Management Plan for the Conservation of Snake River White Sturgeon in Idaho

Idaho Department of Fish and Game
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Executive Summary

The Idaho Department of Fish and Game (IDFG) developed this Management Plan for the Conservation of Snake River White Sturgeon to provide policy direction to staff and to ensure the long-term persistence of the species within in its historical range. This management plan will be implemented in consultation with other state and federal agencies, tribal agencies, Idaho Power Company, and other interested stakeholders. This plan reflects Idaho Fish and Game Commission policy and direction to the IDFG and includes management philosophy expressed as goals and objectives. The objectives of the management plan include providing for coordinated management of white sturgeon in the Snake River, providing for an orderly and sustainable no harvest recreational fishery, facilitating data collection for stock assessments, integrating and defining the role of artificial propagation, increasing public awareness through information and education, and obtaining public acceptance and compliance for the plan.

Introduction

The white sturgeon *Acipenser transmontanus* is the largest freshwater fish in North America historically reaching lengths over 5 m and weights exceeding 500 kg. It is one of eight sturgeon species found in North America. The range of white sturgeon includes the Pacific Northwest from southeast Alaska to central California. In Idaho, the historical distribution of white sturgeon included the Snake River upstream to Shoshone Falls, the Salmon River as far upstream as McKim Creek, and the Kootenai River drainage in northern Idaho. In 1994, white sturgeon inhabiting the Kootenai River in north Idaho were listed as endangered by the U.S. Fish and Wildlife Service under the Endangered Species Act and management and recovery is directed under a separate document (U.S. Fish and Wildlife Service 1999).

The IDFG goal for Snake River white sturgeon is to preserve, restore, and enhance populations capable of providing sport fishing opportunities. By statute, the IDFG manages the fish and wildlife of the state for the public (*Idaho Code* Section 36-103). The IDFG 2007-2012 Fisheries Management Plan (IDFG 2007) lists five guiding principles governing white sturgeon management within their historical range.

1. Status of existing sturgeon populations will be determined and monitored, and factors suppressing populations will be evaluated.
2. Sport fishing will be regulated commensurate with population status.
3. Habitat loss or degradation will be opposed and measures will be promoted to improve limiting factors
4. Importation of non-native sturgeon will be restricted to avoid potential genetic or disease impacts to native stocks.
5. Sturgeon populations may be supplemented with native stocks where necessary to maintain future management options, to research survival rates, to utilize suitable rearing habitat where natural recruitment does not exist, or to create fishing opportunity.

The purpose of this management plan is to describe historic and current status of Snake River white sturgeon populations and sport fisheries, identify limiting factors, provide objectives and strategies for population and fishery management, and to identify important information needs for fishery management into the future.

History and Status of Snake River White Sturgeon

Historically, white sturgeon were abundant and ranged freely throughout the Columbia and Snake River basins as far upriver as Shoshone Falls, a natural 65 m high migration barrier located near Twin Falls, Idaho (Figure 1). The first

significant human exploitation of white sturgeon probably began in the late 1880's when demand for primarily caviar ballooned on the east coast of the United States. During that era, the harvest of white sturgeon in the lower Columbia River increased to over one million pounds annually. This high rate of exploitation was not sustainable and white sturgeon populations became precipitously low. Although historical information for the Snake River is lacking, it is likely that white sturgeon in Idaho were also significantly exploited and populations were impacted by overharvest.

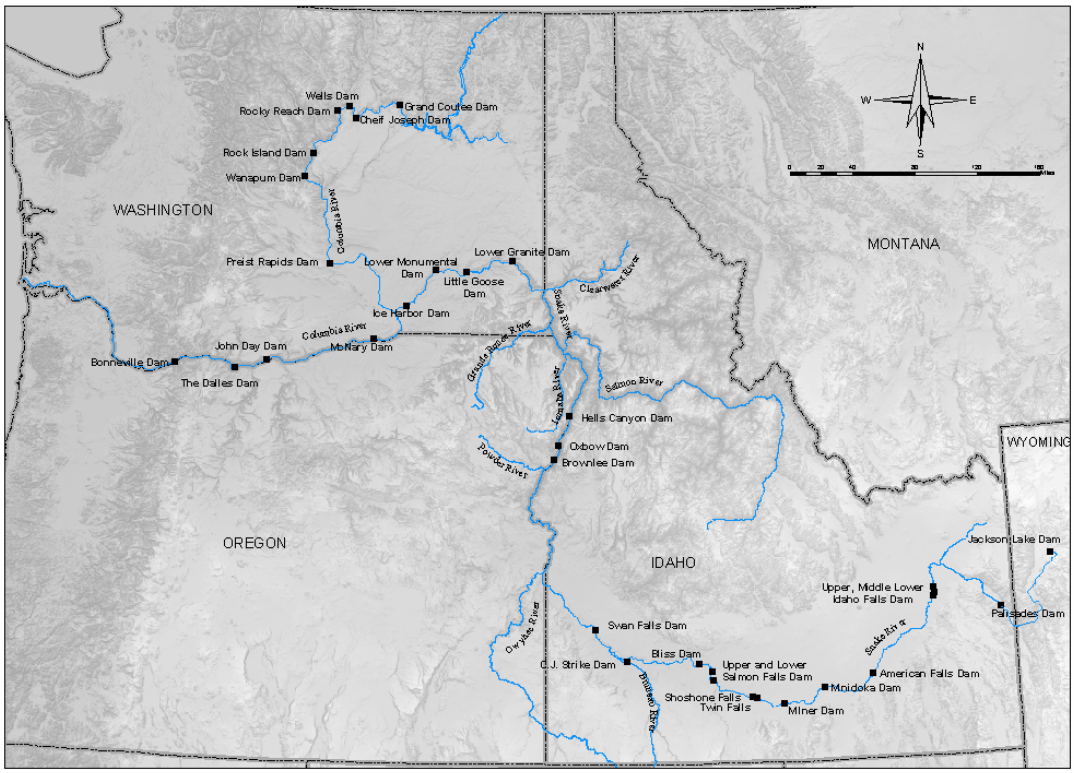


Figure 1. Map of the Snake River, tributary to the Columbia River. The historical range of Snake River white sturgeon is from Shoshone Falls, located in south central Idaho downstream into the Columbia River. (Source, Idaho Power Company).

As human development increased in Idaho, the demands placed on fisheries resources also increased. Access to diverse spawning, rearing, and feeding habitats was eliminated or severely reduced by the construction of dams on the Snake River beginning in the early 1900's. With hydroelectric facilities in place on the Snake River in Idaho, white sturgeon no longer had free access to hundreds of miles of large-river habitat. Swan Falls Dam was constructed in the early 1900s in the middle Snake River followed by Upper Salmon Falls and Lower Salmon Falls dams. By the 1950's, Bliss and C.J. Strike dams were in place. The Hells Canyon complex of Brownlee, Oxbow, and Hells Canyon dams were completed by 1968. By the mid-1970s, the four lower Snake River dams were completed (Lower Granite, Monumental, Little Goose, Ice Harbor). The construction of dams by Idaho Power Company along the course of the middle Snake River has restricted white sturgeon to river reaches that do not provide the diversity of habitats necessary for successful reproduction and rearing. White sturgeon are currently segmented into nine reaches of the Snake River including the Hells Canyon complex. Of the nine reaches, only two support viable populations characterized by self-sustaining natural recruitment. These reaches are Bliss Dam to C.J. Strike Reservoir and Hells Canyon Dam to Lower Granite Reservoir. Reaches other than these two show little or no detectable reproduction.

Although there has been documentation of downstream movement past dams, there are no passage structures on Snake River hydropower facilities to provide for volitional upstream or downstream movement. White sturgeon do not readily use conventional fish ladders as they are not built for fish of that size and the height of most dams on the Snake River generally precludes the feasibility of passage structures. Movement downstream is hazardous for white sturgeon because they must move over a spillway during high flows or through turbine units where they stand a high chance of injury or death from blade strikes. The inability of white sturgeon to move freely past dams on the Snake River has resulted in unbalanced population structure in reaches that lack the habitat diversity to support all life history stages.

Alterations in the annual, seasonal, and daily flow regimes and patterns from upriver water management and hydropower operations do not provide for and/or interfere with the necessary environmental and behavioral cues that provide suitable spawning or rearing conditions. For example, load following at the Bliss Dam hydroelectric facility under certain flow conditions can adversely impact white sturgeon spawning activity and success (Lepla and Chandler 2001).

Dam construction largely eliminated anadromous salmon, steelhead, and lamprey which provided a historically abundant food supply for white sturgeon. As anadromous fish runs dwindled to extinction above Hells Canyon Dam, white sturgeon were obligated to seek other food sources for survival. The impact on white sturgeon population productivity and condition is unknown.

The dams and associated operations, inundation of free-flowing river habitat, large-scale irrigation withdrawals, and degraded water quality have had a substantial cumulative impact on white sturgeon habitat quality and quantity. The introduction and spread of non-native fish species into the Snake River may have caused adverse competitive interactions, predation, or possibly disease issues.

White sturgeon are well adapted to thrive in large, free-flowing riverine environments such as the Snake River in Idaho. Prior to dam construction, white sturgeon probably moved substantial distances to find optimum spawning, rearing, feeding, and wintering habitats. Other unique life history characteristics include late maturation for females (15-30 years of age) and infrequent spawning by individual fish (up to once every 10 years). Preferred spawning habitats are higher gradient river reaches, and fertilized adhesive eggs may drift miles downstream in currents before attaching to suitable substrate and incubating. These specific life history aspects may now be a hindrance to survival in a very altered and regulated system.

While the development of the irrigation and hydropower systems have contributed significantly to the present depressed state of white sturgeon in the Snake River, past sport fishing has also played a role in reducing numbers and creating unbalanced populations. Prior to 1971, sport harvest of Snake River white sturgeon was permitted and total harvest was unregulated. Since 1971, the IDFG has regulated sport fishing to catch-and-release only, but the slow growth rates, late maturation, and infrequent spawning means that it can take decades for populations to recover from past overharvest or other sources of mortality. In some reaches the low number of adult females and their infrequent spawning have slowed or prevented population growth even with catch and release angling rules. Currently, there is a high demand for white sturgeon angling opportunity, particularly in three reaches: 1) below Bliss Dam, 2) below Hells Canyon Dam, and 3) immediately below C.J. Strike Dam. The altered habitat and low population productivity in the Snake River means it is unlikely that any sustainable harvest opportunity on wild fish can be provided in the foreseeable future.

Although catch and release regulations have been in place for several decades, the biological aspects and population level effects of repeated catch and release angling is largely unknown for white sturgeon. Booth et al. (1995) indicated that angling can be one of the most severe forms of exhaustive exercise that fish experience. Several studies on different species of fish have shown that exhaustive exercise, including angling, results in a variety of severe physiological disturbances that can alter reproductive performance and cause delayed mortality (Nelson 1998; Lambert and Dutil 2000; Schreer et al. 2001). White sturgeon may be susceptible to injury and mortality from ghost gear – terminal fishing tackle broken off and remaining on the river bottom. In July 2001, Idaho Power Company (Ken Lepla, Idaho Power Company, personal communication) performed necropsies on two adult white sturgeon found dead

below C.J. Strike Dam. Idaho Power Company detected 3-20 angler hooks in the digestive tracts, several of which had punctured the esophagus and intestinal tracts.

The states of Washington and Oregon have designated an almost 10-km reach of the Columbia River below Bonneville Dam as a spawning sanctuary where all fishing is prohibited during the peak spawning period. Implementation of the sanctuary was based on observed dead over-legal size fish washing ashore downstream, observations of ingested hooks in both dead and live fish, and data on stress levels measures in fish sampled from the catch and release fishery (Ward et al. 2002). Additionally, Washington Department of Fish and Wildlife (WDFW) staff began dissecting white sturgeon carcasses in 2000 looking for fish hooks retained in the intestinal tract. From 2000 to 2006, 8% to 48% of the carcasses examined contained one or more hooks or suffered from torn gill arches or punctured arteries in the throat area. Twenty percent of the intact carcasses examined in 2007 contained hooks or suffered potentially lethal damage from removed hooks (Ward et al. 2004) It remains unclear whether mortality from catch-and-release angling and "ghost gear" is significant enough to affect population abundance or size structure. With the increasing popularity of white sturgeon angling and the vulnerability of these populations to any form of exploitation, it is important that future evaluations include assessments of angler use and fishing-related mortality. If warranted, the IDFG will propose gear restrictions to reduce angling-related mortality.

The Snake River upstream of Shoshone Falls is highly regulated and operations are complex and authorized both by state law and federal water contracts. The potential for operational changes in water management to significantly benefit Snake River white sturgeon are minimal at best so IDFG management actions will largely focus elsewhere. Snake River flows increase substantially from Shoshone Falls to King Hill through influx of 142-170 cubic meters per second of reliable spring water discharge from the Thousand Springs Formation, but the recharge water and resulting improved habitat complexity cannot overcome a greater limitation: reach length. Due to early life history behavior, the relatively short distance between the Upper and Lower Salmon Falls dams and between Lower Salmon Falls and Bliss dams likely prevent any possibility of in-reach recruitment supporting self-sustaining populations, flows and habitat diversity notwithstanding.

Because the various Snake River reaches have a range of characteristics and are essentially isolated from one another, this management plan addresses white sturgeon on a reach by reach basis. Within the native distribution of white sturgeon, population and recreational fishery objectives are developed for each reach based on the physical habitat and flow conditions and the current status of the population and fishery. Additionally, this management plan addresses expansion of white sturgeon into new waters outside their historical distribution to provide unique recreational opportunities.

Limiting Factors

Dams and Reservoirs

Historically, the free-flowing Snake River in Idaho provided a diversity of habitats for white sturgeon and readily supported all life stages. Prior to the early 1900s, white sturgeon had access to all available habitats for various life history functions (e.g., spawning), and for seasonal foraging opportunities. This ability to move freely about the Snake River because of unimpeded access was undoubtedly important. However, beginning as early as 1900, construction of dams and reservoirs on the Snake River in Idaho significantly altered habitats available for white sturgeon, fragmenting the river corridor into smaller segments and reducing access to critical habitats such as spawning areas.

White sturgeon life history and reproductive strategies are typical of large river species. They can migrate significant distances to find appropriate spawning, rearing, and feeding habitats. They spawn in relatively high gradient, turbulent river reaches, and eggs and larvae disperse long distances downstream in the current. This life history becomes a limitation when white sturgeon are confined to relatively short river reaches that lack the required habitats for all life stages. Under current conditions, many of the fragmented reaches of the Snake River show little or no evidence of natural sturgeon recruitment. Small populations within abbreviated river segments are especially vulnerable to stochastic or catastrophic events. In short river segments, populations are vulnerable to downstream losses (past dams) that reduce production potential (Idaho Power Company 2005). Eggs and larvae are most likely lost from short river segments, essentially preventing recruitment in the reach where they were spawned.

Older age classes of white sturgeon have also been documented to move downstream of dams on the Snake River. This is particularly true of shorter reaches. This downstream movement either occurs through dam turbines (entrainment) or through spill gates during periods of spill (Idaho Power Company 2005). Idaho Power Company field sampling conducted to date has identified at least 59, mostly hatchery sturgeon, which have successfully moved downstream past one or more Snake River dams between American Falls and Swan Falls. There is a significant risk of mortality for larger white sturgeon because they are more likely to be struck by turbine blades than are smaller fish.

Jager et al. (2001) demonstrated via simulation models that increased habitat fragmentation led to an exponential decline in the likelihood of persistence of white sturgeon populations. Thus, it is challenging to conserve and manage sturgeon populations in a system like the Snake River that is so fragmented by dams and reservoirs.

