RECOVERY POTENTIAL ASSESSMENT FOR ATLANTIC STURGEON (MARITIMES DESIGNATABLE UNIT)

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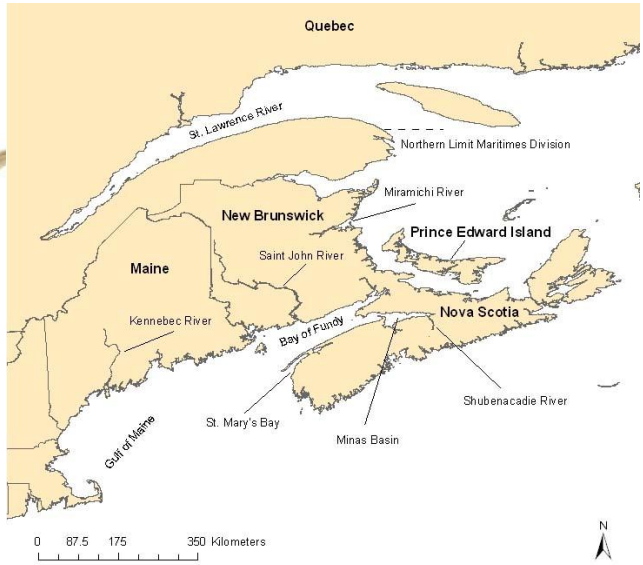

Figure 1. Map showing the approximate location of the Atlantic Sturgeon Designatable Unit, Saint John River, and the Minas Basin.

Context

The Maritimes Designatable Unit (DU) of Atlantic Sturgeon was evaluated as 'Threatened' by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) in May 2011 on the basis of a single spawning location within the lower Saint John River area, a relatively small breeding population numbering in the low thousands and uncertainty of the effects on population viability of regulated commercial and recreational fisheries. The population has never been formally assessed and comprehensive information on current abundance is lacking, as is the case for most of the known spawning populations of Atlantic Sturgeon along the eastern seaboard of North America.

A Recovery Potential Assessment (RPA) process has been developed by Fisheries and Oceans Canada (DFO) Science to provide the information and scientific advice required to meet the various requirements of the Species at Risk Act (SARA). The scientific information provided in the RPA serves as advice to the Minister regarding the listing of the species under SARA and is used when analyzing the socio-economic impacts of listing, as well as during subsequent consultations, where applicable. It is also used to evaluate activities that could contravene the SARA should the species be listed, as well as in the development of a recovery strategy. This assessment considers the scientific data available to assess the recovery potential of the Maritimes DU of Atlantic Sturgeon.

This Science Advisory Report is from the January 15-16, 2013, Recovery Potential Assessment for Atlantic Sturgeon (Maritimes Designatable Unit). Additional publications from this meeting will be posted on the Fisheries and Oceans Canada (DFO) Science Advisory Schedule as they become available.

