Response to ISRP Comments
Project 198605000
White Sturgeon Mitigation and Restoration in the Columbia and Snake Rivers
Upstream from Bonneville Dam

In their 2000 review of this project, the ISRP recommended that the sponsors develop an umbrella proposal for all sturgeon research in the basin and a long-term strategy and plan indicating how the sponsors are moving toward their objectives. The draft Program Summary appears to fulfill this recommendation. However, the ISRP also called for a peer-reviewed synthesis of the state of the science on Columbia River white sturgeon. This is a highly desirable activity and a description of progress toward this goal or an explanation of why the synthesis has not occurred would be helpful.

A peer-reviewed synthesis of the state of the science on Columbia River white sturgeon. This product is highly desirable, but we believe it is beyond the scope of project 198605000. However, to address this need we have coordinated with more than 50 sturgeon biologists and interested scientists from throughout the Basin in a workshop sponsored by 198605000 August 12-14, 2002. Those in attendance were enthusiastic about working together to develop a synthesis that addresses our current understanding of population biology, sampling techniques, conservation aquaculture, health management, genetics, status of geographic or reservoir-specific populations, and prioritizes or outlines research information gaps that impede recovery of white sturgeon populations and fisheries. Representatives from the Columbia Basin Fish and Wildlife Authority and from Bonneville Power Administration agreed to help set up a web space and list-server that will allow sturgeon biologists from throughout the Basin to form working groups and contribute to the synthesis.

1. *Both harvest restrictions and transplantation of juveniles from downriver stocks into mainstem reservoirs is occurring simultaneously.* **(a)** *What were the harvest restrictions that were implemented?* **(b)** *How do the sponsors plan to sort out the effects of each of these mitigation activities on sturgeon population dynamics?* **(c)** *The sponsors indicate that since implementation of the more intensive harvest management growth of fish has slowed, perhaps indicating a density-dependent effect. How is this phenomenon being addressed? Will transplantation contribute further slowing of growth?*

1a. The need for a reduction in annual harvest was identified following the first year of field sampling funded under project 198605000. A joint state/tribal Sturgeon Management Task Force was created in 1988 to manage sport and commercial fisheries for a 22% reduction in harvest from the 1985-87 average. The minimum sport legal size limit was increased in 1988 from 36 inches to 40 inches. The commercial setline season was decreased from 10 months to 4 months and sales during salmonid gillnet seasons were limited. The 22% reduction was achieved for 1988-90, however, annual harvest guidelines were implemented in 1991 to assure stable continuing white sturgeon harvest and to maintain broodstock recruitment (recruitment to age 25 years). In Bonneville Reservoir the intent of regulation changes has been to maintain a broodstock recruitment rate equivalent to that under a 15% annual harvest of white sturgeon 36 to 72 inches in total length. In The Dalles and John Day reservoirs (where juvenile recruitment limits productivity) the target is a broodstock recruitment rate equivalent to that under a 10% annual harvest of white sturgeon 36-72 inches in total length. These target harvest rates were derived based on reservoir-specific population characteristics applied in an age-structured population model (Beamesderfer et al. 1995).

Over the years the harvestable slot size has narrowed for both sport and treaty-commercial fisheries in all three reservoirs to apportion the catch, extend fishing seasons, and increase yield. The harvestable slot size for treaty-commercial fisheries is now 48-60 inches in Bonneville, The Dalles, and John Day reservoirs. In Bonneville Reservoir the sport fishery slot limit is 42-60 inches, and in The Dalles and John Day reservoirs the sport fishery slot is 48-60 inches. Sport fishery daily bag limits have gone from 2 fish/day to 1 fish/day to extend the fishing season. Allowable harvest numbers (harvest guidelines) are set specific to each fishery (to apportion the catch) and in each reservoir as new information on size-specific abundance is acquired (to maintain an appropriate exploitation rate). Details of year-specific regulation changes are reported in Washington and Oregon Columbia River fisheries status reports (Table 81 in WDFW and ODFW 2000). Year 2002 guidelines allow 5,120 white sturgeon to be harvested:

	Reservoir		
Fishery	Bonneville	The Dalles	John Day
Sport	1,520	700	165
Treaty Commercial	1,250	1,100	335
	2,820	1,800	500

