

Staff summary of Issues and Recommendations
Species Specifics (other than Salmon, Steelhead and wildlife)

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

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Current 2009 Fish and Wildlife Program Section:

Mountain Whitefish, Mussels (freshwater) and Eulachon (candlefish)(smelt)

The current Program makes no mention of these species

Burbot

VI, Mainstem Plan, Section D, 2 Strategies in Specific Areas, Mainstem habitat (page 43)

Lamprey

II, Basinwide Provisions, Section C, 1, a. Objectives for Biological Performance, Anadromous Fish Losses (page 11)

II, Basinwide Provisions, Section D, 1, Habitat Strategies (page 14)

VI, Mainstem Plan, Section C, 1, Overarching Objectives and Priorities for the Mainstem (page 36)

VI, Mainstem Plan, Section C, 2, b. Mitigation and passage conditions for anadromous fish (page 38)

VI, Mainstem Plan, Section D, 2 Strategies in Specific Areas, Mainstem habitat (page 43)

VI, Mainstem Plan, Section D, 2 Strategies in Specific Areas, Adult fish passage (page 46)

VI, Mainstem Plan, Section D, 2 Strategies in Specific Areas, Lamprey and Sturgeon passage, a. Lamprey (page 47)

VI, Mainstem Plan, Section D, 2 Strategies in Specific Areas, Control of Predators, c. (page 53)

Sturgeon

II, Basinwide Provisions, Section C, 1, a. Objectives for Biological Performance, Resident Fish Losses (page 12)

VI, Mainstem Plan, Section C, 2, c. Resident fish and wildlife (page 39)

VI, Mainstem Plan, Section D, 1 Overarching Strategies (page 40)

VI, Mainstem Plan, Section D, 2 Strategies in Specific Areas, Mainstem habitat (page 43)

VI, Mainstem Plan, Section D, 2 Strategies in Specific Areas, Lamprey and Sturgeon passage, b. Sturgeon (page 47)

VI, Mainstem Plan, Section D, 2 Strategies in Specific Areas, Water management,

VI, Mainstem Plan, Section D, 2 Strategies in Specific Areas, Water management,

VI, Mainstem Plan, Section D, 2 Strategies in Specific Areas, Control of Predators, c. (page 53)

VI, Mainstem Plan, Section D, 2 Strategies in Specific Areas, Annual and in-season decision-making (page 55)

II. Overview of Recommendations

In addition to the many references to salmon and steelhead, the Council received extensive recommendations regarding other specific species for the amendments. The majority of these are addressing Pacific lamprey and sturgeon (white and green), but other species, such as, burbot, eulachon, mountain whitefish and freshwater mussels were also addressed.

Generally, the recommendations address the need for the Program language to be more inclusive and robust to the importance of these species to the ecosystem and the culture inherent in the Basin. Artificial production is recommended for consideration to restore the population and geographic range for some of these fish.

III. Recommendation summary and synthesis:

A. Mountain Whitefish

1. Incorporate additional information
 - a. Facts box should include mountain whitefish
2. Planning assumptions for systemwide water management should balance needs for resident species upstream of storage

B. Burbot

1. Fully fund needs of the Tribe's integrated fish and wildlife program for genetics and culture
2. Planning assumptions for systemwide water management should balance needs for resident species upstream of storage

C. Mussels

1. Incorporate additional information and reflect the importance of the species
2. Assess current status in the Spokane Arm and Columbia River adjacent to the Spokane Indian Reservation
3. Continue to support ongoing efforts
4. Model to a hierarchical habitat classification tool to identify key-recoverable habitats

D. Eulachon

1. Incorporate additional information and reflect the importance of the threatened (30) species and language addressing recovery
 - a. Biological objectives
 - b. Add details to the scientific principals addressing ocean mortality and sufficient biological diversity
 - c. Develop High-Level indicator
2. Fund protection, mitigation and enhancement efforts
3. Fund monitoring and evaluation needs for abundance, and characteristics affecting survival
4. Mainstem and Hydrograph

- a. Address changes in the hydrograph of the Columbia River and adverse effects to eulachon egg and larvae survival in the Columbia River and Columbia River plume
 - b. Address passage effects at Bonneville Dam and monitor and report numbers observed
 - c. Conduct target monitoring for toxicants
 - d. Study the role as an alternative prey for sea lions
- 5. Ocean and Estuary
 - a. Monitor and evaluate the ecological importance to the environment and relationship to recovery
 - b. Develop an oceanographic indicators ecosystem conditions model
 - 6. Model to a hierarchical habitat classification tool to identify key-recoverable habitats
 - 7. Planning assumptions for systemwide water management should balance needs for resident species upstream of storage

E. **Lamprey**

- 1. Incorporate additional information in the Program to be more reflective of the importance of the species in all sections of the Program
 - a. cultural
 - b. food web and ecosystem aspects
 - c. Development of life-cycle and bioenergetics models will help identify critical limiting factors and prioritize recovery actions
 - d. Develop High-Level indicator
 - e. Create a monitoring framework to report status
 - f. Add details to the scientific principals addressing ocean mortality and sufficient biological diversity
 - g. Conduct workshops to provide guidance sampling protocols and study designs and develop a data base clearinghouse
 - h. Investigate life history of Pacific lamprey in selective populations in tributary streams of the lower and mid-Columbia and Snake rivers
 - i. Model to a hierarchical habitat classification tool to identify key-recoverable habitats
- 2. Artificial and translocation Actions
 - a. acknowledge and continue efforts associated with translocation are beneficial
 - b. evaluating artificial production alone is not sufficient
 - i. Evaluate the role of lamprey artificial propagation as a research tool and for supplementation of local groups
- 3. Continue to support ongoing efforts
- 4. Mainstem

- a. Develop and incorporate regional approach to evaluate passage, abundance, distribution, and population structure
 - b. Passage Standard - adopt an interim passage standard for adult Pacific lamprey of 80% per mainstem dam to be accomplished within 10 years
 - c. Predation
 - i. determine predation on adult and juvenile lamprey during mainstem passage migration
 - ii. evaluate the extent of pinniped predation in the lower Columbia River from below Bonneville Dam to the mouth of the river
 - d. Conduct target monitoring for toxicants
 - e. Operation effects in the Willamette
 - f. Planning assumptions for systemwide water management should balance needs for resident species upstream of storage
5. Ocean and Estuary
- a. Effects of ocean harvest should be evaluated on Pacific lamprey food resources
 - b. Ocean conditions should be considered in evaluating freshwater habitat management and to understand all stages of the salmon, steelhead and Pacific lamprey life cycles
6. Water Quality
- a. reduce mainstem toxic contaminants and investigate effects on health and dam passage and CEC's and as part of restoration actions
7. Incorporate various plans and agreements
- a. Tribal Pacific Lamprey Restoration Plan for the Columbia River Basin
 - b. USFWS Pacific Lamprey Conservation Agreement
 - c. Best Management Practices to Minimize Adverse Effects to Pacific Lamprey, USFWS, Forest Service 2010
 - d. *Upper Willamette River Conservation and Recovery Plan for Chinook Salmon*
8. Climate Change
- a. Determine the potential effects of climate change on lampreys, including the effects of increasing water temperatures and changing runoff regimes on lamprey energetics and performance
9. Support reintroduction in same manner as acknowledged for salmon and steelhead and blocked areas
10. Planning assumptions for systemwide water management should balance needs for resident species upstream of storage

F. **Sturgeon**

1. 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 including research associated with critical uncertainties and appropriate monitoring and evaluation, and adequately fund. In addition, consolidate measures to address sturgeon restorations and include green sturgeon
2. Incorporate additional information in the Program to be more reflective of the importance of the species in all sections of the Program
3. Mainstem
 - a. Predation - implement strategies to reduce non-native piscivorous predation (15) and manage marine mammals to reduce predation
 - b. FCRPS operations
 - i. Continue to operate the hydropower system in a manner consistent with FCRPS biological opinion that balances needs of anadromous fish, white sturgeon, and other native fish species in the Columbia River
 - ii. Operate the FCRPS to provide flows consistent with normative river conditions
 - iii. Operate to reduce mortality, and make modifications during maintenance activities to minimize entrainment and mortality
 - c. Passage improvements and opportunities
 - d. Conduct target monitoring for toxicants
 - e. Dredging should be conducted to minimize mortality
 - f. Planning assumptions for systemwide water management should balance needs for resident species upstream of storage
4. Habitat -

Continue to identify, protect and restore habitat areas and ecological functions that are associated with productive spawning, resting, rearing, and migrating, substrate enhancement
5. Water Quality
 - a. Council should consider updating the Fish and Wildlife Plan to request that the appropriate agencies assess foodweb transfer, sediment transport, and biological effects of emerging and legacy organic contaminants under current management regimes, and the potential success of restoration projects within the basin
6. Council should incorporate ISAB recommendations for addressing hydrosystem impacts on Upper Columbia River White Sturgeon
7. Fund a cooperative project among the Spokane Tribe of Indians, Confederated Colville Tribes and the Washington Department of Fish and Wildlife to complete a baseline assessment of white sturgeon populations and associated habitats in Lake Roosevelt from Grand Coulee Dam to the international border, including the Spokane Arm of Lake Roosevelt
8. Harvest - Continue to enhance the abundance and productivity of white sturgeon in the mainstem in order to rebuild self sustaining populations able to support harvest

9. Hatchery
 - a. Continue to utilize and adaptively manage conservation hatchery programs as interim measures to avoid extinction of unique sturgeon populations
 - b. Hatchery production of sturgeon can be an appropriate mitigation strategy to supplement populations where natural recruitment is currently limited
 - c. Upon successful completion of the 3-step process, complete construction of a conservation white sturgeon hatchery, and begin operation and maintenance phase, including continuation of the marking program and development of a genetic management plan to protect remaining genetic diversity of the population

10. Climate Change
 - a. Effects of flow changes

11. Create a monitoring framework to report status

12. Kootenai River white sturgeon
 - a. Implement actions to restore natural recruitment
 - b. Incorporate additional information
 - i. Facts box should include Kootenai white sturgeon
 - c. Fully fund needs of the Tribe's integrated fish and wildlife program for genetics and culture - including sturgeon genetics

- 13. Green Sturgeon**
 - a. Planning assumptions for systemwide water management should balance needs for resident species upstream of storage
 - b. The Program should consolidate measures intended to address white sturgeon and green sturgeon restoration into set of strategies in the Mainstem Plan

Recommendations

Montana Fish, Wildlife and Parks (2)

- Adopt Strategic Recommendations for White Sturgeon - 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.
- Page 7. Quick facts box We recommend adding Kootenai white sturgeon and mountain whitefish, and change rainbow trout to redband trout.

Oregon Department of Fish and Wildlife (3)

- Recommendation 2: Insert new second paragraph under *Anadromous Fish Losses* on Page 11 as follows: "***No comparable analysis exists for Pacific lamprey; however, it is apparent that losses have been substantial. The Council recognizes and supports efforts to restore Pacific lamprey numbers, including adoption of the Tribal Pacific Lamprey Restoration Plan for the Columbia River Basin and the USFWS Pacific Lamprey***

Conservation Agreement into the Fish and Wildlife Program. Restoration of Pacific lamprey numbers and directed mitigation for hydrosystem lamprey losses should incorporate actions recommended in these plans.”

- Recommendation 3: Insert new bullet under *Anadromous Fish Losses* on Page 11 as follows: ***“Continue restoration of Pacific lamprey by (1) restoring lamprey passage and habitat in the mainstem and in tributaries that historically supported spawning lamprey populations, (2) continuing efforts to translocate adult Pacific lamprey to appropriate areas to reduce upstream passage losses, and (3) evaluating artificial propagation as a way to mitigate for lost lamprey production when passage and habitat improvements alone are insufficient. Attain self sustaining and harvestable populations of lamprey throughout their historic range.”***
- Recommendation 4: Revise second bullet under *Objectives for Environmental Characteristics* on Page 13 to read: ***“Protect, enhance, restore, and connect freshwater habitat in the Columbia River mainstem and tributaries for the life history stages of naturally spawning anadromous and resident salmonids and Pacific lamprey.”***
- Recommendation 5: Revise fourth paragraph under *Habitat Strategies* on Page 14 to read: ***“For example, passage through the hydrosystem causes loss to salmon, steelhead, lamprey and resident fish. Measures at the dams can and should be taken to reduce this loss. As an offset for hydrosystem-caused losses, the Program (may also) calls for improvements in spawning and rearing habitats in tributaries, the lower river, and estuary. By restoring these habitats, which were not damaged by the hydrosystem, the Program helps to compensate for the existence of the hydrosystem.”***
- Recommendation 6: Insert new section ***g. Pacific Lamprey Production*** on Page 19: ***“The Council recognizes progress in the development of a Framework for Pacific Lamprey Supplementation Research in the Columbia River Basin. Translocation efforts have been successful at increasing adult spawning activity, larval recruitment, and larval distribution and have provided important Pacific lamprey life history information. Current and future translocation actions should be guided by the lessons learned from ongoing efforts. It is not likely that fragmented, isolated or non-existent lamprey groups within the Columbia River Basin will naturally recolonize the upper portions of their range given the paucity of adult returns and numerous threats, including the existing mainstem environment. Therefore, the long-term restoration of Columbia River Basin lamprey may require the structured release of artificially propagated lamprey in priority areas to achieve a variety of management and conservation objectives.***
 - ***Continue development and implementation of lamprey translocation in accordance with tribal guidelines as a component of a regional recovery plan***
 - ***Evaluate the role of lamprey artificial propagation as a research tool and for supplementation of local groups”***
- Recommendation 7: Add sentence to opening paragraph for *Primary Strategy* on Page 31 as follows: ***“Identify the effects of ocean conditions on anadromous fish survival and use this information to evaluate and adjust inland actions. This should include evaluating the effects of ocean harvest on Pacific lamprey food resources.”***
- Recommendation 8: Revise *Manage for Variability* on Page 31 to include Pacific Lamprey in the text.
- Recommendation 9: Revise third bullet under *Estuary Strategies* on Page 32 to include Pacific Lamprey.