SUMMARY

- Estimates of Atlantic Sturgeon spawner abundance in the Saint John River indicate low to modest population abundance, in the range of 1,000 to 3,000 spawners per year.
- A potential medium-term recovery target could be, at a minimum, to maintain the current annual spawner abundance in the lower Saint John River of approximately 1,000-3,000 spawners, while supporting a population with a broad body size and age distribution for both sexes.
- A potential distribution target would be that all life history stages should be found in the Saint John River, with interannual appearances of multiple age classes within known marine foraging areas (e.g. the Minas Basin).
- The lower Saint John River between Mactaquac and the Reversing Falls, including tributaries, is considered to be important habitat for the Maritimes Designatable Unit of Atlantic Sturgeon, as this bounds the only known spawning area in the Designatable Unit. Adults can begin to ascend the Saint John River as early as May, and spawning is thought to extend into late August.
- The Saint John River Estuary (below the Reversing Falls) is considered to be important habitat for the Maritimes Designatable Unit of Atlantic Sturgeon for its role as a migration route in and out of the Saint John River.
- Migrant, foraging juvenile (as young as 3 years), sub-adult and adult Atlantic Sturgeon are abundant in the Minas Basin during the summer months, and this is also considered to be important habitat for the Maritimes Designatable Unit of Atlantic Sturgeon. The Minas Passage is considered important habitat for the migration of Atlantic Sturgeon in and out of the Minas Basin.
- Current knowledge does not indicate any particular residence requirements, as defined by the *Species at Risk Act* and DFO guidance material, for Atlantic Sturgeon.
- The primary threat to the Maritimes Designatable Unit of Atlantic Sturgeon is the commercial fishery, which has been authorized since 2010 to remove 350 Atlantic Sturgeon (175 males and 175 females) per year. The recreational angling fishery has a release rate of approximately 98%, and survival of Atlantic Sturgeon that are released live is considered to be very high. There are currently two Aboriginal fishing licences for Atlantic Sturgeon, with very low reported landings (<5 per year). Some Atlantic Sturgeon have been authorized by DFO to be caught and retained for aquaculture purposes (i.e., breeding). It is prohibited to retain Atlantic Sturgeon captured as bycatch in other fisheries, but rates of incidental capture and total mortality are not well known and may warrant assessment. The Annapolis Tidal Generating Station is known to be a source of mortality for Atlantic Sturgeon in the Bay of Fundy; however, the number of individuals reported to be killed each year is low with 11 mortalities recorded since 1985. The proportion of these that are from the Saint John River is not known.
- There are a number of existing mitigation measures available to reduce the mortality of Atlantic Sturgeon in the Maritimes Designatable Unit. Additional measures could include: a maximum mesh size limit to increase escapement of larger bodied mature females, an extended seasonal closure to protect a greater proportion of the spawning biomass, an increase in the minimum size, mandatory reporting of Atlantic Sturgeon bycatch in other fisheries, verification of the bycatch rates reported, and a reduction in the allowable take of Atlantic Sturgeon from the Saint John River.

- A population model for the Maritimes DU of Atlantic Sturgeon continues to be developed, and it is not possible to project future biomass with any certainty at the current time. However, given the broad age composition of the adult population (Females: 16-44 years, Males: 17-39 years), and the large number of Saint John River juveniles and sub-adults that have been observed in the Minas Basin, it is expected that the population will continue to persist at approximately current levels in the short to medium term (5-10 years) and is not considered to be at risk of extinction within the next generation.

BACKGROUND

Rationale for Assessment

When the *Committee on the Status of Endangered Wildlife in Canada* (COSEWIC) evaluates an aquatic species as 'Threatened' or 'Endangered', Fisheries and Oceans Canada (DFO), as the responsible jurisdiction under the *Species at Risk Act* (SARA), is required to undertake a number of actions. Many of these actions require scientific information on the current status of the species, population, or designatable unit (DU), threats to its survival and recovery, habitat needs, and the feasibility of its recovery. Formulation of this scientific advice has typically been developed through a Recovery Potential Assessment (RPA) that is conducted shortly after the COSEWIC assessment. This timing allows for the consideration of peer-reviewed scientific analyses into SARA processes, including listing decisions and recovery planning.

The Maritimes DU of Atlantic Sturgeon was evaluated as 'Threatened' by COSEWIC in May 2011 (COSEWIC 2011). DFO Science was asked to undertake an RPA for the Maritimes DU of Atlantic Sturgeon based on DFO's protocol for conducting RPAs (DFO 2007).

Maritimes Designatable Unit

Atlantic Sturgeon (*Acipenser oxyrinchus*) is a demersal, anadromous species distributed along the Atlantic coast of North America from the southern United States to Labrador. Two spawning populations of Atlantic Sturgeon are known to exist in Canadian waters: one in the Saint John River, New Brunswick, and another in the St. Lawrence River, Québec (Figure 1). These populations have been separated by COSEWIC into distinct DUs: the Maritimes Population DU and the St. Lawrence River Population DU, respectively (COSEWIC 2011).

Throughout the species range, sub-adults and adults migrate extensively in coastal waters, where they may form mixed assemblages (e.g. in the Minas Basin of the Bay of Fundy); however, the species is highly philopatric and returns to its native river to spawn. Genetic studies that have examined mitochondrial DNA (Grunwals et al. 208; Wirgin et al. 2012) and microsatellite DNA (King et al. 2001; Wirgin et al. 2012) have shown that Atlantic Sturgeon sampled within spawning habitat (or during spawning times) comprise populations that are genetically distinct from other sturgeon populations. The Saint John River population has been shown to differ genetically from the St. Lawrence River population and all other extant spawning populations occurring in more southerly rivers for which genetic information is available, including the adjacent Kennebec River (State of Maine) population. There are records of Atlantic Sturgeon found in other rivers and estuaries within the Maritimes DU (including records of juveniles and adults in the Miramichi River), but the genetics of these populations have not been studied and it is not known whether they represent additional distinct populations within the DU.

