 18. Rationale: The Program, as currently implemented by BPA, is anadromous fish centric and should more strongly consider impacts to native resident fish. The program seems to call out or emphasize focus on several non-native species, but this focus should not de-emphasize the need to address other non-native species in the Basin that have an effect on native fish populations (e.g. lake trout, northern pike, white crappie, yellow perch, etc...).
 - Non-native fish have significant negative effects on native resident fish species
 - Northern pike have greatly reduced native fish populations in the Pend Oreille system
 - Walleye and smallmouth bass have reduced native resident populations in Lake Roosevelt
 - Relative abundance of smallmouth bass has nearly doubled in areas of John Day Reservoir in recent years and this may influence predation on juvenile salmonids Competitive interactions between northern pikeminnow and smallmouth bass, may cause a shift in northern pikeminnow diets and habitat use, which could in turn exacerbate predation on juvenile salmonidsThe decades of emphasis on northern pikeminnow control has narrowed piscivorous predation to a singular focus with very little emphasis on baseline studies on populations, habitat use, and diets in the mainstem and major tributaries
 - White crappie predation on juvenile spring Chinook salmon in Lookout and Hills Creek reservoirs may significantly increase mortality rates
 - Lake trout threaten bull trout and other native trout in areas where lake trout have been introduced into native trout habitat
- The Program should support, and BPA should fund, additional research into the overall magnitude of the impacts of non-native predators including studies on abundance, movement and habitat use, and food web interactions in order to help guide improved management of non-natives

8. Confederated Tribes of Grand Ronde, CTGR (18) (submitted by Lawrence Schwabe)

- **Recommendation 17** — Under section b. Resident Fish Mitigation Settlement Agreements on page 23, the Program should reflect the following: *BPA should fund the Agencies and Tribes to develop a*

methodology and complete resident fish loss assessments. The selection of a method should be at the discretion of the entities involved in performing the survey; however, to standardize the process and ensure a consistent level of accuracy across the basin the Council should form a workgroup of resident fish managers to address this issue. A framework for assessing resident fish losses shall be in place by 2015 with assessments initiated that same year. Rationale: The Northwest Power and Conservation Council's (Council) amended Fish and Wildlife Program (Program) provides for resident fish mitigation "where construction and inundation losses have been assessed and quantified by the appropriate agencies and tribes, mitigation should occur through the acquisition of appropriate interests in real property at a minimum ratio of 1:1 mitigation to lost distance or area." Despite the mitigation provisions, the Program does not prescribe specific methodology for the calculation of lost resident fish habitat due to construction and inundation. Because of this omission, resident fish managers (i.e., Columbia Basin Fish and Wildlife Authority's (CBFWA) members and non-members) in the Columbia River Basin, working through the CBFWA Resident Fish Advisory Committee (RFAC), developed a methodology to allow for the consistent quantification of inundated resident fish habitat (CBFWA Members Action Notes, October 7, 2009). The CBFWA sent a letter on October 8, 2009 to the Council suggesting a recommended methodology to calculate the amount of resident fish habitat that has been inundated by the construction of the Federal Columbia River Power System. The inundation methodology could serve as the foundation for future identification of operational losses. The Council should develop and adopt a standard methodology through a public process that includes independent science review and the participation of the resident fish managers throughout the Columbia River Basin.

9. Confederated Tribes of the Umatilla India Reservation, CTUIR (19) (submitted by Kat Brigham)

- Current Program. Freshwater Mussels. New Section: a. Recommendation: Include language in the Fish and Wildlife Program to recognize the importance of freshwater mussels regarding ecosystem diversity, function, and traditional cultural opportunities in the basin. The CTUIR pilot freshwater mussel project should continue and move from a research phase into a restoration and monitoring phase that will provide critical information regarding reintroduction and restoration that can be later applied to a larger scale. b. Rationale: Freshwater mussels are critically endangered world-wide. In western North America (genera Anodonta, Margaritifera, and Gonidea) are notoriously understudied, although they have historically been a major component of the biomass in western aquatic systems and likely have a disproportionately large impact on ecological stability and processes in these systems. Freshwater mussels were historically abundant in the Columbia Basin and can provide a myriad of ecosystem services that benefit other aquatic species, including salmonids. Recent studies suggest that freshwater mussels also benefit Pacific lamprey populations, in part by retaining organic matter in the system. Freshwater mussels have been harvested for food and shell material by Native Americans for over 10,000 years and are considered an important cultural resource. Recently BPA and CTUIR have funded pioneering work on the genetic composition, taxonomy, host fish, physiology and habitat associations of western freshwater mussels. Now that some of the basic questions (e.g., genetics, host fish) regarding western freshwater mussels have been answered, applied pilot actions and research can be appropriately designed and implemented to begin reintroduction and restoration efforts. Such studies and pilot efforts are critical for effective monitoring, conservation, and informing expanded restoration programs.

10. Cowlitz Indian Tribe, Cowlitz I.T. (22) (submitted by William Ivall)

- **4.0 Resident Fish , 4.1 Address the Threat of Climate Change to Resident Fish** , Current Program: Page 22-23, Resident Fish Mitigation , Measure: BPA should fund perpetual land protection which includes conservation easements, land purchases, or other long term measures to combat climate change impacts on resident fish. Rationale and proposed Program language to be added to Section 7 of Basinwide Strategies on Page 22: *"Climate change threatens the existence of native resident fish in the Columbia basin. The ISAB directs the Council to consider requiring project proposals and management plans to consider the potential impact on project outcomes of climate change and its associated variability and uncertainty. Perpetual land protection efforts are one of the most effective ways to combat climate change. By protecting and restoring key habitat features such as riparian shading, channel morphology and improved base flows, population resiliency increases. Targeting those parcels with the combination of connectivity and intact healthy riparian and stream habitat will give those systems more resiliency as climate change and variability take effect."*

- **4.2 Address Management of Non-natives as Resident Fish Mitigation**, Current Program: Page 22-23, Resident Fish Mitigation, Measure: BPA should fund efforts to address all primary limiting factors affecting resident fish including non-native species eradication and suppression and coordinate these efforts with companion efforts that protect anadromous fish from non-native species. Rationale and proposed Program language to be added to Section 2 and/or Section 7 under Basinwide Strategies: *“The threat of non-native species increasingly complicates the protection, restoration, and enhancement of resident fish species throughout the basin. Competition, predation and hybridization by non-natives often reduces the effectiveness of habitat protection and restoration efforts for native fish populations. Funding should be directed to treat the problem, not the symptoms, including research to better understand food-web interactions. Where non-native species have been identified as a primary limiting factor in subbasin plans, increased effort and funding should be directed to eradicate or suppress non-native species in conjunction with the proven methods that benefit their habitats.”*
- **4.4 Resident Fish Loss Assessments**, Current Program: Page 22-23, Resident Fish Mitigation and Crediting, Measure: BPA should fund the Agencies and Tribes to develop a methodology and complete resident fish loss assessments. The selection of a method should be at the discretion of the entities involved in performing the survey; however, to standardize the process and ensure a consistent level of accuracy across the basin the Council should form a workgroup of resident fish managers to address this issue. A framework for assessing resident fish losses shall be in place by 2015 with assessments initiated that same year. Rationale: The Northwest Power and Conservation Council’s (Council) amended Fish and Wildlife Program (Program) provides for resident fish mitigation “where construction and inundation losses have been assessed and quantified by the appropriate agencies and tribes, mitigation should occur through the acquisition of appropriate interests in real property at a minimum ratio of 1:1 mitigation to lost distance or area.” Despite the mitigation provisions, the Program does not prescribe specific methodology for the calculation of lost resident fish habitat due to construction and inundation. Because of this omission, resident fish managers (i.e., Columbia Basin Fish and Wildlife Authority’s (CBFWA) members and non-members) in the Columbia River Basin, working through the CBFWA Resident Fish Advisory Committee (RFAC), developed a methodology to allow for the consistent quantification of inundated resident fish habitat (CBFWA Members Action Notes, October 7, 2009). The CBFWA sent a letter on October 8, 2009 to the Council suggesting a recommended methodology to calculate the amount of resident fish habitat that has been inundated by the construction of the Federal Columbia River Power System. The inundation methodology could serve as the foundation for future identification of operational losses. The Council should develop and adopt a standard methodology through a public process that includes independent science review and the participation of the resident fish managers throughout the Columbia River Basin.
- **5.4 White Sturgeon**, Current Program: Page 12, 39, 41, 43, 47-49, 53, and 55, Measure: BPA should adequately fund sturgeon recovery and the recommendations from the Draft 2013 Framework.
- Recommendation 1: The Program should consolidate measures intended to address sturgeon restoration into set of strategies in the Mainstem Plan. Incorporate recommendations of Oregon’s White Sturgeon Conservation Plan and the White Sturgeon Framework Plan into the Program. The Framework should be identified as a Program appendix on White Sturgeon. Rationale: White sturgeon are widely recognized as iconic mainstem fish species severely affected by construction and operation of the hydrosystem (ISAB 2013, Draft framework 2013, ISAB programmatic review, Kootenai and select Zone 6 sturgeon reports 1995 and 2012). About “4% (\$9.5 million) of annual direct Fish and Wildlife Program expenditures of \$246 million in 2012 were dedicated to white sturgeon. Kootenai sturgeon projects account for the majority of sturgeon-related expenditures (\$6.5 million). The remainder is distributed among one general and six accord projects” (Draft Framework 2013). The Council’s Fish and Wildlife Program accounts for just a portion of total expenditures within the basin to restore white sturgeon populations. Four non-FCRPS hydropower entities, Idaho Power Company, Grant PUD, Chelan PUD, and Douglas PUD, fund substantial white sturgeon restoration programs within the reaches impacted by their hydropower projects. “Of all fish species in the Basin, the status of white sturgeon is most strongly tied to conditions in the mainstem, which are directly affected by the hydrosystem. The white sturgeon has declined greatly in abundance throughout most of the Columbia Basin. Only the population segment below Bonneville Dam still shows substantial natural recruitment, despite the fact that it is affected by hydrosystem operations at all dams upstream. It is anticipated that diminished natural recruitment will be a major factor influencing sturgeon status and the sustainability of harvest fisheries. Natural recruitment of sturgeon is potentially affected by hydrosystem operations directly, through blocked passage or inundation of preferred spawning areas, and indirectly, through the effects of water flow and sediment release on spawning success. In addition, recently

documented predation on adult sturgeon by Steller sea lions just below the Bonneville Dam may threaten that population (ISAB 2013)” In response to a Council request, sturgeon project sponsors recently completed a basin-wide framework plan for white sturgeon that synthesizes existing information and recommends actions to address limiting factors and information gaps. Strategic recommendations should be incorporated in to the mainstem plan as a sturgeon chapter. After ISRP review, the framework should be adopted into the Program.