- Recommendation 10: Revise first paragraph under *Vision of the Mainstem Plan* on page 35 as follows: “...especially spawning, rearing, resting, migration, **and over-wintering habitats** for salmon, steelhead, lamprey, sturgeon, and resident fish populations.”
- Recommendation 11: Revise second bullet under 2. *Specific Objectives...* on Page 36 to read: “Protect, enhance, restore and connect freshwater habitat in the mainstem for the life history stages of naturally spawning anadromous and resident salmonids **and lamprey**. Protect and enhance ecological connectivity between aquatic areas, riparian zones, floodplains, and uplands in the mainstem.”
- Recommendation 12: Revise third bullet under “Migration and passage conditions for anadromous fish” on Page 38 as follows: “The Council will consult with ...to determine the possibility of adopting hydrosystem survival performance standards for non-listed populations of anadromous fish including lamprey. **Efforts should be implemented to adopt an interim passage standard for adult Pacific lamprey of 80% per mainstem dam to be accomplished within 10 years and to improve passage further in subsequent years.**”
- Recommendation 13: Revise final bullet under *Water Quality* on Page 44 as follows: “Implementing actions to reduce toxic contaminants in the water to meet state, tribal and federal water quality standards. The federal action agencies should partner with and support federal, tribal, state, and regional agencies’ efforts to monitor toxic contaminants in the mainstem Columbia and Snake rivers and evaluate whether these toxic contaminants adversely affect anadromous or resident fish important to this Program. If so, implement actions to reduce these toxic contaminants or their effects if doing so will provide survival benefits for fish in mitigation of adverse effects caused by the hydropower system. In particular, investigate whether exposure to toxics in the mainstem, combined with the stress associated with dam passage, leave juvenile salmon **and adult and juvenile lamprey** more susceptible to disease and result in increased mortality or reduced productivity.”
- Recommendation 14: Revise introductory text under *Lamprey and Sturgeon Passage, a. Lamprey*, on Page 47 to read: “**In recent years awareness of the effects of the hydrosystem on lamprey has increased, and the need for substantial additional effort addressing lamprey has become an emerging issue. In the Columbia River Basin....** (retain entire existing paragraph). **Artificial propagation needs to be evaluated as a tool for restoring lamprey and mitigating for losses. Development of life-cycle and bioenergetics models will help identify critical limiting factors and prioritize recovery actions. Budgets and staffing must be adequate to monitor the effects of actions taken to address lamprey issues.**”
- Recommendation 15: Revise/add bullets under *Lamprey* on Page 47 as follows: “Bonneville and the Corps, in coordination with federal, state, and tribal fish managers and the Council, should (**implement the following measures to improve adult and juvenile Pacific lamprey passage survival and reduce delays in migration identify**), develop, implement, and monitor measures to help restore Pacific lamprey including:
 - (Identify) **Specific fish passage structures for adult and juvenile lamprey**
 - **Regional approaches to evaluate passage, abundance, distribution, and population structure, including the mainstem Columbia, Snake and Willamette rivers**
 - **Develop tags suitable for adult and juvenile lamprey and a regional lamprey tagging forum**
 - **Develop a regional strategy for monitoring passage into tributaries to better understand differences in counts of adult lamprey between dams**
 - **Increase knowledge regarding the use of the mainstem as spawning habitat**

- *Identify operations at mainstem hydropower dams **such as ramping rates and water elevation changes** that delay, obstruct, or kill migrating **adult and juvenile** lamprey*
- ***Monitor and address effects of hydrosystem operations on juvenile lamprey residing in reservoirs***
- *Develop and implement (**lamprey**) passage aids for **adult and juvenile lamprey** at known passage obstacles*
- *Monitor lamprey passage at mainstem hydropower dams to evaluate passage improvement actions and to identify additional passage problem areas,*
- *Assess lamprey passage efficiency, direct mortality, and/or other metrics relating to migratory success of lamprey, (**and**)*
- *Determine predation on **adult and juvenile** lamprey during (**mainstem passage migration**)*
- ***Determine the potential effects of climate change on lampreys, including the effects of increasing water temperatures and changing runoff regimes on lamprey energetics and performance. Develop adaptation strategies to address these affects, and***
- ***Support the USFWS Pacific Lamprey Conservation Agreement through collaborative development and management of data.***
- Recommendation 16: Revise text under *Reintroduction of Anadromous Fish in Blocked Areas* on Page 56 as follows: “...*evaluate the feasibility of salmon, steelhead, **and Pacific lamprey** reintroduction, consistent with the objectives in the appropriate subbasin plans.*”
- Recommendation 17: Revise first paragraph under *Updating Existing Subbasin Management Plans* on Page 58 as follows: “***The Council recognizes that work has continued in some subbasins to refine and update management plans. The Council also recognizes that work has continued outside the Program, such as recovery planning, and the Tribal Pacific Lamprey Restoration Plan, that will influence implementation of the Council’s Program at the subbasin level. The Council recognizes the objectives and recommended actions of the Tribal Pacific Lamprey Restoration Plan as updates to subbasin plans.***”
- ***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.
- 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 building/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.

- (Attachment 2, Section 5.5), Current Program: Lower Columbia Subbasin Plan (1 paragraph on Page 2-18)

Recommendation 1: Include measurable eulachon objectives in the Fish and Wildlife Program. Measures: BPA should fund protection, mitigation and enhancement of eulachon through the following measures:

- Develop biological objectives for eulachon that are consistent with recovery.
- Monitor and evaluate eulachon abundance in the Columbia River Basin via annual spawning stock biomass surveys following protocols developed by the Washington Department of Fish and Wildlife and acoustic estimates by NOAA - NWFSC.
- Monitor and evaluate the causal mechanisms and migration/behavior characteristics affecting survival of larval eulachon during their first weeks in the Columbia River estuary, plume, and ocean environments.
- Monitor and evaluate the ecological importance of the tidal freshwater, estuary, plume, and nearshore ocean environments to the viability and recovery of eulachon in the Columbia River Basin.
 - Develop an oceanographic indicators ecosystem conditions model to determine the significance of plume and nearshore ocean conditions that affect eulachon survival.
 - Adjust the timing, magnitude, and frequency of hydrosystem flows (especially spring freshets) entering the estuary and plume to better reflect the natural hydrologic cycle, improve access to habitats, and provide better transport of coarse sediments and nutrients in the estuary and plume if these are found to be limiting to eulachon life history.

Rationale: The Program currently does not address eulachon, an anadromous fish native to the Columbia River, and a species listed as threatened under the Endangered Species Act. This species has been heavily impacted by changes to the lower mainstem and estuary caused by construction and operation of the hydropower system. Substantial changes to flow, sediment delivery and the food web in the lower river have been well documented. These measures are needed to address uncertainties regarding the effect of changes in the Columbia River hydrograph on survival, productivity and recovery potential of eulachon. As the Northwest Power Act directs the Council to develop a program to protect, mitigate, and enhance fish and wildlife in the basin affected by the development, operation, and management of hydroelectric projects, the Council should update the Program to include eulachon and develop biological objectives for this species. As eulachon are listed as a threatened species under the Endangered Species Act, NOAA is in the process of developing a recovery plan, and has prepared a Federal Recovery Outline for eulachon that includes recovery tasks as part of a preliminary recovery strategy. The recommended measures are consistent with NOAA's Federal Recovery Outline for eulachon. Recovery of ESA-listed species is consistent with the Program's goals and objectives. Furthermore, measures adopted by the Council and funded by BPA to assist in the recovery of listed

species affected by the development, operation, and management of hydroelectric projects is consistent with the Northwest Power Act and the Program.

- **Recommendation 2:** To address changes in the hydrograph of the Columbia River on eulachon productivity and abundance, the Council should:
 - Monitor eulachon abundance in the Columbia River via annual spawning stock biomass surveys.
 - Link biological data to river discharge.
- **Recommendation 3:** To address changes in the hydrograph of the Columbia River and adverse effects to eulachon egg and larvae survival in the Columbia River and Columbia River plume, the Council should:
 - Monitor and evaluate temporal and spatial species composition, abundance, and foraging rates of juvenile eulachon predators at representative locations in the estuary and plume.
 - Monitor and evaluate the causal mechanisms and migration/behavior characteristics affecting survival of larval eulachon during their first weeks in the plume/ocean.
 - Investigate the ecological importance of the tidal freshwater, estuary, plume, and nearshore ocean environments to the viability and recovery of eulachon in the Columbia River Basin.
 - Investigate the causal mechanisms and migration/behavior characteristics affecting survival of larval eulachon during their first weeks in the plume/ocean.
 - Develop a hydrodynamic numerical model for the estuary and plume to support critical uncertainties investigations.
 - Operate the FCRPS to more closely approximate the shape of the natural hydrograph and to enhance flows and water quality to improve larval survival in the plume and ocean environments.
- **Recommendation 4:** To address passage-related adverse effects at Bonneville Dam, the Council should:
 - Monitor and report numbers of adult eulachon observed in samples from the Juvenile Bypass System and observed in the Adult Fish Passage System.

Rationale: The Program currently does not address eulachon, an anadromous fish native to the Columbia River, and a species listed as threatened under the Endangered Species Act. This species has been heavily impacted by changes to the lower mainstem and estuary caused by construction and operation of the hydropower system. Substantial changes to flow, sediment delivery and the food web in the lower river have been well documented. These measures are needed to address uncertainties regarding the effect of changes in the Columbia River hydrograph on survival, productivity and recovery potential of eulachon. As the Northwest Power Act directs the Council to develop a program to protect, mitigate, and enhance fish and wildlife in the basin affected by the development, operation, and management of hydroelectric projects, the Council should update the Program to include eulachon and develop biological objectives for this species. As eulachon are listed as a threatened species under the Endangered Species Act, NOAA is in the process of developing a recovery plan, and has prepared a Federal Recovery Outline for eulachon that includes recovery tasks as part of a preliminary recovery strategy. The recommended measures are consistent with NOAA's Federal Recovery Outline for eulachon. Recovery of ESA-listed species is consistent with the Program's goals and objectives. Furthermore, measures adopted by the Council and funded by BPA to assist in the recovery of listed

species affected by the development, operation, and management of hydroelectric projects is consistent with the Northwest Power Act and the Program.