ASSESSMENT

Status and Trends

The assessment of the population is based upon monitoring and sampling of fish captured within the commercial fishery for adult sturgeons that occurs along the main stem of the lower Saint John River during the months of May, July, and August. Spawner abundance estimates, which are derived from mark-recapture experiments, can be complicated by variability in the timing of onset of the fishery (freshets can prevent fishing during May in some years) and the regulated closure of the fishery during the month of June. Estimates of current annual Atlantic Sturgeon spawner abundance in the Saint John River for the years 2009, 2010, 2011, and 2012 when mark-recapture experiments were attempted vary based on the estimation procedures used. Nonetheless, all estimates yield mutually consistent estimates of annual spawner population abundances, in the range of 1,000 to 3,000 spawners per year.

Table 1. Summary of single sample population estimates for Saint John River Atlantic Sturgeon derived using the Bayes algorithm of Gazey and Staley (1986) for the years 2009 to 2012 estimated using either tags applied in May and subsequent recaptures during the months of July and August or all data pooled across the fishing season.

	2009		2010		2011		2012	
Variable	**May**	**Season**	**May**	**Season**	**May**	**Season**	**May**	**Season**
Marks	-	193	110	236	-	171	44	93
Catch	-	702	357	502	-	485	338	329
Recaptures	-	45	17	48	-	46	8	33
Abundance								
Mode	-	3,010	2,300	2,470	-	1,800	1,800	930
Median	-	3,050	2,450	2,505	-	1,825	2,125	950
LowCI-95%	-	2,330	1,550	1,910	-	1,400	1,020	690
UppCI-95%	-	4,170	4,150	3,345	-	2,475	4,855	1,350

While the spawning frequency for this population has not been established, it is expected to be in the order of 3-4 years for females and 1-3 years for males, which means that not all adults enter the river to reproduce every year. The total number of adults in the population is, therefore, likely greater than the numbers estimated to contribute to spawning in a given year.

Based on tagging and other studies conducted in the Minas Basin, estimates of the summer aggregation abundance of Atlantic Sturgeon in the Minas Basin, which is composed primarily of juveniles and sub-adults (ages 3-29 years), suggest a recurring aggregation in the order of 10,000 (6,000-14,000) fish. Genetic analysis indicated that approximately 60% of these were of Saint John River origin (with 40% from the US), with a high frequency of annual returns (Wirgin et al. 2012).

The Saint John River population was not commercially exploited until the year 1880 when an intensive and largely unregulated gill-net based fishery removed 273 t (Figure 2). A precipitous year over year decline in annual landings, to a low of 7.4 t in 1886, resulted in a 10 year closure of the fishery beginning in 1887. Estimates of the virgin population abundance are not possible for this population because of uncertainty in the annual levels of fishing effort. However, the

cumulative reported fishery removals from 1880 to 1886 of approximately 700 t indicate a minimum of 7,000 to 14,000 adults assuming average individual biomasses of 100 kg and 50 kg respectively. Annual commercial landings from the Saint John River and Estuary fishery have not exceeded 41 t in any year since the re-opening of the fishery in 1897 (Figure 2).