Generally, the relationship between stream reach length and natural recruitment and stock structure is evident in the Snake River with one exception. The Swan Falls-Brownlee reach is the longest segment of free flowing river remaining in the Snake River but displays little evidence of natural recruitment and has low population abundance. This is thought to be caused by poor water quality (Idaho Power Company 2005). The other remaining long reaches of the Snake River support the four largest populations of white sturgeon (in descending order) and include: Hells Canyon-Lower Granite, Bliss-C.J. Strike, Shoshone Falls-Upper Salmon Falls, and C.J. Strike-Swan Falls. The remaining five reaches of the Snake River show little to no evidence of natural recruitment.

Dams and reservoirs in general also result in other environmental and/or physical conditions that alter habitat for Snake River white sturgeon. The natural seasonal flow regime of the Snake River has been altered by dams and water management, which has resulted in shifts in the timing and volume of peak runoff conditions. This altered flow regime is different than historical conditions under which white sturgeon evolved. Dam and reservoir construction has altered water quality, most notably including dissolved oxygen and temperature, in some instances making it less than optimum or seasonally unsuitable for white sturgeon. Dams have altered the distribution of nutrients and substrate that historically occurred during spring runoff conditions. These changes have altered the composition and abundance of prey. Dams in the Columbia and lower Snake River have depleted upriver runs of salmon, steelhead, and Pacific lamprey that undoubtedly provided abundant sources of food for white sturgeon. Finally, reservoir development has altered the former river ecosystem into a series of slack water reservoir environments with changes in fish species composition and abundance. This may have increased predation by and competition with other species.

Flow Regulation

The Snake River is extensively regulated to provide water for agriculture, hydropower, and municipalities, and to provide flood control. Several dams in the upper Snake River basin were constructed to store and divert water for irrigation purposes. This has resulted in alterations in the natural hydrograph and significant reductions in the natural flow of the Snake River.

White sturgeon depend on natural river environments and seasonal floods to provide optimum spawning conditions. These seasonal flow patterns cue maturation, migration, and spawning (Idaho Power Company 2005). Intensive water management practices in the upper Snake River basin for irrigation and flood control can substantially alter the magnitude and timing of the spring hydrograph downstream. Reductions in spring flows are primarily the result of refilling of U.S. Bureau of Reclamation upstream storage projects drafted during the previous year to meet irrigation storage contracts. These water management practices also shift peak spring flows (Figure 2) so that they do not occur in

tandem with optimum spawning temperatures for white sturgeon (Idaho Power Company 2005). This can result in reduced spawning and early rearing habitats for white sturgeon. Recruitment of juvenile white sturgeon has been documented to be positively related to the volume of spring flow (Kohlhorst et al. 1989; Parsley and Beckman 1994; Miller and Beckman 1995; Brink and Chandler 2000; Chandler and Lepla 1997).

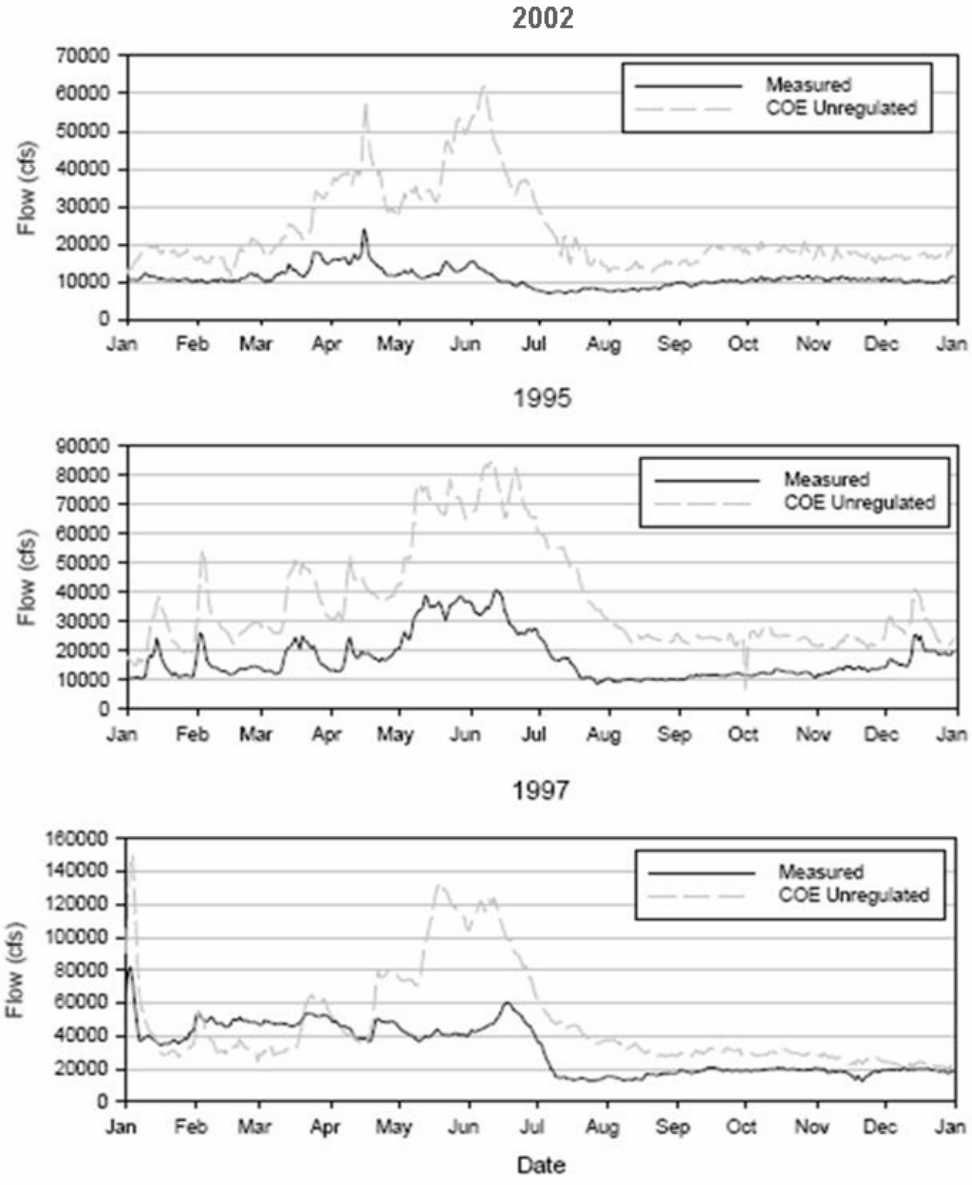


Figure 2. Daily average U.S. Army Corps of Engineers unregulated and measured (U.S. Geological Survey gage 13269000) Snake River flow at Weiser, Idaho, for low (2002), medium (1995) and high (1997) water years. Source Idaho Power Company 2008.

Hydropower operations can result in daily flow fluctuations (Figure 3) downstream of projects for power generation and this can affect recruitment potential for white sturgeon (Idaho Power Company 2005). Instream flow studies conducted by Idaho Power Company below Lower Salmon Falls, Bliss, C.J. Strike, and Hells Canyon dams have illustrated that load following or power peaking operations can substantially reduce the amount of spawning, incubation, and larval habitats for white sturgeon, particularly during low water years (Idaho Power Company 2005). For instance, the estimated age structure of white sturgeon sampled in 2000 below Bliss Dam indicated that natural recruitment of white sturgeon was poor during below normal water years when aggressive load following operations occurred (1988, 1989, and 1990; Brink and Chandler 2000). In years with similar hydrology but limited or no load following (1992, 1993, and 1994), higher recruitment of white sturgeon occurred.

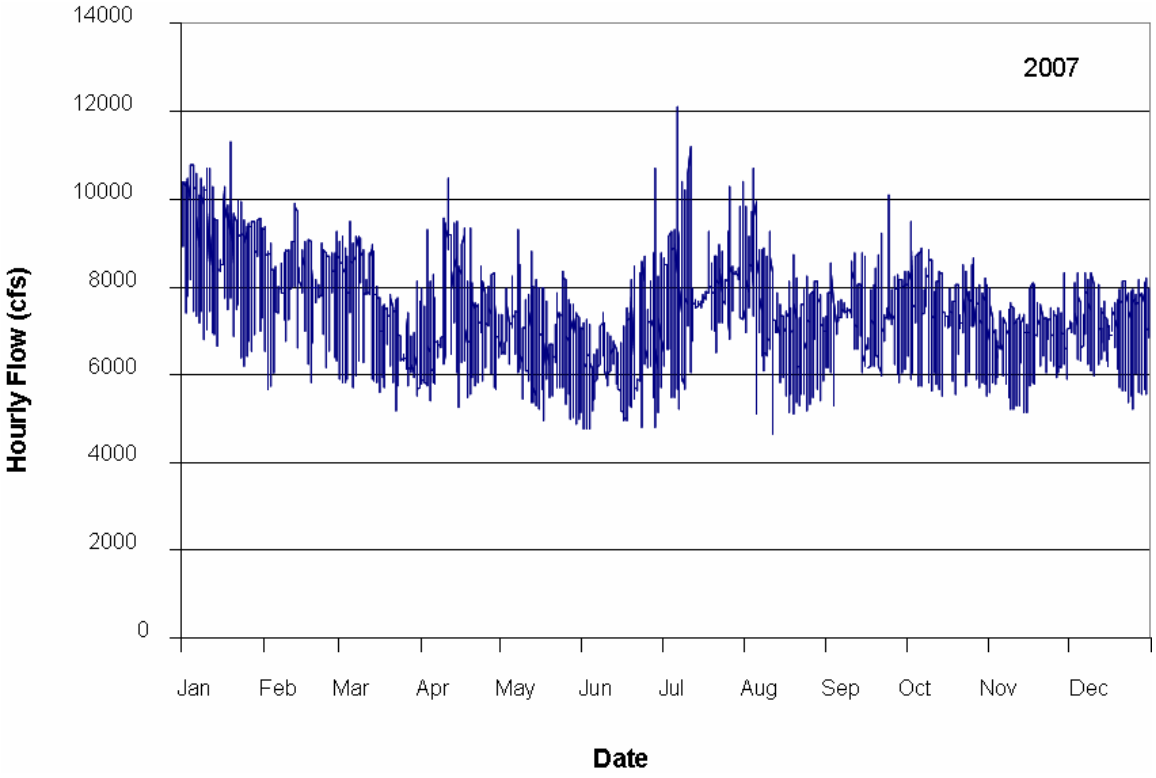


Figure 3. Hourly river flow below Bliss Dam in the Snake River measured near King Hill, ID (U.S. Geological Survey gage 13154500) during 2007. Source, Idaho Power Company, unpublished data.

In comments the IDFG submitted to the FERC regarding relicensing of Idaho Power Company's Bliss Project, we expressed concerns over load following operations on white sturgeon spawning, rearing, and incubation. The FERC declined to address our specific concerns and when a new license was issued, they did not order Idaho Power Company to alter operations of the Bliss Project because of the loss of peak generating capacity. Nonetheless, continued monitoring of the population and stock structure to document potential impacts due to load following operations and water year should occur.

Water Quality

Water quality throughout the Snake River has been impacted by the cumulative effects of intensive agriculture and industrial activities (Clark et al. 1998: Harrison et al. 2000). Much of the mainstem Snake River is listed as impaired or water quality-limited (Idaho Department of Environmental Quality 1998). Observations from this study included declines in dissolved oxygen, increases in water temperature, elevated nutrient levels and other contaminants, and elevated total dissolved gases.

Water quality degradation generally worsens during low flow periods from mid- to late summer. During the summer irrigation season when water demand is high, reduced stream flows and irrigation return water combine to cause degraded water quality conditions. Return flows to the Snake River are significant contributors of nitrogen, phosphorus, pesticides, and sediment (Clark et al. 1998).

White sturgeon can be directly impacted by degraded water quality conditions in the Snake River. Generally, it occurs in the summer when multiple stressors combine such as low flows, elevated water temperature, and low dissolved oxygen levels. Mortalities of white sturgeon directly attributable to degraded water quality conditions have been documented in the Snake River in the Swan Falls Dam to Brownlee Dam reach (Grunder et al. 1993).

Snake River White Sturgeon Management Categories

The IDFG proposes three separate categories of white sturgeon populations in the Snake River. These categories are based upon those defined by a multi-state position document on genetic considerations concerning cutthroat trout management (Utah Division of Wildlife Resources 2000).

1. White Sturgeon Core Conservation Populations- Defined as those populations which are self-sustaining that support sport fisheries with regular natural recruitment and all age/size classes represented. Core conservation populations have adequate flow regime, water quality, and physical habitat characteristics to meet all life history requirements in most years. IDFG management emphasis will be on protecting and enhancing habitat and water

quality to promote sustainability by natural recruitment, and on protecting the genetic integrity and diversity of the population. Sport fishing for white sturgeon will continue under the current catch-and-release regulation and its effect on reproductive success/recruitment and angling-related mortality will be assessed. Conservation enforcement efforts will focus on these reaches to minimize illegal harvest.

2. White Sturgeon Conservation Populations – Defined as reaches with existing white sturgeon populations and sport fisheries but with infrequent or no natural recruitment and unbalanced age/size structure. These reaches may receive recruitment from downstream drift or may have received hatchery supplementation in the past, but lack the flow, water quality, and/or physical habitat characteristics to meet all life history requirements in most years. IDFG management emphasis will be on collaboratively working with regulators and other stakeholders emphasizing the protection and enhancement of habitat and water quality. To rebuild spawning populations or enhance angling opportunity, supplementation with hatchery fish or translocated wild fish may be considered only after careful deliberation. Sport fishing for white sturgeon will continue under the current catch-and-release regulation and angling-related mortality will be assessed.

3. White Sturgeon Sportfish Populations – Defined as suitable large river waters where white sturgeon can provide or have provided diversity to existing fisheries. In some instances this will be outside the historical distribution. These river reaches are expected to lack the flow regime, water quality, and physical habitat characteristics to meet all life history requirements, and angling opportunity would be provided by the periodic stocking of hatchery-reared Snake River white sturgeon. Sport fishing for white sturgeon would be under the current catch-and-release regulation although a limited harvest fishery may be an option in the future.

Snake River White Sturgeon Management Activities

The low productivity and long life span of white sturgeon requires a long-term management perspective focused on the full range of life history requirements. Achieving management goals may require a combination of strategies and appropriate management techniques which may vary by stream reach based on the designated management category and the status of populations. Within Idaho, the IDFG is the lead agency responsible for white sturgeon management and recreational fisheries; however, along the shared state boundaries with Oregon and Washington we will actively cooperate in management activities with the Oregon Department of Fish and Wildlife and Washington Department of Fish and Wildlife. The Nez Perce Tribe, as per treaty rights associated with the Nez Perce Tribe Treaty of 1855, conducts research on white sturgeon populations in the Hells Canyon-Lower Granite Dam reach of the Snake River and has a tribal harvest fishery in the same area. The Nez Perce

Tribe has developed a separate white sturgeon management plan for the Hells Canyon reach of the Snake River (Nez Perce Tribe 2005). The IDFG will cooperate with the Nez Perce Tribe in this reach of the Snake River.

Idaho Power Company is an electric utility that owns and operates a number of hydroelectric facilities in southern and western Idaho on the mainstem Snake River. As a result of relicensing the Middle Snake River projects (Shoshone Falls, Upper Salmon Falls, Lower Salmon Falls, Bliss) and the C.J. Strike Project, Idaho Power Company is responsible for implementing a number of protection, mitigation, and enhancement activities to benefit white sturgeon in the Snake River. Idaho Power Company is currently in the process of seeking new licenses for their Hells Canyon (Brownlee, Oxbow, Hells Canyon) and Swan Falls projects.

