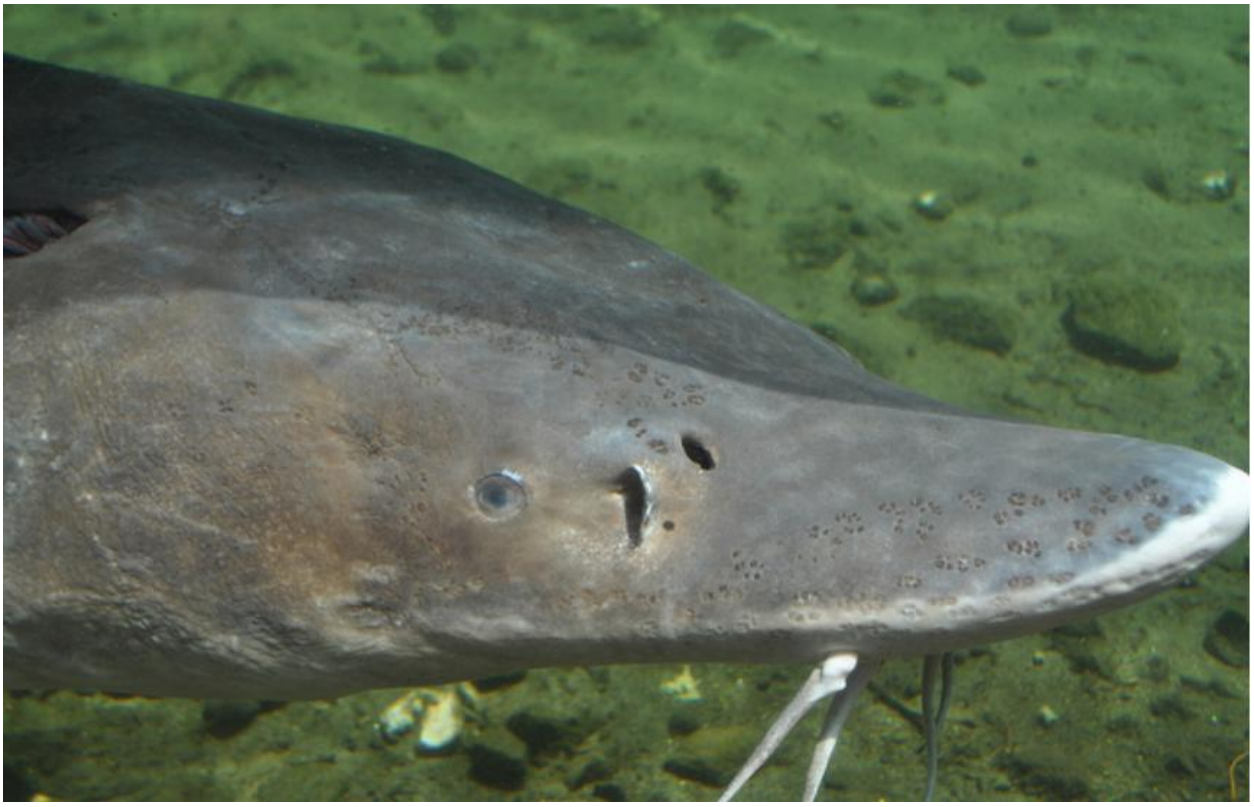
Independent Scientific Review Panel

Review of the Draft Columbia Basin White Sturgeon Planning Framework



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Background

In response to the Northwest Power and Conservation Council's March 1, 2013 request, the ISRP reviewed the *Draft Columbia Basin White Sturgeon Planning Framework* (February 2013). The Council called for preparation of the Sturgeon Planning Framework to address ISRP comments in the Research, Monitoring, and Evaluation and Artificial Production Category Review regarding sturgeon in the lower Columbia River (ISRP 2010-44). The ISRP provided a favorable review of specific sturgeon projects but noted that an effective basinwide management plan for white sturgeon was needed for planning future research and restoration.