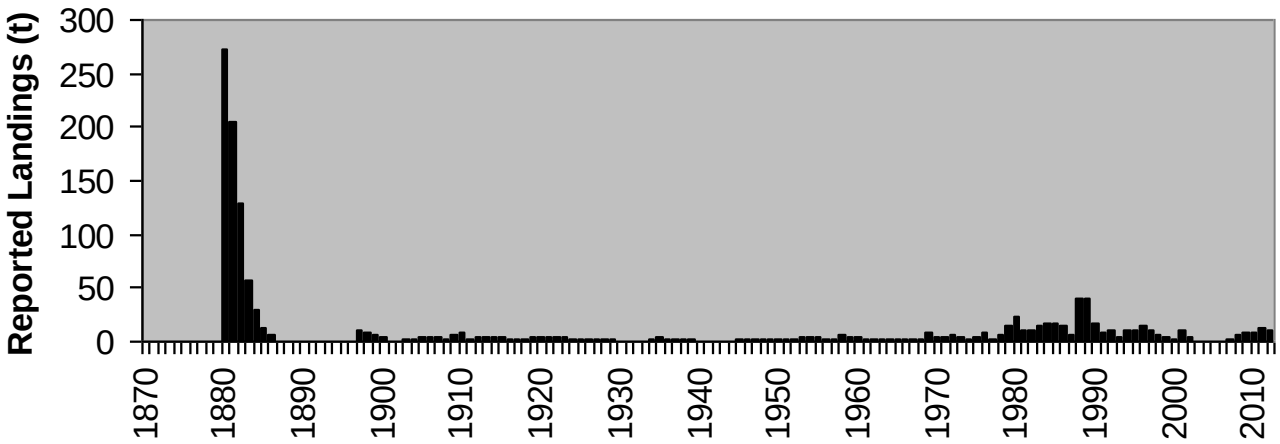

Figure 2. Annual reported landings from the Saint John River and Harbour Atlantic Sturgeon fishery. The fishery began in 1880 and was closed between 1887 and 1897. No landings were reported for the years 1932, 1933, 2005, and 2006.

Effective Population Size (Ne)

Genotyping of 232 adult Saint John River Atlantic Sturgeon sampled from the 2010 and 2011 gillnet fisheries at 16 and 21 loci (nuclear DNA) yielded effective population size estimates (Ne) of 95 (upper and lower 95% confidence bounds: 73 and 127) and 118 (upper and lower 95% confidence bounds: 89 and 149) fish, respectively. Both estimates lie above the minimum threshold of 50 suggested to be critical for immediate risk of inbreeding but below the minimum threshold of 500 that has been suggested as necessary to maintaining long-term evolutionary potential (Franklin 1980). Detection of 13-15 full family groups within the sample population of 232 adults indicates that the current spawner population is possibly quite small. However, this should be considered to be a preliminary finding until additional samples acquired over several spawning seasons become available for genetic assessment.

Median estimates of census population sizes (Nc) of 2,450 (May 2010) and 2,125 (May 2012) adults, and an effective population size value of Ne = 110, suggest an average Ne/Nc ratio of 0.04-0.05, whereas the extreme range for the Ne/Nc ratios is estimated to be 0.02-0.21 at the extreme lower and upper 95% CI for Ne and Nc. All but the highest possible estimated Ne/Nc ratio rank towards the low end of the range of Ne/Nc ratios that have been reported elsewhere. The median Ne/Nc ratio reported in 83 studies, across all taxonomic groups, was 0.14 (Palstra and Ruzzante 2008).

Range and Distribution

In summer, adult and juvenile Atlantic Sturgeon are common in the Lower Saint John River and Estuary and the Cumberland and Minas basins in the Inner Bay of Fundy. Aggregations of Atlantic Sturgeon may occur elsewhere within the Bay of Fundy (e.g., St. Mary's Bay). Commercial catch records and other sources of information indicate that Atlantic Sturgeon are relatively widespread around the Bay of Fundy, the Atlantic Coastal areas of Nova Scotia and

Newfoundland, and the Gulf of St. Lawrence. There is some mixing of Atlantic Sturgeon from US waters in the Bay of Fundy, but no fish of US origin have been detected in the Saint John River fishery, and no adult fish tagged and released from the commercial Saint John River fishery have appeared in another river known to support a spawning population. As yet, no tagged fish from the St. Lawrence River have been captured in the Bay of Fundy.

There is no indication that the range and distribution of Atlantic Sturgeon has changed over time.

Life-History Parameter Estimates

Growth

Saint John River Atlantic Sturgeon have been reported to reach lengths of 459 cm and body weights of 364.9 kg (Scott and Crossman 1983). They may live to be more than 60 years for females and about 30 years for males;males generally tend to be smaller than females of the same age.