Habitat Protection and Enhancement

The IDFG believes the most effective approach to maintaining healthy and viable white sturgeon populations within their native range is to protect stronghold populations and habitat, and as is feasible, to improve habitat. However, attaining significant improvements in existing, degraded habitat conditions will prove challenging. For instance, improvements in water quality will be both costly and long-term. Future hydropower operations at Snake River dams in Idaho have largely been determined by the FERC in new licenses issued in the recent past, so the ability to affect significant operational changes to benefit sturgeon are remote. Adequate flows and the timing of flows are critical to perpetuate spawning activities and promote egg incubation and growth of larval and juvenile white sturgeon. In the Bliss and Hells Canyon reaches of the Snake River, where stronghold wild populations exist, the IDFG will promote protection of habitat conditions in these areas. The IDFG will work with state and federal regulatory and management agencies and the Nez Perce Tribe to optimize white sturgeon spawning success, incubation, and juvenile rearing conditions. This is especially critical with core conservation populations that are supported entirely by natural recruitment. IDFG staff will continue to provide technical support and input to state and federal regulatory agencies regarding land management, water quality, hydropower operations, and flow management.

Population Monitoring

Intensive assessments of white sturgeon abundance and size structure will occur in each reach at approximately five to ten-year intervals. Idaho Power Company, as a condition of federal licenses for their hydropower facilities, will conduct these scheduled surveys in consultation and/or cooperation with IDFG. Additional sampling by IDFG and Idaho Power Company will occur as needed. Additionally, the Nez Perce Tribe will continue assessing the white sturgeon population in the Hells Canyon reach and Salmon River. The IDFG and the Nez Perce Tribe have a data sharing agreement in place. Standard methods to

collect white sturgeon will include setlines, hook and line, gillnetting, and trawling. White sturgeon egg deposition and reproductive success may be monitored in some reaches using egg mats, bottom trawls, or other methods as they are developed. Methods to sample larvae and juveniles will be refined to better document conditions that influence reproduction. Abundance estimates will be based on multiple mark-recapture efforts in each reach, and size structure in each reach will be described using the total catch from standard sampling gear. Radio telemetry may be used to evaluate habitat use, spawning movements, to monitor translocated fish, or to assist in angling-related mortality assessments.

Standardized sampling methods are important so that descriptions of abundance and size structure can be compared across time or among reaches. Within a reach, changes in abundance or size structure would be a result of changes in recruitment, growth, or survival and would require further investigation to determine the cause.

Evaluating Fishing-related Mortality

The effects of catch-and-release angling on white sturgeon populations are largely unknown. Even low levels of fishing-related mortality could impact population size structure and abundance, especially in reaches with poor habitat and low reproductive success, or where fish are concentrated below dams. White sturgeon angling effort appears to be increasing throughout the Snake River, but there has been no structured fishery monitoring so total effort and catch is largely unknown except for the intensively fished reach immediately below C.J. Strike Dam.

To assess losses associated with non-consumptive fisheries in Idaho, we propose to collaborate with other agencies, Idaho Power Company, and the Nez Perce Tribe. A greater challenge is to be able to effectively characterize the indirect and cumulative impacts of a strictly catch and release fishery on long-term survival, growth, productivity, and population viability (ODFW staff, personal communication).

The IDFG proposes to examine white sturgeon angling effort and catch in relation to population status and trends for key river reaches. The C.J. Strike reach was surveyed during 2007-2008 due to intensive angling pressure in a relatively short river section, but other reaches such as Bliss and Hells Canyon will be assessed as well. Angling effort and catch data will be collected by traditional creel survey or by some form of mandatory reporting for sturgeon anglers.

Fishing Regulations, Angler Education, and Enforcement

The IDFG will continue to provide barbless hook, catch-and-release fishing opportunity for Snake River white sturgeon. To minimize angling-related

stress and mortality, anglers are prohibited from removing white sturgeon from the water once caught. Given the current status and productivity of wild populations, no harvest opportunity is expected to be offered for the foreseeable future. Other than the above fishing regulations, there are no other gear restrictions required when fishing for Snake River white sturgeon. In the state fishing rules, the IDFG suggests the use of specific terminal tackle but we do not currently require the use of such tackle (e.g., circle hooks, monofilament vs. braided line). Additional fishing restrictions are an option to be considered by the IDFG depending on population surveys, continuing research on mortality sources, and policy direction from the Idaho Fish and Game Commission.

Sport fishing will continue where white sturgeon were introduced outside their historical distribution in the Snake River below American Falls Dam and in Idaho Falls. Although these fisheries are supported by hatchery white sturgeon, the same statewide regulations apply. In the future, the IDFG may consider offering limited harvest fisheries in hatchery-supported reaches.

The IDFG will continue to develop and distribute information on white sturgeon status and fishing opportunity in Idaho and will promote angling and fish handling techniques that minimize fishing-related mortality. Sturgeon angling tips, recommended terminal tackle, and proper handling methods are provided in the fishing rules proclamation book. The IDFG will also produce a video on white sturgeon biology, status, and fishing techniques for use at sports shows, fairs, and other public venues.

IDFG conservation officers will continue to educate the public and ensure compliance with regulations on white sturgeon fisheries. Highest priority for these efforts will be on reaches designated as Core Conservation Populations. Other reaches (Conservation Populations and Sportfish Populations) will receive focused enforcement effort as needed.

Translocation

Construction of Snake River dams has created nine artificial reaches with little or no genetic exchange among populations. Translocation is the capture and transport of wild white sturgeon from one reach to another. Translocation objectives may vary on a reach by reach basis. Theoretically, adult fish could be moved from reaches that lack spawning and larval rearing habitat into reaches where natural spawning can be successful (e.g., from the C.J. Strike reach to the Bliss reach). Surplus juvenile fish might be collected from productive reaches and used to supplement populations where little or no recruitment exists. Such translocations would artificially restore some degree of connectivity and potentially genetic exchange among reaches. Any translocation efforts will include a comprehensive evaluation plan to document survival, movement, growth, diseases, and reproductive activities. The IDFG will consult with state fish and wildlife agencies (Oregon, Washington) and the Nez Perce Tribe if donor

fish are identified from river reaches along shared state boundaries. However, the IDFG does not anticipate translocating white sturgeon from the Hells Canyon reach of the Snake River.

Conservation Aquaculture

Conservation of wild, self-sustaining populations of white sturgeon is the IDFG's top priority. Core Conservation Populations will be strictly managed for natural recruitment. The IDFG will not stock, nor will it permit other entities to stock hatchery reared white sturgeon into Core Conservation Populations. In reaches where natural recruitment is absent or inadequate, hatchery supplementation is one management option to maintain population abundance and diversity and provide fishing opportunity. Hatchery-reared white sturgeon were stocked in the late 1980s on an experimental basis in several Snake River reaches. White sturgeon culture techniques are well developed and released hatchery fish appear to survive and grow at rates comparable to wild fish. One concern with hatchery supplementation is the relatively low number of broodstock fish typically available for hatchery production. Most of the hatchery offspring in a given year are siblings or half-siblings, and high stocking rates would result in populations with relatively little genetic variation. The long-term genetic risks of hatchery supplementation will need to be carefully weighed against the shorter term risks of population collapse. Any future supplementation will only involve Snake River F_1 generation fish. As with other management alternatives, supplementation will be evaluated on a reach-by-reach basis, and any supplementation program will include broodstock (genetic) objectives and an evaluation component to monitor survival, movement, and growth of stocked fish.

A conservation aquaculture program was proposed by Idaho Power Company as part of their White Sturgeon Conservation Plan (Idaho Power Company 2005). The IDFG will take a cautious approach to conservation aquaculture for white sturgeon, but we will consider such a program where appropriate. The IDFG envisions a conservation aquaculture program involving Idaho Power Company and the College of Southern Idaho located in Twin Falls, Idaho. A cooperative agreement would have to be developed and signed by the parties prior to development of an aquaculture program for Snake River white sturgeon. The IDFG will consider white sturgeon supplementation only after the following conditions have been met:

- Careful consideration of the impacts on naturally producing populations both locally and in downstream reaches of the Snake and Columbia rivers;
- Available habitat, food sources, hydrological conditions, and water quality have been improved or restored, and
- To the extent possible, hydropower operation constraints and other limiting environmental factors have been addressed.

Prior to making any decision on an aquaculture program for Snake River white sturgeon, the IDFG will coordinate with the appropriate stakeholders, most notably adjacent state fish and wildlife managers and the Nez Perce Tribe. There are a number of uncertainties associated with a conservation aquaculture program. Of particular concern is downstream drift of stocked fish into Core Conservation Populations and the long-term risks to genetic integrity. Based on past practices of using very few adult broodstock, closely related progeny, and large numbers stocked with documented downstream movement, there is reason for anxiety. That is why the IDFG is proposing conservation aquaculture as a potential tool to be used only after very careful deliberation involving key stakeholders.

Commercial Aquaculture

The IDFG will work with the Idaho Department of Agriculture to monitor commercial aquaculture operations with respect to importing non-native white sturgeon in their hatcheries (e.g., Sacramento River, CA). Sturgeon are regularly purchased by private pond owners for ornamental purposes in the Magic Valley and Southwest regions of the IDFG.

Mortality Monitoring

Anglers and other river recreationists occasionally observe injured or dead white sturgeon in the Snake River or its reservoirs. Assessing the cause of adult mortalities over time will help describe the relative importance of environmental and disease constraints, hydropower impacts, angling-related effects, illegal harvest, and other mortality sources. The IDFG and Idaho Power Company have established protocols for investigating, examining, and collecting appropriate samples from mortalities whenever possible since we cannot investigate all reported sturgeon mortalities. Examinations may range from a simple field necropsy to a more complete physical and pathological assessment.

Idaho Power Company White Sturgeon Conservation Plan

Idaho Power Company submitted a Snake River White Conservation Plan to the Federal Energy Regulatory Commission (FERC) in August 2005 (Idaho Power Company 2005). In May 2006, the FERC approved conservation measures for four segments of the Snake River including Shoshone Falls, Upper and Lower Salmon Falls, Bliss, and C.J. Strike. Approval of conservation measures for Swan Falls and Hells Canyon are pending awaiting the FERC's issuance of new licenses for these projects. The conservation plan is a guidance document meant to assist with implementation of protection, mitigation, and enhancement measures for Snake River white sturgeon populations impacted by Idaho Power Company's hydroelectric projects. The geographic scope of the conservation plan includes the Snake River from Shoshone Falls downstream to Lower Granite Dam.

IDFG participates in an ongoing White Sturgeon Technical Advisory Committee that was initiated by IPC beginning in 1991. The purpose of this committee is to provide technical guidance to IPC for white sturgeon research activities during its relicensing efforts, as well as implementing protection, mitigation, and enhancement measures. Representatives from state and federal agencies and Indian tribes have participated on this committee to review study results and resource issues affecting white sturgeon. During the process, information presented to the committee included: 1) status surveys of white sturgeon populations, 2) limiting factors for each reach, and 3) modeled results of a population viability analysis specific to reaches of the Snake River (Idaho Power Company 2005).

An important component of this white sturgeon conservation plan is development of a conservation aquaculture program. Conservation aquaculture has been implemented for the Kootenai River white sturgeon, a federally listed species (USFWS 1999). Hatchery-spawned and reared offspring from wild adults could be used as a potential tool to bypass current recruitment bottlenecks and replace failed natural recruitment (Idaho Power Company 2005). While this program may prove effective for restoring juvenile and adult abundances, there are no guarantees that conservation aquaculture could promote natural recovery (Idaho Power Company 2005). The White Sturgeon Technical Advisory Committee concluded that a conservation aquaculture program should not be developed without first thoroughly exploring the benefit of habitat restoration actions and without evaluating the genetic implications of hatchery supplementation on wild stocks of white sturgeon.

Snake River White Sturgeon Populations and Management (Historical Distribution)

This section of the white sturgeon management plan describes the IDFG management category by river reach (Table 1), historical and contemporary research, population status, and limiting factors. Management objectives are provided for each reach of the Snake River.

Table 1. Management categories by river reach for Snake River white sturgeon populations from Shoshone Falls downstream to Lower Granite Dam.

River Reach	Management Category
Snake River at Idaho Falls*	Sportfish
American Falls Dam to Lake Walcott*	Sportfish
Shoshone Falls to Upper Salmon Falls Dam	Conservation
Upper Salmon Falls Dam to Lower Salmon Falls Dam	Conservation
Lower Salmon Falls Dam to Bliss Dam	Conservation
Bliss Dam to C.J. Strike Dam	Core
C.J. Strike Dam to Swan Falls Dam	Conservation
Swan Falls Dam to Brownlee Dam	Conservation
Brownlee Dam to Oxbow Dam	Conservation
Oxbow Dam to Hells Canyon Dam	Conservation
Hells Canyon Dam to Lower Granite Dam	Core

*Outside historical range of Snake River white sturgeon.

SHOSHONE FALLS TO UPPER SALMON FALLS DAM

Management Category: Conservation Population

This reach represents the uppermost natural distribution of white sturgeon in the Snake River. Upstream reservoir development and irrigation withdrawals and return flows have substantially altered both water quality and quantity compared to historical conditions. Flows passing over Shoshone Falls and through this reach are largely dependent on the water quantity passing Milner Dam (40 rkm upstream). In most years with average or below average runoff, the high spring flows are captured and stored upstream. In higher water years, the hydrograph is bimodal. Stream flow increases in late spring, decreases as irrigation withdrawal occurs, and then increases again in high water years as snow melt in the upper Snake River causes flows to exceed storage capacity and irrigation delivery. During the irrigation season, all of the water in the river can be diverted for irrigation purposes.

There are several large rapids in this reach that can provide adequate spawning velocities, but high spring flows to disperse eggs and larvae beyond the spawning areas are absent in most years. The altered hydrograph can also remove or shift the peak spring flows out of synchronicity with suitable spawning temperatures.

Between Shoshone Falls and the town of Buhl, Idaho, several tributaries and springs contribute about 56 cubic meters per second to the Snake River. During the irrigation season, most of the tributary inflow is irrigation returns. Excessive nutrients have increased summer algae and macrophyte production to the point that nighttime dissolved oxygen levels can decline to near zero parts per million in some areas. Most of the river recharge occurs downstream of Buhl near the lower end of this reach where the Thousand Springs and Banbury Springs complexes contribute between 142-170 cubic meters per second.

Lukens (1981) completed the first comprehensive survey of white sturgeon in this reach in 1980, nine years after the no-harvest rule was implemented. He estimated that 14 white sturgeon of wild origin inhabited this river reach and none were less than 92 cm total length (TL). At that time the population was severely depressed with no evidence of recent recruitment. A total of 1,588 white sturgeon of hatchery origin were released in this reach from 1990 to 2000 (Table 2). In 2001, Idaho Power Company surveyed this reach (Lepla et al. 2002). Estimated total abundance of white sturgeon increased to 777 (95% CI 574-1201), of which 94% were hatchery fish. A total of only 13 wild fish were captured during this effort, with only two less than 80 cm TL. An estimated 47 wild fish were present in the reach. The low overall abundance of wild fish and the near absence of small wild sturgeon in both studies indicate that little if any recruitment had occurred in the wild population for over 20 years.

Table 2. Hatchery-reared white sturgeon stocked in the Upper Salmon Falls Dam to Shoshone Falls reach.

Year Released	Brood Year	Number	Mean TL (cm)
1990	1988	171	64-68
1991	1990	530	28-33
1994	1993	352	38-46
1998	1997	158	35
1999	1997	120	35
2000	unknown	254	unknown

The lack of wild recruitment is likely due to the low abundance of adult fish coupled with the lack of suitable spawning, incubation, and larval rearing habitats. The lack of suitable habitat is again a combination of inadequate flows and water quality (USEPA 2001). Of the 12 water years (1988-2000) analyzed by IPC, six (50%) were below normal, 25% normal, and 25% above normal.

Even in normal or high water years, the timing of increasing flows in concert with optimal spawning temperatures may not be suitable for successful spawning.