Washington Department of Fish and Wildlife (4)

- Recommendation 2: Insert new second paragraph under *Anadromous Fish Losses* on Page 11 as follows: ***“No comparable analysis exists for Pacific lamprey; however, it is apparent that losses have been substantial. The Council recognizes and supports efforts to restore Pacific lamprey numbers, including adoption of the Tribal Pacific Lamprey Restoration Plan for the Columbia River Basin and the USFWS Pacific Lamprey Conservation Agreement into the Fish and Wildlife Program. Restoration of Pacific lamprey numbers and directed mitigation for hydrosystem lamprey losses should incorporate actions recommended in these plans.”***
- Recommendation 3: Insert new bullet under *Anadromous Fish Losses* on Page 11 as follows: ***“Continue restoration of Pacific lamprey by (1) restoring lamprey passage and habitat in the mainstem and in tributaries that historically supported spawning lamprey populations, (2) continuing efforts to translocate adult Pacific lamprey to appropriate areas to reduce upstream passage losses, and (3) evaluating artificial propagation as a way to mitigate for lost lamprey production when passage and habitat improvements alone are insufficient. Attain self-sustaining and harvestable populations of lamprey throughout their historic range.”***
- Recommendation 4: Revise second bullet under *Objectives for Environmental Characteristics* on Page 13 to read: ***“Protect, enhance, restore, and connect freshwater habitat in the Columbia River mainstem and tributaries for the life history stages of naturally spawning anadromous and resident salmonids and Pacific lamprey.”***
- Recommendation 5: Revise fourth paragraph under *Habitat Strategies* on Page 14 to read: ***“For example, passage through the hydrosystem causes loss to salmon, steelhead, lamprey and resident fish. Measures at the dams can and should be taken to reduce this loss. As an offset for hydrosystem-caused losses, the Program (may also) calls for improvements in spawning and rearing habitats in tributaries, the lower river, and estuary. By restoring these habitats, which were not damaged by the hydrosystem, the Program helps to compensate for the existence of the hydrosystem.”***
- Recommendation 6: Insert new section g. *Pacific Lamprey Production* on Page 19: ***“The Council recognizes progress in the development of a Framework for Pacific Lamprey Supplementation Research in the Columbia River Basin. Translocation efforts have been successful at increasing adult spawning activity, larval recruitment, and larval distribution and have provided important Pacific lamprey life history information. Current and future translocation actions should be guided by the lessons learned from ongoing efforts. It is not likely that fragmented, isolated or non-existent lamprey groups within the Columbia River Basin will naturally recolonize the upper portions of their range given the paucity of adult returns and numerous threats, including the existing mainstem environment. Therefore, the long-term restoration of Columbia River Basin lamprey may require the structured release of artificially propagated lamprey in priority areas to achieve a variety of management and conservation objectives.***
 - ***Continue development and implementation of lamprey translocation in accordance with tribal guidelines as a component of a regional recovery plan***
 - ***Evaluate the role of lamprey artificial propagation as a research tool and for supplementation of local groups”***

- Recommendation 7: Add sentence to opening paragraph for *Primary Strategy* on Page 31 as follows: “*Identify the effects of ocean conditions on anadromous fish survival and use this information to evaluate and adjust inland actions. **This should include evaluating the effects of ocean harvest on Pacific lamprey food resources.***”
- Recommendation 8: Revise *Manage for Variability* on Page 31 to include Pacific Lamprey in the text.
- Recommendation 9: Revise third bullet under *Estuary Strategies* on Page 32 to include Pacific Lamprey.
- Recommendation 10: Revise first paragraph under *Vision of the Mainstem Plan* on page 35 as follows: “...*especially spawning, rearing, resting, migration, and over-wintering habitats for salmon, steelhead, lamprey, sturgeon, and resident fish populations.*”
- Recommendation 11: Revise second bullet under 2. *Specific Objectives...* on Page 36 to read: “*Protect, enhance, restore and connect freshwater habitat in the mainstem for the life history stages of naturally spawning anadromous and resident salmonids and lamprey. Protect and enhance ecological connectivity between aquatic areas, riparian zones, floodplains, and uplands in the mainstem.*”
- Recommendation 12: Revise third bullet under “*Migration and passage conditions for anadromous fish*” on Page 38 as follows: “*The Council will consult with ...to determine the possibility of adopting hydrosystem survival performance standards for non-listed populations of anadromous fish including lamprey. **Efforts should be implemented to adopt an interim passage standard for adult Pacific lamprey of 80% per mainstem dam to be accomplished within 10 years and to improve passage further in subsequent years.***”
- Recommendation 13: Revise final bullet under *Water Quality* on Page 44 as follows: “*Implementing actions to reduce toxic contaminants in the water to meet state, tribal and federal water quality standards. The federal action agencies should partner with and support federal, tribal, state, and regional agencies’ efforts to monitor toxic contaminants in the mainstem Columbia and Snake rivers and evaluate whether these toxic contaminants adversely affect anadromous or resident fish important to this Program. If so, implement actions to reduce these toxic contaminants or their effects if doing so will provide survival benefits for fish in mitigation of adverse effects caused by the hydropower system. In particular, investigate whether exposure to toxics in the mainstem, combined with the stress associated with dam passage, leave juvenile salmon **and adult and juvenile lamprey** more susceptible to disease and result in increased mortality or reduced productivity.*”
- Recommendation 14: Revise introductory text under *Lamprey and Sturgeon Passage, a. Lamprey*, on Page 47 to read: “*In recent years awareness of the effects of the hydrosystem on lamprey has increased, and the need for substantial additional effort addressing lamprey has become an emerging issue. In the Columbia River Basin.... (retain entire existing paragraph). **Artificial propagation needs to be evaluated as a tool for restoring lamprey and mitigating for losses. Development of life-cycle and bioenergetics models will help identify critical limiting factors and prioritize recovery actions. Budgets and staffing must be adequate to monitor the effects of actions taken to address lamprey issues.***”
- Recommendation 15: Revise/add bullets under *Lamprey* on Page 47 as follows: “*Bonneville and the Corps, in coordination with federal, state, and tribal fish managers and the Council, should **(implement the following measures to improve adult and juvenile***

Pacific lamprey passage survival and reduce delays in migration identify), develop, implement, and monitor measures to help restore Pacific lamprey including:

- *(Identify) Specific fish passage structures for adult and juvenile lamprey*
- *Regional approaches to evaluate passage, abundance, distribution, and population structure, including the mainstem Columbia, Snake and Willamette rivers*
- *Develop tags suitable for adult and juvenile lamprey and a regional lamprey tagging forum*
- *Develop a regional strategy for monitoring passage into tributaries to better understand differences in counts of adult lamprey between dams*
- *Increase knowledge regarding the use of the mainstem as spawning habitat*
- *Identify operations at mainstem hydropower dams such as ramping rates and water elevation changes that delay, obstruct, or kill migrating adult and juvenile lamprey*
- *Monitor and address effects of hydrosystem operations on juvenile lamprey residing in reservoirs*
- *Develop and implement (lamprey) passage aids for adult and juvenile lamprey at known passage obstacles*
- *Monitor lamprey passage at mainstem hydropower dams to evaluate passage improvement actions and to identify additional passage problem areas,*
- *Assess lamprey passage efficiency, direct mortality, and/or other metrics relating to migratory success of lamprey, (and)*
- *Determine predation on adult and juvenile lamprey during (mainstem passage migration)*
- *Determine the potential effects of climate change on lampreys, including the effects of increasing water temperatures and changing runoff regimes on lamprey energetics and performance. Develop adaptation strategies to address these affects, and*
- *Support the USFWS Pacific Lamprey Conservation Agreement through collaborative development and management of data.”*
- Recommendation 16: Revise text under *Reintroduction of Anadromous Fish in Blocked Areas* on Page 56 as follows: “...evaluate the feasibility of salmon, steelhead, **and Pacific lamprey** reintroduction, consistent with the objectives in the appropriate subbasin plans.”
- Recommendation 17: Revise first paragraph under *Updating Existing Subbasin Management Plans* on Page 58 as follows: “The Council recognizes that work has continued in some subbasins to refine and update management plans. The Council also recognizes that work has continued outside the Program, such as recovery planning, and the **Tribal Pacific Lamprey Restoration Plan**, that will influence implementation of the Council’s Program at the subbasin level. The Council recognizes the objectives and recommended actions of the **Tribal Pacific Lamprey Restoration Plan** as updates to subbasin plans.”
- **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.

- 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 building/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.**

- **Lower Columbia Subbasin Plan (1 paragraph on Page 2-18)**

Recommendation: Include measurable eulachon objectives in the Fish and Wildlife Program. **Measures:** BPA should fund protection, mitigation and enhancement of eulachon through the following measures:

- **Develop biological objectives for eulachon that are consistent with recovery.**

- **Monitor and evaluate eulachon abundance in the Columbia River Basin via annual spawning stock biomass surveys following protocols developed by the Washington Department of Fish and Wildlife and acoustic estimates by NOAA - NWFS.**

- **Monitor and evaluate the causal mechanisms and migration/behavior characteristics affecting survival of larval eulachon during their first weeks in the Columbia River estuary, plume, and ocean environments.**

- Monitor and evaluate the ecological importance of the tidal freshwater, estuary, plume, and nearshore ocean environments to the viability and recovery of eulachon in the Columbia River Basin.
 - Develop an oceanographic indicators ecosystem conditions model to determine the significance of plume and nearshore ocean conditions that affect eulachon survival.
 - Adjust the timing, magnitude, and frequency of hydrosystem flows (especially spring freshets) entering the estuary and plume to better reflect the natural hydrologic cycle, improve access to habitats, and provide better transport of coarse sediments and nutrients in the estuary and plume if these are found to be limiting to eulachon life history.
- **Recommendation 1:** To address changes in the hydrograph of the Columbia River on eulachon productivity and abundance, the Council should:
 - Monitor eulachon abundance in the Columbia River via annual spawning stock biomass surveys.
 - Link biological data to river discharge.
- **Recommendation 2:** To address changes in the hydrograph of the Columbia River and adverse effects to eulachon egg and larvae survival in the Columbia River and Columbia River plume, the Council should:
 - Monitor and evaluate temporal and spatial species composition, abundance, and foraging rates of juvenile eulachon predators at representative locations in the estuary and plume.
 - Monitor and evaluate the causal mechanisms and migration/behavior characteristics affecting survival of larval eulachon during their first weeks in the plume/ocean.
 - Investigate the ecological importance of the tidal freshwater, estuary, plume, and nearshore ocean environments to the viability and recovery of eulachon in the Columbia River Basin.
 - Investigate the causal mechanisms and migration/behavior characteristics affecting survival of larval eulachon during their first weeks in the plume/ocean.
 - Develop a hydrodynamic numerical model for the estuary and plume to support critical uncertainties investigations.
 - Operate the FCRPS to more closely approximate the shape of the natural hydrograph and to enhance flows and water quality to improve larval survival in the plume and ocean environments.
- **Recommendation 3:** To address passage-related adverse effects at Bonneville Dam, the Council should:
 - Monitor and report numbers of adult eulachon observed in samples from the Juvenile Bypass System and observed in the Adult Fish Passage System.

Washington State Governor's Salmon Recovery Office (5)

- Create a monitoring framework and report on the status of lamprey, sturgeon and eulachon across the Columbia River Basin on a regular basis.
- Report passage counts at dams annually and map lamprey distribution every 5 years.
- Add to scientific principles (pages 9 and 10), - *Salmon, steelhead, lamprey, sturgeon and eulachon accommodate ocean mortality and environmental variability by having life*

histories that have sufficient level of productivity and a wide range of biological diversity (i.e., resiliency)

- Fully Incorporate Estuary, Plume and Nearshore Ocean in Program.
 - Under measure 7 - determine the effects of climate change, acidification, salinity, estuary turbidity maximum (emt), and localized hypoxia are likely to affect forage fish in the coming decades.

Lower Columbia Fish Recovery Board (6)

- Give greater recognition to the need to protect, mitigate and enhance eulachon populations
- Eulachon and white sturgeon are significant Lower Columbia fish species. Eulachon is not currently addressed in the Council F&W. This species was listed as threatened under ESA in 2012. Substantial changes in flows, sediment delivery, and the lower river food web resulting from the operation of the hydropower system have affected eulachon survival, productivity, and recovery potential. The F&W program should adopt biological objectives for eulachon and provide for eulachon life cycle research, status monitoring, assessment of habitat needs and conditions, and restoration measures.
 - Adopt biological objectives for eulachon and provide for eulachon life cycle research, status monitoring, assessment of habitat needs and conditions and restoration measures.
- The Lower Columbia River and Oregon Coast White Sturgeon Conservation Plan (ODFW, August 2011) finds that the Lower Columbia white sturgeon population is not at risk; however, limiting factors and threats do exist that could compromise its long term health. The most significant factors affecting this white sturgeon population include pinniped predation below Bonneville Dam and the effects of flow variations due to the federal hydropower operations on spawning success. The plan also notes that alteration of flow patterns reduces habitat quality and quantity and can alter migration patterns.
 - Support efforts to assess and reduce pinniped predation on Lower Columbia white sturgeon. Support efforts to assess and mitigate for the effects of altered flow patterns on Lower Columbia white sturgeon spawning success, migration patterns, and the quantity and quality of needed habitat.

Columbia River Inter-Tribal Fish Commission (14)

- *The Council shall consider incorporating food web concepts and ecosystem management within the Fish and Wildlife Program. The first steps may include investigations of species and topics where current knowledge is limited, such as freshwater mussels, lamprey, sturgeon and toxics.*
- **4.2 Lamprey**
Recommendation 1: Edit third bullet under *Habitat* on Page 7 to read: “*Ocean conditions should be considered in evaluating freshwater habitat management and to understand all stages of the salmon, steelhead and Pacific lamprey life cycles.*”

Recommendation 2: Insert new second paragraph under *Anadromous Fish Losses* on Page 11 as follows: “*No comparable analysis exists for Pacific lamprey; however, it is apparent that losses have been substantial. The Council recognizes and supports efforts to restore Pacific lamprey numbers, including adoption of the Tribal Pacific Lamprey*

Restoration Plan for the Columbia River Basin and the USFWS Pacific Lamprey Conservation Agreement into the Fish and Wildlife Program. Restoration of Pacific lamprey numbers and directed mitigation for hydrosystem lamprey losses should incorporate actions recommended in these plans.”

