

STURGEON AND PADDLEFISH - U.S. AND CANADA

Polyodon spathula (Paddlefish), *Acipenser oxyrinchus* (Atlantic Sturgeon), *Acipenser fulvescens* (Lake Sturgeon), *Scaphirhynchus platorhynchus* (Shovelnose Sturgeon), *Acipenser transmontanus* (White Sturgeon)

SUMMARY

The wild Sturgeon populations of the U.S. and Canada are suffering from overfishing and habitat degradation. Because these species are long-lived, and little is known about habitat requirements, recovery will be slow. Management is weak because coordination of management agencies is poor, and there is insufficient data on populations to determine sustainable catch levels.

Criterion	Points	Final Score	Color
Life History	0.25	2.40 - 4.00	
Abundance	0.50	1.60 - 2.39	
Habitat Quality and Fishing Gear Impacts	1.50	0.00 - 1.59	
Management	1.50		
Bycatch	1.75		
Final Score	1.10		
Color			

LIFE HISTORY

Core Points (only one selection allowed)

If a value for intrinsic rate of increase ('r') is known, assign the score below based on this value. If no r-value is available, assign the score below for the correct age at 50% maturity for females if specified, or for the correct value of growth rate ('k'). If no estimates of r, age at 50% maturity, or k are available, assign the score below based on maximum age.

1.00 Intrinsic rate of increase <0.05; OR age at 50% maturity >10 years; OR growth rate <0.15; OR maximum age >30 years.

Most of the sturgeon caviar and meat in the world market comes from the Caspian Sea. However, sturgeons in that region are severely depleted, leaving the possibility of an increased demand on North American Sturgeons and Paddlefish. While there are many sturgeon species in North America, this evaluation focuses on those sturgeons that are sold commercially, and on the closely related North American Paddlefish. The species that are commercially fished in the United States are Paddlefish, Shovelnose Sturgeon and White Sturgeon. In Canada, Lake and Atlantic Sturgeons are fished (Williamson, 2003).

Intrinsic rates of increase were not available. Atlantic Sturgeon mature from 7 to over 28 years of age, and can reach a maximum age of 60; Paddlefish males mature from 5-9 years, females mature from 8-12 years, and both reach a maximum age of 30+; Shovelnose sturgeon reach maturity at 5-7 years, and can reach a maximum age of 27; Lake sturgeon males mature from 12-22 years, females from 14-27 years, and both can reach a maximum age of over 152; White sturgeon males reach maturity from 10-20 years, females from 15-30, and reach a maximum age of 82+ years (Williamson 2003). While some of these species score a 2 here, the average age of maturity for the species group is greater than 10.

2.00 Intrinsic rate of increase = 0.05-0.15; OR age at 50% maturity = 5-10 years; OR a growth rate = 0.16–0.30; OR maximum age = 11-30 years.

3.00 Intrinsic rate of increase >0.16; OR age at 50% maturity = 1-5 years; OR growth rate >0.30; OR maximum age <11 years.

Points of Adjustment (multiple selections allowed)

-0.25 Species has special behaviors that make it especially vulnerable to fishing pressure (e.g., spawning aggregations; site fidelity; segregation by sex; migratory bottlenecks; unusual attraction to gear; etc.).

Some Sturgeon species are anadromous (e.g., White, Atlantic), while others remain in fresh water all of their lives. Sturgeons and Paddlefish return to their home rivers to

spawn. Fishers can easily target sturgeon groups when they are making their upriver migration (Williamson 2003).

- 0.25 Species has a strategy for sexual development that makes it especially vulnerable to fishing pressure (e.g., age at 50% maturity >20 years; sequential hermaphrodites; extremely low fecundity).**

Sturgeon have very low fecundity. Spawning frequency varies from 1-8 years depending on the species and varies within species as well. Females usually have a longer spawning cycle than males. Spawning intervals for the species covered in this evaluation are as follows- Atlantic Sturgeon: 1-4 years for males and 3-5 for females; Paddlefish: 1-2 years for males, 2-4 for females; Lake Sturgeon: 2-3 years for males, 4-6 for females; White Sturgeon: 1-2 years for males and 2-6 for females. The spawning interval of Shovelnose Sturgeons has not been defined (Williamson 2003).