Preliminary estimates of theoretical total lengths (L_{inf}) for male (201±7.5 cm TL) and female (222±6.9 cm TL) Saint John River fish are lower than those estimated for the Hudson River population (male 234±15 cm, female 278±7.5 cm). However, these are possibly underestimated due to an absence of smaller bodied, immature fish in the sample population (Figure 3). As well, it is not known at this time if larger, and possibly older, fish are represented in the annual spawning assemblages but are not susceptible to capture in the 33 cm mesh gillnets that predominate in the fishery.

Estimates of the growth coefficient (k) indicate that both male (k=0.11± 0.02) and female (k=0.095±0.015) Saint John River fish grow at a faster rate than male (k=0.093± 0.016) and female (k=0.074±0.006) Hudson River fish.

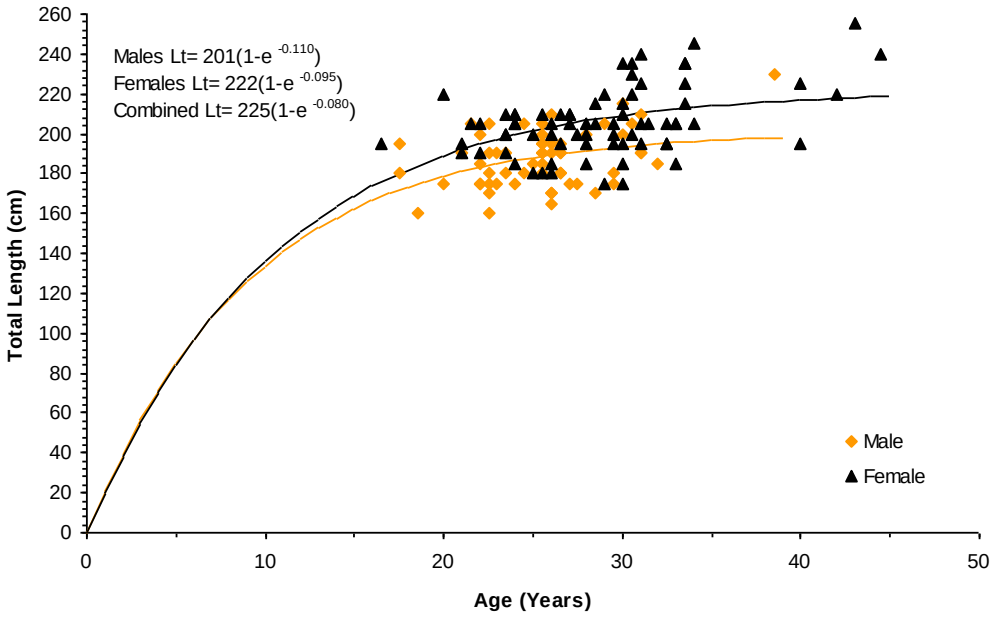

Figure 3. Scatterplots of total length (cm) versus estimated age (years) for male (diamonds) and female (triangles) adult Atlantic Sturgeon sampled during the 2010 and 2011 fishing seasons. The von Bertalannfy growth functions have been calculated for each sex using the data pooled between years.

Maturity

As was the case with the estimation of growth traits, uncertainty as to whether gill net selectivity occurs in the fishery lends uncertainty to estimation of the age distribution of the male and female components of the spawning population. For this reason, the generation time for Saint John River Atlantic Sturgeon is considered to be the age at first maturity, estimated to be 16 and 17 years for males and females, respectively, rather than the average age of parents.

Minimum lengths of sexually mature males and females in the Saint John River fishery since 2009 are 127 cm TL and 147 cm TL, respectively. In the St. Lawrence River, male sturgeons first mature at 16 - 24 years of age, at a size of approximately 150 cm fork length (FL) and a weight of 36 kg. Females reach maturity at an age of 27- 28 years, at a size of 180 - 200 cm FL and a weight of 64 kg. In the Hudson River, male and female Atlantic Sturgeon reach maturity at 117 and 173 cm FL (133 and 197 cm TL) and ages 12 and 14 respectively.

Fecundity

Female Atlantic Sturgeon are highly fecund. Large bodied members of the St. Lawrence River population have been estimated to contain 25,000 eggs per kg of (total) body weight (Scott and Crossman 1973). Ovaries can represent between 12% - 25% of total body weight at maturity. Generally, females are thought to spawn once every 2-6 years and males are thought to spawn every 1-5 years. Based on fishery sampling of 200 females in the Saint John River, the average weight of eggs (minus ovary) was approximately 3 kg per female, which represents approximately 5% of body weight. There are approximately 70,000-75,000 eggs in 1 kg of Saint John River Atlantic Sturgeon eggs (Acadian Sturgeon and Caviar, Carter's Point, NB, *personal communication*).