As described in the preface to the Sturgeon Planning Framework, the Council recommended that sturgeon hatchery planning projects implemented by the Columbia River Inter-Tribal Fish Commission (2007-155-00) and the Yakama Nation (2008-455-00) lead development of the comprehensive management plan. The lower Columbia sturgeon monitoring and mitigation project (1986-050-00) sponsored by the Oregon and Washington Departments of Fish and Wildlife, the Inter-Tribal Fish Commission, and other agencies and tribes involved with related sturgeon projects also collaborated in the plan development. The planning area includes the mouth of the Columbia upstream to Priest Rapids on the mainstem and up to Lower Granite Dam on the Snake River. The plan was also to include summary information for sturgeon areas above Priest Rapids and Lower Granite.

Beginning in 2009, three regional sturgeon workshops were convened that have led to the development of the Sturgeon Planning Framework. ISRP members attended these workshops and found them very useful in identifying key issues, strengths, and weaknesses in the sturgeon programs, projects, and activities basinwide.

Our review below follows the table of contents in the Sturgeon Planning Framework, which is organized to address the issues raised by the ISRP and the Council in the Category Review. Our review focuses on how well the Sturgeon Planning Framework addresses those scientific issues.

Summary Comments

The Draft Columbia Basin White Sturgeon Planning Framework document (Framework) is a commendable effort and a positive step by the planning group, contributors, and workshop participants. The Framework is a comprehensive document incorporating much of what is known about white sturgeon life history, status, and fisheries in the Columbia River Basin. It also includes many useful references.

However, the document only partially responds to several of the five data gaps identified by the ISRP in their last review of the sturgeon projects (ISRP 2010-44), as follows:

1. An effective basinwide management plan for white sturgeon is still lacking and is the most important need for planning future research and restoration. Now that general information gaps and research needs have been identified, specific studies designed to meet those needs should be developed and incorporated into the Framework. This brings with it two challenges. First, how will research goals be prioritized? And second, once prioritized, decisions on how, where, and who will do the work will need to take place. Resolving these issues will require coordination among Columbia River white sturgeon managers, researchers, and the Action Agencies.

2. Study designs for investigating specific factors affecting recruitment of white sturgeon are lacking. Factors affecting recruitment are poorly understood and remain a serious roadblock to natural long-term restoration. The Framework authors recognize that the highest priority data gap is to understand why there is inadequate recruitment above Bonneville Dam. At the sturgeon workshops they theorized "with a high degree of certainty that this is due to: (1) low diversity, (2) lack of adults, and (3) flow levels that were either too low or not the right type or time. They also identified predation as a likely factor." These hypotheses need to be evaluated with specific, well-designed studies including population genetics studies, flow-survival studies, and more focused predation studies. The lack of accurate age determination methods also continues to limit understanding variations in annual recruitment and its causes. The general recommendations developed in the framework are not sufficiently detailed to provide clear guidance for a strategic research plan.

3. The Framework document does not thoroughly address the importance of the estuary and ocean in sturgeon production below Bonneville Dam including the possible importance to sturgeon production in upriver areas prior to dam construction and potential to limit upriver restoration efforts. The description of white sturgeon use of estuarine habitats should include more detail, and the literature review and synthesis on anadromy of the species is incomplete. Factors associated with estuary and ocean use, versus only freshwater use, do not seem to be well understood. Additional studies should be proposed to fill knowledge gaps. The document gives the impression that estuarine habitat is less heterogeneous than freshwater habitat, but this is not necessarily the case.

4. The productivity of the newly created pools above Bonneville Dam for sturgeon is poorly understood. The Framework document provides little coverage of this topic indicating that productivity above Bonneville is low, perhaps due to lack of dam passage, poor recruitment, and lack of anadromy. It would be helpful to have an expanded narrative on this issue and recommendations for obtaining the needed information.