Supplementation with hatchery-reared white sturgeon bypasses the habitat constraints affecting spawning, incubation, and larval rearing. In this reach, juvenile hatchery fish appear to have survival rates comparable to other viable wild populations found in the Bliss and Hells Canyon reaches (Lepla et al. 2002). It remains unclear whether hatchery fish can successfully spawn and create a self-sustaining population. Information gathered during a 2008 stock assessment in this reach confirmed that the hatchery fish are developing normally and spawning (Idaho Power Company, unpublished data). Additional effort is underway to document natural recruitment, or the lack of recruitment, which will help determine appropriate management strategies for the future.

Due to past stocking practices and high survival resulting in few families being represented, natural recruitment in this reach may decrease genetic diversity (Idaho Power Company 2005). Idaho Power Company has recently contracted with the Genomic Variation Laboratory at the University of California Davis to assist the White Sturgeon Technical Advisory Committee in development of a genetic monitoring plan for Snake River white sturgeon.

The current catch and release sport fishery for white sturgeon in this reach is considered fair, with most of the angling pressure occurring below Kanaka Rapids and Auger Falls. There are no estimates available for total angling effort or catch.

Management Objectives

1. Increase abundance of white sturgeon

    a. The white sturgeon population in this reach is considered to be below carrying capacity. In cooperation with Idaho Power Company, the population will be intensively evaluated at 5-year intervals. Standardized sampling methods will be used to describe trends in abundance, size structure, fish condition, and recruitment.

    b. If natural recruitment of juvenile white sturgeon occurs and is considered adequate, no additional supplementation is warranted, and the population will be allowed to increase naturally over time. If no recruitment or inadequate recruitment is documented, additional but limited supplementation may be considered to maintain the population and fishing opportunity. Supplementation could occur via translocation or conservation aquaculture.

c. If a decision is made to pursue conservation aquaculture, it will be done in concert with the appropriate stakeholders and only after careful deliberation. All hatchery-reared white sturgeon will be externally marked and PIT tagged to differentiate them from wild fish.

2. Maintain or increase fishing opportunity for white sturgeon

a. Evaluate angler effort, catch, and satisfaction.

b. Assess effects of catch-and-release angling on the white sturgeon population and evaluate regulation changes if needed.

c. Promote sturgeon angling and proper fish handling techniques.

SHOSHONE FALLS TO UPPER SALMON FALLS DAM

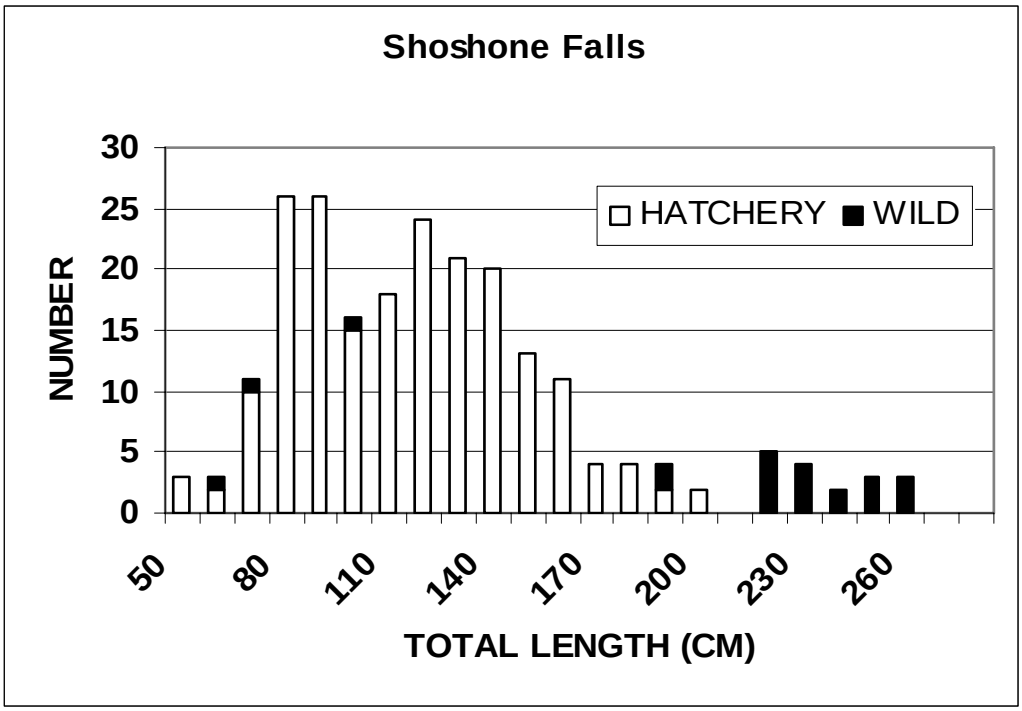
Snake River

47 kilometers of free flowing river
7 kilometers of reservoir
44 kilometers of sturgeon rearing habitat

2001 Abundance and Size Structure

(IDFG and IPC file data)

Population estimate = 777 white sturgeon



UPPER SALMON FALLS DAM TO LOWER SALMON FALLS DAM

Management Category: Conservation Population

The Lower Salmon Falls to Upper Salmon Falls reach is part of a three dam complex comprised mostly of reservoir habitat with the exception of a 1 km by-pass of Dolman Island. Flows in the braided bypass channels often are less than 14 cubic meters per second. A survey by IDFG in 1979-81 found no white sturgeon. Lukens (1981) concluded no spawning habitat was available for white sturgeon.

The relatively close spacing between dams (11 km) limits the amount of available free flowing habitat and the short distance between dams is conducive to downstream losses of early life history stages through egg or larval drift. Establishment of a self-sustaining white sturgeon population in this section is very unlikely under these conditions. Emigration of white sturgeon into this reach could be expected as densities in the upstream segment increase. In fact, in a 2004 population survey, Idaho Power Company captured 19 hatchery white sturgeon originally stocked upstream in the Shoshone Falls to Upper Salmon Falls reach (Ken Lepla, Idaho Power Company, personal communication).

Within this impounded reach there may be some potential to develop a limited sport fishery supported by hatchery-reared white sturgeon. Appropriate stocking rates are unknown, but based on observed white sturgeon abundance in free-flowing sections this reach would be expected to support up to 300-400 fish (all age classes combined) with approximately 30-40 adult fish (> 183 cm). A stocking program, if pursued, would include a thorough evaluation of fish survival and growth, downstream entrainment rates, genetic risks to downstream populations, and angler effort and catch.

Management Objectives

1. If a decision is made to pursue conservation aquaculture, it will be done in concert with the appropriate stakeholders and only after careful deliberation. All hatchery-reared white sturgeon will be externally marked and PIT tagged to differentiate them from wild fish.

2. Based on evaluation, develop recommendations for long-term management strategies. Poor survival, low angler success, or high emigration rates would trigger termination of the stocking program.

3. Conduct periodic (every 3-5 years) within and below this reach to assess survival, growth, condition, and movement of stocked fish.

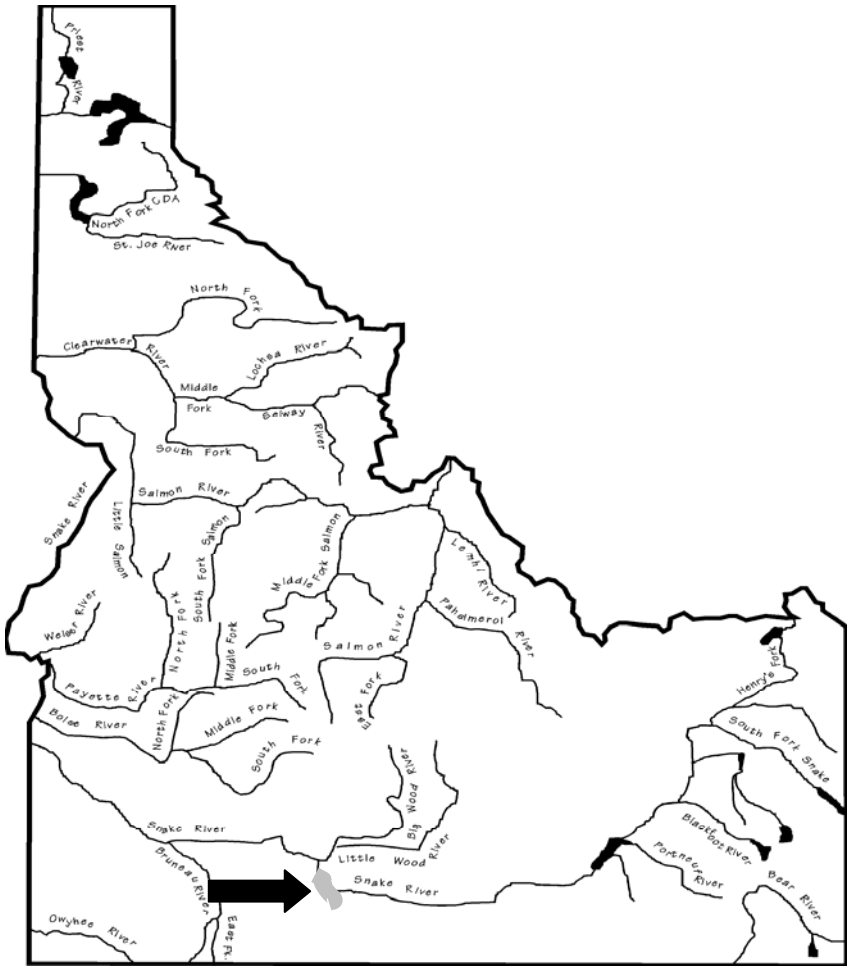
4. Use spot creel surveys or other techniques (e.g., mail survey) to assess angler participation, catch rates, and satisfaction.

UPPER SALMON FALLS DAM TO LOWER SALMON FALLS DAM

Snake River

1 kilometer of free flowing river
10 kilometers of reservoir
11 kilometers of sturgeon rearing habitat

Population estimate = 21 (95% CI 19-27); Idaho Power Company 2004



LOWER SALMON FALLS DAM TO BLISS DAM

Management Category: Conservation Population

Between Lower Salmon Falls Dam and Bliss Dam, the river canyon is narrow with bedrock and rubble lining a number of deep pools and rapids. The Malad River, formed below the confluence of the Big and Little Wood rivers, enters in this section. For 13 km below Lower Salmon Falls Dam, the river is free-flowing with relatively high gradient (2m/km) and provides white sturgeon spawning habitat even at the lowest flows (Cochnauer 1983). Bliss Dam, constructed in 1950 at the site of a natural falls, impounds the lower 8 km of the reach.

Three studies have concluded few wild sturgeon remain between Bliss Dam and Lower Salmon Falls Dam. In the first study, Lukens (1981) reported capturing 11 wild sturgeon in the Lower Salmon Falls tailrace. The population was severely depressed with little evidence of recent recruitment.

Between 1989 and 1994 a total of 2,612 hatchery-reared, yearling white sturgeon were stocked below Lower Salmon Falls Dam to improve abundance and provide a sport fishery (Table 3). The released white sturgeon were the offspring of wild fish captured from the Bliss reach and held for spawning at College of Southern Idaho (CSI) Hatchery in Twin Falls, Idaho.

In 1993 Lepla and Chandler (1995b) sampled 38 white sturgeon throughout this reach, of which five were wild and 33 were hatchery-reared. Wild fish ranged from 60 to133 cm TL and hatchery-reared white sturgeon ranged from 40 to 90 cm TL.

Idaho Power Company conducted another stock assessment in this reach March through August 2004 and sampled 44 white sturgeon, 9 of which were wild and 35 were hatchery origin. With the exception of two fish, all of the white sturgeon were sampled in the vicinity of the Lower Salmon Falls tailrace. Wild fish ranged from 96 to 216 cm TL and hatchery-reared white sturgeon ranged from 64 to 231 cm TL. Based on mark-recapture sampling, Idaho Power Company estimated the abundance of white sturgeon > 70 cm (combined wild and hatchery) to be 83 (95% C.I. 53-196) (Lepla et al. 2004).

Based on observed annual survival rates (S=0.88) for white sturgeon in other river sections, more hatchery fish should have been available for capture in 1993. Discounting the wild segment of the population, the hatchery segment should have totaled about 1,500 white sturgeon during the 1993 study. Because of the small number of recaptures, no population estimate was possible. However in 1991-1993 (Lepla and Chandler 1995b) also captured 15 hatchery-reared white sturgeon below Bliss Dam, all of which were stocked in the river section above Bliss Dam. These fish likely passed through the turbines as no

spill events occurred during this time period (Ken Lepla, Idaho Power Company, personal communication).

Table 3. Hatchery reared white sturgeon stocked in the Lower Salmon Falls Dam to Bliss Dam reach.

Year Released	Brood Year	Number	Mean TL (cm)
1989	1988	2195	33-48
1991	1990	202	33.3
1994	1993	176	33-48

The short river reach limits the available habitat and is likely conducive to high downstream losses of white sturgeon eggs, larvae, and juveniles (Jager et al. 2001). Restoring an abundant self-sustaining population does not appear feasible under existing conditions.

Although it appears many stocked fish dispersed downstream to the Bliss reach, enough fish remained to create a significant fishery immediately below Lower Salmon Falls Dam. With very limited natural recruitment expected in this reach, maintenance of white sturgeon populations and fishing opportunity would be reliant on periodic supplementation with hatchery fish or by translocating wild fish from other reaches. Downstream drift into this reach may also occur, especially if the expanding adult population in the Shoshone Falls reach can produce new wild recruits. Appropriate stocking rates or carrying capacity are unknown, but based on observed white sturgeon abundance in free-flowing sections this reach would be expected to support up to 630 fish (all age classes combined) with approximately 60 adult fish (>183 cm). Based on downstream drift of hatchery white sturgeon into the Bliss Reach from a previous release, which is managed as Core Conservation Population, the IDFG will carefully deliberate prior to considering the development of a conservation aquaculture program.

Management Objectives

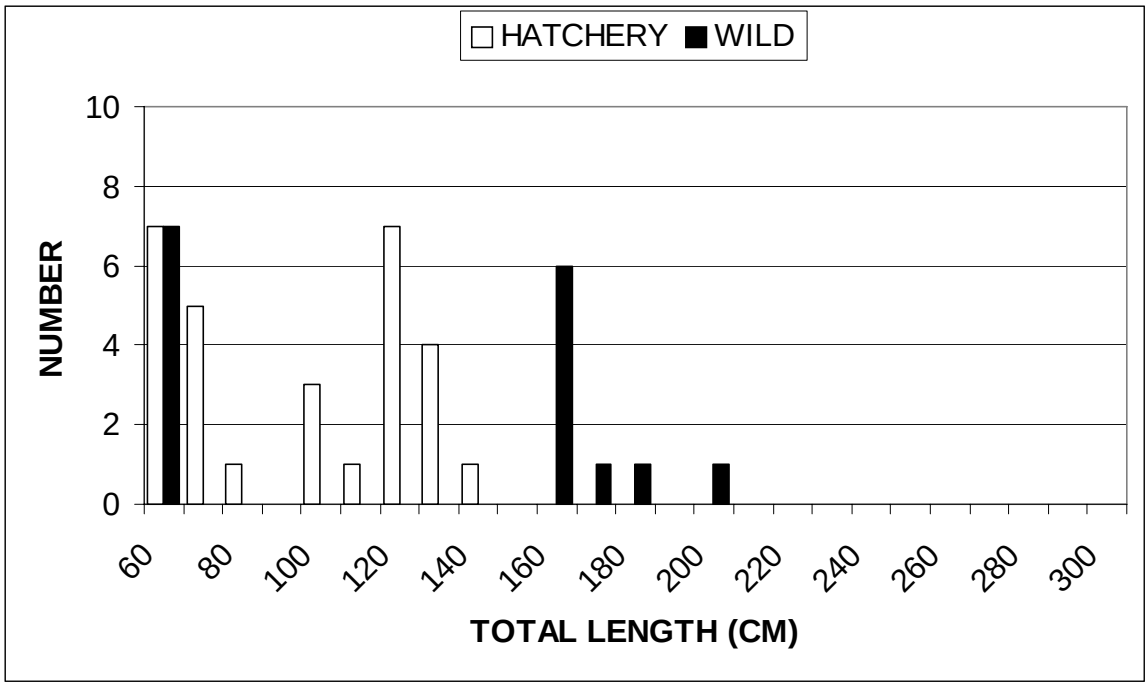
1. If a decision is made to pursue conservation aquaculture, it will be done in concert with the appropriate stakeholders and only after careful deliberation. All hatchery-reared white sturgeon will be externally marked and PIT tagged to differentiate them from wild fish. Consider tranlocations of adults or juveniles from other areas or consider the utility and risks associated with a conservation aquaculture program.

    a. Use spot creel surveys or other techniques (e.g., mail surveys) to assess angler participation, catch rates, and satisfaction.
    b. Conduct periodic (every 3-5 years) within and below this reach to assess survival, growth, condition, and movement of stocked fish.

