Oregon White Sturgeon

Interim Risk Assessment

Sturgeon are a long-lived fish, with some white sturgeon reported to be over 100 years old. This fact calls into question the use of criteria used in this report to assess the status of sturgeon. These criteria look at a relatively short time period – the last five years in some cases. This represents a small fraction of a sturgeon generation and likely cannot determine increasing or decreasing trends. ODFW recognizes that utilizing the NFCP interim criteria to assess the status of the three SMUs of sturgeon would not be appropriate. Therefore, we have not assessed the conservation risk to sturgeon in this report. ODFW will elevate the priority to develop conservation plans for these SMUs, which will allow more appropriate methods of status assessment to be considered. The outcomes of applying the NFCP interim criteria to these SMUs are included here to point out the limitations of the criteria and to share some information about these SMUs.

There are two sturgeon species indigenous to Oregon, white sturgeon (*Acipenser transmontanus*) and green sturgeon (*A. medirostris*). White sturgeon are found in the ocean inside the 50-fathom line, and in large freshwater streams and estuaries along the Pacific coast from California to British Columbia. They also inhabit the mainstem Columbia River system as far upstream as the Kootenai River, which has the only federally ESA-listed population of white sturgeon. In addition to the mainstem Columbia River, white sturgeon are found in several of its major tributaries, particularly the Snake, Salmon, and Willamette rivers. White sturgeon are the largest freshwater fish species found in North America. They are long-lived (up to 100 years or more), and take many years to reach maturity (up to 25 years). These and other factors make sturgeon populations especially vulnerable to overharvest, and very slow to recover from low population sizes. Populations of white sturgeon throughout their range were heavily overfished in the late 1800s, resulting in collapse of many populations. Recovery of populations took many years, but sport and commercial harvest fisheries are currently allowed in the ocean inside the 50-fathom line, in coastal rivers and estuaries, and in the Columbia River from McNary Dam downstream. White sturgeon inhabiting Oregon waters currently have no special state or federal status, although a change in status to "sensitive-vulnerable" has been recently proposed for white sturgeon inhabiting middle Snake River reservoirs. The state of Idaho considers white sturgeon, including those inhabiting waters shared with Oregon, to be a species of concern.

Existing Populations

Although available genetic evidence does not suggest genetically distinct populations of white sturgeon within Oregon (Anders et al. 2000), groups of fish are segregated from one another by dams and limited passage at those dams. This report presents white sturgeon in Oregon as one SMU, comprised of seven populations (Table 1). The groupings for these populations were chosen based upon the segregation of many of the groups and similarities in biology and management strategies among individual segments within the SMU. While these groupings may not represent historical populations, they do represent groups that currently function, for the most part, separate from one another. These populations, or groupings, are the lower Columbia River (downstream of Bonneville Dam) and Oregon coastal population, the lower Columbia River reservoirs populations in Bonneville, The Dalles, and John Day Reservoirs, the McNary Reservoir population, the middle Snake River population (the free-flowing Snake River from the confluence of the lower Salmon River to Hells Canyon Dam), and the middle Snake River reservoirs (Hells Canyon, Oxbow, and Brownlee reservoirs) population.

Table 1. Populations list and existence status for the Oregon White Sturgeon SMU.

Exist	Population	Description
Yes	Lower Columbia/Coastal	Columbia River downstream of Bonneville Dam, Willamette River downstream of Willamette Falls, Coastal estuaries and rivers, Oregon coast inside 50 fathom line.
Yes	Bonneville Reservoir	Bonneville Dam to The Dalles Dam.
Yes	The Dalles Reservoir	The Dalles Dam to John Day Dam.
Yes	John Day Reservoir	John Day Dam to McNary Dam.
Yes	McNary Reservoir	McNary Dam to Priest Rapids Dam (Columbia River) and Ice Harbor Dam (Snake River).
Yes	Middle Snake River	Unimpounded Snake River from the confluence of the Salmon River to Hells Canyon Dam.
Yes	Middle-Snake River Reservoirs	Hells Canyon, Oxbow, and Brownlee reservoirs.

Habitat Use Distribution

To pass this criterion, a population must occupy at least 50% of historically used habitat. Currently, all white sturgeon populations in Oregon are believed to still have access to 100% of historically used habitat. Dams have fragmented the SMU, but limited passage and the development of land-locked populations or sub-populations have resulted in no net loss of habitat distribution. White sturgeon are still found everywhere in Oregon where they were historically present, and the entire SMU passes this criterion.

The historical use of the Willamette River above Willamette Falls by white sturgeon is poorly understood. It is generally believed that white sturgeon either did not occupy this area, or did so in relatively low numbers. Currently, this area receives annual or semi-annual supplementation of juvenile white sturgeon produced from wild broodstock in a private hatchery. This population is believed to be entirely supported by hatchery stocking and is not thought to be an historic population.