5. Consideration of adaptive management approaches should include a review of harvest regulations with the intent of facilitating the efficient, low-cost acquisition of creel data needed for stock assessment. The Framework document does provide a good detailed description of the current and planned harvest regulations. For the lower Columbia River harvest management unit, the Oregon Department of fish and Wildlife (ODFW) has developed a well-reasoned conservation plan with a population viability analysis model to monitor the status of the population below Bonneville. However, a more critical, creative assessment is needed of harvest management approaches such as specific time-area closures and harvest caps to develop a harvest strategy designed to provide optimal information for sustainability. The ISRP suggests that the unique life history aspects of white sturgeon calls for more pro-active and creative adaptive harvest management approaches.

The move to fast-track sturgeon hatcheries and supplementation is strongly emphasized in the Framework. That emphasis may be warranted in specific locations, but the ISRP has concerns that release of hatchery juvenile sturgeon in the mainstem Columbia River above Bonneville may pose risks to the large self-sustaining sturgeon population below Bonneville. This self-sustaining segment below Bonneville is the foundation of future natural reproductive capability in the basin and perhaps throughout the range of the white sturgeon. Maintaining its viability should be the highest priority. Further justification for a hatchery approach and a discussion of risk assessment and monitoring should be added. Comments regarding the apparent success of hatchery programs (e.g., Kootenai) should be qualified in terms of the ability to hatch, rear, and release post age-0 fish. These successes, while impressive, do not necessarily equate with long-term viability of hatchery-reared fish as future successful parents of viable, naturally spawning fish.

Similar questions need to be asked about the relative reproductive success of hatchery origin sturgeon as are being asked for salmon and steelhead. Studies need to be designed to determine if hatchery sturgeon and their progeny are as reproductively competent as those originating from wild sturgeon. Unlike salmonids, where such an assessment can be evaluated in 10-15 years, a similar appraisal for sturgeon may take half a century. Perhaps of more importance are the genetic ramifications of using artificial culture. Due to their high fecundity and scarcity, relatively few sturgeon are used at any one time for broodstock. This means that sturgeon populations supplemented by hatchery fish may be susceptible to a Ryman-Laikre effect. That is, genetic diversity may be significantly reduced because the higher survival of hatchery fish causes an over representation of their genes in a population. Recent success at collecting naturally produced 14-day old sturgeon larvae offers a potential improvement. Genetic analyses of these fish indicated that 200 such individuals possessed 90% of the genetic diversity of their population. Collected larvae are then artificially reared and eventually released using procedures similar to those employed in a standard sturgeon hatchery. A full discussion that compares the pros and cons of using larval collections, standard hatchery methods, and translocation as supplementation tools should be added to the Framework. In addition to the potential benefits to hatchery programs of collecting wild larval sturgeon, the

benefits to understanding the ecology of wild larval and juvenile fish and factors affecting their inter-annual abundance can be even greater in the long run.

The Framework document would be more effective if the narrative was shortened. There is considerable redundant text, for example the Management Unit summaries in Chapter 7. Editing to reduce the length of the document would be useful. Alternatively, some material could be placed in an Appendix.

Comments on Chapters

Introduction - Planning and Policy Guidance

The document presents a good perspective on the work of the numerous planning agencies and policy makers involved in white sturgeon management in the Columbia River Basin.

After many years of studies, why is the species still considered a "data gap" species?

The recruitment success rate appears to be poorly known. In the text: "The periodic strategy is believed to have evolved in response to highly stochastic environments, in which mortality of young may be very high and highly variable. In these environments, successful reproduction may depend on specific cues or conditions, which may be relatively rare events." Historically, how regular was recruitment in the different river reaches? The ISRP suggests that planning should consider the possibility that sporadic or episodic recruitment may have been common throughout much of the range of the species. Yet regular, and in many cases annual, recruitment is listed as a goal for wild and hatchery programs. Although restoration need not mimic that historical pattern, there may be ecological consequences, such as competition, to such recruitment. Density-related issues may arise if carrying capacity is over-estimated.

The definitions of life history stages (p. 29) are vague. What exactly is a sub-adult? This terminology seems largely undefined compared to the approach used for paddlefish where life stages, including prime spawners, are defined in more precise terms separately by sex (Scarnecchia et al. 2007). Perhaps because of the effective slot limit in place for harvest, knowledge of life history "stages" is fragmentary because only harvest-slot fish can typically be sacrificed.