- 0.25 Species has a small or restricted range (e.g., endemism; numerous evolutionarily significant units; restricted to one coastline; e.g., American lobster; striped bass; endemic reef fishes).**

Atlantic Sturgeon historically inhabited most of the Eastern seaboard of North America, from Labrador to Florida, with a spawning range composed of a distinct subset of rivers between Newfoundland and Florida. The historic range of North American Paddlefish is throughout the Mississippi River basin, the Missouri River basin, the Great Lakes and some southern Ontario waters in Canada. Shovelnose Sturgeon inhabit most of the Mississippi and Missouri River basins. Lake Sturgeon historically inhabited the Great Lakes, the Mississippi River drainage, and the Hudson-James Bay drainage. They are generally confined to freshwater. White Sturgeon historically occupied major rivers and nearshore waters of the Pacific coast of the U.S., with known spawning populations in only a few major river systems between the Sacramento-San Joaquin rivers in California and the Fraser River in British Columbia (Williamson 2003). All of these species have relatively small ranges, confined to just one coastline or a few drainages within the North American continent.

- 0.25 Species exhibits high natural population variability driven by broad-scale environmental change (e.g. El Nino; decadal oscillations).**
- +0.25 Species does not have special behaviors that increase ease or population consequences of capture OR has special behaviors that make it less vulnerable to fishing pressure (e.g., species is widely dispersed during spawning).**
- +0.25 Species has a strategy for sexual development that makes it especially resilient to fishing pressure (e.g., age at 50% maturity <1 year; extremely high fecundity).**
- +0.25 Species is distributed over a very wide range (e.g., throughout an entire hemisphere or ocean basin; e.g., swordfish; tuna; Patagonian toothfish).**

+0.25 Species does not exhibit high natural population variability driven by broad-scale environmental change (e.g., El Nino; decadal oscillations).

0.25 Points for Life History

ABUNDANCE

Core Points (only one selection allowed)

Compared to natural or un-fished level, the species population is:

1.00 Low: Abundance or biomass is <75% of BMSY or similar proxy (e.g., spawning potential ratio).

While abundance of all Sturgeon populations has been poorly documented, there is a lot of evidence that abundance is well below historic levels for all species. Atlantic Sturgeon's range has contracted, and spawning has ceased at many historic spawning areas. Paddlefish are no longer present in Canada, and in the United States natural Paddlefish populations are considered extirpated in Maryland, New York, North Carolina, and Pennsylvania. Shovelnose sturgeon also have a reduced range, and have been extirpated from New Mexico, North Carolina, and Pennsylvania. Lake Sturgeon remains relatively widespread in Canada, but its range has been significantly reduced within the United States. Recruitment of the Kootenai River population of White Sturgeon has decreased since the mid-1960s (Williamson 2003).

2.00 Medium: Abundance or biomass is 75-125% of BMSY or similar proxy; OR population is approaching or recovering from an overfished condition; OR adequate information on abundance or biomass is not available.

3.00 High: Abundance or biomass is >125% of BMSY or similar proxy.

Points of Adjustment (multiple selections allowed)

-0.25 The population is declining over a generational time scale (as indicated by biomass estimates or standardized CPUE).

While catches for many of these species are in decline, this is at least partially the result of moratoriums on fishing and increased restrictions on the fisheries. We cannot therefore use the decreased catch size as a proxy for declining abundance. Thus no points were subtracted here.

-0.25 Age, size or sex distribution is skewed relative to the natural condition (e.g., truncated size/age structure or anomalous sex distribution).

Many of the populations have a disproportionate ratio of young fish to old fish, because the larger, older fish have been overfished. In contrast, some populations have disproportionate numbers of older fish. The Kootenai population of White Sturgeon has had no significant recruitment since 1974, and by 1997, the population was estimated at approximately 1,468 wild fish, with few individuals younger than 25 years of age (Williamson 2003).

A study of Atlantic Sturgeon in Canada determined that recruitment has been low in recent years. Also, a survey found a significantly higher number of ripe females than ripe males (Trencia et al. 2002).

-0.25 Species is listed as "overfished" OR species is listed as "depleted", "endangered", or "threatened" by recognized national or international bodies.

White, Shortnose, Pallid, and Alabama Sturgeons are listed as 'endangered' under the U.S. Endangered Species Act, and Gulf sturgeon as 'threatened.' The Kootenai River population of White sturgeon are listed as 'endangered' as well (TESS 2004).

The IUCN lists Lake sturgeon, Shovelnose Sturgeon and Paddlefish as 'vulnerable,' and Atlantic and White Sturgeon as 'lower risk' (IUCN 2004).

All Sturgeon species are listed under Appendix II of CITES. Appendix II species are those that 'are not necessarily now threatened with extinction but that may become so unless trade is closely controlled' (CITES 2004).

-0.25 Current levels of abundance are likely to jeopardize the availability of food for other species or cause substantial change in the structure of the associated food web.

+0.25 The population is increasing over a generational time scale (as indicated by biomass estimates or standardized CPUE).