- Recommended Draft Language: Insert the following text into the *Mainstem Plan as Strategies for White Sturgeon*: “*The Program supports a vision of abundant and diverse white sturgeon populations and optimum sustainable fisheries throughout the historical range, achieved by a combination of natural production and careful supplementation, and supported through an adaptive, collaborative, coordinated, science-based mitigation, management, monitoring, and evaluation program to be achieved over the coming 50 years. Seven basic elements are incorporated into this vision: sustainability; natural production; biological characteristics; an inclusive program scope; effective monitoring, research, and evaluation; and rebuilding/mitigation. To date, the Council has supported sturgeon program efforts that have effectively documented biology, status and limiting factors throughout the region. White sturgeon distribution, abundance, and productivity throughout the Columbia and Snake river basins are severely limited by habitat changes, particularly those associated with hydropower system construction and operation. Large areas of suitable sturgeon habitat remain throughout most of the historical range upstream from Bonneville Dam but use is currently limited by widespread passage limitations and natural recruitment problems that are the direct and/or indirect result of the development and operation of the Columbia River hydrosystem. The Council endorses additional work that contributes to conservation, recovery or mitigation goals identified in the Columbia Basin White Sturgeon Planning Framework (NPCC 2013). Strategies to achieve the sturgeon vision include: - Operate the FCRPS to provide operations consistent with normative river conditions, including increased spring and summer flows and spill. Recruitment in many impounded areas has been positively correlated with high annual discharge April—July. Sturgeon are expected to benefit from court-ordered dam operational measures being implemented for salmon and steelhead. - Continue to utilize and adaptively manage conservation hatchery programs as interim measures to avoid extinction of unique sturgeon populations. - Hatchery production of sturgeon can be an appropriate mitigation strategy to supplement populations where natural recruitment is currently limited. This strategy should: (1) Be conservative and responsible in establishing protocols for source populations and numbers of hatchery fish released; (2) Build on knowledge gained from ongoing hatchery efforts in other areas; (3) Utilize experimental hatchery releases and monitoring to assess ecological factors and population productivity limitations; and (4) Optimize hatchery production and practices consistent with monitoring natural production and environmental carrying capacity which will most effectively be identified using an experimentally adaptive approach. - Some opportunities for sturgeon passage improvements exist but benefits are likely to be limited by habitat-related natural recruitment problems in most areas. Passage strategies for white sturgeon should include: (1) Detailed evaluations of costs, benefits and risks of passage improvements relative to other potential strategies; (2) Consideration of opportunities to incorporate sturgeon-friendly features in existing fish ladders during future ladder designs and planned modification where consistent with sturgeon population goals and objectives; (3) Opportunities for non-volitional passage by taking advantage of fish trapped in dewater draft tubes or fish ladders during maintenance; and (4) Continued review of protocols used to prevent fish stranding/mortality during planned maintenance activities at passage facilities. - Investigate the use of site-specific habitat measures such as substrate enhancement and channel restoration as viable alternatives for improving natural recruitment in some areas. - Support fishery monitoring and management in combination with the suite of other restoration options to mitigate for lost productivity and contribute to population rebuilding efforts in areas where harvest is warranted, but where natural recruitment is currently limited and the subpopulation does not represent a unique component of the historical diversity. - Manage marine mammals to reduce predation of white sturgeon downstream of Bonneville Dam. - Operate the hydrosystem to reduce mortality on white sturgeon. Block access to turbine draft tubes during turbine dewatering and other maintenance operations to minimize white sturgeon entrainment and mortality. - Conduct dredging operations in a manner minimizing operation-related mortality on white sturgeon. - Conduct research that addresses critical white sturgeon uncertainties identified in the Columbia Basin White Sturgeon Planning Framework. - Monitor and evaluate mitigative white sturgeon restoration actions, and population responses to environmental condition consistent with the Columbia*

Basin White Sturgeon Planning Framework.” - Assess the effects of climate change on basin sturgeon populations and develop adaptation strategies to address these impacts.

- Recommendation 2: The Council should incorporate ISAB recommendations for addressing hydrosystem impacts on Upper Columbia River White Sturgeon: - Develop a credible white sturgeon habitat model for the UCR to quantify habitat throughout the year in conjunction with mainstem hydrosystem operations - Identify the specific aspects of hydrosystem operations, such as duration of fluctuations in water releases and of water levels, that affect natural spawning, reproduction, growth and survival of larval and juvenile fishes, and overall recruitment success of white sturgeon in the UCR - Investigate the potential impacts of trace element contamination of UCR sediments on the quality of critical white sturgeon habitat throughout the UCR from Lake Roosevelt upstream to the International Border. Rationale: White Sturgeon in the Upper Columbia River (UCR) are considered a ‘Species at Risk’ by the Canadian federal government, are a species of active research for the Washington Department of Fish and Wildlife (WDFW), and are the focus of a recent UCR White Sturgeon Recovery Plan developed by US and Canada entities. That plan highlights a number of issues as contributing to poor white sturgeon populations and greatly diminished natural recruitment, including but not limited to, habitat diversity, flow regulation, water temperature, water clarity, total dissolved gas (TDG), contaminants, food availability, fish community alteration, predation, exploitation and incidental catch. Selected topics have benefited from recent studies by USGS, US EPA, WDFW, and the Colville and Spokane Tribes, but issues such as habitat diversity, flow regulation effects, temperature and elevated trace-element concentrations in bed sediments are in need of research. Specific to the UCR, the physical habitat for various life stages of white sturgeon have not been characterized or quantified, nor has the potential for trace-element contaminants to compromise critical habitats. The amount, distribution and complexity of benthic substrates in Lake Roosevelt are currently unknown. Various life stages of white sturgeon are known to utilize and benefit from particular habitat types in the lower Columbia River, but similar understanding is not available for the UCR. Proper characterization of habitat availability would benefit fisheries managers in estimating what a sustainable population size should be. Substrate size, location and complexity (as substrate diversity) are key variables currently lacking characterization. Recent additions of detailed bathymetry of the Lake Roosevelt pool and lower portions of the UCR provided by US Bureau of Reclamation, and LiDAR (light detection and ranging) are key tools ready for application in developing a white sturgeon habitat model. Superimposed on a habitat model for the UCR are the multiple lines of evidence that indicate trace element contamination in the sediments of the UCR may be a critical habitat stressor to the reproductive success of white sturgeon in the reach between Lake Roosevelt and the International Border. Preliminary evidence suggest that hydrosystem controlled conditions in the mainstem river play a controlling factor on exposure of white sturgeon to dissolved trace elements mobilized from river bed sediments.

11. Kalispel Tribe of Indians, Kalispel T.I. (23) (submitted by Deane Osterman)

- To further this interest and help fulfill the Program's existing vision, we recommend that the Council incorporate the following into its amended Program:
 - 1) The actions required by the July 2012 Memorandum of Agreement between the Kalispel Tribe, the Bonneville Power Administration, the U.S. Army Corps of Engineers, and the U.S. Bureau of Reclamation ("Kalispel Fish Accord").
 - 2) The actions required by the U.S. Fish and Wildlife Service's 2000 Biological Opinion entitled "Effects to Listed Species from Operations of the Federal Columbia River Power System" ("2000 BiOp"), including any modifications to this BiOp resulting from consultation due to the 2010 designation of bull trout critical habitat.
- These clarifications with respect to recommendations 1 and 2:
 - (a.) The 2000 BiOp's expired timelines related to bull trout passage at Albeni Falls Dam will be superseded by the Corps' September 16, 2013 project schedule:

Task/Milestone	Date
Complete Alternatives Milestone	Aug 2013
Identify TSP and Prepare Integrated Draft Report/EA for DQC and Concurrent Reviews	April 2014
Complete TSP Milestone	Jul 2014
Complete/compile reviews (Public, Agency Technical, Legal/Policy, etc.)	Nov 2014
Agency Decision Milestone	Feb 2015
Complete Feasibility Level Analysis	Aug 2015

Final Report Milestone	Dec 2015
NWD approves Decision Document and, if required, forward to HQ	Apr 2016

Note: Schedule is pre-decisional, best-case, and subject to appropriations

- (b) This statement: "The Northwest Power Act provides an independent obligation for providing fish passage at Albeni Falls Dam. The dam extirpated migratory bull trout from downstream waters in the Pend Oreille River and its tributaries more than 50 years ago, rendering over 230 miles of bull trout habitat functionally useless. Fish passage is necessary to achieve the aquatic resource objectives for the Columbia River Basin, Intermountain Province, and Pend Oreille Subbasin. These objectives include, but are not limited to: (1) maintaining functional ecosystems for resident fish, (2) restoring resident fish species to near historic abundance throughout their historic ranges, and (3) providing abundant harvest opportunities for tribal members (including Kalispel people, who have not been able to harvest bull trout in Reservation waters for decades due to the construction and operation of Albeni Falls Dam). The Council accordingly identifies fish passage at Albeni Falls Dam as one of the Program's highest priorities under the Northwest Power Act, and supports the timely completion of the bull trout feasibility study through the Kalispel Fish Accord as a way of achieving this conservation objective."
- (c) This statement: "Using the collaborative process set forth in the Kalispel Fish Accord, Bonneville and the Corps shall expeditiously identify and implement conservation measures to reduce the likelihood of harm to bull trout prior to the construction of permanent fish passage at Albeni Falls Dam. Implementation of these measures shall not delay performance of actions that are already planned for completion under the Accord."
- 4. The amendment recommendations of the Upper Columbia United Tribes ("UCUT"), to the extent they are consistent with the Kalispel Fish Accord.