Species Description

The document provides the basic background information on what is known about the biology and ecology of the white sturgeon in the Columbia River Basin. However, it is apparent that despite several long-term studies, some significant information gaps remain. Age determination of sturgeon and the effective use of ages to define life history stages, reproductive state, and expected longevity appear to remain a serious deficiency in understanding sturgeon and limit

our ability to optimally manage the harvest. The Framework states that "the accuracy of fin ray ages continues to be debated among scientists throughout the region and may vary among populations depending on growth." A systematic development of an age-validation approach (Campana 2001) needs to be initiated at several locations throughout the basin. This approach should involve methods for older fish already in the population, for example conventional tagging and bomb methods (Bruch et al. 2009), and instituting a systematic tagging program for age-0 through age-2 fish. The ability to assess age of recruits and overall stock age structure is critical to assessing year class strength and factors affecting recruitment.

Table 3 shows von Bertalanffy growth curves for sturgeon inhabiting various pools, but needs to be shown for sexes separately. It is noted in the text that sturgeon are strongly sexually size dimorphic.

The Framework notes condition, reporting that "condition factor is an index of skinniness or plumpness based on weight for a given length." It would be worth examining some different indices of energy content, including lipid content of various organs and the possible use of gonadal fat bodies (GFB) as is used in paddlefish (Scarnecchia et al. 2007). Although river dwelling sturgeon are less likely to have as much GFB as reservoir dwelling paddlefish, sturgeon GFBs may correlate with age, number of spawns (i.e., early spawners or prime spawners), and especially differences in feeding conditions between pools or changes in productivity (Scarnecchia et al. 2009).

It would also be worth examining reproductive periodicity as a function of age. In paddlefish, it was found that young female spawners (ages 16-25) still had GFB storage, were still increasing in the gonadosomatic index (GSI), were still growing substantially in length and weight, and most commonly spawned every three years. In contrast, prime female spawners (ages 25-40) had depleted their GFBs, had maximized their GSI, and were spawning at 2-year intervals. That is, they spawned at their maximum rate of gonadal recrudescence. In fact, these attributes made them "prime spawners." These concepts may be helpful in evaluating observed sturgeon life histories.

Metabolic differences among management units will lead to some predictable differences in rate of growth, maturation, and progress through the various life stages (e.g., maturation rate, prime reproduction; Scarnecchia et al. 2011).

Current Status

This chapter is quite general. However, additional useful information is provided in Chapter 7 (Management Unit summaries).

On page 50, it is stated that: "In more recent years, juvenile sturgeon have been transplanted upstream from Willamette Falls by the Oregon Department of Fish and Wildlife." It would be helpful to have a summary table or narrative on all white sturgeon transplants or translocations

that have taken place throughout the basin. Perhaps the ones listed are the only ones that have been implemented. It would also be helpful to know how successful these efforts have been and how it is viewed by the planning group and contributors as a restoration option.

The relation between stock numbers and possible effects of anadromy on stock size estimates could use clarification. For example, on page 52 regarding fish numbers below Bonneville Dam, it is stated that: "Numbers appeared to peak during the 1990s and have subsequently declined by approximately half (ODFW and WDFW 2013). Jones (2011) estimated abundance at 665,000 for fish at least ≥ 53 cm FL. These estimates do not include that portion of the population downstream of Bonneville Dam but outside the mainstem lower Columbia River (e.g., coastal estuaries and near-shore marine environments). This decline has been related to decreasing annual recruitment and may also be influenced by increased mortality due to growing predation by sea lions." If the white sturgeon is anadromous, according to unpublished ODFW data as stated later, might a substantial part of the population have been excluded in this datum? It would be helpful to include perspective on whether omitting the apparent marine part of the population is a concern.