1b. We expect that transplanting white sturgeon and reducing harvest may have some overlapping effects on white sturgeon population dynamics. Both activities are intended to increase the abundance of sub-adult white sturgeon to compensate for reduced juvenile recruitment in these reservoirs. Transplanted fish are marked, so their relative contribution to abundance can be directly measured as part of periodic stock assessments. Density-dependent effects that may result from increased abundance include reduced condition, growth, survival, and juvenile recruitment. Among these, condition factor will be measured and reported as relative weight. Significant reductions in relative weight over time will be used as an indicator of potential density problems. In response to reduced condition we will scale back or stop transplanting fish (or lower the minimum size limit), but this will not necessarily allow us to sort out the effects of each of these mitigation activities.

It is conceivable that reduced growth and survival may not be related to reduced condition factor. Direct measurement of these characteristics has proven challenging for sturgeon biologists throughout the Basin due in large part to bias and imprecision in age interpretation (Rien and Beamesderfer 1995). More frequent periodic stock assessments (outlined in the response to question 1c) will allow growth to be monitored from recaptures of PIT tagged fish at large for multiple years and survival to be measured and monitored as changes in length specific abundance. Still, detection of the change is easier than determining its specific cause. Unless changes in condition, growth, and survival are manifest in specific size classes relating to transplanted or harvestable fish, we will not necessarily be able to sort out the relative effects of each of these mitigation activities.

The most challenging effect to sort out may be the potential reduction of juvenile recruitment. We measure recruitment through annual index surveys using trawls and gill nets. High density in the most densely populated Columbia River reservoir, Bonneville, is the result of regular recruitment resulting from suitable spawning velocities. We do not know if recruitment would be even greater in Bonneville Reservoir if white sturgeon density were reduced. However, Bonneville Reservoir's regular recruitment leads us to believe that reduced condition factor and growth rate (which are documented for Bonneville Reservoir) will be observed in John Day and The Dalles reservoirs before recruitment declines in response to density.

In summary, we intend to measure, analyze, and assess changes and trends in population characteristics. We will attempt to attribute effects to specific mitigation activities should they appear in specific length classes of white sturgeon. However, we do not hold out hope that we will be able to determine cause and affect relationships while undertaking a multi-pronged recovery effort. Instead we will respond to observed density-dependent effects by modifying or curtailing fish transplant activities, and maintaining harvest rates that assure broodstock recruitment.

1c. We did not intend to convey that growth had slowed in response to harvest management actions. We do not believe that is the case. Our intent was to illustrate the utility of periodic monitoring and that fisheries managers are able to respond quickly to the new information. Further, we intended to illustrate the need for more frequent monitoring of reservoir populations. Infrequent monitoring works well when the population behaves as expected. However, this illustrates a case where growth was slower than predicted by age interpretation and infrequent stock assessment which resulted in excessive harvest and which may result in reduced broodstock recruitment to the naturally reproducing population. To reduce the risk of making decisions with outdated or mis- information we propose to increase the frequency of reservoir-specific stock assessment to once every three years.

Specifics on new growth rate estimates. Recaptures of substantive numbers of PIT tagged fish allowed us to describe growth from recapture data in 2001. Observed growth is much slower than described using ages interpreted from pectoral fin-spine cross sections. Project sponsors have previously identified an under-aging bias (Rien et al. 1995), but recapture data from fish at large for multiple years has allowed us to quantify the magnitude of the problem and incorporate slower growth estimates into population growth projections. Fisheries managers responded to new information by reducing allowable harvest guidelines for treaty-commercial and sport fisheries in John Day Reservoir. We intend to report on the growth problem preliminarily in our 2002 annual progress report and in detail in peer-reviewed publications in cooperation with other sturgeon biologists in the Basin who have similar observations.