12. Nez Perce Tribe, NPT (25) (submitted by David Johnson)

- Section II D. Basinwide Provisions - Basinwide Strategies Resident Fish Mitigation, Page 22.
Recommendation: BPA to fund perpetual land protection which includes conservation easements, land purchases, or other long term measures to combat climate change impacts on resident fish.
- Recommendation: BPA to fund efforts to address all primary limiting factors affecting resident fish including non-native species eradication and suppression and coordinate these efforts with companion efforts that protect anadromous fish from non-native species.

13. Spokane Tribe of Indians (26), STI (submitted by B.J. Kieffer)

- RESIDENT FISH MITIGATION , Resident fish and resident fish habitat loss has occurred in the Spokane Tribe's usual and accustomed areas as a result of the construction and continual operation of Grand Coulee Dam. These losses must be mitigated for in these areas. The current program address's mitigation for resident fish populations that are impacted through historical and continuing hydro-system operations. Council will ensure the following guidance language in the Program be maintained and implemented: (Section 7, Page 22) 7. Resident Fish Mitigation, The habitat, artificial production, harvest, and hydrosystem protection and mitigation strategies set forth above address effects on both anadromous and resident fish. There are additional considerations that apply particularly to resident fish mitigation in those areas of the Program that have completed quantitative resident fish loss assessments and where land acquisitions are a primary tool for mitigation. These considerations, similar to the mitigation strategies that address wildlife losses, include:
- Resident Fish Mitigation and Crediting, Resident fish loss assessments resulting from the construction of hydroelectric facilities have generally been quantified in terms of acres or stream miles of key habitat for focal species inundated or blocked. Such losses are most effectively mitigated by acquiring interests in real property for the primary purpose of preserving, enhancing, restoring, and/or creating fish and wildlife habitat equal to the quantity and quality of habitat lost. In areas where construction and inundation losses have been assessed and quantified by the appropriate agencies and tribes, mitigation should occur through the acquisition of appropriate interests in real property at a minimum ratio of 1:1 mitigation to lost distance or area.
- Resident Fish Mitigation Settlement Agreements, BPA should fund resident fish mitigation via habitat acquisitions that take place through long-term agreements that have clear objectives, a plan for action over time, a committed level of funding that provides a substantial likelihood of achieving and sustaining the

stated mitigation objectives, and provisions to ensure effective implementation with periodic monitoring and evaluation. Resident fish mitigation agreements should include:

- Measurable objectives, including the estimated resident fish habitat losses addressed by acquisitions.
 - Demonstration of consistency with the policies, objectives and strategies in the Council's program.
 - A committed level of funding that provides a substantial likelihood of achieving and sustaining the stated mitigation objectives.
 - Adequate funding for Operation and Maintenance.
 - When possible, protection for riparian habitat that can benefit both fish and wildlife, and protection for high quality native habitat and species of special concern, including endangered, threatened, or sensitive species.
 - Sufficient funding to demonstrate a substantial likelihood of achieving and sustaining the resident fish mitigation objectives.
 - Resident fish mitigation agreements may include the protection of un-degraded or less degraded habitat or, in appropriate circumstances may include protection and improvement of degraded habitat when necessary for effective mitigation. In the latter case, any mitigation agreements with Bonneville should include sufficient funding to enhance, restore, and create habitat functions and values for the target species of resident fish on acquired lands that are degraded.
- Management Plan and Operation and Maintenance Funding, Resident fish mitigation measures shall include a management plan adequate to sustain the habitat values for the life of the project. Resident fish mitigation measures shall include sufficient funding for operation and maintenance over the long term to demonstrate a substantial likelihood of achieving and sustaining the mitigation objectives.
 - From table - Assess current status in the Spokane Arm and Columbia River adjacent to the Spokane Indian Reservation [about freshwater mussels]

14. Upper Columbia United Tribes (27), UCUT (submitted by DR Michael)

- Nothing about resident fish mitigation or other resident fish

15. Upper Snake River Tribes Foundation, USRTF (28) (submitted by Heather Ray)

- 4.0 Resident Fish , 4.1 Address the Threat of Climate Change to Resident Fish , Current Program: Page 22-23, Resident Fish Mitigation , Measure: BPA should fund perpetual land protection which includes conservation easements, land purchases, or other long term measures to combat climate change impacts on resident fish. Rationale and proposed Program language to be added to Section 7 of Basinwide Strategies on Page 22: “Climate change threatens the existence of native resident fish in the Columbia basin. The ISAB directs the Council to consider requiring project proposals and management plans to consider the potential impact on project outcomes of climate change and its associated variability and uncertainty. Perpetual land protection efforts are one of the most effective ways to combat climate change. By protecting and restoring key habitat features such as riparian shading, channel morphology and improved base flows, population resiliency increases. Targeting those parcels with *the combination of connectivity and intact healthy riparian and stream habitat will give those systems more resiliency as climate change and variability take effect.*”
- 4.2 Address Management of Non-natives as Resident Fish Mitigation , Current Program: Page 22-23, Resident Fish Mitigation , Measure: BPA should fund efforts to address all primary limiting factors affecting resident fish including non-native species eradication and suppression and coordinate these efforts with companion efforts that protect anadromous fish from non-native species. Rationale and proposed Program language to be added to Section 2 and/or Section 7 under Basinwide Strategies: “The threat of non-native species increasingly complicates the protection, restoration, and enhancement of resident fish species throughout the basin. Competition, predation and hybridization by non-natives often reduces the effectiveness of habitat protection and restoration efforts for native fish populations. Funding should be directed to treat the problem, not the symptoms, including research to better understand food-web interactions. Where non-native species have been identified as a primary limiting factor in subbasin plans, increased effort and funding should be directed to eradicate or suppress non-native species in conjunction with the proven methods that benefit their habitats.”
- 4.4 Resident Fish Loss Assessments , Current Program: Page 22-23, Resident Fish Mitigation and Crediting , Measure: BPA should fund the Agencies and Tribes to develop a methodology and complete resident fish

loss assessments. The selection of a method should be at the discretion of the entities involved in performing the survey; however, to standardize the process and ensure a consistent level of accuracy across the basin the Council should form a workgroup of resident fish managers to address this issue. A framework for assessing resident fish losses shall be in place by 2015 with assessments initiated that same year. Rationale: The Northwest Power and Conservation Council's (Council) amended Fish and Wildlife Program (Program) provides for resident fish mitigation "where construction and inundation losses have been assessed and quantified by the appropriate agencies and tribes, mitigation should occur through the acquisition of appropriate interests in real property at a minimum ratio of 1:1 mitigation to lost distance or area." Despite the mitigation provisions, the Program does not prescribe specific methodology for the calculation of lost resident fish habitat due to construction and inundation. Because of this omission, resident fish managers (i.e., Columbia Basin Fish and Wildlife Authority's (CBFWA) members and non-members) in the Columbia River Basin, working through the CBFWA Resident Fish Advisory Committee (RFAC), developed a methodology to allow for the consistent quantification of inundated resident fish habitat (CBFWA Members Action Notes, October 7, 2009). The CBFWA sent a letter on October 8, 2009 to the Council suggesting a recommended methodology to calculate the amount of resident fish habitat that has been inundated by the construction of the Federal Columbia River Power System. The inundation methodology could serve as the foundation for future identification of operational losses. The Council should develop and adopt a standard methodology through a public process that includes independent science review and the participation of the resident fish managers throughout the Columbia River Basin.