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Recommendation 4: Revise second bullet under *Objectives for Environmental Characteristics* on Page 13 to read: ***“Protect, enhance, restore, and connect freshwater habitat in the Columbia River mainstem and tributaries for the life history stages of naturally spawning anadromous and resident salmonids and Pacific lamprey.”***

Recommendation 5: Revise fourth paragraph under *Habitat Strategies* on Page 14 to read: ***“For example, passage through the hydrosystem causes loss to salmon, steelhead, lamprey and resident fish. Measures at the dams can and should be taken to reduce this loss. As an offset for hydrosystem-caused losses, the Program (may also) calls for improvements in spawning and rearing habitats in tributaries, the lower river, and estuary. By restoring these habitats, which were not damaged by the hydrosystem, the Program helps to compensate for the existence of the hydrosystem.”***

Recommendation 6: Insert new section *g. Pacific Lamprey Production* on Page 19: ***“The Council recognizes progress in the development of a Framework for Pacific Lamprey Supplementation Research in the Columbia River Basin. Translocation efforts have been successful at increasing adult spawning activity, larval recruitment, and larval distribution and have provided important Pacific lamprey life history information. Current and future translocation actions should be guided by the lessons learned from ongoing efforts.”***

It is not likely that fragmented, isolated or non-existent lamprey groups within the Columbia River Basin will naturally recolonize the upper portions of their range given the paucity of adult returns and numerous threats, including the existing mainstem environment. Therefore, the long-term restoration of Columbia River Basin lamprey may require the structured release of artificially propagated lamprey in priority areas to achieve a variety of management and conservation objectives.

- ***Continue development and implementation of lamprey translocation in accordance with tribal guidelines as a component of a regional recovery plan***
- ***Evaluate the role of lamprey artificial propagation as a research tool and for supplementation of local groups”***

Recommendation 7: Add sentence to opening paragraph for *Primary Strategy* on Page 31 as follows: “*Identify the effects of ocean conditions on anadromous fish survival and use this information to evaluate and adjust inland actions. **This should include evaluating the effects of ocean harvest on Pacific lamprey food resources.***”

Recommendation 8: Revise *Manage for Variability* on Page 31 to include Pacific Lamprey in the text.

Recommendation 9: Revise third bullet under *Estuary Strategies* on Page 32 to include Pacific Lamprey.

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Recommendation 11: Revise second bullet under 2. *Specific Objectives...* on Page 36 to read: “*Protect, enhance, restore and connect freshwater habitat in the mainstem for the life history stages of naturally spawning anadromous and resident salmonids **and lamprey**. Protect and enhance ecological connectivity between aquatic areas, riparian zones, floodplains, and uplands in the mainstem.*”

Recommendation 12: Revise third bullet under “*Migration and passage conditions for anadromous fish*” on Page 38 as follows: “*The Council will consult with ...to determine the possibility of adopting hydrosystem survival performance standards for non-listed populations of anadromous fish including lamprey. **Efforts should be implemented to adopt an interim passage standard for adult Pacific lamprey of 80% per mainstem dam to be accomplished within 10 years and to improve passage further in subsequent years.***”

Recommendation 13: Revise final bullet under *Water Quality* on Page 44 as follows: “*Implementing actions to reduce toxic contaminants in the water to meet state, tribal and federal water quality standards. The federal action agencies should partner with and support federal, tribal, state, and regional agencies’ efforts to monitor toxic contaminants in the mainstem Columbia and Snake rivers and evaluate whether these toxic contaminants adversely affect anadromous or resident fish important to this Program. If so, implement actions to reduce these toxic contaminants or their effects if doing so will provide survival benefits for fish in mitigation of adverse effects caused by the hydropower system. In particular, investigate whether exposure to toxics in the mainstem, combined with the stress associated with dam passage, leave juvenile salmon **and adult and juvenile lamprey** more susceptible to disease and result in increased mortality or reduced productivity.*”

Recommendation 14: Revise introductory text under *Lamprey and Sturgeon Passage, a. Lamprey*, on Page 47 to read: “*In recent years awareness of the effects of the hydrosystem on lamprey has increased, and the need for substantial additional effort addressing lamprey has become an emerging issue. In the Columbia River Basin.... (retain entire existing paragraph). **Artificial propagation needs to be evaluated as a tool for restoring lamprey and mitigating for losses. Development of life-cycle and***

bioenergetics models will help identify critical limiting factors and prioritize recovery actions. Budgets and staffing must be adequate to monitor the effects of actions taken to address lamprey issues.”

Recommendation 15: Revise/add bullets under *Lamprey* on Page 47 as follows:

“Bonneville and the Corps, in coordination with federal, state, and tribal fish managers and the Council, should (implement the following measures to improve adult and juvenile Pacific lamprey passage survival and reduce delays in migration identify), develop, implement, and monitor measures to help restore Pacific lamprey including:

- *(Identify) Specific fish passage structures for adult and juvenile lamprey*
- *Regional approaches to evaluate passage, abundance, distribution, and population structure, including the mainstem Columbia, Snake and Willamette rivers*
- *Develop tags suitable for adult and juvenile lamprey and a regional lamprey tagging forum*
- *Develop a regional strategy for monitoring passage into tributaries to better understand differences in counts of adult lamprey between dams*
- *Increase knowledge regarding the use of the mainstem as spawning habitat*
- *Identify operations at mainstem hydropower dams such as ramping rates and water elevation changes that delay, obstruct, or kill migrating adult and juvenile lamprey*
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- *Develop and implement (lamprey) passage aids for adult and juvenile lamprey at known passage obstacles*
- *Monitor lamprey passage at mainstem hydropower dams to evaluate passage improvement actions and to identify additional passage problem areas,*
- *Assess lamprey passage efficiency, direct mortality, and/or other metrics relating to migratory success of lamprey, (and)*
- *Determine predation on adult and juvenile lamprey during (mainstem passage migration)*
- *Determine the potential effects of climate change on lampreys, including the effects of increasing water temperatures and changing runoff regimes on lamprey energetics and performance. Develop adaptation strategies to address these affects, and*
- *Support the USFWS Pacific Lamprey Conservation Agreement through collaborative development and management of data.”*

Recommendation 16: Revise text under *Reintroduction of Anadromous Fish in Blocked Areas* on Page 56 as follows: *“....evaluate the feasibility of salmon, steelhead, and Pacific lamprey reintroduction, consistent with the objectives in the appropriate subbasin plans.”*

Recommendation 17: Revise first paragraph under *Updating Existing Subbasin Management Plans* on Page 58 as follows: *“The Council recognizes that work has continued in some subbasins to refine and update management plans. The Council also recognizes that work has continued outside the Program, such as recovery planning, and the Tribal Pacific Lamprey Restoration Plan, that will influence implementation of the Council’s Program at the subbasin level. The Council recognizes the objectives and recommended actions of the Tribal Pacific Lamprey Restoration Plan as updates to subbasin plans.”*

- **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.

- **4.4 Eulachon**

Current Program: Lower Columbia Subbasin Plan (1 paragraph on Page 2-18)

The Program currently does not address eulachon, an anadromous fish native to the Columbia River, and a species listed as threatened under the Endangered Species Act. This species has been heavily impacted by changes to the lower mainstem and estuary caused by construction and operation of the hydropower system. Substantial changes to flow, sediment delivery and the food web in the lower river have been well documented. Measures are needed to address uncertainties regarding the effect of changes in the Columbia River hydrograph on survival, productivity and recovery potential of eulachon. As the Northwest Power Act directs the Council to develop a program to protect, mitigate, and enhance fish and wildlife in the basin affected by the development, operation, and management of hydroelectric projects, the Council should update the Program to include eulachon and develop biological objectives for this species.

- **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:

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.

Colville Confederated Tribes (15)

- The state and federal agencies and tribes should continue to work cooperatively with NOAA Fisheries, states, tribes, and the Council to review, evaluate, develop, and implement strategies to reduce non-native piscivorous predation on native fishes, including salmon and redband trout (both anadromous and resident), and white sturgeon, especially by smallmouth bass, channel catfish, walleye, and northern pike.
- Continue to identify, protect and restore habitat areas and ecological functions that are associated with productive spawning, resting, rearing, and migrating salmon and steelhead,

white sturgeon, and other native fish in the Columbia River mainstem, including the Okanogan, Methow, Entiat, Wenatchee and the blocked area, as supported by the existing Accord..

- Continue to enhance the abundance and productivity of white sturgeon in the mainstem in order to rebuild self sustaining populations able to support harvest. Continue to operate the hydropower system in a manner consistent with FCRPS biological opinion that balances needs of anadromous fish, white sturgeon, and other native fish species in the Columbia River
- Implement actions to restore natural recruitment in Columbia River white sturgeon populations and to recover listed Kootenai River white sturgeon.

Yakama Nation (17)

- Lamprey - same as CRITFC (above)

Confederated Tribes of Grand Ronde (18)

- Lamprey - Pacific lampreys are another significant species to the Tribe. Willamette Falls, the only remaining place in the Northwest where lampreys exist in sufficient numbers to permit Tribal gathering, is within the Grand Ronde Tribe's ceded lands. Historically Willamette Falls was the site of a village of the Clawiwalla band of Chinook, one of the antecedent tribes of Grand Ronde. This was a traditional gathering site that many other tribes used by paying due tribute to the Clawiwalla. Cultural significance - Historically lampreys were such an important food source because of the relative ease of gathering them at the Falls, and because their meat is so high in the protein and fats essential for survival. Other lamprey products were important for medicines, and the spinal cords were used as a lashing or binding material. Today Tribal members continue to prepare lamprey meat and use its tissues in the traditional way.
- Eulachon — Also known as ooligan, hooligan, Pacific smelt, and candlefish, the eulachon run of the Lower Columbia River has historically been a very important food source, particularly for the Wahlalla (Cascades) band of Chinook, one of the antecedent tribes of Grand Ronde, inhabiting the banks of the Lower Columbia from modern-day Cascade Locks downstream to around modern-day Portland. Eulachon is very rich in oil, which has dozens of uses from a food (often mixed with berries) to a wood preservative.
- Sturgeon — The Clackamas band of Chinook , one of the antecedent tribes of Grand Ronde, historically fished for sturgeon at the confluence of the Willamette and Columbia Rivers, and also further up the Willamette all the way to the modern-day Lake Oswego area. Sturgeon is another very important food source for the Tribe.
- C.1 Amendments to Vision for the Columbia River Basin
Recommendation 4 - Edit third bullet under *Habitat* on Page 7 to read: *Ocean conditions should be considered in evaluating freshwater habitat management and to understand all stages of the salmon, steelhead and Pacific lamprey life cycles.*
- **Recommendation 7** - Insert new second paragraph under *Anadromous Fish Losses* on Page 11 as follows: *No comparable analysis exists for Pacific lamprey; however, it is apparent that losses have been substantial. The Council recognizes and supports efforts to restore Pacific lamprey numbers, including the Tribal Pacific Lamprey Restoration Plan for the Columbia River Basin and the USFWS Pacific Lamprey Conservation Agreement.*

Restoration of Pacific lamprey numbers and mitigation for lamprey losses should incorporate actions recommended in these plans.

- **Recommendation 12** - Revise second bullet under *Objectives for Environmental Characteristics* on Page 13 to read: *Protect, enhance, restore, and connect freshwater habitat in the Columbia River mainstem and tributaries for the life history stages of naturally spawning anadromous and resident salmonids and Pacific lamprey.*
- **Recommendation 14** — (NPCC Program, Page 19: D. Basinwide Strategies / 1. Artificial Production Strategies). Insert new section g. *Pacific Lamprey Production* on Page 19:

The Council recognizes progress in the development of a Framework for Pacific Lamprey Supplementation Research in the Columbia River Basin. Translocation efforts have been successful at increasing adult spawning activity, larval recruitment, and larval distribution and have provided important Pacific lamprey life history information. Current and future translocation actions should be guided by the lessons learned from ongoing efforts.

It is not likely that fragmented, isolated or non-existent lamprey groups within the Columbia River Basin will naturally recolonize the upper portions of their range given the paucity of adult returns and numerous threats, including the existing mainstem environment. Therefore, the long-term restoration of Columbia River Basin lamprey may require the structured release of artificially propagated lamprey in priority areas to achieve a variety of management and conservation objectives.