+0.25 Age, size or sex distribution is functionally normal.

+0.25 Species is close to virgin biomass.

+0.25 Current levels of abundance provide adequate food for other predators or are not known to affect the structure of the associated food web.

0.50 Points for Abundance

HABITAT QUALITY AND FISHING GEAR IMPACTS

Core Points (only one selection allowed)

Select the option that most accurately describes the effect of the fishing method upon the habitat that it affects

1.00 The fishing method causes great damage to physical and biogenic habitats (e.g., cyanide; blasting; bottom trawling; dredging).

2.00 The fishing method does moderate damage to physical and biogenic habitats (e.g., bottom gillnets; traps and pots; bottom longlines).

Most Sturgeon are caught in gillnets in commercial fisheries, and by hook and line in recreational fisheries (Trencia et al. 2002; Anonymous, pers. comm. 2004). It is unclear what proportion of fish is taken with bottom gillnets rather than midwater gillnets, but is likely that most are taken with bottom nets, because sturgeon are bottom-dwellers.

3.00 The fishing method does little damage to physical or biogenic habitats (e.g., hand picking; hand raking; hook and line; pelagic long lines; mid-water trawl or gillnet; purse seines).

Points of Adjustment (multiple selections allowed)

-0.25 Habitat for this species is so compromised from non-fishery impacts that the ability of the habitat to support this species is substantially reduced (e.g., dams; pollution; coastal development).

Human-caused habitat modification and degradation (e.g., dams, channelization, dredging, pollution) and their resulting ecological impacts (blocked migration corridors, loss of spawning and feeding grounds, deterioration of water quality, etc.) are frequently cited as root factors in the decline of North American Sturgeon and Paddlefish species (Williamson 2003).

-0.25 Critical habitat areas (e.g., spawning areas) for this species are not protected by management using time/area closures, marine reserves, etc.

While there are some management measures in place, such as seasonal closures, spawning areas for at least some of these species remain undefined and unprotected (Trencia et al. 2002; Knights et al. 2002). Much more needs to be understood about spawning behavior in order to adequately protect critical habitat areas.

-0.25 No efforts are being made to minimize damage from existing gear types OR new or modified gear is increasing habitat damage (e.g., fitting trawls with roller rigs or rockhopping gear; more robust gear for deep-sea fisheries).

- 0.25 If gear impacts are substantial, resilience of affected habitats is very slow (e.g., deep water corals; rocky bottoms).
- +0.25 Habitat for this species remains robust and viable and is capable of supporting this species.
- +0.25 Critical habitat areas (e.g., spawning areas) for this species are protected by management using time/area closures, marine reserves, etc.
- +0.25 Gear innovations are being implemented over a majority of the fishing area to minimize damage from gear types OR no innovations necessary because gear effects are minimal.
- +0.25 If gear impacts are substantial, resilience of affected habitats is fast (e.g., mud or sandy bottoms) OR gear effects are minimal.

1.50 Points for Habitat Quality and Fishing Gear Impacts

MANAGEMENT

Core Points (only one selection allowed)

Select the option that most accurately describes the current management of the fisheries of this species.

- 1.00 Regulations are ineffective (e.g., illegal fishing or overfishing is occurring) OR the fishery is unregulated (i.e., no control rules are in effect).
- 2.00 Management measures are in place over a major portion over the species' range but implementation has not met conservation goals OR management measures are in place but have not been in place long enough to determine if they are likely to achieve conservation and sustainability goals.**

There is some management in place for Sturgeon fisheries. Sport fishing restrictions commonly include creel limits, closed seasons, size limits, gear restrictions, prohibition of high-grading (removing and releasing smaller fish from the creel so that larger fish can be caught without exceeding the limit), and sanctuaries or closures of certain waters. Commercial restrictions often include size limits, closed seasons, closures of designated waters, gear restrictions, and catch reporting requirements. Catch quotas have also been used for many years, particularly in saltwater commercial fisheries.

However, management of Sturgeons is complicated because some of the species are anadromous, and fall under the jurisdiction of a range of federal, state, and provincial authorities within the United States and Canada. The species that are listed as Endangered under the Endangered Species Act (ESA) are subject to designated recovery plans. The White Sturgeon in the Columbia River are managed by the congressionally established Columbia River Compact, as well as by a management agreement between Oregon and Washington. Twenty-eight states on the Mississippi River Basin have joined the Mississippi Interstate Cooperative Resource Association (MICRA), which attempts to coordinate the management of species located within the greater Mississippi River Basin.