LOWER SALMON FALLS DAM TO BLISS DAM

Snake River
- 13 kilometers of free flowing river
- 8 kilometers of reservoir
- 21 kilometers of sturgeon rearing habitat

Population estimate = 83 fish > 70 cm (95% CI 53 -196) (Lepla et al. (2004)



Population structure 1993 (Lepla and Chandler 1995b).

BLISS DAM TO C.J. STRIKE DAM

Management Category: Core Conservation Population

There are 106.7 km of free-flowing Snake River and reservoir between C.J. Strike Dam and Bliss Dam. C.J. Strike Reservoir is 38 km long. The reach includes over 16 km of flowing river in the canyon area from Bliss Dam to Clover Creek, located near the community of King Hill. The river falls about 1 m/km through this canyon reach. It is typically fast, deep (10 m) run-type habitat with intermittent pools and riffles with several pools up to 15 m deep.

For about 53 km below Clover Creek, the river flows through relatively flat terrain with lower gradient (0.6 m/km) down to the C.J. Strike Pool. The run-type habitats in this reach support abundant aquatic vegetation in the summer. There are a few pools 8-10 m deep and one pool over 20 m deep.

Historically, many of the larger white sturgeon (272-363 kg) harvested in Idaho came from this section, and this reach still supports the most abundant and productive population upstream from Hells Canyon Dam (Cochnauer 1983). In 1979-81, Cochnauer (1983) estimated that 2,192 sturgeon ranging between 60-270 cm TL inhabited the river between Bliss and C.J. Strike dams. Population size structure included 68% juvenile white sturgeon < 92 cm TL, 30% between 92-183 cm TL, and 2% > 183 cm TL.

Sport anglers caught an estimated 389 sturgeon in 1990 of which 35% were < 92 cm TL.

By 1991-93, about 20 years after catch-and-release rules were implemented, the white sturgeon population had increased to 2,662 fish over 60 cm (Lepla and Chandler 1995a). In this study, juvenile white sturgeon < 92 cm TL comprised only 2-6% of the catch. The decline in abundance of small fish corresponded with an unusually prolonged period of drought and below normal Snake River flows for eight consecutive years (1987-1994). A 2000 survey (Ken Lepla, Idaho Power Company, personal communication) found the number of wild juvenile white sturgeon (< 92 cm TL) had increased to 45% of the catch. This increase in abundance of juvenile sturgeon followed several years (1995-1998) of normal or above normal spring run-off which created favorable hydrologic conditions during spawning months.

A 2005-2006 survey in this reach suggested a continued increase in white sturgeon abundance over nearly 30 years of monitoring. Idaho Power Company captured 648 white sturgeon (92% wild, 8% hatchery origin), 60 of which were recaptures yielding an estimate of 3,013 fish > 70 cm TL, although again the proportion of smaller fish (< 92 cm) was less than 5% of the total catch (Idaho Power Company 2007).

Instream flow studies conducted below Bliss Dam have shown load-following operations can reduce incubation and larval weighted useable area (WUA) by up to 30% during low and median water years while reductions in spawning WUA were less (8-10%) (Brink and Chandler 2000). The estimated age structure of white sturgeon sampled in 2000 below Bliss Dam indicated that natural recruitment of white sturgeon was poor during below normal water years (1988, 1989, 1990) when aggressive load following operations occurred (Brink and Chandler 2000). In years with similar hydrology but limited or no load following (1992, 1993, and 1994), higher recruitment of white sturgeon occurred.

Recent young-of-year indexing efforts by Idaho Power Company are strengthening the relationship between year-class strength and hydrologic year type and highlight the importance of the spring freshet and also the age at length relationships for Snake River white sturgeon (WSTAC Meeting Minutes, February 28, 2008; provided by Idaho Power Company). For instance, a strong year class of white sturgeon was produced in 2006 (wet year) even with load-following occurring after the spring freshet. A total of 233 white sturgeon (age 0 and age 1) from the 2006 year class were captured with trawl and small mesh sampling. By contrast, low flow years in 2007-2008 have produced no detectable recruitment of age 0 white sturgeon with similar gear. Run-of-river operations at Bliss during low flow years (2004 and 2005) also did not produce an abundance of young white sturgeon (Idaho Power Company 2007). Magnitude of water year appears to be a primary factor that influences year-class strength (Ken Lepla, Idaho Power Company, personal communication). Because of this information collected by Idaho Power Company, the IDFG believes that state water managers should be informed of the apparent relationship between year class strength of white sturgeon and magnitude of water year. If significantly more upstream water development occurs that impacts spawning season flow regimes, this could impact white sturgeon reproductive success in the middle Snake River upstream of Brownlee Reservoir.

During low and median water years 23%-35% of the bottom 2 m layer of the lower end of C.J. Strike pool exhibits depressed dissolved oxygen and can be lethal to white sturgeon (Lepla and Chandler 2001).

The Bliss Dam to C.J. Strike Dam reach of the Snake River supports one of the two most productive populations of white sturgeon in Idaho. Based on positive changes in population composition, there appears to be successful reproduction and overall growth of the populations. The present population size is over 3,000 white sturgeon > 70 cm TL, but recruitment appears variable and closely correlated with springtime Snake River flows.

As mentioned earlier, this population appears to be the source of fish below C.J. Strike Dam. Based on tag returns, it appears that approximately 2% of the population emigrates downstream annually.

Management Objectives

White sturgeon in the Bliss to C.J. Strike reach will be managed as a Core Conservation Population.

1. Manage as a self-sustaining population supported by natural recruitment with no influence from hatchery-reared fish.

    a. The IDFG will not stock, nor will we permit other entities to stock hatchery-reared white sturgeon into this reach.
    b. In collaboration with IPC, adult white sturgeon of wild origin may be translocated into this reach from adjacent reaches where spawning and larval rearing habitat is lacking. Such translocations will be limited in scope, and be accompanied by monitoring activities to assess survival, movement, and spawning behavior.
    c. In collaboration with IPC, wild juvenile white sturgeon may in some years be collected and translocated to other Snake River reaches where natural recruitment is poor and/or wild populations are depressed.

2. Maintain or increase catch-and-release fishing opportunity for white sturgeon.

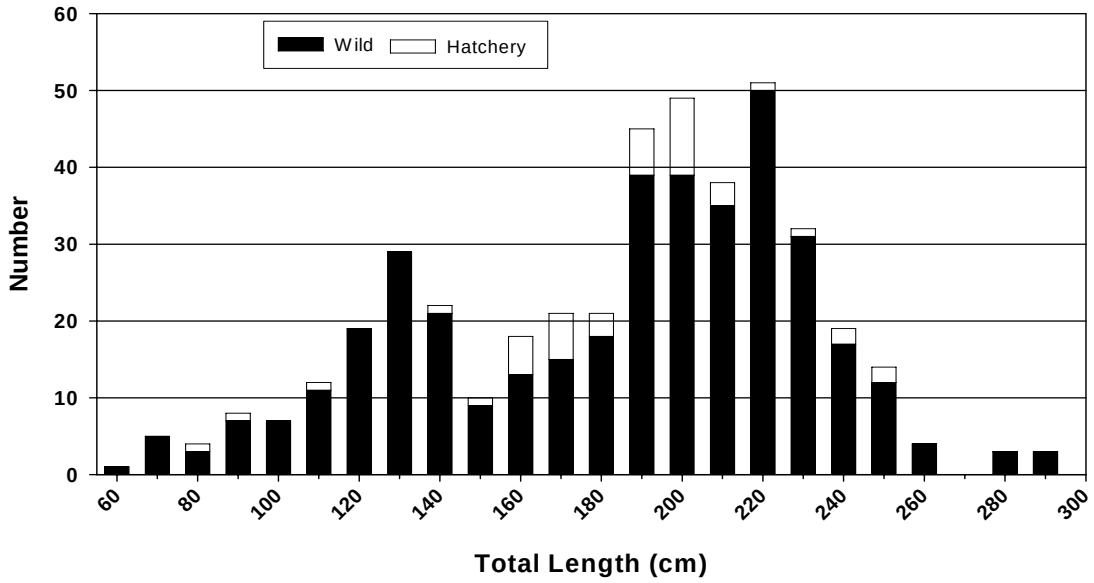
    a. Evaluate angler effort, catch, and satisfaction.
    b. Assess effects of catch-and-release angling on white sturgeon populations, and evaluate regulation changes if needed.
    c. Promote sturgeon angling and proper fish handling techniques to minimize angling-related mortalities.
    d. Promote targeted enforcement patrols in this reach.

3. In cooperation with Idaho Power Company, the population will be intensively evaluated at approximately 5-year intervals. Standardized sampling methods will be used to describe trends in abundance, size structure, fish condition, and recruitment. IPC will conduct annual indexing efforts targeting young-of-year and age 1 white sturgeon to better understand population recruitment trends, length at age relationships, and underlying limiting factors.

BLISS DAM TO C.J. STRIKE DAM

Snake River
- 67 kilometers of free flowing river
- 38 kilometers of reservoir
- 90 kilometers of sturgeon rearing habitat

Population estimate = 3,013 white sturgeon (as of 2006) > 70 cm TL (Idaho Power Company 2007)



Population abundance and structure in 2006 (Idaho Power Company 2007).

C.J. STRIKE DAM TO SWAN FALLS DAM

Management Category: Conservation Population

From the early 1900s to 1936, Swan Falls Dam constricted, but did not span the Snake River. Today Swan Falls Dam impounds water for 17 km upstream. The pool has a mean depth of about 2 m with a 365 ha surface area. The project is a load attenuating facility.

The C.J. Strike to Swan Falls reach has 40 km of free flowing water comprised mainly of low gradient shallow run habitat, island complexes, and a few deep pools. There are no rapids or narrow channels to create high velocity zones and turbulent upwelling often associated with staging and spawning areas (Lepla and Chandler 2001). Only during median or high water years is spawning habitat available and then only immediately below C.J. Strike Dam. There is no spawning habitat available at 141-283 cubic meters per second through the C.J. Strike Dam project (Lepla and Chandler 1997). Historically, it is unlikely white sturgeon used this low gradient section for spawning, but they may have reared in this section.

Cochnauer (1983) suggested that the small population of white sturgeon between C.J. Strike and Swan Falls dams was spawning-limited as fish less than 5 years of age were not captured. In addition, the population may have been declining since the early 1970s (Cochnauer et al. 1985). During the sampling period 1986-1987 fish ranged from 100 cm to 180 cm TL. In 1989 anglers documented that 20% of the catch in this reach were small fish < 91 cm TL. In 1990, sport anglers caught an estimated 181 sturgeon with 18% < 92 cm, 64 % 92-183 cm, and 18% > 183 cm TL.

Low abundance of white sturgeon < 92 cm TL was documented during 1979-81, 1994-1996 (Lepla and Chandler 1997), and during 2006-2007 surveys (Idaho Power Company, unpublished data). Lepla and Chandler (1997) estimated this reach had a population of 726 fish or 16 fish / km. In 2007, IPC estimated abundance of white sturgeon in this reach at 566 fish (95% C.I. 330-1,995; Ken Lepla, Idaho Power Company, personal communication). Although the total reach length is 57 km, most of this population is concentrated in the upper 13 km.

A 2001 survey conducted by IPC evaluated recruitment levels in response to normal and above normal flows in the middle Snake River. In contrast to a positive post-drought recruitment trend upstream in the population between Bliss and C.J. Strike dams, there was no similar response below C.J. Strike in the more favorable water years. There was no increase in the abundance of small sturgeon. The downstream movement (averaging 1.6% of the upstream population annually) of mid-size and larger white sturgeon from the Bliss-C.J. Strike reach is likely supporting the current population structure below C.J. Strike Dam.

Powerhouse-related mortalities have also occurred at C.J. Strike Dam. Since 1996, at least five sturgeon mortalities were reported as a result of turbine blade strike injuries as the fish entered the draft tube when units were off-line (Ken Lepla, IPC, personal communication). In 2000, Idaho Power Company began using compressed air blasts prior to unit start-ups in an effort to “clear” white sturgeon away from the turbine blades. Further modifications were completed in 2004 so that the turbine blades can be completely dewatered with

compressed air prior to turbine start-ups. Since these modifications, white sturgeon mortalities directly related to turbine strikes appear to have declined. Equipment malfunctions and/or human error may still make fish susceptible to turbine strikes, and Idaho Power Company continues to improve reliability of this system and to intensively monitor the tailrace during and after turbine start-ups.

From 2004-2007, about 25 adult white sturgeon mortalities have been reported in this reach. Most have occurred in late spring and most have been mature or maturing fish. When possible, the carcasses have been retrieved by IDFG or Idaho Power Company staff to determine the cause of death. Field necropsies and pathological examinations have not identified any consistent injuries or other factors associated with these mortalities. Recognizing that there may be more fish that go unreported, this is an alarmingly high rate of mortality which could impact this relatively small population if it continues. IDFG and Idaho Power Company have established a contact list to report white sturgeon mortalities in this and other river reaches, and will continue efforts to identify and address the causative factor.

Dissolved oxygen levels in the tailrace of C.J. Strike Dam have been recorded as low as 5.1 mg/l; however, intervals of low dissolved oxygen are brief, usually lasting less than a week.

The tailrace immediately below C.J. Strike Dam is an intensively used white sturgeon fishery. With good shoreline access and fish concentrated below the dam, anglers fish year-round and from spring through fall there is frequently fishing activity 24 hours a day. The IDFG initiated a year-long white sturgeon creel survey beginning in May 2007 and ending in April 2008 from C.J. Strike Dam downstream to the Grandview Bridge in an attempt to quantify angling effort and describe the average frequency of hooking and landing for fish in this reach. We provided 1,282 sturgeon fishing report cards to 433 individual anglers. We received usable information from 90% of those cards. Across the entire year, the average catch rate was one fish per 20 hours of effort. However, the catch rate varied considerably by month. Approximately 37,000 hours of fishing effort were expended for white sturgeon between C.J. Strike Dam and the Grandview Bridge. The vast majority of effort was by bank anglers (85%) immediately below the dam. Combining effort and catch rate, 1,822 white sturgeon were caught and an additional 2,356 were hooked but not landed. Comparing these figures to estimated population size, we determined that an average white sturgeon in this reach was hooked 7.4 times per year. This figure includes a fish being landed 3.2 times and lost another 4.2 times per year.

The IDFG plans to monitor fishing effort periodically while Idaho Power Company will continue to monitor population abundance and structure. If fishing effort continues to increase or population levels continue to decline, other management options, including regulation changes, will need to be considered.