 - *Continue development and implementation of lamprey translocation in accordance with tribal guidelines as a component of a regional recovery plan*
 - *Evaluate the role of lamprey artificial propagation as a research tool and for supplementation of local groups*
- **Recommendation 18** — The High-Level Indicators paragraph on page 26 of the current Program should continue to expand to include reporting high level indicators in the Lower Columbia Province, as well as develop indicators for resident fish, pacific lamprey, and eulachon.
- **D AMENDMENT S TO OCEAN**

D.1 Amendments to Primary Strategy

Recommendation 20: Add sentence to opening paragraph for *Primary Strategy* on Page 31 as follows: *Identify the effects of ocean conditions on anadromous fish survival and use this information to evaluate and adjust inland actions. This should include evaluating the effects of ocean harvest on Pacific lamprey food resources.*

Recommendation 23: Revise *Manage for Variability* on Page 31 to include Pacific Lamprey in the text.
- **E AMENDMENTS TO LOWER COLUMBIA RIVER ESTUARY**

E.1 Amendments to Estuary Strategies

Recommendation 24: Revise third bullet under *Estuary Strategies* on Page 32 to include Pacific Lamprey.

Rationale: Pacific lamprey is a culturally significant species. In the focus of anadromous fish, salmon and steelhead tend to receive the spotlight but focus should also be directed to Pacific lamprey given their historic distribution includes a large portion of the Columbia River Basin and the direct effect hydropower has on the species is significant

F.2 Amendments to Biological Objectives (Mainstem Plan)

Recommendation 26: Revise second bullet under 2. *Specific Objectives...* on Page 36 to read: *Protect, enhance, restore and connect freshwater habitat in the mainstem for the life history stages of naturally spawning anadromous and resident salmonids and lamprey. Protect and enhance ecological connectivity between aquatic areas, riparian zones, floodplains, and uplands in the mainstem.*

- **Recommendation 27:** Revise third bullet under "Migration and passage conditions for anadromous fish" on Page 38 as follows: *The Council will consult with ...to determine the possibility of adopting hydrosystem survival performance standards for non-listed populations of anadromous fish including lamprey. Efforts should be implemented to adopt an interim passage standard for adult Pacific lamprey of 80% per mainstem dam to be accomplished within 10 years and to improve passage further in subsequent years.*
- **Recommendation 30:** Revise final bullet under *Water Quality* on Page 44 as follows: *Implementing actions to reduce toxic contaminants in the water to meet state, tribal and federal water quality standards. The federal action agencies should partner with and support federal, tribal, state, and regional agencies' efforts to monitor toxic contaminants in the mainstem Columbia and Snake rivers and evaluate whether these toxic contaminants adversely affect anadromous or resident fish important to this Program. If so, implement actions to reduce these toxic contaminants or their effects if doing so will provide survival benefits for fish in mitigation of adverse effects caused by the hydropower system. In particular, investigate whether exposure to toxics in the mainstem, combined with the stress associated with dam passage, leave juvenile salmon and adult and juvenile lamprey more susceptible to disease and result in increased mortality or reduced productivity.*
- **Recommendation 35:** Revise introductory text under *Lamprey and Sturgeon Passage*, a. Lamprey, on Page 47 to read: *In recent years awareness of the effects of the hydrosystem on lamprey has increased, and the need for substantial additional effort addressing lamprey has become an emerging issue. In the Columbia River Basin....* (retain entire existing paragraph).
- **Recommendation 36:** Revise/add bullets under *Lamprey* on Page 47 as follows: *Bonneville and the Corps, in coordination with federal, state, and tribal fish managers and the Council, should identify, develop, implement, and monitor measures to help restore Pacific lamprey including:*
 - *Specific fish passage structures for adult and juvenile lamprey*
 - *Regional approaches to evaluate passage, abundance, distribution, and population structure, including the mainstem Columbia, Snake and Willamette rivers*
 - *Develop tags suitable for adult and juvenile lamprey and a regional lamprey tagging forum*
 - *Develop a regional strategy for monitoring passage into tributaries to better understand differences in counts of adult lamprey between dams*
 - *Increase knowledge regarding the use of the mainstem as spawning habitat*
 - *Identify operations at mainstem hydropower dams such as ramping rates and water elevation changes that delay, obstruct, or kill migrating adult and juvenile lamprey*
 - *Monitor and address effects of hydrosystem operations on juvenile lamprey residing in reservoirs*
 - *Develop and implement passage aids for adult and juvenile lamprey at known passage obstacles*

- *Monitor lamprey passage at mainstem hydropower dams to evaluate passage improvement actions and to identify additional passage problem areas,*
- *Assess lamprey passage efficiency, direct mortality, and/or other metrics relating to migratory success of lamprey*
- *Determine predation on adult and juvenile lamprey during migration*
- *Determine the potential effects of climate change on lampreys, including the effects of increasing water temperatures and changing runoff regimes on lamprey energetics and performance*
- *Support the USFWS Pacific Lamprey Conservation Agreement through collaborative development and management of data*
- **Recommendation 37** — Update sturgeon passage and mitigation strategies on Page 47 with the following: BPA should adequately fund sturgeon recovery and the recommendations from the Draft 2013 Framework. The Program should consolidate measures intended to address white sturgeon and green 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.
- **Recommendation 38:** Insert the following text into the Mainstem Plan as Strategies for White Sturgeon:
 - *Operate the FCRPS to provide flows consistent with normative river conditions, including increased spring and summer 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."*
- **Recommendation 42:** Program language should be amended to the Pinniped Predator Control section (Pages 52-53) to establish funding responsibility by replacing the second paragraph on Page 53 with the following:
"The Corps [or Bonneville] should fund federal, tribal and state agencies to evaluate the extent of pinniped predation on salmonids, sturgeon, and Pacific lamprey in the lower Columbia River from below Bonneville Dam to the mouth of the river."
- **Recommendation 43:** Revise text under *Reintroduction of Anadromous Fish in Blocked Areas* on Page 56 as follows:*evaluate the feasibility of salmon, steelhead, and Pacific lamprey reintroduction, consistent with the objectives in the appropriate subbasin plans.*
- **Recommendation 46:** The NPCC should amend the Lower Columbia Subbasin Plan (1 paragraph on Page 2-18) to include more specific objectives and strategies for eulachon. BPA should fund protection, mitigation and enhancement of eulachon through the following measures:
 - Develop biological objectives for eulachon that are consistent with recovery.
 - Monitor and evaluate eulachon abundance in the Columbia River via annual spawning stock biomass surveys following protocols developed by the Washington Department of Fish and Wildlife and acoustic estimates by NOAA - NWFS.
 - Monitor and evaluate the causal mechanisms and migration/behavior characteristics affecting survival of larval eulachon during their first weeks in the Columbia River estuary, plume, and ocean environments.
 - Monitor and evaluate the ecological importance of the tidal freshwater, estuary, plume, and nearshore ocean environments to the viability and recovery of eulachon in the Columbia River Basin.
 - Develop an oceanographic indicators ecosystem conditions model to determine the significance of plume and nearshore ocean conditions that affect eulachon survival. Adjust the timing, magnitude, and frequency of hydrosystem flows (especially spring freshets) entering the estuary and plume to better reflect the natural hydrologic cycle,

improve access to habitats, and provide better transport of coarse sediments and nutrients in the estuary and plume if these are found to be limiting to eulachon life history.

- **Recommendation 47:** The Council should adopt into the Willamette Subbasin Plan the 2008 Willamette Biological Opinion (NMFS 2008) and the of the *Upper Willamette River Conservation and Recovery Plan for Chinook Salmon* (ODFW and NMFS 2011) as well as Pacific Lamprey (see Table C, D, E, F, G) as Biological Objectives in the Willamette Subbasin Plan - see table.
- **Recommendation 48** — On page 59 of the Program, the Confederated Tribes of Grand Ronde would like to incorporate Tribal specific program measures listed in Table B as Implementing Measures Recommended for 2008 — 2018. See table B - for a reintroduction project and effects of hydro-operations (Willamette)

Confederated Tribes of the Umatilla Indian Reservation (19)

- For lamprey see YN above
- 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.

Confederated Tribes of the Warm Springs Reservation of Oregon (21)

- For lamprey see YN above

Cowlitz Indian Tribe (22)

- Update language throughout the plan to reflect the importance of protecting and restoring lamprey populations. Lamprey populations are a small fraction of historic estimates. The

Tribe supports efforts to protect and restore lamprey populations. The Tribe supports incorporating the 17 recommendations regarding lamprey in the attached comments.

- Add language addressing eulachon recovery. The Program currently does not address eulachon, which were ESA-listed after a successful petition by the Cowlitz Indian Tribe. This species has been heavily impacted by changes to the lower mainstem and estuary caused by construction and operation of the hydropower system. Substantial changes to flow, sediment delivery and the food web in the lower river have been well documented. While the reasons for eulachon decline are not fully understood, the FCRPS has affected the ecosystem in which eulachon have evolved. The attached measures are needed to address uncertainties regarding the effect of changes in the Columbia River hydrograph on survival, productivity and recovery potential of eulachon. As the Northwest Power Act directs the Council to develop a program to protect, mitigate, and enhance fish and wildlife in the basin affected by the development, operation, and management of hydroelectric projects, the Council should update the Program to include eulachon and develop biological objectives for this species.

Kootenai Tribe of Idaho (24)

- Sufficient research funding is necessary to support specific targeted research needs under the Tribe's integrated fish and wildlife program and its constituent projects (i.e., project numbers 1988-064-00, 1994-049-00, 2002-002-00, 2002-008-00, 2002-011-00, and 1992-061-05). In particular, targeted research is needed to enhance our understanding of critical uncertainties including: 1) sturgeon genetics, 2) burbot genetics, 3) burbot culture, and 4) recruitment failure, and 5) ecosystem process uncertainties (i.e., floodplain food web and nutrient cycling).

Nez Perce Tribe (25)

- For lamprey see YN above and the others that reflect the "Columbia River Basin Fish and Wildlife manager's Draft Reference for Developing 2014 Fish and Wildlife Program Amendment Recommendations"
- Recommendation 2: Insert new second paragraph under *Anadromous Fish Losses* on Page 11 as follows: "***No comparable analysis exists for Pacific lamprey; however, it is apparent that losses have been substantial. The Council recognizes and supports efforts to restore Pacific lamprey numbers, including adoption of the Tribal Pacific Lamprey Restoration Plan for the Columbia River Basin and the USFWS Pacific Lamprey Conservation Agreement into the Fish and Wildlife Program. Restoration of Pacific lamprey numbers and directed mitigation for hydrosystem lamprey losses should incorporate actions recommended in these plans.***"
- ***Page 11, Bullet 4, reword to: Restoration of Pacific lamprey by (1) restoring lamprey passage and habitat in the mainstem and in tributaries that historically supported spawning lamprey populations, (2) translocating adult Pacific lamprey to suitable areas to partially mitigate for upstream passage losses, (3) mitigate for lost lamprey production and severe range reduction, and 4) adaptively applying artificial production methods when passage and habitat improvements alone are insufficient. Restoration actions are***

intended to attain self-sustaining and harvestable populations of lamprey throughout their historic range.”

- Section II D. Basinwide Provisions - Basinwide Strategies
 - Page 18, primary strategies - reword to -”to replace lost salmon, steelhead and Pacific lamprey in blocked and unblocked areas”
- Section V A. - Columbia River Estuary - Estuary Strategies
 - Page 32, Bullet 3, Revise wording to:”Evaluate salmon, steelhead and Pacific lamprey migration and survival rates in the lower Columbia River, the estuary, and the marine environment.”
- Section VI B - Mainstem Plan - Vision of the Mainstem Plan
 - Page 35, Full Paragraph 1. Reword to:“...*especially spawning, rearing, resting, migration, and over-wintering habitats for salmon, steelhead, lamprey, sturgeon, and resident fish populations.*”
- Section VI C- Mainstem Plan - Biological Objectives
 - Page 36, Bullet II. Reword to: “*Protect, enhance, restore and connect freshwater habitat in the mainstem for the life history stages of naturally spawning anadromous and resident salmonids and lamprey. Protect and enhance ecological connectivity between aquatic areas, riparian zones, floodplains, and uplands in the mainstem.*”
 - Page 38, Bullet III. Reword to: *The Council will consult with ...to determine the possibility of adopting hydrosystem survival performance standards for non-listed populations of anadromous fish including lamprey. Efforts should be implemented to adopt an interim passage standard for adult Pacific lamprey of 80% per mainstem dam to be accomplished within 10 years and to improve passage further in subsequent years.*”
- Section VI D- Mainstem Plan - Mainstem Strategies
 - Page 44, Final Bullet under Water Quality. Reword to: *Implementing actions to reduce toxic contaminants in the water to meet state, tribal and federal water quality standards. The federal action agencies should partner with and support federal, tribal, state, and regional agencies’ efforts to monitor toxic contaminants in the mainstem Columbia and Snake rivers and evaluate whether these toxic contaminants adversely affect anadromous or resident fish important to this Program. If so, implement actions to reduce these toxic contaminants or their effects if doing so will provide survival benefits for fish in mitigation of adverse effects caused by the hydropower system. In particular, investigate whether exposure to toxics in the mainstem, combined with the stress associated with dam passage, leave juvenile salmon and adult and juvenile lamprey more susceptible to disease and result in increased mortality or reduced productivity*
- Section VI D- Mainstem Plan - Mainstem Strategies
 - Page 47, Paragraph 1, under this section. Add introductory sentence to read: ‘In recent years awareness of the effects of the hydrosystem on lamprey has increased, and the need for substantial additional effort addressing lamprey has become an emerging issue.....’