- 5.4 White Sturgeon ,Current Program: Page 12, 39, 41, 43, 47-49, 53, and 55 , Measure: BPA should adequately fund sturgeon recovery and the recommendations from the Draft 2013 Framework.
- Recommendation 1: The Program should consolidate measures intended to address sturgeon restoration into set of strategies in the Mainstem Plan. Incorporate recommendations of Oregon's White Sturgeon Conservation Plan and the White Sturgeon Framework Plan into the Program. The Framework should be identified as a Program appendix on White Sturgeon. Rationale: White sturgeon are widely recognized as iconic mainstem fish species severely affected by construction and operation of the hydrosystem (ISAB 2013, Draft framework 2013, ISAB programmatic review, Kootenai and select Zone 6 sturgeon reports 1995 and 2012). About "4% (\$9.5 million) of annual direct Fish and Wildlife Program expenditures of \$246 million in 2012 were dedicated to white sturgeon. Kootenai sturgeon projects account for the majority of sturgeon-related expenditures (\$6.5 million). The remainder is distributed among one general and six accord projects" (Draft Framework 2013). The Council's Fish and Wildlife Program accounts for just a portion of total expenditures within the basin to restore white sturgeon populations. Four non-FCRPS hydropower entities, Idaho Power Company, Grant PUD, Chelan PUD, and Douglas PUD, fund substantial white sturgeon restoration programs within the reaches impacted by their hydropower projects. "Of all fish species in the Basin, the status of white sturgeon is most strongly tied to conditions in the mainstem, which are directly affected by the hydrosystem. The white sturgeon has declined greatly in abundance throughout most of the Columbia Basin. Only the population segment below Bonneville Dam still shows substantial natural recruitment, despite the fact that it is affected by hydrosystem operations at all dams upstream. It is anticipated that diminished natural recruitment will be a major factor influencing sturgeon status and the sustainability of harvest fisheries. Natural recruitment of sturgeon is potentially affected by hydrosystem operations directly, through blocked passage or inundation of preferred spawning areas, and indirectly, through the effects of water flow and sediment release on spawning success. In addition, recently documented predation on adult sturgeon by Steller sea lions just below the Bonneville Dam may threaten that population (ISAB 2013)" In response to a Council request, sturgeon project sponsors recently completed a basin-wide framework plan for white sturgeon that synthesizes existing information and recommends actions to address limiting factors and information gaps. Strategic recommendations should be incorporated in to the mainstem plan as a sturgeon chapter. After ISRP review, the framework should be adopted into the Program.
- Recommended Draft Language: Insert the following text into the Mainstem Plan as Strategies for White Sturgeon: "The Program supports a vision of abundant and diverse white sturgeon populations and optimum sustainable fisheries throughout the historical range, achieved by a combination of natural production and careful supplementation, and supported through an adaptive, collaborative, coordinated, science-based mitigation, management, monitoring, and evaluation program to be achieved over the coming 50 years. Seven basic elements are incorporated into this vision: sustainability; natural production; biological characteristics; an inclusive program scope; effective monitoring, research, and evaluation; and rebuilding/mitigation. To date, the Council has supported sturgeon program efforts that have effectively

documented biology, status and limiting factors throughout the region. White sturgeon distribution, abundance, and productivity throughout the Columbia and Snake river basins are severely limited by habitat changes, particularly those associated with hydropower system construction and operation. Large areas of suitable sturgeon habitat remain throughout most of the historical range upstream from Bonneville Dam but use is currently limited by widespread passage limitations and natural recruitment problems that are the direct and/or indirect result of the development and operation of the Columbia River hydrosystem. The Council endorses additional work that contributes to conservation, recovery or mitigation goals identified in the Columbia Basin White Sturgeon Planning Framework (NPCC 2013). Strategies to achieve the sturgeon vision include:

- Operate the FCRPS to provide operations consistent with normative river conditions, including increased spring and summer flows and spill. Recruitment in many impounded areas has been positively correlated with high annual discharge April—July. Sturgeon are expected to benefit from court-ordered dam operational measures being implemented for salmon and steelhead.
- Continue to utilize and adaptively manage conservation hatchery programs as interim measures to avoid extinction of unique sturgeon populations.
- Hatchery production of sturgeon can be an appropriate mitigation strategy to supplement populations where natural recruitment is currently limited. This strategy should:
 - (1) Be conservative and responsible in establishing protocols for source populations and numbers of hatchery fish released;
 - (2) Build on knowledge gained from ongoing hatchery efforts in other areas;
 - (3) Utilize experimental hatchery releases and monitoring to assess ecological factors and population productivity limitations;
 - and (4) Optimize hatchery production and practices consistent with monitoring natural production and environmental carrying capacity which will most effectively be identified using an experimentally adaptive approach.
- Some opportunities for sturgeon passage improvements exist but benefits are likely to be limited by habitat-related natural recruitment problems in most areas. Passage strategies for white sturgeon should include:
 - (1) Detailed evaluations of costs, benefits and risks of passage improvements relative to other potential strategies;
 - (2) Consideration of opportunities to incorporate sturgeon-friendly features in existing fish ladders during future ladder designs and planned modification where consistent with sturgeon population goals and objectives;
 - (3) Opportunities for non-volitional passage by taking advantage of fish trapped in dewater draft tubes or fish ladders during maintenance; and
 - (4) Continued review of protocols used to prevent fish stranding/mortality during planned maintenance activities at passage facilities.
- Investigate the use of site-specific habitat measures such as substrate enhancement and channel restoration as viable alternatives for improving natural recruitment in some areas.
- Support fishery monitoring and management in combination with the suite of other restoration options to mitigate for lost productivity and contribute to population rebuilding efforts in areas where harvest is warranted, but where natural recruitment is currently limited and the subpopulation does not represent a unique component of the historical diversity.
- Manage marine mammals to reduce predation of white sturgeon downstream of Bonneville Dam.
- Operate the hydrosystem to reduce mortality on white sturgeon. Block access to turbine draft tubes during turbine dewatering and other maintenance operations to minimize white sturgeon entrainment and mortality.
- Conduct dredging operations in a manner minimizing operation-related mortality on white sturgeon.
- Conduct research that addresses critical white sturgeon uncertainties identified in the Columbia Basin White Sturgeon Planning Framework.
- Monitor and evaluate mitigative white sturgeon restoration actions, and population responses to environmental condition consistent with the Columbia Basin White Sturgeon Planning Framework.”
- Assess the effects of climate change on basin sturgeon populations and develop adaptation strategies to address these impacts.

- Recommendation 2: The Council should incorporate ISAB recommendations for addressing hydrosystem impacts on Upper Columbia River White Sturgeon:
 - Develop a credible white sturgeon habitat model for the UCR to quantify habitat throughout the year in conjunction with mainstem hydrosystem operations
 - Identify the specific aspects of hydrosystem operations, such as duration of fluctuations in water releases and of water levels, that affect natural spawning, reproduction, growth and survival of larval and juvenile fishes, and overall recruitment success of white sturgeon in the UCR
 - Investigate the potential impacts of trace element contamination of UCR sediments on the quality of critical white sturgeon habitat throughout the UCR from Lake Roosevelt upstream to the International Border.

Rationale: White Sturgeon in the Upper Columbia River (UCR) are a considered a ‘Species at Risk’ by the Canadian federal government, are a species of active research for the Washington Department of Fish and Wildlife (WDFW), and are the focus of a recent UCR White Sturgeon Recovery Plan developed by US and Canada entities. That plan highlights a number of issues as contributing to poor white sturgeon populations and greatly diminished natural recruitment, including but not limited to, habitat diversity, flow regulation, water temperature, water clarity, total dissolved gas (TDG), contaminants, food availability, fish community alteration, predation,

exploitation and incidental catch. Selected topics have benefited from recent studies by USGS, US EPA, WDFW, and the Colville and Spokane Tribes, but issues such as habitat diversity, flow regulation effects, temperature and elevated trace-element concentrations in bed sediments are in need of research. Specific to the UCR, the physical habitat for various life stages of white sturgeon have not been characterized or quantified, nor has the potential for trace-element contaminants to compromise critical habitats. The amount, distribution and complexity of benthic substrates in Lake Roosevelt are currently unknown. Various life stages of white sturgeon are known to utilize and benefit from particular habitat types in the lower Columbia River, but similar understanding is not available for the UCR. Proper characterization of habitat availability would benefit fisheries managers in estimating what a sustainable population size should be. Substrate size, location and complexity (as substrate diversity) are key variables currently lacking characterization. Recent additions of detailed bathymetry of the Lake Roosevelt pool and lower portions of the UCR provided by US Bureau of Reclamation, and LiDAR (light detection and ranging) are key tools ready for application in developing a white sturgeon habitat model. Superimposed on a habitat model for the UCR are the multiple lines of evidence that indicate trace element contamination in the sediments of the UCR may be a critical habitat stressor to the reproductive success of white sturgeon in the reach between Lake Roosevelt and the International Border. Preliminary evidence suggest that hydrosystem controlled conditions in the mainstem river play a controlling factor on exposure of white sturgeon to dissolved trace elements mobilized from river bed sediments.

Federal F&W Agencies/Other Federal agencies

16. National Oceanic and Atmospheric Administration, NOAA-F (30) (submitted by Elizabeth Gaar)

- Nothing on resident fish

17. NOAA Fisheries Northwest Fisheries Science Center , NOAA-NW (31) (submitted by Walton Dickhoff)

- Nothing on resident fish

18. US Fish and Wildlife Service, USFWS (33) (submitted by Richard Hannon)

- Bull Trout , Recommendations for the Program - primarily for Sections for Biological Objectives, Basin-wide Strategies, and Mainstem Strategies. Bull trout have declined throughout their range due to habitat degradation and fragmentation, blockage of migratory corridors, poor water quality, past fisheries management practices, impoundments, dams, water diversions, and the introduction of nonnative species. Because of the sharp declines bull trout were listed as threatened under the Endangered Species Act (USFWS 2000). The biological opinion (USFWS 2006) and the stipulated court settlement (USDC 2008) for the Kootenai River and the operation of Libby Dam, and the 2008 biological opinion for the Willamette River basin project (USFWS 2008) gave further documentation on the need to protect bull trout. Extensive research on bull trout has been conducted since 2000 (Anglin et al. 2010, Barrows et al. 2012, Bretz, 2009, Faler et al. 2008) that documents the tributary use and mainstem Columbia and Snake rivers use by bull trout. The final rule for designation of critical habitat for bull trout in the coterminous United States was made in 2010 (USFWS 2010). The Action Agencies have requested reinitiating consultation because of the critical habitat listing. Based on the actions required under the current biological opinions, results of research since 2000 and the designation of bull trout critical habitat, the following are our recommendations for the Council's Fish and Wildlife Program.
- Recommendation : Revise the first paragraph under Resident Fish Losses on page 12: The development and operation of the hydrosystem has resulted in losses of native resident fish and resident fish diversity for species such as bull trout (listed as threatened under the ESA), cutthroat trout, kokanee, white sturgeon and other species. The following objectives address resident fish losses:
- Recommendation : To include the importance of the Bull Trout BiOp (and not just the salmon BiOp), the sentence in the second paragraph under C. Biological Objectives, 1. Overarching Objectives and Priorities for the mainstem, paragraph page 36: Achieving the biological performance standards and fulfilling the relevant RPAs and RPMs for listed species set forth in the biological opinions is a key biological objective of the Council's Program and this mainstem plan.
- Recommendation : Add the following sub-bullet to the second bullet under C.2.a on page 36. Evaluate how projects, reservoir conditions and operations impact connectivity among basins for bull trout.