Because this population appears to be supported primarily by downstream drift, and because the reach does not appear to have adequate spawning and larval rearing habitat, reproductively mature fish have little chance to contribute to future populations. Translocation of a limited number of adults to productive reaches could promote genetic exchange between reaches. In 2006 and 2007, Idaho Power Company translocated a total of six mature, female white sturgeon (fitted with transmitters), originally captured from the C.J. Strike Dam to Swan Falls Dam reach, into the adjacent upstream Bliss reach. All of these fish showed evidence of spawning movement behavior. Several of these females were later captured by Idaho Power Company and were confirmed to have spawned.

Management Objectives

1. Increase abundance of white sturgeon

    a. The white sturgeon population in this reach has declined somewhat from 1997 to 2007 with current abundance estimated at 566 fish. While there is no established method to estimate carrying capacity, the IDFG believes this reach should support 700-800 white sturgeon (all age classes combined). In cooperation with Idaho Power Company, the population will be intensively evaluated at approximately 5-year intervals with the next scheduled survey around 2011. Standardized sampling methods will be used to describe trends in abundance, size structure, fish condition, and recruitment.

    b. If natural recruitment or downstream drift of juvenile white sturgeon occurs and is considered adequate, no supplementation will occur, and the population will be allowed to increase naturally. If no recruitment or inadequate recruitment is documented, hatchery supplementation and/or translocation of wild fish may be considered to maintain the population and fishing opportunity.

    c. If a decision is made to pursue conservation aquaculture, it will be done in concert with the appropriate stakeholders and only after careful deliberation. All hatchery-reared white sturgeon will be externally marked and PIT tagged to differentiate them from wild fish.

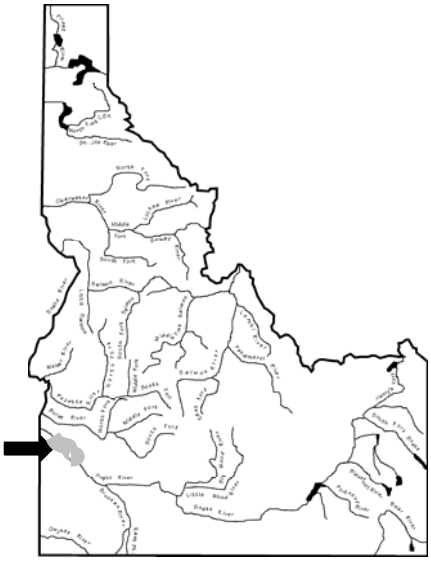
2. Maintain or increase fishing opportunity for white sturgeon

    a. Evaluate angler effort, catch, and satisfaction.

    b. Assess effects of catch-and-release angling on the white sturgeon population and evaluate regulation changes if needed.

c. Promote sturgeon angling and proper fish handling techniques.

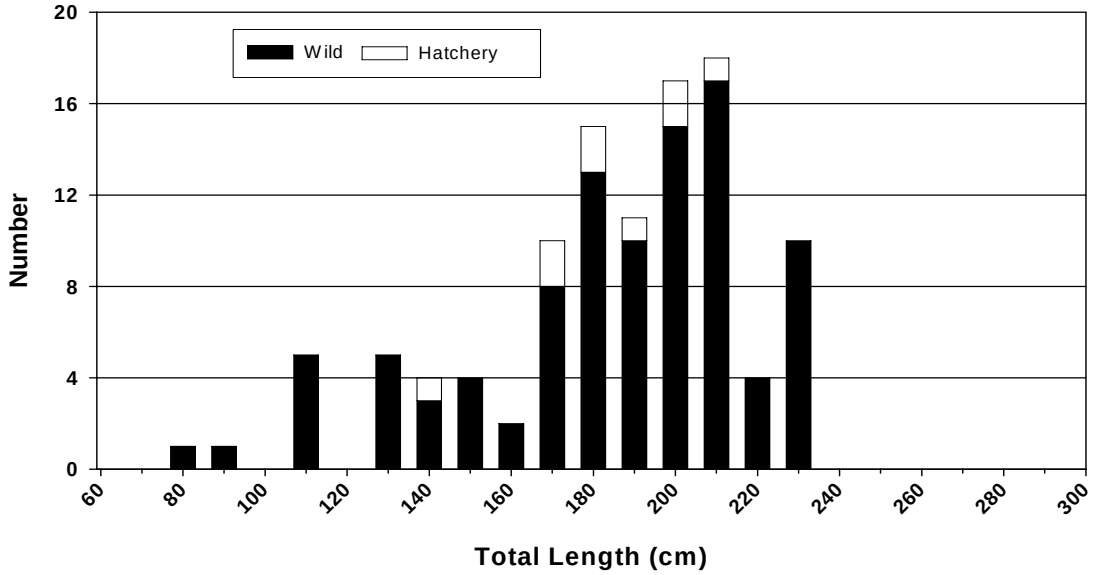
C.J. STRIKE DAM TO SWAN FALLS DAM



Snake River

40 kilometers of free flowing river
17 kilometers of reservoir
42 kilometers of sturgeon rearing habitat

Population estimate = 566 white sturgeon
(as of 2006-2007) > 70 cm TL



Population structure in the C.J. Strike Dam to Swan Falls Dam Reach in 2007 (Source Idaho Power Company unpublished data).

SWAN FALLS DAM TO BROWNLEE DAM

Management Category: Conservation Population

The river stretch from Swan Falls Dam to Brownlee Dam upstream is characterized by a canyon section in the upper 22 km with the river valley broadening in the lower 167 km. Brownlee Reservoir inundates approximately 88 km of riverine habitat. Swan Falls Dam is operated as a load attenuating facility.

Water quality in this reach has been severely degraded by nutrient loading from irrigation returns, and industrial and municipal sources (Harrison et al. 1999; Myers et al. 2001). The hydrograph is influenced by water storage and irrigation demands in the upper Snake River Basin. As with the other facilities, the hydrograph is bimodal and the high flows that trigger spawning may not coincide with suitable spawning temperatures.

Although the Swan Falls-Brownlee reach of the Snake River represents the longest river segment remaining, few white sturgeon reside in the reach. During a 1981 IDFG study, 1,105 setline hours were utilized to capture one sturgeon. A 1985 study yielded 18 sturgeon between 30 and 249 cm TL with a mean total length of 164 cm. During 1986-1988, IDFG personnel randomly fished the Swan Falls reach catching 29 sturgeon in 1986, 59 in 1987, and 2 in 1988. The size of these fish ranged from 60 cm to 398 cm TL with most (81%) greater than 183 cm TL. A 1992 study by IDFG (Kruse-Malle 1993) yielded only one sturgeon indicating abundance was low. A subsequent study in 1993 (Kruse-Malle and Moore 1995) yielded 13 white sturgeon. These fish ranged in total length from 90 to 213 cm TL, with only three fish 90-110 cm TL and the remainder >150 cm TL. All of these fish were caught within 11 km of Swan Falls Dam. No sturgeon were captured with 80 hours of gill net effort in upper Brownlee Reservoir.

During a 1996-1997 study by Idaho Power Company, catch rates and overall number of white sturgeon (n = 44) sampled was again very low (Lepla et al. 2001), and consisted primarily of larger and older individuals with few (4%) less than 80 cm TL. The majority (75%) of sturgeon was captured in the narrow canyon section near Swan Falls Dam while only 11 fish were sampled in Brownlee Reservoir. Abundance of sturgeon greater than 90 cm TL was estimated at 155 individuals or about 7 fish / rkm in the river segment from Swan Falls Dam to Walters Ferry.

During low flow years, low dissolved oxygen conditions that are lethal to sturgeon can comprise up to 80% of the bottom 2-m layer in Brownlee Reservoir. In worst-case scenarios, the transition area at the upstream end of the pool can

become anoxic throughout the water column (Lepla et al. 2001). In July 1990 lethal dissolved oxygen conditions (< 1 mg/l) combined with high water temperatures (25-26 ^{o}C) caused the deaths of an observed 28 adult white sturgeon in the upper end of Brownlee Reservoir (Grunder et al. 1993). All of these fish were greater than 115 cm TL, a reflection of the population structure in this reach.

Across multiple surveys in this reach, the size structure of white sturgeon consistently indicates little to no recruitment. The absence of small fish may partly be a result of the low number of adult fish or the altered flow regime, but poor water quality is likely the primary limitation to successful spawning, incubation, and recruitment. Appropriate spawning habitat is present in the upper reach near Swan Falls Dam but spawning activity has only been documented in one year. Idaho Power Company (Lepla et al. 2001) sampled three white sturgeon eggs/larvae in 1997. This indicates that at least one female sturgeon was mature and spawned in 1997. The one larval sturgeon collected in the upper end of Brownlee Reservoir may have been spawned one week earlier.

Although this reach includes over 200 km of free-flowing river, only the upper 22 km (Swan Falls Dam to Walters Ferry) is considered to be appropriate habitat for juvenile and adult white sturgeon. The remainder of the reach is generally shallow and low gradient with few pools, but also includes the upper end of Brownlee Reservoir which may provide some juvenile and adult habitat in most years. IDFG considers this population to be considerably below carrying capacity due to very poor in-reach recruitment and minimal downstream drift over the last 30 years. Further, water quality improvements are likely to take decades more to implement and provide measurable benefits. The IDFG believes that given these constraints, it is unlikely that white sturgeon populations will recover to self-sustaining levels in the foreseeable future, and more proactive efforts will be required to maintain populations and fishing opportunity.

Idaho Power Company proposes to conduct an assessment of degraded water quality impacts on early life stages of white sturgeon and recruitment success in the Swan Falls Dam to Brownlee Dam reach (Idaho Power Company 2005). The IDFG supports implementation of this measure to identify the mechanisms limiting recruitment within this sturgeon population. This is a necessary assessment prior to development of effective restoration measures.

The management objectives below focus on white sturgeon populations and fishing opportunity, but also on improving habitat conditions to address limitations to in-reach recruitment.

Management Objectives

1. Pending results of Idaho Power Company's water quality assessment, we will strive to increase abundance of white sturgeon.

a. The white sturgeon population in this reach is considered to be below carrying capacity. Based on available habitat in the upper 22 km, the IDFG believes this reach should support 600-700 white sturgeon (all age classes combined). This objective should be considered preliminary and subject to adjustment as monitoring data are available.

b. Population objectives may be achieved by translocating wild juvenile fish from other Snake River reaches, supplementation with hatchery-reared fish, or a combination of these approaches.

c. If a decision is made to pursue conservation aquaculture, it will be done in concert with the appropriate stakeholders and only after careful deliberation. All hatchery-reared white sturgeon will be externally marked and PIT tagged to differentiate them from wild fish.

d. In cooperation with Idaho Power Company, the population will be intensively evaluated at approximately 10-year intervals. Standardized sampling methods will be used to describe trends in abundance, size structure, fish condition, and recruitment.

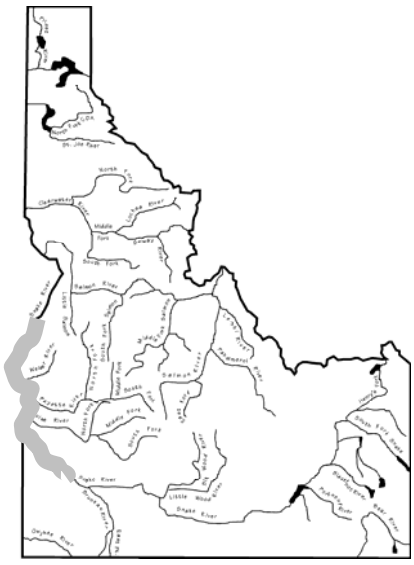
2. Maintain or increase fishing opportunity for white sturgeon

a. Evaluate angler effort, catch, and satisfaction.

b. Assess effects of catch-and-release angling on white sturgeon, and evaluate regulation changes if needed.

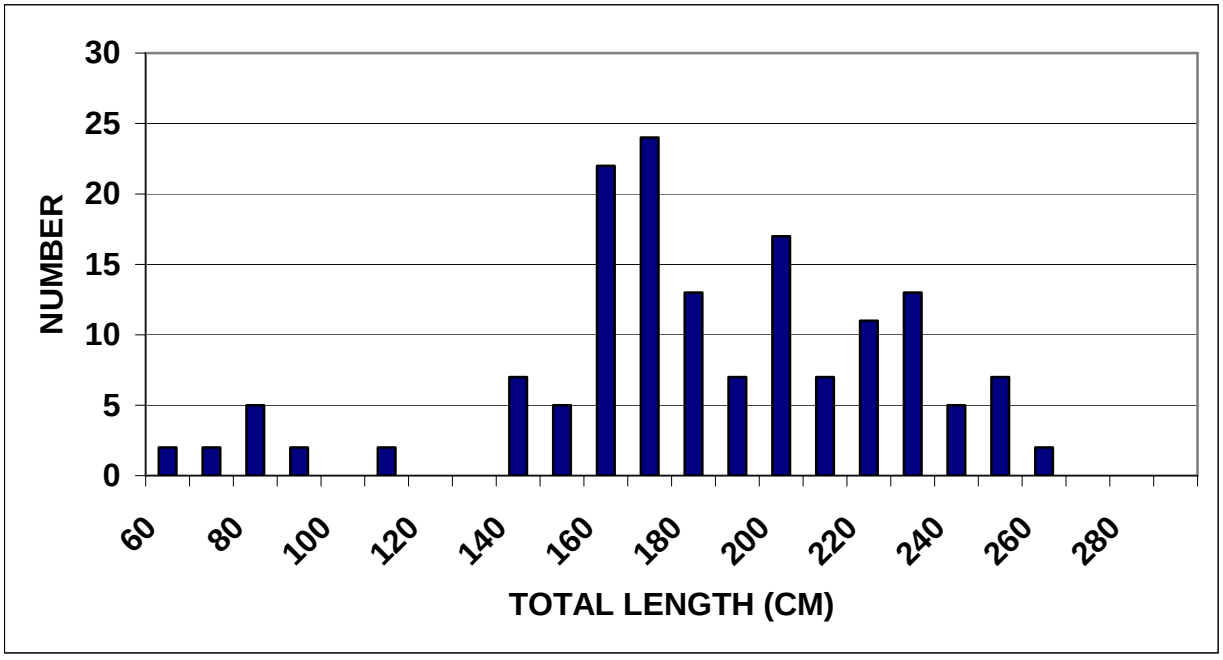
c. Promote sturgeon angling and proper fish handling techniques.

SWAN FALLS DAM TO BROWNLEE DAM



Snake River
189 kilometers of free flowing river
84 kilometers of reservoir
222 kilometers of sturgeon rearing habitat

Population estimate = 155 white sturgeon > 90 cm TL
(from Swan Falls Dam to Walters Ferry, 2001)



Population abundance and structure 1996-1997 (Lepla et al. 2001).

BROWNLEE DAM TO OXBOW DAM

Management Category: Conservation Population

The Brownlee Dam to Oxbow Dam reach is a short river segment similar to the downstream Hells Canyon Dam to Oxbow Dam section. The Oxbow Reservoir pool extends 19 km upstream with suitable white sturgeon spawning habitat probably limited to only the area immediately below Brownlee Dam. Technically there is no free-flowing river section, but flowing water does occur for a limited distance during spill events or when the dam turbines are in operation. Oxbow Reservoir experiences poor water quality conditions during low flow years as the result of receiving anoxic water from Brownlee Reservoir (Myers et al. 2001; Lepla et al. 2001). Low dissolved oxygen levels lethal to white sturgeon can comprise up to 73% of the bottom 2-m in Oxbow Reservoir during low flow years.

Hatchery-reared white sturgeon were planted in this reach of river in 1991 (brood year 1990) and 1994 (brood year 1993). In 1991, 43 individuals (mean TL 33.3 cm) were stocked and in 1994, 70 individuals (mean TL 38.9 cm) were stocked.