The numbers in Table 5 for individual units do not add up to the overall estimate of the number of fish in the Columbia River. Table 5 indicates a population of 1,010,000 in the Columbia for fish longer than 20 inches. How can the numbers of 1,010,000 vs. 665,000, the sum of all individual management units, be reconciled when they apparently are for the fish of about the same size? Further, consistency in use of metric versus English units should be maintained. For example on page 52 a length criterion of 20 inches is used. We recommend the use of metric.

Page 53: "An estimated 15,994 juvenile hatchery-produced sturgeon were present in the Kootenai population in 2012 from releases of 200,274 fish between 1992 and 2011 (Beamesderfer and Garrison 2013)" – This statement implies a survival rate of 8%, but more detail is required. For example, a perspective on what the variation in survival was among the release years would be helpful.

Section 3.3 – The authors have given data on standing crop, not productivity.

The Framework states that "Productivity of sturgeon populations in the Columbia and Snake rivers upstream from John Day Dam is very low." It was estimated that it might be 15% of the un-impounded reach. This low productivity (that is, capacity for production) seems to argue against expanded hatchery programs because of the lack of carrying capacity in many river sections.

It would be a very useful quantitative exercise to assess aggregate expected productivity of the river sections and their expected carrying capacity for sturgeon, versus current and proposed overall hatchery capacity, to see just how many hatcheries are needed to meet probable carrying capacity limitations.

Overview of Fisheries

The description of white sturgeon fisheries was well done. However, the management structure itself appears overly optimistic about what is possible in terms of fishery management policy, approaches, and conservation needs. For example, the report states that: "Currently, white sturgeon harvest in lower Columbia River commercial fisheries is managed to distribute landings throughout the year in order to maximize economic benefit and help distribute the catch throughout the five commercial fishing zones (Figure 21)… Lower Columbia River white sturgeon recreational fisheries are managed to provide year-long harvest opportunities seven days per week, minimize in-season emergency action, and maintain diverse fishing opportunities." The ISRP is unaware of any sturgeon fisheries elsewhere that are being effectively managed with this liberal, continuous fishing approach. This open, liberal approach may work for common, recruitment-rich species but is not typically successful for a valuable, long-lived, late-maturing fish that require effective and continuous monitoring. The rationale for this liberal approach needs justification. Increased use of time/area closures should be considered and evaluated as a way to increase effectiveness and facilitate stock assessment. Fisheries should be designed specifically to obtain needed stock assessment information. The loss of fishing opportunity under this more limited harvest approach might be mitigated for by including additional catch-and-release opportunities, as occurs more widely in the upper basin.

Page 61: Since 1989, lower Columbia River white sturgeon fisheries have been managed for optimum sustained yield (OSY). What criteria were established and what methodology was used to determine OSY? How well does this metric take into account uncertainties in age structure and productivity of the stock?

Overview of Limiting Factors and Threats

The discussion is comprehensive, with the caveat that the ratings of limiting factors and threats are based on expert opinion. In an expert opinion approach, it would be useful to know how much variation in expert opinion there was and from how broad of an area expert opinion was sought.

On Page 69 it is stated that pile rows provide structure and velocity refuges, and may provide habitat for species that prey on rearing white sturgeon. What are those predators?

More careful evaluation of the potential effects of sea lions needs to be conducted. In many sturgeon populations, once fish are recruited to a size beyond fish-based predation, natural mortality rates are very low. In the below Bonneville segment and other segments potentially affected by dams, dam-related mortality and potential mortality of post-recruits from sea lions needs to be carefully evaluated and consistently monitored, because unnaturally high mortality in those life stages could lead to serious stock consequences. High predation mortality may also necessitate curtailment of fisheries as compensation.

Comprehensive Plan

This is a solid part of the framework conceptually. The planning process should involve development of a vision, goals, objectives, and tasks in that order. The objectives, at least, should be quantitative wherever possible. The seven strategies to achieve goals are the strength of the plan, each with reasonable alternatives. It is important, however, to give priorities and timelines for the alternatives; these would be more like objectives to be met over a specified time period and will give benchmarks for progress. In addition it would be helpful to learn how the alternatives were arrived at. Did the same group assess all the rebuilding methods or were more people involved in some meetings or workshops than in others? For example, many more alternatives were proposed for hatcheries than for other possible techniques. The alternatives seem to be an amalgamation rather than a selective, focused approach consistent with a well-articulated vision.