Page 47, Lamprey
Revise/add bullets as follows;

“Bonneville and the Corps, in coordination with federal, state, and tribal fish managers and the Council, should implement and monitor measures to help restore lamprey including:

- *Specific fish passage structures for adult and juvenile lamprey*
- *Regional approaches to evaluate passage, abundance, distribution, and population structure, including the mainstem Columbia, Snake and Willamette rivers*
- *Develop tags suitable for adult and juvenile lamprey and a regional lamprey tagging forum*
- *Develop a regional strategy for monitoring passage into tributaries to better understand differences in counts of adult lamprey between dams*
- *Increase knowledge regarding the use of the mainstem as spawning habitat*
- *Identify operations at mainstem hydropower dams such as ramping rates and water elevation changes that delay, obstruct, or kill migrating adult and juvenile lamprey*
- *Monitor and address effects of hydrosystem operations on juvenile lamprey residing in reservoirs*
- *Develop and implement passage aids for adult and juvenile lamprey at known passage obstacles*
- *Monitor lamprey passage at mainstem hydropower dams to evaluate passage improvement actions and to identify additional passage problem areas,*
- *Assess lamprey passage efficiency, direct mortality, and/or other metrics relating to migratory success of lamprey*
- *Determine predation on adult and juvenile lamprey during migration*
- *Determine the potential effects of climate change on lampreys, including the effects of increasing water temperatures and changing runoff regimes on lamprey energetics and performance. Develop adaptation strategies to address these affects, and*
- *Support the collaborative development and management of data for lamprey, as identified by the U.S. Fish and Wildlife Service.*

Page 56.

Reword to: *"...evaluate the feasibility of salmon, steelhead, and Pacific lamprey reintroduction, consistent with the objectives in the appropriate subbasin plans."*

Page 58, Paragraph 1.

Reword to: *"The Council recognizes that work has continued in some subbasins to refine and update management plans. The Council also recognizes that work has continued outside the Program, such as recovery planning, and the Tribal Pacific Lamprey Restoration Plan, that will influence implementation of the Council's Program at the subbasin level. The Council recognizes the objectives and recommended actions of the Tribal Pacific Lamprey Restoration Plan as updates to subbasin plans."*

Spokane Tribe of Indians (26)

- 3. As partial mitigation for resident fish losses, fund a cooperative project among the Spokane Tribe of Indians, Confederated Colville Tribes and the Washington Department of Fish and Wildlife to complete a baseline assessment of white sturgeon populations and associated habitats in Lake Roosevelt from Grand Coulee Dam to the international border, including the Spokane Arm of Lake Roosevelt. (Upper Columbia Subbasin Objectives 1A1, 1B2, 2A2, 2C1; Spokane Subbasin Objectives 1A1, 1C3, 2A, 2C2)
Conduct baseline population assessments to monitor hatchery and wild sturgeon populations (size, abundance of age classes, age/length frequency, recruitment rate, mortality, distribution **and** migration patterns, life history, habitat use, etc.), environmental factors limiting sturgeon abundance, and effectiveness of recovery measures. (Upper Columbia Subbasin Objectives 1A1, 1B2, 2A2, 2C1; Spokane Subbasin Objectives 1A1, 1C3, 2A1, 2C2)
- Objectives 1A1, 1C3, 2A1, 2C2)
Implement recovery measures based on knowledge gained through assessments, limiting factors workshops, Upper Columbia White Sturgeon Recovery Initiative Plans and Lake Roosevelt sturgeon recovery plans. (Upper Columbia Subbasin Objectives 1A1, 1B2, 2A2, 2C1; Spokane Subbasin Objectives 1A1, 1C3, 2A1, 2C2)
Continue interim hatchery production, including 100% PIT-tagging of hatchery sturgeon and 100% PIT-tagging and sonic tagging of broodstock collected in the upper Columbia River. (Upper Columbia Subbasin Objectives 1A1, 1B2, 2A2, 2C1; Spokane Subbasin Objectives 1A1, 1C3, 2A1, 2C2)
- 4. Sturgeon are disappearing in the first year of life in the upper Columbia River. Limiting factors are under investigation under the Lake Roosevelt Sturgeon Recovery Project, but a sturgeon hatchery is necessary to conserve the remaining population. As partial mitigation for fish losses, fund completion of the Northwest Power and Conservation Council's 3-step process and plan development for a dedicated conservation sturgeon hatchery for Lake Roosevelt and the upper Columbia River. Upon successful completion of the 3-step process, complete construction of a conservation white sturgeon hatchery, and begin operation and maintenance phase, including continuation of the marking program and development of a genetic management plan to protect remaining genetic diversity of the population. (Upper Columbia Subbasin Objectives 1A5, 2A1, 2A2, 2C1; Spokane Subbasin Objectives 1C3, 2C2)
- 8. Assess current status of mussel populations in the Spokane Arm and the Columbia River adjacent to the Spokane Indian Reservation. (Upper Columbia Subbasin Objectives 1A1; Spokane Subbasin Objectives 1A1, 1C1, 1C2).

Upper Snake River Tribes Foundation (28)

- For lamprey see YN above
- For sturgeon see WDFW/ODFW above
- For eulachon see WDFW/ODFW above
- Recommendation 1: Add language to the Scientific Principles, pages 9 and 10:
 - The Columbia River ecosystem includes the estuary, plume, and near shore ocean environments.

- Salmon, steelhead, lamprey, sturgeon and eulachon accommodate ocean mortality and environmental variability by having life histories that have a sufficient level of productivity and a wide range of biological diversity (i.e., resiliency).
- Recommendation 2: Add language to Plume and Nearshore Ocean Strategies , page 31. Retain the Ocean strategies and add:
 - To Primary strategy, “It is important to continue basic monitoring over time to increase understanding of the estuary, plume and nearshore ocean’s role in anadromous fish survival and to have both baseline and real time information that can assist inland management decisions
 - Add “ Ocean Strategy 3 - Identify the effects of ocean conditions on anadromous fish survival and use this information to evaluate and adjust inland management actions.

NOAA Fisheries (30)

- Eulachon:
 - We recommend adding eulachon to the individual species that are highlighted in the Program as threatened. We released a recovery outline in July 2013. We anticipate releasing a proposed eulachon recovery plan within the few years.
 - The enclosure provides specific measures for eulachon.
- Lamprey:
 - Incorporate and support implementation of the 2012 Pacific Lamprey Conservation Agreement.
- Eulachon
Recommendation:
The Program should incorporate and BPA should fund protection, mitigation and enhancement of eulachon through the following measures:
 - Develop biological objectives for eulachon that are consistent with recovery.
 - Monitor and evaluate eulachon abundance in the Columbia River via annual spawning stock biomass surveys following protocols developed by the Washington Department of Fish and Wildlife and acoustic estimates by NOAA - NWFSC.
 - Monitor and evaluate the causal mechanisms and migration/behavior characteristics affecting survival of larval eulachon during their first weeks in the Columbia River estuary, plume, and ocean environments.
 - Monitor and evaluate the ecological importance of the tidal freshwater, estuary, plume, and nearshore ocean environments to the viability and recovery of eulachon in the Columbia River Basin.
 - Develop an oceanographic indicators ecosystem conditions model to determine the significance of plume and nearshore ocean conditions that affect eulachon survival.
 - Adjust the timing, magnitude, and frequency of hydrosystem flows (especially spring freshets) entering the estuary and plume to better reflect the natural hydrologic cycle, improve access to habitats, and provide better transport of coarse sediments and nutrients in the estuary and plume if these are found to be limiting to eulachon life history.

NOAA Fisheries Northwest Fisheries Science Center (31)

- *2.1 Conduct targeted monitoring for vulnerable fish species to address data gaps specific to contaminant exposure and accumulation.* Field assessments conducted to date by NOAA and the Lower Columbia Estuary Partnership have profiled persistent bioaccumulative toxicants in juvenile fall Chinook salmon from Lower Columbia River population segments (LCREP 2007; Sloan et al. 2010; Yanagida et al. 2012; Johnson et al. 2013). However, as highlighted recently in a needs assessment by the Columbia River Toxics Workgroup (EPA 2010), much less is known about exposure risks to interior Columbia Basin spring and fall Chinook or any stocks of coho, chum, and steelhead. Similarly, toxic threats to eulachon, lamprey, and sturgeon are very poorly understood.

U.S. Fish and Wildlife Service (USFWS) (33)

- We recommend the Council support these research needs and add the following text as a bullet under C. Biological Objectives, 2. Specific Objectives and Performance Standards for Habitat Characteristics and for Population Performance, b. Migration and passage conditions for anadromous fish, page 39.

The Council recognizes the need to improve passage and survival of juvenile and larval Pacific lamprey migrating through the mainstem and advises the Corps and Bonneville, in coordination with Federal, State, and Tribal fish managers to ensure the rigorous collection of data needed to answer the following uncertainties of juvenile and larval lamprey passage.

- Determine spatial distribution (vertical and horizontal) of juvenile Pacific lamprey in forebays of mainstem Columbia and Snake River dams
 - Complete a systematic investigation of juvenile bypass systems (JBS) impacts on juvenile Pacific lamprey at the lower Columbia and Snake River dams.
 - Determine timing and magnitude of Pacific lamprey macrophthalmia outmigration at mainstem Columbia and Snake River dams.
- Lamprey and Sturgeon Passage, a. Lamprey on page 47.
The need to develop better aids to passage and a more complete understanding of passage problems through the FCRPS has become critical. A systematic ladder and entranceway evaluation survey, integrated with biological information and a stage-based model to evaluate lamprey passage at each FCRPS project should be completed.
 - Complete a systematic ladder and entranceway evaluation survey of all eight of the lower Columbia and Snake River FCRPS projects
 - Develop a database with lamprey biological information and physical characteristics of ladders and entranceways by specific hydroelectric project that is easily accessible to all regional managers
 - Integrate a stage-based model approach with lamprey biological information and physical characteristics of ladders and entranceways to evaluate and prioritize needs for regional lamprey passage improvements
 - Third bullet under “Migration and passage conditions for anadromous fish” on Page 38 as follows:
The Council will consult with ...to determine the possibility of adopting hydrosystem survival performance standards for non-listed populations of

anadromous fish including lamprey. Efforts should be implemented to adopt an interim passage standard for adult Pacific lamprey of 80% per 6 of 27 mainstem dam to be accomplished within 10 years and to improve passage further in subsequent years.

- Adding the following text at the end of the section *Lamprey and Sturgeon Passage, a. Lamprey* on page 47.

Many needs have been identified by regional co-managers for Pacific lamprey, and among the most critical are the need to fill in data gaps in Pacific lamprey occupancy and distribution and the creation of a shared data clearinghouse.

The Council asks the Corps and BPA to fully support the following:

- *Conduct occupancy and distribution surveys in basins identified through the Pacific lamprey Conservation Initiative (i.e., basins where distribution is unknown). Surveys should use a statistically rigorous probabilistic design.*
 - *Conduct workshops for regional partners to provide guidance on the sampling methodology and study design for occupancy and distribution surveys. A series of workshops should be held to blanket the geographical range of Pacific lamprey in the Pacific Northwest.*
 - *Develop a data clearinghouse for Pacific lamprey based on a GIS framework containing occupancy and distribution, threat information, demographics and needed actions. This geographic framework should be WEB based and available to partners.*
- We recommend the Council support this by inserting new bullet under *Anadromous Fish Losses* on Page 11 as follows:

Continue restoration of Pacific lamprey by (1) restoring lamprey passage and habitat in the mainstem and in tributaries that historically supported spawning lamprey populations, (2) continuing efforts to translocate adult Pacific lamprey to appropriate areas to reduce upstream passage losses, and (3) evaluating artificial propagation as a way to mitigate for lost lamprey production when passage and habitat improvements alone are insufficient. Attain self-sustaining and harvestable populations of lamprey throughout their historic range.

Inserting a new section h. Pacific Lamprey Artificial Production on Page 19:

It is not likely that fragmented or isolated lamprey groups within the Columbia River Basin will naturally recolonize the upper portions of their range given the lack of adults and numerous threats, including the existing mainstem environment. Therefore, the long-term restoration of Pacific lamprey in the Columbia River Basin may require the structured release of artificially propagated lamprey in priority areas to achieve a variety of management and conservation objectives.