Idaho Power Company caught no white sturgeon in Oxbow Reservoir in 1998 (Lepla et al. 2001) although six mortalities occurred in the Brownlee tailrace from 1994-2001. These sturgeon ranged in length from 154-183 cm TL (Ken Lepla, IPC, personal communication). Most carcasses showed signs of external injury that presumably resulted from turbine blade strike.

The potential for natural recruitment in this reach is low due to inadequate spawning habitat, poor water quality, and egg/larval transport out of the system. Downstream drift from upriver populations also appears unlikely. The IDFG does not believe that a self-sustaining white sturgeon population or fishery is possible under current conditions. With only 1 km of free flowing water, the number of white sturgeon that can be supported and maintained in this section is also in question. In addition, draft tubes (turbine outlets) in Brownlee Dam have not been retrofitted to exclude white sturgeon prior to turbine startups. If sturgeon were more abundant, frequent turbine strikes and mortalities would be expected.

There appears to be limited opportunity to provide a white sturgeon sport fishery in the Oxbow pool. The IDFG would consider a limited conservation aquaculture program only after careful deliberation and consultation with the Oregon Department of Fish and Wildlife, Washington Department of Fish and Wildlife, and Nez Perce Tribe. Management classification would remain a Conservation Population with an objective of providing catch-and-release fishing opportunity and no expectation that white sturgeon would become self-sustaining. A key component of this decision would be genetic or other risks

associated with downstream drift of hatchery-reared white sturgeon into the Hells Canyon reach, one of two Core Conservation Populations.

Management Objectives

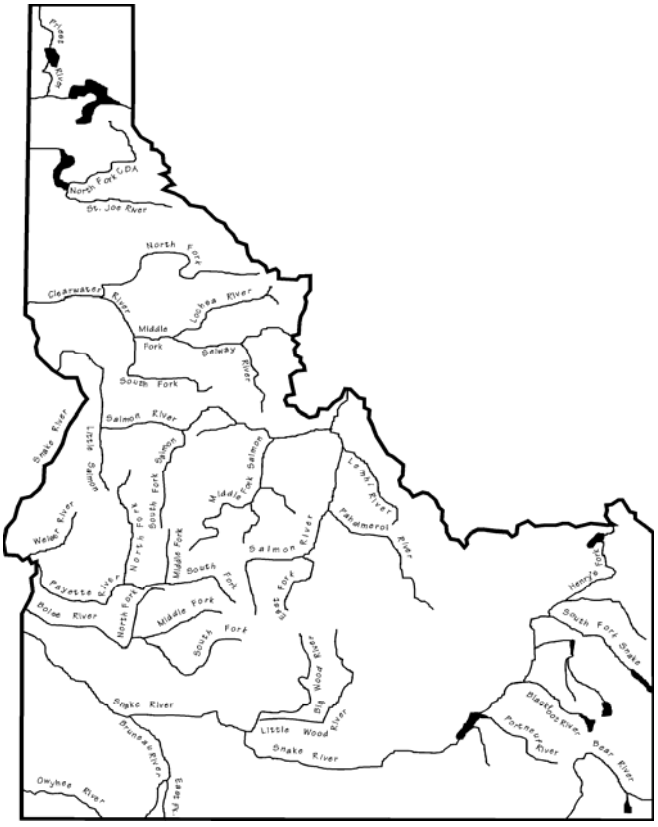
1. If a decision is made to pursue conservation aquaculture, it will be done in concert with the appropriate stakeholders and only after careful deliberation. All stocked fish will be externally marked and PIT tagged prior to release to differentiate them from wild fish.

2. Based on evaluation, develop recommendations for long-term management strategies. Poor survival, low angler success, or high emigration rates would immediately trigger termination of the stocking program.

BROWNLEE DAM TO OXBOW DAM

Snake River
1 kilometer of free flowing river
19 kilometers of reservoir
20 kilometers of sturgeon rearing habitat

Population estimate = None available



OXBOW DAM TO HELLS CANYON DAM

Management Category: Conservation Population

This is another relatively short (40 km) reach in the Snake River, consisting primarily of impounded reservoir habitat and little free flowing river with the exceptions of the tailrace area and the Oxbow by-pass. Hells Canyon Reservoir experiences poor water quality conditions during low flow years as a result of severe water quality discharged from Brownlee Reservoir and flowing through Oxbow Reservoir (Myers et al. 2001). During low flow years, anoxic conditions lethal to white sturgeon can comprise 40-55% of the reservoir's bottom 2 m layer from July through September (Lepla and Chandler 2001). The short reach length may be contributing to lack of recruitment (Jager et al. 2000). Very limited spawning habitat is available and larval export through Hells Canyon Dam is likely during typical spring flows.

The IDFG stocked 100 white sturgeon (brood year 1990) averaging 33.3 cm TL in 1991. In 2000, the Nez Perce Tribe stocked an additional 50 juveniles as part of a project to evaluate feasibility of a put-and-take fishery in the reservoir.

Abundance of white sturgeon in the Hells Canyon pool has been consistently low since the earliest surveys following development of the Hells Canyon hydropower complex (Welsh and Reid 1971). In 1992, Oregon Department of Fish and Wildlife personnel sampled below Oxbow Dam using setlines in the free flowing stretch. A total of six wild white sturgeon (180-250 cm TL) and one hatchery-reared fish (40 cm TL) were captured. In 1998, Idaho Power Company (Lepla et al. 2001) captured three wild sturgeon ranging in total length from 139-250 cm and one hatchery-reared fish (63 cm TL). All were captured in the upstream end of Hells Canyon Reservoir.

The low number of white sturgeon, both adults and juveniles, suggest limited reproduction and recruitment have been occurring in this section since impoundment. It appears no significant increase in abundance of wild sturgeon has occurred over the past 30 years, even with catch-and-release regulations in place. Assessments of recruitment potential in Hells Canyon Reservoir suggest the important limitations are water quality, spawner numbers, and larval export (Jager et al. 2000, 2001). The IDFG does not believe that a self-sustaining white sturgeon population or fishery is possible under current conditions.

As with the Brownlee-Oxbow reach, there is limited opportunity to provide a white sturgeon sport fishery in the Oxbow pool without some form of supplementation provided by a conservation aquaculture program. Pending public support and consultation with the Oregon Department of Fish and Wildlife, Washington Department of Wildlife, and the Nez Perce Tribe, additional hatchery

supplementation may be attempted on an experimental basis, but only after careful deliberation. Management classification would remain a Conservation Population with an objective of providing catch-and-release fishing opportunity and no expectation that white sturgeon would become self-sustaining. A key component of this decision would be genetic or other risks associated with downstream drift of hatchery-reared white sturgeon into the Hells Canyon reach, one of two Core Conservation Populations in Idaho.

Management Objectives

1. If a decision is made to pursue conservation aquaculture, it will be done in concert with the appropriate stakeholders and only after careful deliberation. All stocked fish will be externally marked and PIT tagged prior to release.

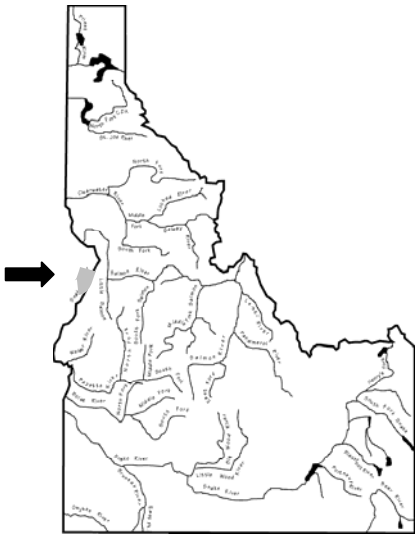
2. Assess public and agency support and feasibility for providing a sport fishery supported by a conservation aquaculture program.

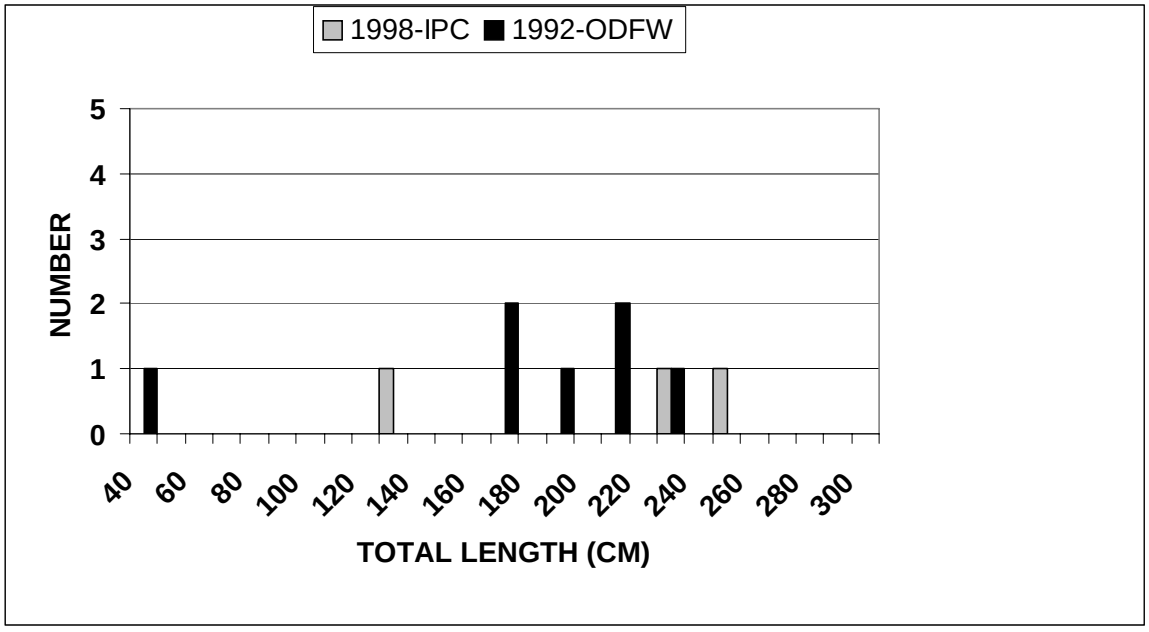
3. Based on evaluation, develop recommendations for long-term management strategies. Poor survival, low angler success, or high emigration rates would immediately trigger termination of the stocking program.

OXBOW DAM TO HELLS CANYON DAM

Snake River
6 kilometers of free flowing river
36 kilometers of reservoir
39 kilometers of sturgeon rearing habitat

Population estimate = None available





Population structure in 1998 (Lepla et al. 2001) and 1992 (Beamesderfer and Farr 1992).

HELLS CANYON DAM TO LOWER GRANITE DAM (INCLUDING SALMON RIVER)

Management Category: Core Conservation Population

The white sturgeon population inhabiting the Hells Canyon reach is one of two productive, self-sustaining populations in the Snake River. While fragmented from other Snake and Columbia River populations, white sturgeon in this reach have access to diverse habitats, which in most years can meet life history requirements for all life stages.

The Snake River flows 224 km between Hells Canyon Dam and Lower Granite Dam. White sturgeon in this river reach became increasingly isolated with the construction of dams culminating with the completion of Lower Granite Dam in the early 1970's. The reach includes 53 km of slack water in Lower Granite Reservoir and 172 km of free-flowing Snake River. The upper 108 km is a series of short rapids, long riffles and dispersed pools (>9 m depth) resulting in a gradient of 1.8 m/km, while the lower section, with a gradient of 0.7 m/km, consists of a few, relatively deep pools and long deep runs, interspersed with minor riffle areas. The reservoir extends approximately 5 km upstream beyond the confluence of the Snake and Clearwater rivers (at the community of Lewiston, Idaho). From Lower Granite Reservoir at Lewiston to the Hells Canyon tailrace, the river forms the Washington-Idaho border for the first 59 km and the Oregon-Idaho border for 114.2 km. Near the upper end of the reservoir, the river emerges from Hells Canyon, the deepest canyon in North America. There are large tributaries including the Clearwater, Salmon, Grande Ronde, and Imnaha rivers.

Upstream impoundments influence water temperature, water quality, and the annual hydrograph pattern of the free-flowing section of the Snake River below Hells Canyon Dam. Hells Canyon Dam operates as a peaking facility from late spring until the fall, so flows and surface elevation of the free-flowing section of river near the dam may vary. Water levels are held relatively constant during the fall through spring to protect spawning, incubation, and early rearing environments for listed fall Chinook salmon (*Oncorhynchus tshawytscha*). The upstream impoundments alter the natural hydrograph by increasing fall, winter, and early spring flows, while reducing peak flows and extending the duration of high flows later in the spring (Coon et al. 1977). The water released from deep within the reservoir is cooler in the summer and warmer in the winter than the pre-impoundment inflow (Coon et al. 1977).

The first comprehensive study on the Hells Canyon population occurred in 1972-1975 immediately after the completion and the start of operations of Lower Granite Dam (Coon et al. 1977). A subsequent study by the IDFG was conducted during 1982-1984 (Lukens 1985). The University of Idaho captured and released white sturgeon as part of a reservoir habitat utilization study from 1990-1994 (Bennett et al. 1993; Lepla 1994). Idaho Department of Fish and

Game personnel sampled white sturgeon during 1991-1994 (Kruse-Malle 1993; Kruse-Malle and Moore 1995). Idaho Power Company and the Nez Perce Tribe later coordinated efforts (Lepla et al. 2001; Tuell and Everett 2001). Most recently, Everett et al. (2004) provided a summary on population status in Hells Canyon from 1997-2002.

Coon et al. (1977) described the distribution of sturgeon by size group between Lower Granite and Hells Canyon dams prior to the closing of Lower Granite Dam. Small sturgeon, 51-76 cm TL, were found throughout the river, but were not abundant between Lower Granite Dam and Blyton Landing. Fish <91 cm TL used sandy bottom holes in the river. Mid-sized fish, 91-183 cm TL, tended to use more turbulent holes in the narrower portion of the river canyon and were most abundant near the mouth of the Salmon River. Sturgeon greater than 183 cm TL were typically found in upstream areas primarily between Johnson Bar and Three Creeks. The sturgeon population size was estimated at 8,000-12,000 fish in 1972-1975 (Coon et al. 1977). About 6,880-10,320 white sturgeon were 46-91 cm TL, 320-480 white sturgeon were 92-183 cm TL, and 800-1,200 white sturgeon were >183 cm TL.

In 1981-1983 Lukens (1983) estimated the population to be only 4,000 fish. However, he cautioned against direct comparisons with the population estimate by Coon et al (1977), citing differences in methodology. Lukens (1983) reported that abundance of white sturgeon in the 92-183 cm length group increased after catch and release regulations had been in place for Idaho anglers for about 10 years. Mid-sized sturgeon comprised 15-18% of sampled fish in 1981-83 compared to 3-4% in the mid-1970's (Coon et al. 1977; Lukens 1983, 1985).

From 1990 to 1994, the University of Idaho sampled white sturgeon in Lower Granite Reservoir to describe the use of deep water areas in the impoundment. During the study, they captured 2,105 white sturgeon ranging from 10 cm to 270 cm fork length (FL) (Bennett et al. 1993). As part of that study, Lepla (1994) estimated 1,093 white sturgeon from 10.3 cm to 203 cm FL inhabited Lower Granite Reservoir during 1990-91. Lepla's techniques were similar to Coon et al. (1977) and Lukens (1985), but were limited to set lines and gill nets. The population composition in the reservoir was somewhat different than that observed in the free-flowing river as most of the fish were less than 110 cm FL. Fifty six percent of captures were in the upper 20% of the reservoir.

During a similar time period, 1991-1994, IDFG personnel used angling gear to sample white sturgeon in the free-flowing section of the Snake River (Kruse-Malle 1993; Kruse-Malle 1995). They captured 350 fish ranging from 63 cm to 288 cm TL. Eighteen percent of the fish captured were greater than 183 cm TL. Over 90% of the fish were captured upstream of rkm 285.