Abundance

The criterion for abundance requires abundance of the population to be at least 25% of the historic abundance in at least three of the last five years. Historic abundance levels for white sturgeon are relatively unknown. Because white sturgeon are highly migratory, current abundance might not reflect historic abundances within their current distribution. Historically, white sturgeon certainly utilized areas now inundated by dams, however, it is unknown whether their use was transitory or long-term, therefore assigning a portion of historic abundance to these areas is probably inappropriate. For populations with sufficient available abundance data, current abundance was judged against average abundance over the period for which data were available (Table 2). Stock structure was examined to assess whether a stock demonstrated a balanced population structure based on size/age-distribution, with small fish as the most abundant size classes, and fewer, but sufficient abundances of larger sizes and broodstock-sized fish. Populations in which most of the fish were in the middle-size or broodstock-size classes were considered unbalanced. For populations with limited or absent abundance data, current abundance or population size/age structure was judged against neighboring populations, against population structures associated with relatively abundant populations and balanced stock structure, or were assigned based on professional judgment.

Population estimates for the lower Columbia River downstream of Bonneville Dam are available for the period 1987-1997 (DeVore et al. 2000). Recent fisheries trends indicate the population is stable compared to average abundances during the period 1987-1997. During that period,

average abundance of white sturgeon 54-166 cm fork length was approximately 300,000 fish (range 175,000-445,000). Methods of estimating abundance of white sturgeon in this area are complicated by assumptions of a closed population which are unrealistic, but unavoidable under current funding and management conditions. This stock is at low risk based on abundance information. No abundance estimates are available for coastal white sturgeon stocks, but it is assumed that the lower Columbia River provides the primary production for these stocks, and low risk would be implied. The Lower Columbia/Coastal population passes this criterion.

Because pre-dam white sturgeon populations were highly transitory, comparisons of the abundance of populations in impoundments with free-ranging populations existing before dam construction are probably inappropriate because little information exists on the usage of habitats now segregated by dams. However, persistence of white sturgeon populations in these isolated habitats is dependent on their ability to maintain sufficient abundance to ensure population viability.

Detailed population estimates for lower Columbia River reservoirs (Bonneville, The Dalles, and John Day Reservoir populations) have been generated fairly consistently since the late-1970s and early-1980s. However, abundance data is unavailable before this timeframe. Stocks within the three lower Columbia River Reservoirs are currently managed for harvest fisheries.

In Bonneville Reservoir, average abundance of white sturgeon 54-166 cm fork length during 1976-2003 (five estimates) was 75,500 fish (26,000-128,000). The most recent abundance estimate was 120,000 fish in 2003 (Kern et al. 2005). The general trend in abundance of white sturgeon in Bonneville Reservoir over this period has been increasing. The Bonneville Reservoir population of white sturgeon is probably the healthiest impounded white sturgeon population. As a result of consistent annual recruitment, this population also has the most stable stock structure among the impounded Columbia River populations and passes the criterion.

In The Dalles Reservoir, average abundance of white sturgeon 54-166 cm fork length during 1987-2002 (five estimates) was 46,000 fish (11,000-104,000). The most recent estimate in 2002 was the highest recorded at 104,000 fish (Kern et al. 2004). The general trend in abundance has been increasing. This population passes the abundance criterion.

In John Day Reservoir, average abundance of white sturgeon 54-166 cm fork length during 1979-2004 (five estimates) was 28,000 fish (17,000-42,000). The most recent estimate in 2004 was the highest recorded at 42,000 fish (Kern et al. in progress). The general trend in abundance has been stable, or slightly increasing, with increases occurring more slowly than in Bonneville and The Dalles reservoirs. While this population is not considered to be as healthy as those in Bonneville and The Dalles reservoirs, it is not at risk in terms of abundance and passes the criterion.

Less data is available regarding the status of abundance in McNary Reservoir and the middle Snake River reservoirs. Abundances of some stocks have been estimated infrequently, but assessment of these stocks, and of stocks without abundance estimates, is largely limited to comparisons with other populations and professional judgment.

A population assessment in McNary Reservoir in 1995 estimated the abundance of white sturgeon 54-166 cm fork length to be approximately 8,000 fish (Rien et al. 1997). No other estimates have been conducted. During the 1995 assessment, the predominance of fish captured were large fish (>82 cm fork length) with very few small fish present. This size structure was different than the structures of the three reservoirs immediately downstream of McNary Dam, where small fish dominate the catch, and indicates poor historic recruitment of juveniles. This stock does appear to have more abundant broodstock than the three lower Columbia River

reservoirs. While the stock structure does not indicate a healthy population, abundance is sufficient to pass the criterion for persistence of the species in McNary Reservoir.