- Recommendation : Revise the fifth bullet under c. Resident fish and wildlife, page 39: Provide mainstem conditions that help to protect and enhance bull trout habitat and thus help to restore the abundance and productivity of bull trout populations that use the mainstem as they migrate into and out of tributary streams. The U.S. Fish and Wildlife Service's 2000 and 2006 biological opinions concerning hydrosystem operations that affect listed bull trout populations include objectives for that species, which are adopted here. Additionally, on September 30, 2010, the U.S. Fish and Wildlife Service designated critical habitat for bull trout throughout their U.S. range. This listing included the entire mainstem reaches of the Columbia and lower Snake Rivers. The Council's Program and this mainstem plan recognize the importance of this critical habitat for bull trout and support needed efforts to maintain and/or improve this critical habitat where needed.
- Recommendation : Add the following bullet after the revised bullet in Recommendation 4 (page 39). Evaluate mainstem project specific impacts to migrating bull trout
- Recommendation : Revise the first bullet on page 43 with the following: In addition, the Council expects the federal operating agencies, in conjunction with the relevant state and federal fish and wildlife agencies and tribes to:
 - Identify the importance of protecting or improving the critical mainstem habitat for recovering bull trout populations. The Council expects the relevant state and federal fish and wildlife agencies to conduct the necessary research and report the analysis to the Council at the earliest possible date
- Recommendation : Add the following bullet after the revised bullet in Recommendation 6 (page 43). Evaluate reservoir conditions and operations on foraging, overwintering, and migrating bull trout.
- White Sturgeon , White sturgeon are an iconic mainstem fish that has been severely affected by construction and operation of the hydropower system in the Columbia River. This includes Kootenai River White sturgeon which is affected by the construction and operation of Libby Dam. The status of white sturgeon is strongly tied to conditions in the mainstem, which are directly affected by the hydropower system. White sturgeon have declined significantly throughout most of the Columbia Basin, although the population segment below Bonneville Dam still shows substantial natural recruitment. It is anticipated that diminished natural recruitment will be a major factor influencing sturgeon status and the sustainability of harvest fisheries. Natural recruitment of sturgeon is potentially affected by hydropower operations directly, through blocked passage or inundation of preferred spawning areas, and indirectly, through the effects of water flow and sediment release on spawning success. In addition, recently documented predation on adult sturgeon by Steller sea lions just below the Bonneville Dam may threaten that population. The fishery managers in the Columbia Basin recently completed a basin-wide framework plan for White sturgeon that synthesizes existing information and recommends actions to address limiting factors and information gaps.
- Recommendation : We recommend that specific recommendations from this management plan be incorporated into the Program, in the mainstem section, as a sturgeon chapter. After ISRP review, the framework could be adopted into the Program. We recommend the Council consolidate measures intended to address sturgeon restoration into set of strategies in the Mainstem Plan. The Council should also consider the recommendations of Oregon's White Sturgeon Conservation Plan and the White Sturgeon Framework Plan for inclusion into the Program. The Framework should be identified as a Program appendix on White Sturgeon.

19. Bonneville Power Administration, BPA (35) (submitted by Lorri Bodi)

- **Resident Fish:** The Program should support the processes needed for BPA to make final decisions in the resident fish artificial production facilities currently in the proposal or planning stages. Those facilities include only Black Canyon (red band trout), Crystal Springs (Yellowstone cutthroat trout), Kootenai (sturgeon and burbot), and the Columbia River Inter Tribal Fish Commission (CRTFC) (sturgeon) hatcheries.
- **Sturgeon:** The Program should adopt and support on-going efforts to protect and enhance sturgeon populations through implementation of the USFWS Kootenai River White Sturgeon biological opinion; Accord projects related to sturgeon; and habitat improvement projects by the Kootenai Tribe of Idaho and others.

20. US Environmental Protection Agency, USEPA (37) (submitted by Mary Lou Soscia)

- A third recommendation is for the Council to provide a review and assessment of how hydroelectric projects affect toxic contaminants in the Columbia River Basin and how toxic contaminants can impact the fish that are impounded behind dams. Fish species have been affected in various ways by the development and operation of the hydropower system. Dam presence can be associated with the accumulation of toxic sediments and the presence of reservoirs and their operations can be a controlling factor on the chemical conditions, such

as anoxia and mercury as previously discussed, which can impact the distribution and bioavailability of toxics in a reservoir system and in turn may impact recovery efforts.

21. US Geological Survey NW Regional Office, USGS-NW (38) (submitted by Lief Horwitz)

- Sturgeon , Current Fish and Wildlife Program: Page 12, 39, 41, 43, 47-49, 53, and 55, Recommendation: The council should incorporate the following recommendations for addressing hydro system impacts on sturgeon, several of which were recommended by the ISAB:
 - Include the draft Columbia Basin White Sturgeon Planning Framework in the Fish and Wildlife plan. It is expected that the Fish and Wildlife amendments will include summary information from the framework that will include overarching conclusions and recommendations for specific actions based on the basin-wide assessment.
 - Provide a means to integrate information on sturgeon populations that can be used in an overall assessment of sturgeon population or demographic trends within the basin. The Fish and Wildlife Program should require the development of a method to store and quickly analyze information on sturgeon populations and restoration actions throughout the basin.
 - Develop spatially explicit habitat models for all life stages of white sturgeon to quantify habitat throughout the year. These models should incorporate the specific aspects of hydro system operations, such as duration of fluctuations in water releases that affect spawning, dispersal, growth, and survival of white sturgeon.
 - Rationale: Sturgeon management, restoration, and recovery must increasingly involve thinking and acting collectively as a trans-disciplinary team, one that is composed not just of fishery managers and biologists but also includes specialists in the fields of ecological food webs, reservoir operations, flow dynamics, and sediment transport within the highly altered Columbia Basin. This is especially important as initiatives such as artificial supplementation or habitat improvement are proposed, defended and implemented. In February 2013, the states and tribes developed a draft Columbia Basin White Sturgeon Planning Framework at the direction of the NPCC. This was in response to ISRP reviews of specific sturgeon projects, which noted that an effective basin-wide management and RM & E plan for white sturgeon was lacking and was the most important need for planning future sturgeon research and restoration actions. The Fish and Wildlife Program should require the development of a method to store and quickly analyze information on sturgeon populations and restoration actions throughout the basin, which would foster communication on difficult issues. This would provide the capability to understand how management or restoration activities in one sturgeon management unit would influence abundance, management, or restoration in other management units. For instance, there is no requirement for coordinated marking of sturgeon captured in stock assessment activities or marking of hatchery produced sturgeon released for supplementation. Without coordinated marking, there may be duplication in external marks used or uncertainty in origin of fish captured in downstream fisheries. As outlined in the Framework Plan, there is a critical need to develop predictive models of sturgeon productivity based on physical and biological criteria. There are a number of factors related to impoundment and dam operations that contribute to reduced white sturgeon populations and greatly diminished natural recruitment, including habitat fragmentation, loss of habitat diversity, flow regulation, water temperature, water clarity, total dissolved gas (TDG) contaminants, food availability, fish community alteration, and predation. The amount, distribution, and complexity of benthic substrates that provide spawning and foraging areas for white sturgeon needs to be determined. This information, coupled with hydraulic and hydrodynamic models, would form the basis for assessing habitat available for white sturgeon throughout the basin. Proper characterization of habitat availability throughout the basin would benefit fisheries managers in estimating sustainable population sizes and stocking rates where applicable. The models would also enable prediction of the effects of hydropower and flood risk management operations on sturgeon populations

Bonneville Customers/other utilities and user groups

None

Environmental /NGOs

22. Regional Fisheries Enhancement Group, RFE (63) (submitted by Margaret Newuman)

- Page 12 – Resident Fish Loses , Comment: Very little money appears to be available for resident fish restoration. We recommend increasing awareness and funding to native resident fish recovery in the Columbia Basin.

Individuals

None

Reference Material - Specific Content of Documents Referred to within the Recommendations

- A. **Review Draft Columbia White Sturgeon Planning Framework (Feb 2013)**
http://www.nwcouncil.org/media/6288813/White_Sturgeon_Framework_review_draft_Feb2013.pdf

9 FINDINGS

The following conclusions and recommendations were synthesized from a review of the information presented in this document. These findings represent the expert judgment of the individuals on the framework planning team and may or may not reflect the policies of their respective agencies.

9.1 CONCLUSIONS

1. Sturgeon program efforts to date have effectively documented biology, status and limiting factors throughout the region but are not sufficient to achieve conservation, recovery or mitigation goals identified for white sturgeon by this framework.

Extensive investments have been made by the region to evaluate sturgeon status and investigate limiting factors. These efforts have produced tremendous advances in our knowledge of white sturgeon in the last two decades. More limited investments have been made in specific actions designed to conserve, recover, or mitigate for historical sturgeon declines. As a result, current populations are generally stable at low levels or continue to decline. The most intensive conservation and recovery efforts have been focused on the endangered Kootenai population. In the Kootenai, conservation aquaculture has temporarily forestalled extinction but recovery is nowhere in sight. Much more limited actions have been implemented for sturgeon in other areas. Nowhere have efforts successfully mitigated for lost fishery opportunities resulting from widespread habitat impacts. Both conservation and use are essential elements of a comprehensive regional vision for white sturgeon.