During 1997-2000, IPC (Lepla et al. 2001) sampled 925 sturgeon (270 recaptures) between Granite Rapids and the mouth of the Salmon River. The

abundance of sturgeon greater than 60 cm TL upstream from the Salmon River was estimated at 1,312 individuals (95% CI 1,010-1,868) and 16 fish/km. The Nez Perce Tribe (Hoefs 1997; Tuell and Everett 2001) sampled white sturgeon from Lower Granite Dam upstream to the Salmon River during the same timeframe. They estimated the number of similar sized sturgeon from the Salmon River downstream to Lower Granite Dam at 2,313 fish (95% CI 2,040-2,668). Combining these indices yielded a population size of 3,625 (95% CI 3,050-4,536) white sturgeon greater than 60 cm FL or 17 fish / km.

Paired length-weight data shows similar sizes of white sturgeon were comparable in weight with sturgeon in other reaches of the Snake River. Relative weights (based on total lengths) reported by Beamesderfer (1993) for 1972-75 (83%) and 1982-84 (83%) surveys were the same for estimates from 1997-2000 (83%) suggesting fish condition has remained constant during the past 30 years. Annual mortality (A) and survival (S) estimates have also appeared to remain relatively constant. Mortality and survival rate estimates for sturgeon aged 6-13 upstream from the Salmon River were A=0.13 and S=0.87 during 1997-2000 (Lepla et al. 2001) which have remained similar to mortality and survival values reported in 1982-84 by Lukens (1984). Upstream Snake River populations in the Bliss and C.J. Strike reaches showed comparable survival rates. Lepla et al. (2001) reported 11% of adult female white sturgeon sampled above the Salmon River were either ripe or spent, which suggests that approximately 17 (95% CI 5-25) female spawners were present in this reach in a given year.

Although long-term population trend data are not available, white sturgeon remain relatively abundant between Hells Canyon Dam and Lower Granite Reservoir (Cochnauer 1983; Cochnauer et al. 1985; Lukens 1985; Lepla et al. 2001; Tuell and Everett 2001; Everett et al. 2004). Successful reproduction and recruitment occurs in this reach as evidenced by the population being comprised mostly of juvenile fish (less than 92 cm TL). A length frequency histogram of white sturgeon above the Salmon River showed 56% less than 80 cm FL (92 cm TL), 25% between 80-162 cm FL (92-183 cm TL) and 19% greater than 162 cm FL (183 cm TL) (Lepla et al. 2001). Combining sturgeon length data from Tuell and Everett (2001) and Lepla et al. (2001) showed the proportion of mid-size sturgeon (92-183 cm TL) between Hells Canyon and Lower Granite dams has increased steadily from earlier surveys by Coon et al. (1977) and Lukens (1985). This change in size structure has been attributed to catch and release sport fishing regulations implemented during 1971 (Cochnauer et al. 1985; Cochnauer 2002).

Sport harvest of white sturgeon in the Snake River upstream of Lewiston, Idaho has been prohibited since 1971. Prior to 1996, State of Washington sport fishing regulations allowed harvest of white sturgeon of restricted size in Lower Granite Reservoir within Washington. Since 1996, Washington has maintained no-harvest rules for white sturgeon in the reservoir.

As with other Snake River reaches with white sturgeon fisheries, angler effort and catch data are generally lacking for the Hells Canyon reach. Based on IDFG white sturgeon permit data for 1989, Idaho anglers caught and released an estimated 320 white sturgeon (35%< 92 cm TL; 31% 92-183cm TL; 34% > 183 cm TL) in the river reach from Hells Canyon Dam to Lewiston (~183 km). From an Idaho Power Company angler survey in 1999 (Brown 2001), an estimated 322 white sturgeon (21% < 92 cm TL; 39% 92-183 cm TL; 40% > 183 cm TL) were caught and released by boat anglers in the Hells Canyon National Recreation Area (~113 km).

The general public in Idaho is restricted to no harvest fishing for white sturgeon. In 2002 the Nez Perce Tribe began practicing subsistence and ceremonial take of white sturgeon in the Snake River in the reach below Hells Canyon Dam. The Nez Perce Tribe's ability to harvest white sturgeon is secured by treaty rights. However, unlike other data provided to the IDFG by the Nez Perce Tribe under a data sharing agreement, tribal harvest is not. Therefore, state fish and wildlife management agencies cannot account for direct harvest in population monitoring or modeling efforts. Tribal members harvest an unreported number of adult white sturgeon. White sturgeon are vulnerable to overfishing because of their delayed age of maturation and longevity (UCWSRI 2002). With even moderate exploitation of sub-adult fish, too few fish survive to adulthood to spawn and replenish the population. Only very low exploitation rates of 20% or less can be supported by the healthiest of sturgeon populations, and unproductive populations can sustain no harvest at all (Rieman and Beamesderfer 1990). There are other known (e.g., turbine blade strikes) and unknown sources (e.g., catch and release angling) of mortality; however, the IDFG is concerned that unreported Tribal harvest in Hells Canyon may impact white sturgeon productivity and sustainability. The IDFG will work with the Nez Perce Tribe in a cooperative fashion to hopefully reach concensus on how we account for Tribal harvest in population assessments and population modeling.

The only tributary to the Snake River that supports white sturgeon is the Salmon River (rkm 0 to rkm 96.5). White sturgeon have not been found recently in the Grande Ronde or Clearwater rivers, and anecdotal information suggests white sturgeon have rarely been observed in the Clearwater River. White sturgeon captured in the Salmon River ranged from 66 cm to 244 cm TL with a median length of 169 cm TL (Everett et al. 2004). This size structure indicates that spawning is either minimal or does not occur in the Salmon River, and may suggest that these fish may be a migrant component of the mid-sized white sturgeon population found in the Snake River. Abundance of white sturgeon in the Salmon River has not been estimated, but they are assumed to comprise a minor part of the overall Hells Canyon population. More intensive investigations are warranted to determine the status in the Salmon River and better define their relationship to Snake River fish.

The Hells Canyon population is the most abundant population upstream of Lower Granite Dam and exhibits consistent natural recruitment and fish of all size

classes distributed throughout the reach. However, the densities of white sturgeon (17 fish / km) remains lower than expected based on available habitat, observed recruitment patterns, and comparisons to upstream reaches. Inadequate trend data (due to varying sampling methodologies) makes it difficult to describe abundance changes since completion of Hells Canyon and Lower Granite dams. Though the population appears stable, IDFG expected abundance to increase markedly since catch and release rules were implemented in 1971. Estimated survival/mortality rates are identical to the Bliss reach where populations have increased by nearly 50% since 1981. It is important that the next comprehensive population survey in this reach duplicates the methods used in 1997-2001 so that meaningful trend data can be acquired.

Given the uncertainty in overall abundance trends, IDFG proposes to maintain a very conservative framework for population management in Hells Canyon. Emphasis will be on improving white sturgeon populations and fishing opportunity relying entirely on natural production from wild fish. The IDFG will continue to work with the states of Oregon and Washington, the Nez Perce Tribe, and other stakeholders to refine population and fishery objectives.

Management Objectives

White sturgeon in the Hells Canyon Dam to Lower Granite Dam reach will be managed as a Core Conservation Population.

1. Manage as a self-sustaining population supported by natural recruitment with no influence from hatchery-reared fish.

    a. The IDFG will not stock, nor will we permit other entities to stock hatchery-reared white sturgeon into this reach.

    b. In collaboration with other states and the Nez Perce Tribe, juvenile and adult white sturgeon of wild origin may be translocated into this reach from upstream reaches where spawning and larval rearing habitat is lacking. Such translocations will be limited in scope, and be accompanied by monitoring activities to assess survival, movement, growth, and spawning behavior.

2. In cooperation with Idaho Power Company, the population will be evaluated at approximately10-year intervals.

    a. Standardized sampling methods will be used to describe trends in abundance, size structure, fish condition, and recruitment.

3. More intensively sample the lower and middle reaches of the Salmon River to describe abundance, size structure, and origin of white sturgeon and interaction with Snake River fish.

a. Use standardized sampling methods to establish baseline for trend monitoring.

4. Maintain or increase catch-and-release fishing opportunity for white sturgeon.

   a. Evaluate angler effort, catch, and satisfaction.

   b. Assess effects of catch-and-release angling on white sturgeon populations, and evaluate regulation changes if needed.

   c. Promote sturgeon angling and proper fish handling techniques to minimize angling-related mortalities.

   d. Targeted enforcement patrols will occur in this reach.

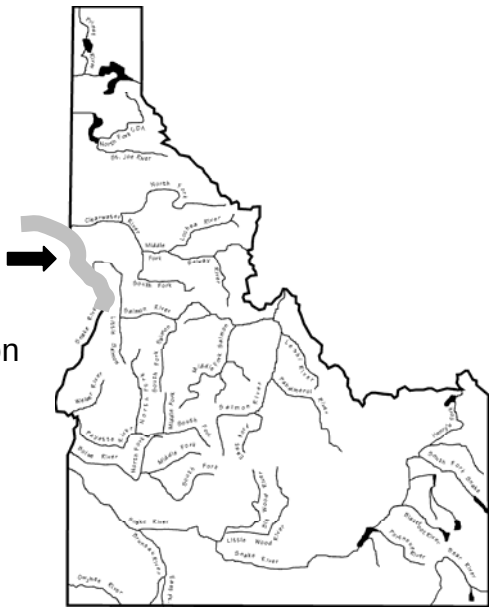
HELLS CANYON DAM TO LOWER GRANITE DAM (including Salmon River)

Snake River

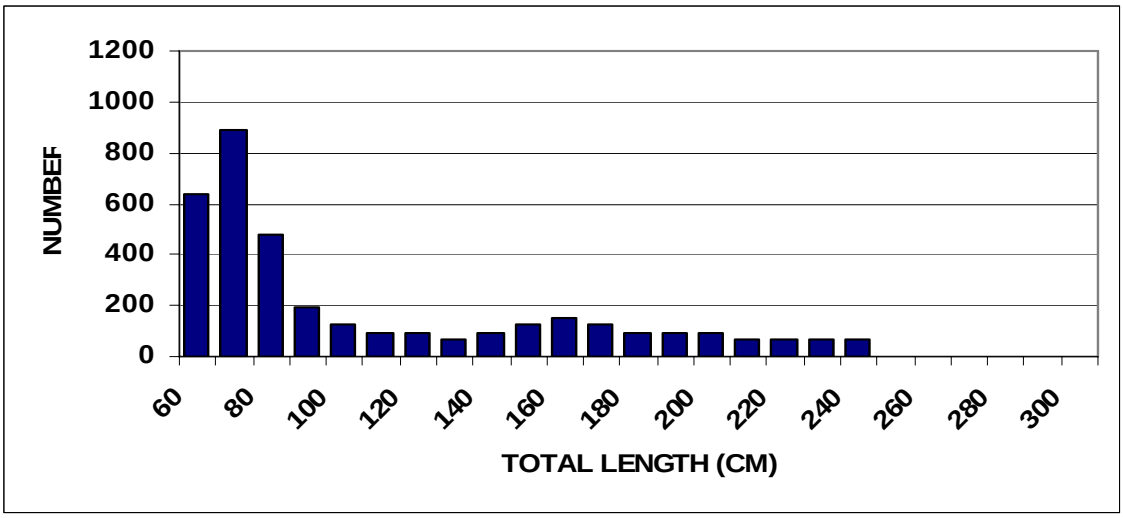
172 kilometers of free flowing river
53 kilometers of reservoir
212 kilometers of sturgeon rearing habitat

Salmon River

86 kilometers of free flowing river to White Bird
0 kilometers of reservoir
86 kilometers of sturgeon rearing habitat to White Bird



Population estimate (Snake River only) = 3,625 white sturgeon
(as of 2002) (95% CI 3,050-4,536) > 60 cm FL
(Source, Idaho Power Company and Nez Perce Tribe)



Population structure and abundance in 2000 (Tuell and Everett 2001; Lepla et al. 2001).

Snake River White Sturgeon Sportfish Populations (outside historic distribution)

NOTE: New species introductions into Idaho waters go through both an internal and external public review process. The IDFG adheres to the American Fisheries Society's seven-step protocol to evaluate biological and ecological risks, disease risks, and potential impacts to other jurisdictions from such introductions. New-species proposals approved through this technical review process are then formally presented for public review and comment and eventual IDFG Commission approval. Protecting native fish and existing fisheries from unwanted species introductions is a critical agency function. Both of the white sturgeon sport fisheries below were subject to this review before any stocking occurred.

AMERICAN FALLS DAM TO LAKE WALCOTT

Management Category: Sportfish Population

Beginning in 1990 the IDFG stocked juvenile hatchery-reared Snake River white sturgeon below American Falls Dam to diversify angling opportunity. Stocking rates have been quite low, with a total of less than 600 fish planted between 1990 and 2005 (Table 4). Survival and growth of the stocked fish has been good, and a very popular catch-and-release fishery has developed with most of the effort and catch in the vicinity of the dam tailrace.

Table 4. Juvenile hatchery white sturgeon stocking history below American Falls Dam.

Year	Number stocked
1990	100
1991	103
1997	100
1998	100
2005	178

In 2002, IDFG personnel (Richard Scully, IDFG, personal communication) captured and released 14 white sturgeon in this section. Fish ranged from 112 to

185 cm TL and all were captured immediately below American Falls Dam even though sampling was conducted at one other site downstream of the dam.

There have been frequent observations of individual white sturgeon from these plants moving downstream of both Minidoka and Milner dams and becoming entrained into canal systems (Doug Megargle, IDFG, personal communication). When possible, these fish are collected and transported upstream to Lake Walcott or to the American Falls tailrace. The likelihood of hatchery white sturgeon from the American Falls reach successfully emigrating into downstream reaches (below Shoshone Falls) appears very small. However, Idaho Power Company has documented one hatchery white sturgeon stocked below American Falls Dam at rkm 1136 recaptured downstream of Pillar Falls at rkm 983.4 (Ken Lepla, Idaho Power Company, personal communication).. Appropriate stocking rates are unknown and will be developed over time in an adaptive management framework.

Management Objectives

White sturgeon in the American Falls reach will continue to be managed as a sportfish population under catch-and-release regulations.

1. Continue periodic supplementation with hatchery-reared Snake River white sturgeon.

    a. Evaluate angler effort, catch, and satisfaction.

    b. Develop a long-term stocking plan (frequency, number, size) based on observations of fish growth and condition, and angler success.

    c. All hatchery fish will be PIT tagged and externally marked to identify year class and detect emigration from this reach.

2. Maintain or increase fishing opportunity for white sturgeon

    a. Promote sturgeon angling and proper fish handling techniques.

SNAKE RIVER AT IDAHO FALLS

Management Category: Sportfish Population

In 2007, to diversify sport fishing opportunity, the IDFG stocked 74 juvenile white sturgeon in the Snake River near Idaho Falls, Idaho. Fish were planted near the Johns Hole Bridge, between the upper and lower power plant dams, where access is good for both bank and boat anglers. Because the nearest wild population is over 250 river kilometers downstream, it is our opinion there are no

important genetic considerations when developing stocking plans for hatchery fish in this area. This introduction is considered experimental pending evaluations of fish survival and angler success.

Management Objectives

White sturgeon in the Idaho Falls reach will be managed as a sportfish population under catch-and-release regulations.

1. Continue periodic supplementation with hatchery-reared Snake River white sturgeon.

    a. Evaluate angler effort, catch, and satisfaction.

    b. Develop a long-term stocking plan (frequency, number, size) based on observations of fish growth and condition, and angler success.

    c. All hatchery fish will be externally marked and PIT tagged externally marked to identify year class and detect emigration from this reach.

2. Maintain or increase fishing opportunity for white sturgeon.

    a. Promote sturgeon angling and proper fish handling techniques.

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