Population estimates conducted by the Nez Perce Tribe during 1999-2001 (Everett et al. 2003) estimated abundance of white sturgeon >60 cm fork length in the free-flowing portion of the Snake River between the Salmon River confluence and Hells Canyon Dam to be approximately 2,500 fish. The structure of the stock was balanced, with the highest abundance being composed of small fish, and sufficient numbers of larger fish to ensure population viability. This population passes the criterion.

Abundance estimates are not available for the middle Snake River reservoirs. Limited fishery and observational information suggests that the population size is much lower than in the aforementioned areas. Stock structure based on limited catch data for Hells Canyon and Brownlee reservoirs indicates that broodstock-sized fish (>166 cm FL) dominate this relatively small population. Considering the low abundances and unbalanced stock structures in the reservoirs, this population is probably at some risk of extinction based on abundance, and fails the criterion.

Table 2. Abundances of white sturgeon (54-166 cm fork length) in the Oregon White Sturgeon SMU.

Population	Current Stock Structure[a]	Average Abundance in 1,000's (range)	Years When Abundance was Estimated	Number of Years at or Above Average Abundance	Most Recent Abundance est. (year)	Abund. Trend	Pass/Fail Criterion
Lower Col. River/Coastal							pass
Lower Columbia R.	balanced	300 (175-445)	1987-1997 (10 ests.)	5	359,000 (1997)	stable	
Coastal	unknown	unknown	--	--	--	unknown, assumed stable	
Bonneville Reservoir	balanced	75 (26-128)	1976-2003 (5 ests.)	2	120,000 (2003)	steadily increasing	pass
The Dalles Reservoir	balanced	46 (11 - 104)	1987-2002 (5 ests.)	2	104,000 (2002)	steadily increasing	pass
John Day Reservoir	balanced	28 (17 -42)	1979-2004 (5 ests.)	3	42,000 (2004)	slowly increasing	pass
McNary Reservoir	unbalanced	--	1995	--	8,000 (1995)	unknown, believed stable	pass
Middle Snake River	balanced	~2.5	1999-2001	--	2001	unknown, believed stable	pass
Mid-Snake R. Reservoirs	unbalanced or assumed unbalanced	unknown	--	--	--	unknown, believed declining	fail

[a]*Stock structure: Balanced = small fish most abundant in population, followed by sufficient abundance of larger fish to imply persistence. Unbalanced = population dominated by older/larger fish, very few small/young fish present. Unknown=insufficient data to assess structure, structure may be assumed by inference from nearby reservoir populations.*

Productivity

Stock-recruitment relationships for white sturgeon are poorly understood, as are density effects on juvenile recruitment. These factors, coupled with difficulties in estimating both broodstock and juvenile abundances, or in some cases, lack of any information on broodstock or juvenile

abundances, preclude the use of salmonid criteria in assessing productivity risks in white sturgeon populations. Where sufficient data for trends in recruitment and population structure exist, populations were judged on their ability to consistently produce detectable recruitment of juveniles at least three of the last five years; on the relative abundance of small fish, indicating past recruitment; and abundance of broodstock-sized fish (Table 3). In populations lacking recruitment information, stock size/age structure was compared to stock structure in populations with consistent, detectable recruitment, which were considered to have a balanced population structure.

Estimates of juvenile white sturgeon recruitment in the Lower Columbia River/Coastal population have been inconsistently conducted in several years (McCabe and Tracy 1994). While available data are insufficient to describe recent trends in recruitment in this area, young-of-year white sturgeon have been found in the lower Columbia River each time surveys were conducted. Spawning success in this area is believed to be the highest within the species current range. Stable population estimates of older aged white sturgeon over many years support this belief. Spawning and recruitment in coastal areas are believed to be low and production of white sturgeon in these areas is believed to be supported by migration of fish produced in the lower Columbia River to these areas. The Lower Columbia/Coastal population passes the productivity criterion.

Relative production of young-of-year white sturgeon in the lower Columbia River reservoirs and McNary Reservoir populations has been monitored annually since 1997, and in some cases longer.

Annual assessments of recruitment in the Bonneville Reservoir population have documented some level of young-of-year recruitment in nearly all years surveyed. A direct association between young-of-year trends in abundance and volume of spring spill at Bonneville Dam has been identified, but not analyzed for statistical significance. The area of suitable spawning habitat is known to be directly linked to the amount of spill at key times during the spawning cycle of white sturgeon (Parsley et al. 1993), and water flows are believed to impact the amount and success of spawning as well as the survival of the resulting progeny. Based on the documentation of young-of-year recruitment in recent years, the Bonneville Reservoir population passes the criterion.

Annual assessments of The Dalles Reservoir population have indicated more variable annual recruitment than that shown in Bonneville Reservoir. Some level of recruitment was documented in five of eight years surveyed, but in only two of the last five years as of 2004. This does not meet the criterion used for assessing productivity, thus The Dalles Reservoir population fails the criterion.