2. White sturgeon distribution, abundance, and productivity throughout the Columbia and Snake river basins are severely limited by habitat changes, particularly those associated with hydropower system construction and operation.

Effects of population fragmentation and habitat limitations on impounded subpopulations are well documented throughout the region. Historical population declines were driven by overfishing but sturgeon recovery was subsequently limited by hydropower development and operation. As fisheries were closed or regulated, sturgeon populations increased and stabilized in areas where conditions were suitable to complete the entire life cycle. Where habitat does not support natural recruitment, only small, often-declining remnant subpopulations exist. Historical levels of productivity and use have not been achieved in any area due to continuing habitat limitations.

3. Large areas of suitable sturgeon habitat remain throughout most of the historical range upstream from Bonneville Dam but use is currently limited by widespread passage and natural recruitment problems.

Most of the basin continues to provide favorable conditions for sturgeon growth, survival and maturation from the juvenile to adult life stages. Subpopulations are currently failing in somewhere during the incubation, early life history or young of the year life stages which appear to require very specific combinations of conditions that are rarely met in today's impounded and regulated system. The lack of effective sturgeon passage prevents sturgeon from redistributing among favorable habitats. However, when favorable habitats have been effectively seeded, substantial numbers of white sturgeon have been produced throughout the system. Thus, remaining habitats provide a significant opportunity for sturgeon improvements.

4. Lack of upstream passage also impacts productivity of the unimpounded white sturgeon subpopulation downstream from Bonneville Dam.

Fragmentation of the historical riverine ecosystem has impacted sturgeon both above and below Bonneville Dam. Until the late 1990s, the unimpounded subpopulation in the lower Columbia below Bonneville Dam was in a long-term increasing trend and supported productive fishery opportunities. However, productivity of this population has recently declined and use is being severely curtailed. Large numbers of sturgeon remain in the population but future declines are likely due to reduced levels of recruitment. The cause of this decline is unclear but a leading candidate is increased predation by seals and sea lions which have recolonized the lower river in significant numbers over the last decade. This predation reduces survival to adulthood and also appears to be disrupting spawning success. Where white sturgeon could historically migrate upstream past rapids to escape this predation pressure to find safe

spawning and rearing environments, these upstream movements are now prevented by Bonneville Dam. Even if sturgeon could be effectively passed upstream, they would now find most historical spawning habitat inundated by reservoirs.

5. Some opportunities for sturgeon passage improvements exist but benefits are likely to be limited by habitat-related natural recruitment problems in most areas.

Passage benefits that increase connectivity can, in some cases, increase gene flow, productivity, and fishery opportunity. However, unintended consequences must be given consideration as they can reduce benefits or prove detrimental. Modeling of upper Snake River populations demonstrated that passage benefits depend on the relative rates of upstream and downstream movements and population productivity in upstream and downstream areas. Many impounded river sections contain habitat that is underutilized by sturgeon due to poor natural recruitment. Net productivity might be improved by providing passage of juvenile and subadult sturgeon into underutilized areas. However, increased upstream passage could be detrimental to net production if adults move from favorable into unfavorable areas. Attempts to improve upstream or downstream passage of sturgeon at dams also risks confounding salmon and steelhead passage.

6. Natural recruitment and productivity of white sturgeon has been widely related to normative river conditions including free-flowing reaches and high spring flows but sturgeon-specific hydro system operations have not been widely considered or implemented in the Columbia Basin. The limited hydro measures implemented for sturgeon in some areas have produced marginal benefits at best.

The most productive sturgeon subpopulations are currently found in river segments that continue to provide diverse habitats and free-flowing conditions. These include the lower Columbia downstream from Bonneville Dam, and Hells Canyon in the Snake River. Some impounded segments including Bonneville and The Dalles reservoirs in the Columbia and the Bliss reach in the Snake continue to provide significant natural recruitment in some years because favorable habitat conditions still exist. Recruitment in many impounded areas has been positively correlated with high annual discharge during spring. It remains unclear whether smaller scale operational measures can produce similar sturgeon recruitment benefits to those produced by large scale annual patterns. Except in the Kootenai, flow measures have not been implemented for sturgeon due to related costs and competing demands. Experimental flow measures have been implemented in the Kootenai River in an attempt to stimulate natural spawning but no significant improvements were observed in response to measures at the scale they were implemented. Sturgeon might be expected to benefit from flow and dam operational measures being implemented for salmon and steelhead. However, the marginal benefits of those actions for sturgeon are unknown.

7. Site-specific habitat measures such as substrate enhancement or channel restoration might be viable alternatives for improving natural recruitment in some areas but benefits and cost-effectiveness remain uncertain.

Site-specific habitat measures have not been widely considered for sturgeon throughout the basin owing to uncertain benefits and the difficulty of implementation in a large mainstem river system. Habitat measures are being explored in limited areas of the upper basin including the Kootenai and Transboundary upper Columbia. An ambitious habitat restoration effort has been initiated in the Kootenai River utilizing channel and riparian restoration in an attempt to restore functional habitat processes. Substrate introduction into the H. L. Keenleyside tailrace is being evaluated to determine if lack of suitable substrate currently limits successful spawning and recruitment of the Transboundary population. Similar efforts are being contemplated in the meander reach of the Kootenai River where sturgeon are currently spawning over unsuitable sand substrate. Benefits of these actions remain to be determined.

8. Careful use of sturgeon hatcheries has the potential to help perpetuate declining wild populations and mitigate for lost natural production in many impounded areas but aquaculture should be regarded as a stop-gap or interim strategy while other alternatives continue to be explored.

In the absence of a clear path to restoration of natural recruitment or a commitment to implementing and evaluating large scale hydro-related actions likely to be required, aquaculture is a realistic alternative for partially meeting some sturgeon goals. In the Kootenai and upper Columbia, conservation aquaculture programs are being used to preserve declining populations and buy time for the identification and implementation of habitat-based measures to restore natural recruitment. In the upper mid-Columbia reservoirs, a hatchery program is being developed under FERC license agreements to mitigate for the failure of natural production in a series of PUD reservoirs. Similar hatchery measures are also being contemplated by Columbia River treaty tribes to mitigate for lost fishery production in

lower mid-Columbia reservoirs. The basin's experience with salmon hatcheries has highlighted the risks to wild populations associated with hatchery impacts. At the same time, potential benefits can substantially outweigh risks in many areas where natural production is limited and conservation aquaculture programs in the upper basin have identified effective risk management practices.

9. Experimental implementation and evaluation of action effectiveness of a combination of passage, system operation, habitat restoration, and hatchery alternatives provides the best prospects for meeting sturgeon conservation, restoration and mitigation goals throughout the basin.

Most work to date has focused on biological research and stock assessment. This work has identified factors limiting specific populations and potential alternatives for ameliorating these limiting factors. Additional research questions can always be identified. In the case of sturgeon, many of these revolve around recruitment failure mechanisms, ecosystem limitations, and ecological interactions. However, significant improvements in sturgeon status and use will require substantive actions to address current limitations. Because potential benefits of specific actions remain somewhat uncertain,

10. Sturgeon planning, coordination and project implementation needs within most management units are effectively served by existing groups.

Sturgeon projects and activities within different Columbia and Snake River management units are already underway, and reflect the responsibilities and authorities of the appropriate jurisdictions. The objectives and strategies directing these various sturgeon projects are tailored to the specific circumstances within each management unit, and participating entities already support significant consultation and coordination among themselves as part of their normal processes. A one-size fits all approach to sturgeon does not work for every management unit due to the specifics of each subpopulation, conditions and involvement. The implementation framework is already in place to move forward with sturgeon conservation, recovery and mitigation efforts throughout the region where resources are adequate for action implementation.

9.2 CRITICAL UNCERTAINTIES

Regional sturgeon data gaps were considered at the 2012 white sturgeon workshop (Beamesderfer et al. 2012). Participants identified and prioritized five overarching data gaps: 1) mechanisms of natural recruitment failure, 2) genetic stock structure, 3) habitat carrying capacity, 4) critical habitat requirements including flows, and 5) fish passage/connectivity benefits.

1. Mechanisms of Natural Recruitment Failure

Participants at the 2012 workshop highlighted the need for a better understanding of the mechanisms of recruitment failures across the region. Factors limiting natural recruitment were also discussed at the 2011 sturgeon workshop. Sporadic or failing natural recruitment is characteristic of impounded sturgeon populations throughout the basin. However, substantial uncertainties remain in our understanding of factors limiting sturgeon reproduction and recruitment, despite more than a quarter century of research. More significantly, avenues and prospects for improvement remain unclear.

Productivity of sturgeon downstream from Bonneville Dam is much greater than in upstream areas where dam construction has fragmented the river and sturgeon into a series of semi-isolated segments where conditions are no longer optimal to support the fish during different life stages. Research shows that white sturgeon populations in reservoirs above the dams continue to spawn with substantial spawning activity occurring in some reservoirs, including Bonneville, The Dalles and John Day but reproduction is often unsuccessful.

Participants at the 2012 workshop determined that recruitment is likely much greater in some areas than in others due to differences in: 1) habitat complexity, quantity, and quality; 2) hydraulic or operation effects of flow; 3) habitat connectivity; and 4) normal river functions. The participants also identified predators and water quality as likely factors. Differences in prey availability, management intensity, density-related factors, stress effects, low spawning stock numbers, and effects of conflicting mandates were also identified as potential factors, although with a lower degree of certainty in effect.