The vision on page 76 for "Abundant and diverse white sturgeon populations and optimum sustainable fisheries throughout the historical range…" seems much too optimistic given that all populations above John Day appear to be essentially gone (Table 5, page 54). Given the long-lifespan documented in the life history section, it seems that it will take more than 25-30 years to even produce a prime female spawner, either through natural reproduction or hatchery efforts. How can one expect to be harvesting these fish within 50 years? Rebuilding will be a slow process.

In Section 6.6 (Implementation), a proposed task is to review existing plans. The Framework document would be improved if a subsample of these plans were briefly reviewed. Sturgeon biologists and managers might be able to obtain a perspective on the complexity of the task and help reconcile differences in strategies that currently are being used by agencies involved in white sturgeon management.

Management Unit Summaries

The level of detail varies by unit, but overall, very good details are given of the abundance, size structure, limiting factors, and current status of white sturgeon for each reach/unit throughout the basin.

Concerning the unit below Bonneville Dam: "Available information (ODFW, unpublished data) indicates that while the majority of white sturgeon downstream of Bonneville Dam inhabit the mainstem Columbia River, they also inhabit the Willamette River (especially downstream of Willamette Falls), Oregon coastal rivers, estuaries, bays, and waters inside the 50 fathom line." These data should be published as they could be important when developing conservation strategies for this species. There is very little information on white sturgeon ecology in coastal waters and if some members of this species wander from one system to another there are implications for population rebuilding efforts.

Table 9 gives ratings on limiting factors, but no information is given on how the scores were

arrived at. Please provide the strategy or approach used to develop the ratings and how they were calculated. This will likely involve a paragraph in the text rather than superscripts in Table 9.

Page 149 - "Hatchery releases of 200,274 juveniles from 1992 through 2011 have established a wild population of hatchery-reared fish of approximately 16,000 sturgeon surviving at least one year in the wild (Beamesderfer and Garrison 2013)." It is not clear how hatchery releases transform to a wild population.

Basinwide Assessment

This section was generally well done. The tables summarizing the various overlapping jurisdictions involved in white sturgeon management were informative and were useful for understanding the complexity of developing a comprehensive plan.

The ISRP suggests that Table 17 that provides limiting factors and threats by management area should include and emphasize climate change and non-natives as problems for the ecosystems supporting white sturgeon. It would also be beneficial for the Framework to clarify how exploitation can be considered a secondary factor.

The ISRP requests that the statement (page190) "Sturgeon hatchery programs are increasingly being considered for sturgeon following the development of effective programs in the Kootenai and Transboundary upper Columbia" be qualified. It is not clear how these programs can be called effective until successful natural recruitment occurs from the released fish and the population is considered viable. As mentioned above, it would be a very useful and necessary quantitative exercise to assess aggregate expected productivity of the sections versus current and proposed overall hatchery capacity to see just how many hatcheries are needed to meet probable carrying capacity limitations.

Framework Findings

While the Framework provides good conclusions and recommendations, further effort is needed to set priorities and timelines. For example, there are 162 research recommendations and such long lists are difficult to use. In addition there are numerous alternative strategies for habitat restoration, hatchery operations, and other related efforts described in Chapter 6. How will these alternatives be prioritized? The ISRP suggests that the authors revise this section and develop targeted research and management programs and projects that will advance sturgeon conservation.

In addition, the Framework does not recognize that sturgeon conservation, as with other focal species in the basin, will require a true landscape approach (ISAB 2011-4). This will involve working across various geographical and species boundaries and actively using adaptive management and structured decision making. As an example of species boundaries, there are

conflicting societal and value decisions concerning hydrosystem/passage mitigation among sturgeon, salmon, and lamprey.

Throughout the document, there are occasional partial sentences, fragments, and missing words. These should be identified and corrected in the next draft.

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