While management certainly exists, management tools such as quotas are dependent on sufficient data to set realistic limits, and such data is unavailable. North American sturgeon populations remain far below sustainable levels. There is also evidence that some caviar from North American species are being sold illegally as Caspian Sea product (Williamson 2003). We awarded a score of 2 here, because although management is in place, it is not meeting sustainability goals.

- 3.00 Substantial management measures are in place over a large portion of the species range and have demonstrated success in achieving conservation and sustainability goals.

Points of Adjustment (multiple selections allowed)

-0.25 There is inadequate scientific monitoring of stock status, catch or fishing effort.

Monitoring of Sturgeon populations has historically been weak, and abundance, population structures and spawning areas remain poorly defined (Williamson 2003; Trencia et al. 2002). Monitoring of catch seems to be adequate for some species in some regions, but overall is not thorough. In addition, any illegal catch is not monitored.

- 0.25 Management does not explicitly address fishery effects on habitat, food webs, and ecosystems.

-0.25 This species is overfished and no recovery plan or an ineffective recovery plan is in place.

These species are overfished, and the recovery plans have yet to prove successful (Williamson 2003). As they are long-lived species, it will take some time before it can be determined if the species are recovering.

- 0.25 Management has failed to reduce excess capacity in this fishery or implements subsidies that result in excess capacity in this fishery.

- +0.25 There is adequate scientific monitoring, analysis and interpretation of stock status, catch and fishing effort.

- +0.25 Management explicitly and effectively addresses fishery effects on habitat, food webs, and ecosystems.
- +0.25 This species is overfished and there is a recovery plan (including benchmarks, timetables and methods to evaluate success) in place that is showing signs of success OR recovery plan is not needed.
- +0.25 Management has taken action to control excess capacity or reduce subsidies that result in excess capacity OR no measures are necessary because fishery is not overcapitalized.

1.50 Points for Management

BYCATCH

Core Points (only one selection allowed)

Select the option that most accurately describes the current level of bycatch and the consequences that result from fishing this species. The term, "bycatch" used in this document excludes incidental catch of a species for which an adequate management framework exists. The terms, "endangered, threatened, or protected," used in this document refer to species status that is determined by national legislation such as the U.S. Endangered Species Act, the U.S. Marine Mammal Protection Act (or another nation's equivalent), the IUCN Red List, or a credible scientific body such as the American Fisheries Society.

- 1.00 Bycatch in this fishery is high (>100% of targeted landings), OR regularly includes a "threatened, endangered or protected species."
- 2.00 Bycatch in this fishery is moderate (10-99% of targeted landings) AND does not regularly include "threatened, endangered or protected species" OR level of bycatch is unknown.**

Bycatch levels remain mostly unknown and poorly monitored. Green sturgeon may be caught in fisheries for White Sturgeon, as well as in salmon and groundfish fisheries (EPIC et al. 2001).
- 3.00 Bycatch in this fishery is low (<10% of targeted landings) and does not regularly include "threatened, endangered or protected species."

Points of Adjustment (multiple selections allowed)

- 0.25 Bycatch in this fishery is a contributing factor to the decline of "threatened, endangered, or protected species" and no effective measures are being taken to reduce it.
- 0.25 Bycatch of targeted or non-targeted species (e.g., undersize individuals) in this fishery is high and no measures are being taken to reduce it.
- 0.25 Bycatch of this species (e.g., undersize individuals) in other fisheries is high OR bycatch of this species in other fisheries inhibits its recovery, and no measures are being taken to reduce it.**

A NMFS/USFWS survey found that while bycatch of Sturgeon in other fisheries does not seem to pose a significant threat to survival, it may impede recovery (Williamson 2003).

- 0.25 The continued removal of the bycatch species contributes to its decline.
- +0.25 Measures taken over a major portion of the species range have been shown to reduce bycatch of "threatened, endangered, or protected species" or bycatch rates are no longer deemed to affect the abundance of the "protected" bycatch species OR no measures needed because fishery is highly selective (e.g., harpoon; spear).
- +0.25 There is bycatch of targeted (e.g., undersize individuals) or non-targeted species in this fishery and measures (e.g., gear modifications) have been implemented that have been shown to reduce bycatch over a large portion of the species range OR no measures are needed because fishery is highly selective (e.g., harpoon; spear).
- +0.25 Bycatch of this species in other fisheries is low OR bycatch of this species in other fisheries inhibits its recovery, but effective measures are being taken to reduce it over a large portion of the range.
- +0.25 The continued removal of the bycatch species in the targeted fishery has had or will likely have little or no impact on populations of the bycatch species OR there are no significant bycatch concerns because the fishery is highly selective (e.g., harpoon; spear).

1.75 Points for Bycatch

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