Workshop participants also examined why natural recruitment is inconsistent or falling among most inland populations. They concluded with a high degree of certainty that this is due to: 1) low diversity, 2) lack of adults, and 2) flow levels that were either too low or not the right type or time. They also identified predation as a likely

factor. Reservoir length and habitat simplification, narrower temperature windows, and reductions in food productivity or access were also identified as potential factors, although with a lower degree of certainty in effect.

Workshop participants also examined the likelihood of increasing natural recruitment. They concluded that it will likely vary across geography and scale, higher in some areas than in others. They also determined that broodstock limitations may be a factor, and that possible solutions may interact with salmonid management. It was also apparent that prospects may be better in areas with larger, more diverse habitats and populations lower in the system supported by downstream drift and better food resources.

2. Genetic Population Structure

Understanding historical and current genetic population structure is one key to developing a comprehensive and coordinated regional framework. Genetics are an important consideration in addressing specific sturgeon issues in different portions of the Columbia and Snake River basin. An ongoing issue throughout the upper basin is the potential for “genetic swamping” of the remaining wild sturgeon by those produced and stocked from the hatchery. Genetic population structure can have important management implications, particularly for hatchery activities (broodstock selection, effective population sizes, and mating protocols). Additional information is needed on apparent genetic structure within Columbia Basin (i.e., what we have to work with today).

3. Habitat Carrying Capacity

Today, not only are many white sturgeon populations isolated between dams, but the availability and suitability of habitat existing in a reach may restrict sturgeon production. Presently, much remains unknown regarding existing habitat and/or flow limitations, and the effect of these limitations on carrying capacity, spawning success, age-0 survival, etc. Efforts to improve sturgeon production in several of the different management units face similar issues and unknowns.

Poor understanding regarding the productivity of different areas and impoundments to produce white sturgeon makes it difficult for managers to establish realistic population objectives, and to develop measures and programs to meet those objectives. It remains unclear whether the fragmented reservoir habitats can support sizeable, sustainable harvest of sturgeon.

Sturgeon programs throughout the basin have been wrestling with this question with varying degrees of success. Participants in the 2011 Mid-Columbia White Sturgeon Workshop determined that a combined approach would be most effective in defining population objectives consistent with system carrying capacity. An empirical, experimental, adaptive management approach was widely recognized as the most preferable approach to this question for the long term. Participants also found that inferences from information on food webs and trophic dynamics can also be an informative tool. Population models can also be useful to establish ballpark numbers for subsequent empirical analysis.

4. Critical Habitat Characteristics Including Flows

The relationship between recruitment failure and habitat conditions is poorly understood. It is particularly unclear whether natural recruitment can be improved by operational changes in water management. Annual stream discharge has been positively correlated with recruitment success in some areas on the basin. However, similar correlations have not been identified for smaller scale differences in flow or dam operations that might realistically be considered for implementation. Implementation of experimental flow measures for sturgeon have largely been limited to the Kootenai River but this effort has not produced desired results at the flow levels that have been tested.

5. Sturgeon Passage Benefits and Risks

While there are many potential benefits from providing sturgeon passage in the Columbia and Snake Rivers, there are also risks that need to be examined and considered before passage is improved. Many of these risks are related to uncertainty and poor understanding of sturgeon movement, behavior and recruitment, and to increased management complexity. There are still many uncertainties to examine surrounding movement and behavior of white sturgeon that could have implications for passage.

9.3 RESEARCH NEEDS

9.3.1 Stock Assessment

Tools

- 1.1. Develop improved methods to characterize individual growth of white sturgeon throughout their life cycle and incorporate these into population forecasts and viability assessments.
- 1.2. Identify and evaluate traditional and novel capture and/or non-capture population abundance estimate designs for juvenile, sub-adult, and adult white sturgeon.
- 1.3. Evaluate utility of annual effective female population size estimates using nuclear DNA.

Adult abundance

- 1.4. Develop a white sturgeon stock-recruitment relationship or other production metric that is capable of relating the size of the adult population to recruitment of the number of age-1 juveniles, or to recruitment of the number of sub-adults and adults that comprise the age/size range of the recreationally and commercially harvestable portion of the population.
- 1.5. Monitor adult female population size and annual recruitment to sub-adult life stage.

Mortality

- 1.6. Assess the current total mortality level for lower Columbia River white sturgeon.
- 1.7. Identify and assess subcomponents associated with total white sturgeon mortality within the lower Columbia River.
- 1.8. Investigate the utility of PIT tags and tagging and novel tag detection technologies for generating survival estimates based on year to year recaptures of white sturgeon.
- 1.9. Assess river-wide white sturgeon losses to pinniped predation.
- 1.10. Identify the periodicity and assess magnitude of stress induced reproduction failures related to both catch-and-release fisheries and failed pinniped predation events.

Productivity

- 1.11. Index annual levels of, and variation in, white sturgeon recruitment in spawning areas of the Columbia River Basin. Correlate age-0 indexing data with relevant measures of annual spawning conditions.
- 1.12. Using genetic tools estimate spawner contributions to juvenile white sturgeon multi-year cohorts on a decadal basis.
- 1.13. Monitor spawning and rearing conditions and available habitat via water releases at mainstem dams and spawning periodicity through mark and recapture maturity work; ensure spawning success and recruitment to age 1 by optimizing water releases and through continued time and area management of sport and commercial fisheries in the Columbia River.
- 1.14. Conduct white sturgeon stock assessments to monitor size distribution, growth, condition and abundance.
- 1.15. Conduct research regarding reservoir productivity for Bonneville Reservoir regarding the sturgeon productivity issues characterized by low relative weights and poor growth rates.

9.3.2 Distribution & Habitat Use

- 1.16. Identify, characterize, catalogue, and monitor spatial and seasonal white sturgeon spawning and rearing habitats.
- 1.17. Investigate estuarine, tidally influenced freshwater and off-channel shallow water habitat usage by juvenile and sub-adult white sturgeon.
- 1.18. Identify and assess seasonal and spatial white sturgeon habitat usage of nearshore (to 600 feet) marine habitats and migration corridors.
- 1.19. Model the impact of past spawning and rearing habitat losses on white sturgeon population dynamics.
- 1.20. Develop more advanced habitat modeling tools to better quantify the amount of spawning and rearing habitat available.

1.21. Determine marine, estuarine, and freshwater habitat usage in areas downstream from Bonneville Dam. Instrument white sturgeon with acoustic and/or radio transmitters to work in coordination with the Pacific Ocean Shelf Tracking (POST) program and other telemetry receivers to determine marine, estuarine, and freshwater habitat usage; work cooperatively with green sturgeon researchers to maximize receiver systems in coastal waterways.

1.22. Investigate the utility of fin spine microchemistry to analyze interchange of white sturgeon among Columbia River and coastal waterways.

1.23. Investigate the utility of genetic analysis tools for estimating the proportions of Columbia, Sacramento, and Fraser River stocks composing the white sturgeon population within those lower Columbia River waters downstream of Bonneville Dam. If these tools prove useful, analyze the stock composition of white sturgeon that occur within these areas.

1.24. Identify, characterize, catalogue, and monitor spatial and seasonal usage of habitats by larval and sub-yearling white sturgeon from Bonneville Dam downstream to the mouth.

9.3.3 Limiting Factors

Hydro development & operations

1.25. Determine the effects of power peaking operations and load following on white sturgeon spawning behavior and success.

1.26. Evaluate spawning habitat in the transition zones ([a] between Bradford and Cascade Islands, and Tanner Creek; [b] downstream from Tanner Creek) downstream from Bonneville Dam to determine how a range of operations at the dam affect hydraulics in the transition zones and the resulting suitability of spawning habitat.

1.27. Identify, assess, and minimize downstream passage mortality at mainstem dams.

1.28. Evaluate the effect of the proposed construction (e.g. spill training wall) in the tailrace of Bonneville Dam on white sturgeon spawning habitat quantity, quality, and distribution.

1.29. Investigate riparian and off-channel shallow water habitat usage by white sturgeon early life history stages in the Ives and Pierce Island complex downstream of Bonneville Dam and determine potential effects of daily and hourly flow variations associated with power peaking on survival of these early life history stages.

1.30. Investigate how the range of spring/summer flows affects the rate and extent of downstream dispersal of white sturgeon larvae and sub-yearlings in the lower Columbia River, including drift to brackish and saltwater portions of the estuary where fish of these life-stages would not survive.

Habitat Alteration

1.31. Monitor dredging and in-water work to document operational related white sturgeon mortality.

1.32. Assess the effects of dredging and dredge spoil deposition on lower Columbia River aquatic invertebrate communities.

1.33. Identify and assess the effects of gravel extraction, construction, and remediation related dredging activities on lower Columbia River white sturgeon.

1.34. Identify and assess the impacts of in-water construction on white sturgeon in the lower Columbia River.

1.35. Investigate the role of pile rows and similar structures in the proposed lower Columbia River white sturgeon ecology.

1.36. Consider additional analysis or research of larval and juvenile downstream passage and mortality to better understand tradeoffs between upstream and downstream subpopulations.

1.37. Conduct research and coordinate with others doing habitat research on the merits of creating spawning habitat and early rearing habitat in selected tailrace areas.

1.38. Work with partners in modeling the impact of channelization and diking of the lower Columbia River on water velocities and downstream dispersal rates of larvae and sub-yearling white sturgeon.

1.39. Work with partners in modeling theoretical water velocities and downstream dispersal rates of larvae and sub-yearling white sturgeon for the Columbia River upstream to Celilo Falls under pre-impoundment and pre-channelization conditions and evaluate the likelihood of early-aged sturgeon washing to the estuary from historic spawning sites upstream of where Bonneville Dam is located.

Water Quality & Contaminants

1.40. Conduct additional baseline research on the contamination levels in fish and gonads of adult broodstock to determine if contamination is changing and potentially affecting productivity of selected populations.