- *Continue development and implementation of lamprey translocation in accordance with tribal guidelines as a component of a regional recovery plan*
 - *Evaluate the role of lamprey artificial propagation as a research tool and for supplementation of lamprey in tributaries*
- Revising introductory text under *Lamprey and Sturgeon Passage, a. Lamprey*, on Page 47 to read:

In recent years awareness of the effects of the hydrosystem on lamprey has increased, and the need for substantial additional effort addressing lamprey

passage and survival has become an emerging issue. In the Columbia River Basin.... (retain remaining existing paragraph then add the following sentences) It is likely that artificial propagation may need to be evaluated as a potential tool for restoring lamprey and mitigating for losses. Development of life-cycle and bioenergetics models will help identify critical limiting factors and prioritize recovery actions. Budgets and staffing must be adequate to monitor the effects of actions taken to address lamprey issues.

- We recommend the Council support this by adding the following to the end of the section Lamprey and Sturgeon Passage, a. Lamprey on page 47.
 - *Investigate life history of Pacific lamprey in selective populations in tributary streams of the lower and mid-Columbia and Snake river.*
 - *Fund development of population dynamic modeling effort for Columbia River Pacific lamprey*
- Revise fourth paragraph under Habitat Strategies on Page 14 to read:

For example, passage through the hydrosystem causes loss to salmon, steelhead, Lamprey and resident fish. Measures at the dams can and should be taken to reduce this loss. As an offset for hydrosystem-caused losses, the Program calls for improvements in spawning and rearing habitats in tributaries, the lower river, and estuary. By restoring these habitats, which were not damaged by the hydrosystem, the Program helps to compensate for the existence of the hydrosystem. To help prevent further lamprey habitat degradation the Council supports the use of Best Management Practices to Minimize Adverse Effects to Pacific Lamprey (USFWS, Forest Service 2010) which provides information on the best management practices for Pacific lamprey that can be incorporated into any stream disturbing activity (e.g., aquatic habitat restoration, prescribed fire, recreational development, grazing, gravel extraction/mining, water diversions, etc.) on lands managed by the Forest Service and Bureau of Land Management throughout the range of Pacific lamprey. In addition, this guidance can help other federal, state, tribal and private land managers with implementing stream disturbing activities that also afford protection for individual Lamprey and Lamprey populations.
- Insert a new paragraph between paragraphs 1 and 2 under *Anadromous Fish Losses* on Page 11 as follows:

No comparable analysis exists for Pacific lamprey; however, it is apparent that losses have been substantial. The Council recognizes and supports efforts to restore Pacific lamprey numbers, 9 of 27 including the Tribal Pacific Lamprey Restoration Plan for the Columbia River Basin and the USFWS Pacific Lamprey Conservation Initiative. Restoration of Pacific lamprey numbers and mitigation for lamprey losses should incorporate actions recommended in these plans.
- Revise first paragraph under Updating Existing Subbasin Management Plans on Page 58 as follows:

The Council recognizes that work has continued in some subbasins to refine and update management plans. The Council also recognizes that work has continued outside the Program, such as recovery planning that is built on subbasin plans and the Tribal Pacific Lamprey Restoration Plan, that will influence implementation of the Council's Program at the subbasin level. The Council recognizes the objectives and recommended actions of the Tribal Pacific Lamprey Restoration Plan as

updates to subbasin plans. The Council also supports the consensus objectives and recommended actions being developed by the multi-agency and tribal groups for tributary and mainstem implementation under the Pacific Lamprey Conservation Initiative as updates to the subbasin plans.

- Edit third bullet under *Habitat* on Page 7 to read:
Ocean conditions should be considered in evaluating freshwater habitat management and to understand all stages of the salmon, steelhead and Pacific lamprey life cycles.
- Append to the third bullet under *Planning Assumptions, Hydropower* on page 8 with:
Systemwide water management, including flow augmentation from storage reservoirs, should balance the needs of anadromous fish with those of resident fish in upstream storage reservoirs so actions taken to advance one species do not unnecessarily disadvantage other species. This would include, for example, Pacific lamprey burbot, green sturgeon, white sturgeon, Columbia River smelt, and whitefish.
- Revise second bullet under *Objectives for Environmental Characteristics* on Page 13 to read:
Protect, enhance, restore, and connect freshwater habitat in the Columbia River mainstem and tributaries for the life history stages of naturally spawning anadromous and resident salmonids and Pacific lamprey.
- Insert new section g. *Pacific Lamprey (Production) Translocation* on Page 19:
The Council recognizes progress in the development of a Framework for Pacific lamprey Supplementation Research in the Columbia River Basin. Translocation efforts have been successful at increasing adult spawning activity, larval recruitment, and larval distribution and have provided important Pacific lamprey life history information. Current and future translocation actions should be guided by the lessons learned from ongoing efforts.
- Add sentence to opening paragraph for *Primary Strategy* on Page 31 as follows:
Identify the effects of ocean conditions on anadromous fish survival and use this information to evaluate and adjust inland actions. This should include evaluating the effects of ocean harvest on Pacific lamprey food resources.
- Revise *Manage for Variability* on Page 31 to include Pacific lamprey in the text.
- Revise third bullet under *Estuary Strategies* on Page 32 to include Pacific lamprey.
- Revise first paragraph under *Vision of the Mainstem Plan* on page 35 as follows:
...especially spawning, rearing, resting, migration, and over-wintering habitats for salmon, steelhead, lamprey, sturgeon, and resident fish populations.
- Revise the second bullet under 2. *Specific Objectives...* on Page 36 to read:
Protect, enhance, restore and connect freshwater habitat in the mainstem for the life history stages of naturally spawning anadromous and resident salmonids and Lamprey. Protect and enhance ecological connectivity between aquatic areas, riparian zones, floodplains, and uplands in the mainstem.
- Revise final bullet under *Water Quality* on Page 44 as follows:
Implementing actions to reduce toxic contaminants in the water to meet state, tribal and federal water quality standards. The Federal action agencies should partner with and support Federal, Tribal, State, and regional agencies' efforts to monitor toxic contaminants in the mainstem Columbia and Snake rivers to evaluate whether

these toxic contaminants adversely affect anadromous or resident fish important to this Program. If so, implement actions to reduce these toxic contaminants or their effects if doing so will provide survival benefits for fish in mitigation of adverse effects caused by the hydropower system. In particular, investigate whether exposure to toxics in the mainstem, combined with the stress associated with dam passage, leave juvenile salmon and adult and juvenile lamprey more susceptible to disease and result in increased mortality or reduced productivity.

- *Revise the text of the first major bullet under Lamprey on Page 47 as follows: Bonneville and the Corps, in coordination with federal, state, and tribal fish managers and the Council, should identify, develop, implement, and monitor measures to help restore Pacific lamprey including:*

Delete the existing six sub-bullets and replace with the following 14 revised sub-bullets.

- *Specific fish passage structures for adult and juvenile lamprey*
- *Regional approaches to evaluate passage, abundance, distribution, and population structure, including the mainstem Columbia, Snake and Willamette rivers*
- *Development of PIT and active tags suitable for adult and juvenile lamprey and establish an annual regional lamprey tagging forum*
- *Development of a regional strategy for monitoring passage into tributaries to better understand differences in counts of adult lamprey between dams*
- *Development and implementation of a regional tagging and monitoring strategy for evaluating the timing of larval and juvenile lamprey movement and active outmigration from tributaries into the mainstem and passing mainstem hydropower projects.*
- *Increase knowledge regarding the use of the mainstem as spawning and rearing habitat with systematic occupancy sampling*
- *Identify operations at mainstem hydropower dams such as ramping rates and water elevation changes that delay, obstruct, or kill migrating adult and juvenile lamprey*
- *Monitor and address effects of hydrosystem operations on juvenile lamprey residing in reservoirs*
- *Develop and implement passage aids for adult and juvenile lamprey at known passage obstacles*
- *Monitor lamprey passage at mainstem hydropower dams to evaluate passage improvement actions and to identify additional passage problem areas,*
- *Assess lamprey passage efficiency, direct mortality, and/or other metrics relating to migratory success of lamprey*
- *Determine predation on adult and juvenile lamprey during migration*
- *Determine the potential effects of climate change on lampreys, including the effects of increasing water temperatures and changing runoff regimes on lamprey energetics and performance*
- *Support the Pacific Lamprey Conservation Agreement through collaborative development and management of a comprehensive GIS data clearing for all mainstem and tributary lamprey data that is accessible by co-managers and the public.*

- Revise text under Reintroduction of Anadromous Fish in Blocked Areas on Page 56 as follows:
 - ...*evaluate the feasibility of salmon, steelhead, and Pacific lamprey reintroduction, consistent with the objectives in the appropriate subbasin plans.*
- We recommend that specific recommendations from this management plan (fishery managers in the Columbia Basin recently completed a basin-wide framework 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.

Bonneville Power Administration (35)

- *Lamprey Passage: The Program should also reflect the lamprey passage improvements at federal dams that are occurring based on commitments in the Accords, which are now also reflected in the U.S. Fish and Wildlife Service Lamprey Conservation Plan. This is consistent with the ISAB comments on hydro strategies.*
- *Lamprey: As the ISAB noted in its recent report on the 2009 Program, lamprey work has taken off in the basin. Individual agency commitments for lamprey that should be included in the Program are reflected in the Accords by BPA, the Army Corps of Engineers (Corps), and the Bureau of Reclamation (Reclamation). These actions are also included in thea lamprey agreement coordinated by the U.S. Fish and Wildlife Service (USFWS) in 2012, which the action agencies have endorsed. While it is not a “recovery plan” per se, as called for by the ISAB, the Lamprey Conservation Agreement is signed by five states and provides a framework for future regional implementation plans that target conservation measures. The agreement indicated that the regional plan for the Columbia Basin would rely on reports already prepared by the tribes, Corps, Reclamation, and others.*
- *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.*
 - Biological Opinions to Amend into the Program Sturgeon:
[http://www.salmonrecovery.gov/Files/BiologicalOpinions/2008/Final%20Libby%](http://www.salmonrecovery.gov/Files/BiologicalOpinions/2008/Final%20Libby%20Final%20Report.pdf)

U.S. Geological Survey, NW Regional Office (38)

- Recommendation: Research is needed on lampreys and the Fish and Wildlife Program should expand its two primary strategies to address these additional topics:

- Implementing a PIT-tagging Fish and Wildlife Program for lampreys throughout the Columbia River Basin, which would not only provide new insight into juvenile fish passage issues, but would also provide unprecedented information on lamprey biology and life history (e.g. growth rates, time spent in the ocean, and homing efficiency—or a lack thereof).
- Determine the potential effects of climate change on lampreys, including the effects of increasing water temperatures and changing runoff regimes on lamprey energetics and performance.
- Embark on studies of juvenile lamprey passage, including research using PIT-tags and active acoustic transmitters.
- Determine the effects of contaminants on lamprey biology, physiology, and performance.
- Explore the feasibility of lamprey aquaculture for supplementing and restoring depressed populations.
- Expand work into lamprey genetics, including population structure and delineation.
- Develop various models for lampreys, including population dynamics and bioenergetics models. Such tools, like those for salmonids, would be useful for predicting the potential effects of environmental stressors and restoration measures on lamprey populations
- 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.
- Recommendation: Research is needed on forage fish in the lower estuary and nearshore ocean areas. We recommend the Fish and Wildlife Program include the following:
 - Identify spawning and rearing habits of forage fish in the estuary
 - Determine the role of forage fish as alternate prey for birds in the lower estuary
 - Elucidate the role eulachon may have as an alternative prey for sea lions
 - Determine how restoration projects in the estuary may contribute to reproductive success and rearing of forage fish
 - Identify the relation between Columbia River flow and forage fish abundance in the estuary

- Identify role forage fish have in survival of juvenile Chinook salmon, coho, and steelhead
 - Determine how climate change, ocean acidification, and localized hypoxia are likely to affect forage fish in the coming decades
- Recommendation: The Council should consider updating the Fish and Wildlife Plan to request that the appropriate agencies assess foodweb transfer, sediment transport, and biological effects of emerging and legacy organic contaminants under current management regimes, and how those processes affect key Columbia River species and the potential success of restoration projects within the basin. Critical uncertainties in understanding impacts of contaminants on key species and foodwebs include:
 - Distributions, levels, and spatial patterns of contaminants of emerging concern (CECs) in the Columbia River basin, including the estuary and coastal ocean.
 - Transfer, accumulation, and persistence of CECs in estuarine, coastal ocean, and riverine foodwebs. Additive and/or synergistic effects of chemical mixtures on species of interest.
 - Levels of chemicals of emerging concern (CECs) that adversely affect the health of key species, such as Pacific lamprey, white sturgeon, and salmonids.
 - Impacts of CECs on the carrying capacity of the Columbia River ecosystem for juvenile salmonids and other key species.
 - Impacts of contaminants on habitat restoration success (contaminants of concern should be assessed and monitored as part of current and future river restoration programs.)
 - Role of contamination in reduced rearing success of white sturgeon in impounded pools of reservoirs versus unimpounded areas. Impacts of contaminants on sturgeon reproduction and rearing success within areas of known high productivity.
 - Role of contaminants (levels of concern and effects of chemical mixtures) on Pacific lamprey declines compared to threats by dam passage. .
 - Investigate impacts of different hydrologic scenarios and management actions on contaminant distributions and foodweb transfer.
 - 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.
- Recommendation: The Council should update the Fish and Wildlife Plan to assess the potential effects of climate change on river hydraulics, temperature, and sediment movement in tributaries and mainstem reaches of the Columbia River Basin and the collateral effects on aquatic biota. Critical uncertainties in understanding future impacts of climate change on target aquatic species include:
 - Changes in the magnitude, timing, and persistence of stream flows throughout the year.
 - Changes in stream temperatures.
 - Changes in sediment transport and habitat formation.
 - Effects of flow changes on salmonids, sturgeon, and lamprey.
 - Impacts of climate change on habitat restoration success.
 - Shifts in the food web and resultant impacts on bioenergetics
- Recommendation: The Council should consider updating the Fish and Wildlife Plan to request that the appropriate agencies support adaptation of the DELFT3d model to a hierarchical habitat classification tool to identify key-recoverable habitats in the lower

Columbia River. Such a tool would be valuable to the management of salmon, lamprey, eulachon, and mussels as well as other first foods.