Recruitment in John Day Reservoir is typically poorer than either of the aforementioned reservoirs. Some level of recruitment has been documented in three of the eight years surveyed, however no recruits have been captured in samples during any of the last five years ending in 2004. The John Day Reservoir population fails the criterion.

Production of young-of-year white sturgeon in McNary Reservoir is generally poor. Some level of recruitment of young-of-year has been documented in McNary Reservoir in two of six years surveyed, and in one of the last five years as of 2004. However, stock structure from population surveys in 1995 indicated relatively low abundances of young fish, representing repeated poor recruitment. The McNary Reservoir population fails the productivity criterion.

Surveys to document young-of-year recruitment in the middle Snake River have not been conducted. However, researchers from the Nez Perce Tribe did use egg mats to document

spawning events in this area. Eggs were found in all years sampled, indicating spawning occurred in each of those years. However, in the absence of young-of-year sampling data, the relative survival from fertilized egg to young-of-year recruit is unknown. The stock structure of this population indicates a balanced population with some recruitment of small fish over time. This population passes the criterion.

Little data is available to describe productivity of the middle Snake River reservoir populations of white sturgeon. Young-of-year recruitment is not monitored. Limited stock structure information is available for Hells Canyon Reservoir and Brownlee Reservoir. The Hells Canyon Reservoir stock has a relative preponderance of broodstock-sized fish in the population, although a few small fish have been captured. Very few fish are found between 82-166 cm fork length, and broodstock-sized fish make up the majority of the low abundance. This stock is likely at high risk due to inconsistent spawning success. The Brownlee Reservoir white sturgeon stock shows a similar preponderance of broodstock-sized fish in the population, but lacks the few small fish present in the Hells Canyon Reservoir stock, indicating poor historic spawning success. Although broodstock-sized fish are present in the population, spawning and/or recruitment success must be very limited. This stock is at high risk based on productivity. No information is available regarding productivity of the Oxbow Reservoir stock of white sturgeon, but its proximity to other troubled stocks would seem to indicate that it is at similar high risk based on productivity. Recent sampling efforts in this reservoir have been unable to capture any white sturgeon. Dead broodstock-sized fish are occasionally seen in the reservoir and are currently the only indication of their presence. The Mid-Snake Reservoirs population fails the productivity criterion.

Table 3. Productivity of white sturgeon in the Oregon White Sturgeon SMU. Productivity is measured primarily by levels of recruitment of young-of-year white sturgeon.

Population / *Stock*	Current Stock Structure[a]	Recruitment Monitored?	Recruits Detected in ? of Monitored Years	Recruits Det'd in ? of Last Five Yrs Samp'd	Pass/Fail Criterion
Lower Columbia River/Coastal					pass
Lower Columbia R.[b]	balanced	intermittently	4 of 4	4 of 4	
Coastal	unknown	no	--	--	
Bonneville Reservoir[b]	balanced	annually	5 of 6	4	pass
The Dalles Reservoir	balanced	annually	5 of 8	2	fail
John Day Reservoir	balanced	annually	3 of 8	0	fail
McNary Reservoir	unbalanced	annually	2 of 6	1	fail
Middle Snake River	balanced	no[c]	--	--	pass
Mid-Snake R. Reservoirs	unknown, assumed unbalanced[d]	no	--	--	fail

[a] *Stock structure: Balanced = small fish most abundant in population, followed by sufficient abundance of larger fish to imply persistence. Unbalanced = population dominated by older/larger fish, very few small/young fish present. Unknown=insufficient data to assess structure, structure may be assumed by inference from nearby reservoir populations.*

[b] *Young-of-year indexing conducted using trawl gear; Indexing in The Dalles, John Day, and McNary reservoirs is conducted using gill nets. The methods produce similar results, but a statistical comparison has not yet been completed.*

[c] *Surveys have documented successful spawning by recovery of fertilized eggs, however, direct indexing of recruitment to young-of-year has not been documented.*

[d] *Stock structure in Hells Canyon Reservoir indicated mostly broodstock-sized fish, with a few small fish, and very few fish in middle size classes.*

Reproductive Independence

To pass the reproductive independence criterion, over 90% of the spawners in a population must be naturally-produced in three of the last five years. Very few hatchery-reared white sturgeon have been released in Oregon waters. A small number of fish produced from wild-caught broodstock have been released in Columbia River reservoirs as part of small-scale research efforts. Some hatchery-reared fish have been released into Snake River reservoirs, however, detailed records regarding these releases could not be found. The progeny released are believed to have been produced from wild-caught local broodstock. We suggest that all populations in Oregon pass this criterion.

Hybridization

To pass the hybridization criterion, the occurrence of interspecific hybridization must be rare or non-existent in three of the last five years. There are no known non-native species in Oregon that can hybridize with white sturgeon. All populations pass this criterion.