2. *Under Objective 1, Task 1b, Phase 2 of monitoring the sponsors propose to estimate survival and recruitment. Specifically, how will this be accomplished?*

Survival of hatchery released fish and natural recruitment will be estimated from known release numbers, period at large, and estimates of population abundance conducted in 2007 and 2009 using mark-recapture methodologies similar to those described under Task 3a -- Monitor the status of white sturgeon populations in Bonneville, The Dalles, and John Day reservoirs. The major change in mark-recapture methods will be to use small-mesh in gill nets as our primary gear to better target juvenile white sturgeon. Abundance and survival of hatchery-released fish will be derived from length specific estimates of abundance and the proportion of hatchery-released fish in each size increment. Natural recruitment is simply the abundance of wild white sturgeon in each length increment. These methodologies are similar to those used to estimate survival of transplanted fish in The Dalles Reservoir (Rien and North 2002)

3. *Objective 2 purports to recommend actions that involve changes to the hydrosystem to optimize physical habitat. A much more comprehensive description of how the sponsors plan to accomplish this objective is needed. What information is available and how will it be utilized to produce the recommendations. Task 2a pertains only to completion of the USGS portion of the work, but this work alone is insufficient to provide recommendations for power system changes.*

   Objective 2 of this proposal – Recommend actions that involve changes to the hydropower system operation and configuration to optimize physical habitat conditions for white sturgeon – uses information from research on white sturgeon biology, habitat use, and behavior to identify ways in which the hydropower system could be operated or altered to benefit white sturgeon populations. As an example of how research results are used by the project sponsors to recommend changes in hydropower system operations, work done during 1986-1993 resulted in a recommendation for minimum flows at McNary Dam during the spawning period for white sturgeon to provide a minimal area of high quality spawning habitat at McNary Dam, which would also ensure the availability of high quality spawning habitat at John Day, The Dalles, and Bonneville dams.

   As outlined in the project history section of the proposal, additional research was done during 1995-2002 to provide more information on seasonal habitat use (depths, velocities, and substrates) and movements by white sturgeon and how water velocities, temperatures, dissolved gas, turbidity, and daily operations at dams can influence spawning, embryo survival, and abundance of age-0 white sturgeon in fall trawl sampling. This work has resulted in several publications and manuscripts in preparation as well as numerous presentations at scientific meetings and workshops. These products describe how river flows, water velocities, water temperatures, dam operations, dissolved gas, and other physical environmental variables influence different life stages of white sturgeon. As an example, Counihan and Parsley (provisionally accepted) describes how hydropower peaking operations may be scouring white sturgeon embryos from riverbed substrates, which could lead to reduced survival of this life stage. Another example includes the work done by Parsley et al. (2002) describing the potential effects of reservoir drawdown on white sturgeon. Findings from this work showed that lowered water surface elevations would result in increases in spawning habitat and decreases in rearing habitat from existing conditions. The completion of write-ups for telemetry studies done in the McNary Reservoir including the Hanford Reach will provide more information on seasonal habitat use and movements (Gallion and Parsley 1999). The completion of write-ups for a telemetry study done in The Dalles Reservoir will provide insight on how river discharge operations at John Day Dam influenced distribution of adult white sturgeon during the spawning period. Ongoing laboratory studies investigating the influence of turbidity on predation of white sturgeon embryos by native and introduced piscivores will benefit recovery efforts by providing insight on how reductions in turbidity resulting from hydropower system development influence recruitment (Gadomski et al. 2002).

   The project sponsors acknowledge that there is little likelihood that project operations at lower Columbia and Snake River dams would actually be altered to benefit sturgeon because system needs are currently driven by ESA-listed species. However, the research that has been done has resulted in recommendations for project operations (flow and temperature) in the Kootenai River where white sturgeon have been listed as endangered. In addition, managers making decisions on hydropower system operations have been known to consider the consequences to white sturgeon when making decisions regarding hydropower system operation changes. Fortunately, much of the research done to date has shown that many operational changes considered for endangered salmonids would also benefit white sturgeon. This is not surprising when one considers that the anadromous salmonids and white sturgeon co-evolved in the Columbia Basin. Thus, improving physical conditions (cooler water temperatures, lower dissolved gas levels, and increased water velocities) for outmigrating juvenile salmonids generally improves spawning, egg incubation, and larval dispersal of white sturgeon, resulting in greater abundance of age-0 white sturgeon during fall trawl sampling (Counihan et al. provisionally accepted).

Task 2a is the only task for Objective 2 of this proposal. The sponsors are requesting funding only to complete write-ups of several research tasks that were begun during 1995-2002. These publications will provide the scientific underpinnings for discussions and decisions on how the hydropower system alterations influence white sturgeon populations. Decisions on lower Columbia and Snake River hydropower system operations may never be based solely on the influence on white sturgeon, but the research done will enable managers to at least discuss and consider the influence of their decisions on this species.

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