Save Our Wild Salmon Coalition (64)

- Regarding the Program’s Biological Objectives, the Council should follow through on the existing language in the 2009 Program, page 11, to initiate a science-based process to inform policy choices on biological objectives as supported by the Independent Scientific Advisory Board.
 - B) Maintain the current basinwide biological objectives expressed in the 2009 Program with modifications, shown here in bold, to represent a 10-year implementation plan for these recommendations:
 - “Halt declining trends in Columbia River Basin salmon and steelhead populations **by 2024** especially those that originate above Bonneville Dam. Significantly improve the smolt-to-adult return rates (SARs) for Columbia River Basin salmon and steelhead, resulting in productivity well into the range of positive population replacement. **Restore healthy characteristics** Continue restoration of lamprey, **sturgeon, and eulachon** populations.”

More Detail on Existing 2009 Program Language

Mountain Whitefish

The current Program makes no mention of the species

Mussels

The current Program makes no mention of freshwater mussel species of western North America

Burbot

VI, Mainstem Plan, Section D, 2 Strategies in Specific Areas, Mainstem habitat (page 43)

- *Implement actions to stabilize and improve burbot populations in the Upper Columbia region*

Eulachon (candlefish)(smelt)

The current Program makes no mention of the species

Lamprey

- II, Basinwide Provisions, Section C, 1, a. Objectives for Biological Performance, Anadromous Fish Losses (page 11)
 - *Continue restoration of lamprey populations.*
 - *Restore lamprey passage and habitat in the mainstem and in tributaries that historically supported spawning lamprey populations. Attain self-sustaining and harvestable populations of lamprey throughout their historical range. Mitigate for lost lamprey production in areas where restoration of habitat or passage is not feasible.*
- II, Basinwide Provisions, Section D, 1, Habitat Strategies (page 14)
 - *For example, passage through the hydrosystem causes loss to salmon, steelhead, lamprey, and some resident fish.*
- VI, Mainstem Plan, Section C, 1, Overarching Objectives and Priorities for the Mainstem (page 36)
 - *These biological objectives and accompanying operational strategies are designed to improve the life-cycle survival of important populations of listed and unlisted salmon, steelhead, lamprey, resident fish, and wildlife.*
- VI, Mainstem Plan, Section C, 2, b. Mitigation and passage conditions for anadromous fish (page 38)
 - *The Council will consult with state and federal fish and wildlife agencies and tribes, the Independent Scientific Advisory Board, and federal operating agencies to determine the possibility of adopting hydrosystem survival performance standards for non-listed populations of anadromous fish, including lamprey. On an interim basis, hydropower project survival performance standards also apply for inriver passage of non-listed salmon and steelhead that migrate through the system.*
- VI, Mainstem Plan, Section D, 2 Strategies in Specific Areas, Mainstem habitat (page 43)
 - *Improve juvenile and adult Pacific lamprey passage survival and reduce delays in migration through mainstem hydroelectric projects.*
- VI, Mainstem Plan, Section D, 2 Strategies in Specific Areas, Adult fish passage (page 46)

- *Emphasis should be placed on research; monitoring, and evaluation; increased accuracy of fish counts; assessment of conversion rates of all adult fish species of interest; including lamprey, through key mainstem reaches;*
- VI, Mainstem Plan, Section D, 2 Strategies in Specific Areas, Lamprey and Sturgeon passage, a. Lamprey (page 47)
 - *Lamprey*
 - *In the Columbia River Basin, Pacific lamprey traditionally migrate hundreds of miles through both mainstem Columbia and Snake river habitats, encountering a variety of obstacles that could negatively affect their populations. Large mainstem hydropower dams, which are designed primarily to effectively pass salmon and steelhead, delay and obstruct adult and juvenile lamprey passage. Predation may also be a limiting factor for mainstem passage of lamprey. Juvenile lamprey have been observed in the stomach contents of smallmouth bass and Northern pikeminnow in the tailraces of lower Columbia River federal dams, and adult lamprey have been observed being taken by California sea lions downstream of Bonneville Dam. Bonneville and the Corps, in coordination with federal, state, and tribal fish managers and the Council, should implement the following measures to improve adult and juvenile Pacific lamprey passage survival and reduce delays in migration:*
 - *Identify specific fish passage structures*
Identify operations at mainstem hydropower dams that delay, obstruct or kill migrating lamprey
 - *Develop and implement lamprey passage aids at known passage obstacles*
 - *Monitor lamprey passage at mainstem hydropower dams to evaluate passage improvement actions and to identify additional passage problem areas*
 - *Assess lamprey passage efficiency, direct mortality, and/or other metrics relating to migratory success of lamprey, and*
 - *Determine predation on lamprey during Mainstem Passage*
- VI, Mainstem Plan, Section D, 2 Strategies in Specific Areas, Control of Predators, c. (page 53)
 - *The federal and state agencies also should evaluate the extent of pinniped predation on salmonids, sturgeon, and Pacific lamprey in the lower Columbia River from below Bonneville Dam to the mouth of the river.*

Sturgeon

- II, Basinwide Provisions, Section C, 1, a. Objectives for Biological Performance, Resident Fish Losses (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, cutthroat trout, kokanee, white sturgeon and other species. The following objectives address resident fish losses:*
 - *Complete the assessments of resident fish losses resulting from the development and operation of the hydrosystem, when and where there is agreement on the appropriate methodology and prioritization of an*

assessment. As these are available, the Council will consider adopting the loss assessments into the Program.

- *Maintain and restore healthy ecosystems and watersheds that preserve functional links among ecosystem elements to ensure the continued persistence, health, and diversity of all species including game fish species, non-game fish species, and other organisms.*
 - *Protect and expand habitat and ecosystem functions in order to increase the abundance, productivity, and life history diversity of resident fish at least to the extent that resident fish have been affected by the development and operation of the hydrosystem.*
 - *Achieve within 100 years population characteristics of resident fish species that represent on average full mitigation for losses of resident fish.*
- VI, Mainstem Plan, Section C, 2, c. Resident fish and wildlife (page 39)
 - *Enhance the abundance and productivity of white sturgeon in the mainstem in order to rebuild and sustain naturally produced populations of sturgeon and sustain an annual harvest of sturgeon. Operate the hydropower system to maximize spawning and rearing*
 - *success of white sturgeon in reservoirs, while operating in concert with the needs of salmonids. The U.S. Fish and Wildlife Service's 2000 and 2006 biological opinions concerning hydrosystem operations that affect listed Kootenai River white sturgeon include specific objectives for that species, incorporated here.*
 - VI, Mainstem Plan, Section D, 1 Overarching Strategies (page 40)
 - *NOAA Fisheries and the U.S. Fish and Wildlife Service have developed various biological opinions for the operation of the Federal Columbia River Power System for the benefit of populations of salmon, steelhead, bull trout and Kootenai white sturgeon listed as threatened or endangered under the Endangered Species Act. The measures in these opinions represent the recommendations of the federal fish and wildlife agencies with jurisdiction over the operational needs of these listed species. The Council accepts these measures as part of the Fish and Wildlife Program for the near term. However, many of the biological opinions' measures must be subject to systematic and rigorous monitoring and evaluation, as described below and in the more specific strategies, to determine if the measures have the biological benefits expected and represent the most cost-effective actions to achieve these benefits. Based on these evaluations, the Council may recommend to the federal operating and fish and wildlife agencies operations that differ from those in the biological opinions if the Council concludes the different operations provide the same or greater benefits to listed fish and wildlife than current operations at a lower cost. The Council is confident that changes in operations of this nature can be made consistent with the flexibility built into the biological opinions.*
 - VI, Mainstem Plan, Section D, 2 Strategies in Specific Areas, Mainstem habitat (page 43)
 - *Implement actions to stabilize and improve Columbia River white sturgeon and to recover listed Kootenai River white sturgeon*
 - VI, Mainstem Plan, Section D, 2 Strategies in Specific Areas, Lamprey and Sturgeon passage, b. Sturgeon (page 47)
 - *Sturgeon*

- *Ongoing changes in system operations and dam configuration affect the movement of white sturgeon in the lower Columbia. Studies indicate that white sturgeon move downstream through the reservoirs and pass downstream through spillways. The installation of removable spillway weirs at dams may affect downstream passage by white sturgeon via spillways. Bonneville and the Corps should:*
 - *Study the effects on downstream passage of white sturgeon with and without removable spillway weirs.*
 - *Estimate mortality by size for fish that pass over spillways and removable spillway weirs and those that pass downstream through turbines. If significant mortality is occurring, identify and evaluate the feasibility of mitigation measures.*
 - *In general, evaluate the importance of connectivity among sturgeon populations; assess whether the mainstem dams isolate sturgeon populations; and if so, evaluate the feasibility of mitigation.*
- VI, Mainstem Plan, Section D, 2 Strategies in Specific Areas, Water management, *Baseline operations of the Federal Columbia River Power System established in the 2008 Biological Opinions* (page 48)
 - *NOAA Fisheries' 2008 Biological Opinions for the FCRPS and the Upper Snake federal projects include a series of measures concerning water management for the benefit of listed juvenile salmon and steelhead, while the U.S. Fish and Wildlife Service's 2000 and 2006 Biological Opinions include a set of measures concerning water management for the benefit of listed bull trout and Kootenai River white sturgeon. The water management measures in these biological opinions are incorporated as part of this Program, and the Council concurs that these are appropriate operations to protect, mitigate, and enhance those anadromous and resident fish listed under the Endangered Species Act and affected by the Columbia hydropower system.*
- VI, Mainstem Plan, Section D, 2 Strategies in Specific Areas, Water management, *Spring operations at Hungry Horse and Libby dams* (page 49)
 - *Operations at Libby Dam to benefit Kootenai River white sturgeon. The U.S. Fish and Wildlife Service's 2006 Biological Opinion concerning hydrosystem operations that affect ESA-listed Kootenai River white sturgeon specifies a "tiered" strategy for flow augmentation from Libby Dam to simulate a natural spring freshet, controlled within flood constraints, to improve the habitat attributes for white sturgeon spawning/recruitment. Volumes dedicated to spring sturgeon flows are determined by forecasted water availability so that higher flows are released when ample water is available and minimal flow augmentation occurs during drought. Augmentation volumes in any given year will depend on flood control constraints, reservoir refill targets, water availability, and benefits to the Kootenai white sturgeon population. The Council recognizes that additional work may be required to further refine appropriate sturgeon operations at Libby Dam, and recommends that regional entities continue to work to increase the biological benefits provided by the tiered flow augmentation volumes.*
- VI, Mainstem Plan, Section D, 2 Strategies in Specific Areas, Control of Predators, c. (page 53)

- *The federal and state agencies also should evaluate the extent of pinniped predation on salmonids, sturgeon, and Pacific lamprey in the lower Columbia River from below Bonneville Dam to the mouth of the river.*
- VI, Mainstem Plan, Section D, 2 Strategies in Specific Areas, Annual and in-season decision-making (page 55)
 - *Have the technical capability to analyze differing hydrosystem operation proposals relative to impacts on salmon, steelhead, sturgeon, and resident fish migration, survival, spawning, and rearing, and relative to impacts on wildlife.*