1.41. Identify and assess the effects of FCRPS operations on water temperatures.

1.42. Identify the effects of low turbidity on white sturgeon recruitment.

1.43. Identify the effects of total dissolved gasses on white sturgeon survival.

1.44. Implement cause and effect studies to determine if pollutants and contaminants affect white sturgeon survival and spawning success.

1.45. Model the effects of changes in a variety of water quality parameters white sturgeon population dynamics.

1.46. Conduct “dose-response” studies to resolve issues surrounding toxins of concern by identifying the specific toxin and contaminant effects on white sturgeon survival and spawning success.

Fishing

1.47. Conduct recreational and commercial fisheries monitoring activities for weight of evidence materials used to evaluate current status as well as trends over time. Information collected should include, but not necessarily be limited to: effort, number of fish of a given size caught and released, average size of catch, and tag recoveries.

1.48. Assess the current fishing mortality levels and evaluate the total mortality level for white sturgeon.

1.49. Identify and assess the magnitude, extent, and effects of illegal harvest on white sturgeon. Include estimates of illegal harvest when evaluating whether target exploitation rates are being met.

1.50. Model the impacts of a variety of harvest regimes, including estimated illegal harvest and post-release mortality from commercial and recreational fishing, on white sturgeon population productivity.

Food Web

1.51. Monitor lamprey and salmon returns to the Columbia River through passage counts, and eulachon returns through a combination of scientific test sampling of adults, and early life history (larval and egg) investigations; support actions aimed at rebuilding those populations towards desired and historic levels.

1.52. Conduct bioenergetics modeling/food web analysis to determine: a) the effects on white sturgeon of a diet consisting of various combinations of native and non-native prey items, and b) how a changing forage base through time might affect the white sturgeon productivity.

1.53. Conduct bioenergetics modeling to determine effects on white sturgeon of operation of the FCRPS and historic loss of habitat caused by development and channel improvements for navigation.

1.54. Conduct an assessment of native invertebrates in Columbia River reaches.

1.55. If declines in native forage species are negatively impacting lower Columbia River white sturgeon, determine population limiting factors for Pacific lampreys, eulachon, and native invertebrates.

Non-Native Species

1.56. Investigate feeding ecology to determine the relative importance of non-native prey items such as American shad and Asian clams to white sturgeon.

1.57. Conduct bioenergetics modeling to determine the effects on white sturgeon of a diet consisting of various combinations of native and non-native prey items.

1.58. Determine if foraging on thiaminase-rich American shad has a negative effect on white sturgeon.

1.59. Investigate inter-specific competition between: juvenile American shad and juvenile white sturgeon; Asian clams and native freshwater mussels; and Mysid shrimp and native amphipods.

Climate Change

1.60. Monitor white sturgeon condition and spawn timing as a possible response to, and as a potential bellwether for, systemic changes Columbia River reaches due to global climate change.

1.61. Model the effects of water temperature increases, changes in the seasonality of the freshet and low elevation run-off, and possible changes in salt-wedge intrusion on white sturgeon spawning success and population dynamics Columbia River waters.

1.62. Monitor and model the effects the above mentioned climate changes on white sturgeon food resources in Columbia River reaches, including the Columbia River mainstem, estuarine, and marine waters.

9.4 CONSERVATION, RESTORATION & MITIGATION RECOMMENDATIONS

The following recommendations reflect a basin-wide perspective. More detailed guidance for specific management areas may be found in area-specific plans which are also summarized in Chapter 7.

Programmatic

1.1. Sturgeon programs and projects throughout the region need to address both conservation/recovery and use/mitigation goals.

1.2. Additional resources will be necessary to meet goals consistent with the regional vision for sturgeon identified by this framework document.

1.3. Include areas above and below Bonneville Dam in a comprehensive treatment of FCRPS effects on white sturgeon.

Passage5

5 Passage recommendations were developed at the 2012 regional sturgeon passage workshop.

1.4. Clarify specific goals and objectives for subpopulations based on current natural recruitment potential, habitat productivity, and limiting factors to provide guidance on potential benefits and risks of increased upstream or downstream passage on a case-by-case basis.

1.5. Include detailed evaluations of costs, benefits and risks of passage improvements relative to other potential strategies including habitat improvement, flow management, fishery regulation and hatchery supplementation in sturgeon mitigation, conservation and restoration plans.

1.6. Consider opportunities for incorporating sturgeon-friendly features in existing fish ladders during future ladder designs and planned modification where consistent with sturgeon population goals and objectives.

1.7. Consider opportunities for non-volitional passage by taking advantage of fish trapped in dewater draft tubes or fish ladders during maintenance. These fish can be released back downstream from dams or transplanted upstream. Fish could also be tagged as a means to gain information on sturgeon behavior and movement in and around dams. This would be cost effective since it occurs with planned maintenance. There is also a need for better communication/coordination with maintenance operations so we can take advantage of these instances as they occur.

1.8. Review current protocols used to prevent fish stranding/mortality during planned maintenance activities (such as dewatering draft tubes) to determine if the level of protection/prevention is adequate and whether improvements could be made. Where appropriate and feasible, improve prevention/control of existing sources of mortality caused by the projects either from dewatering mishaps or blade strikes associated with turbine starts. These include:

- a) Enumeration and documentation of operational white sturgeon mortalities.
- b) Blocking access to turbine draft tubes during turbine dewatering and other maintenance operations as necessary to minimize and avoid white sturgeon entrainment.
- c) Salvage operations for any white sturgeon entrained after emergency turbine dewatering procedures.
- d) Minimization of mortality related to the bringing turbines online. For instance, powerhouse upgrades to digital controls would allow “slow roll” starts to be used for all turbine starts throughout the year.

Hydrosystem Operations

1.9. Continue to experimentally evaluate benefits of specific flow measures for sturgeon in areas of acute necessity (such as the Kootenai River).

1.10. Identify and assess potential sturgeon benefits of normative river operations implemented for salmon and steelhead.

1.11. Pursue other opportunities for operational management to improve conditions for natural recruitment of sturgeon where feasible. Operational opportunities may address:

a) Limitations in the quantity, quality, and distribution of spawning and/or rearing habitat as well as adjacent riparian habitat.

b) Water temperatures and dissolved gas supersaturation levels consistent with white sturgeon spawning, incubation, and early life stage development and dispersal criteria.

c) River flows that minimize predation on white sturgeon early life history stages by native and non-native predators.

Other Limiting Factors

1.12. Identify time periods and specific river reaches or areas when certain in-water work activities should be restricted to avoid impacts to sensitive white sturgeon life stages (e.g. spawning, incubation). Implement in-water work and development permits in coordination with appropriate state and federal agencies to minimize, avoid, or mitigate sturgeon impacts.

1.13. Implement experimental habitat restoration measures in appropriate areas where they may be directly related to sturgeon habitat limitations (e.g. substrate and river function limitations identified in the upper Columbia and Kootenai rivers).

Fisheries

1.14. Identify short and long-term fishery expectations and objectives specific to each sturgeon subpopulation consistent with regional mitigation goals for sturgeon use.

1.15. Continue to regulate harvest and fishery impacts to ensure that the population of mature adults is sufficient to sustain significant levels of natural recruitment in areas where suitable conditions exist, based on an effective fishery monitoring program.

1.16. Employ intensive fishery management to optimize use benefits of harvestable subpopulations as a mitigation measure for widespread hydro system impacts.

1.17. Pursue appropriate opportunities to develop meaningful fisheries in to mitigate for lost productivity in areas where natural recruitment is currently limited and the subpopulation does not represent a unique component of the historical diversity.

1.18. Implement educational and angler awareness programs to inform the public of the consequences of over-harvest of long-lived white sturgeon.

1.19. Provide adequate law enforcement personnel to enforce current laws/regulations that protect white sturgeon and their habitats.

Hatcheries

1.20. Continue to utilize and adaptively manage conservation hatchery programs as interim measures to avoid extinction of unique sturgeon populations.

1.21. Employ hatchery production of sturgeon to supplement other populations where natural recruitment is currently limited.

1.22. Be conservative and responsible in establishing protocols for source populations and numbers of hatchery fish released. Build from ongoing hatchery efforts in other areas.

1.23. Utilize experimental hatchery releases and monitoring to assess ecological factors and population productivity limitations.

1.24. Optimize hatchery production and practices consistent with environmental carrying capacity which will most effectively be identified using an experimentally adaptive approach.

Research, Monitoring & Evaluation

1.25. Integrate status and trends, and action effectiveness monitoring to allow effective adaptive management of future sturgeon programs.

1.26. Need to dedicate some work to assess cross-basin information needs including food habitats, ecological interactions, maturation biology, genetic stock structure, and bioenergetics.

1.27. Additional research, monitoring and evaluation are particularly needed for the unimpounded subpopulation downstream from Bonneville Dam which is essential to the long-term health of the Columbia basin white sturgeon population.

Outreach

1.28. Continue to support state and tribal public involvement processes for outreach, information, and education functions related to sturgeon conservation, management and mitigation in each management unit.

1.29. Facilitate information availability and regional coordination by developing and maintaining a Council web page portraying key sturgeon metrics and links to pertinent resources.

a) Identify and report common metrics that serve as benchmarks for local white sturgeon managers in assessing the response/performance of local populations relative to other areas.

b) These may include: adult abundance, juvenile recruitment, life-stage specific growth and mortality rates, and genetic diversity.

c) Describe assessment protocols and meta-data to assure that comparisons are appropriate.

1.30. Endorse and employ regional and local data management strategies to assure the security, quality and accessibility of white sturgeon data sets.

1.31. Continue to rely on a dispersed data management and sharing system among sturgeon management units for populations that are functionally isolated.