Sex Ratio

Information on the ratio of males to females in Canadian waters is incomplete. A higher female to male ratio in older fish could be expected if, as for other sturgeons, the females live longer, but no age specific studies are available. Samples of commercial catches from the Saint John River indicated that the sex ratios of adults was 2.5:1 (n =91) for males in 1998-1999, whereas the sex ratio of annual catches have varied since 2007 between 1.5 for males to 0.9 for females.

Natural Mortality

Natural mortality of Atlantic Sturgeon in the Bay of Fundy is not known. The broad range of age (size) classes suggests natural mortality is low.

Habitat Considerations

The Canadian *Species at Risk Act* (SARA) requires that Critical Habitat be identified to the extent possible based on the best information available in the Recovery Strategy for all 'Threatened', 'Endangered' or 'Extirpated' species, or a schedule of studies be included that, when completed, would allow the species' Critical Habitat to be identified. The *SARA* defines Critical Habitat as, "… the habitat that is necessary for the survival or recovery of a listed wildlife species and that is identified as the species' critical habitat in the recovery strategy or in an action plan for the species." National Guidance suggests that the identification of Critical Habitat is comprised of several components: biophysical functions, features and attributes, and geographic location.

Functions – Critical Habitat serves a biological function, which is the capacity to support a life-cycle process requirement of the listed species. A function is the result of a biophysical feature and its attributes**,** which together provide the capacity for the function to occur.

Features – Features are the biophysical components of the habitat (e.g., eelgrass beds, macrophytes, riffles, pools, and acoustic environment). Features are the aspects of the habitat that support the functional capacity for life-cycle processes necessary for survival or recovery. Features must be described in terms of their temporal use and/or availability.

Attributes – Every feature is comprised of many attributes, such as temperature, water depth, velocity, gravel size and oxygen level, that operate within optimal ranges and together provide the functional capacity of the feature to support a life-cycle process. Attributes are measurable and indicate why one feature is essential whereas another similar feature is not. Only those attributes deemed essential to a feature and the function it supports should be described.

Geographic location – Can be identified through a variety of approaches, including the Bounding Box Approach, in which the function and features of the habitat can be described but their exact location cannot.

While this Science Advisory Report does not identify Critical Habitat, it provides information to support the identification of Critical Habitat. DFO will consider this Science advice, the requirements of SARA, and National policies and guidance on Critical Habitat identification to complete the identification of Critical Habitat in the Recovery Strategy.

Atlantic Sturgeon are anadromous, meaning they spawn in rivers and spend a portion of their lives at sea. Based on presence of larvae, spent and gravid females, and spermeating (ripe and running) males, Atlantic Sturgeon are known to spawn somewhere below Mactaquac on the Lower Saint John River (above the Reversing Falls), including tributaries, and, thus, the lower Saint John River between Mactaquac and the Reversing Falls, including tributaries, is considered to be important habitat for the Maritimes DU of Atlantic Sturgeon. There is a possibility that other spawning locations exist within rivers of the Maritimes DU, but this has not been substantiated to date.

Adults can begin to ascend the Saint John River as early as May. Some adults may reside within the river throughout the winter prior to spawning in the spring. Spawning is thought to extend into late August. Neither the exact historical (i.e. prior to construction of the Mactaquac Dam in 1968) nor current spawning locations have been reported. Eggs are thought to be deposited on firm substrate where they adhere until hatching. Juveniles reportedly remain in the river for at least their first summer before migrating to estuaries in winter. The Saint John River Estuary (below the Reversing Falls) is considered to be important habitat for the Maritimes DU of Atlantic Sturgeon for its role as a migration route in and out of the Saint John River. By 3-5 years of age, juvenile Atlantic Sturgeon move into the marine environment where they are thought to migrate along the coast following temperature gradients until maturity. Migrant, foraging juvenile (as young as three years), sub-adult and adult Atlantic Sturgeon are abundant in the Minas Basin during the summer months, and this is also considered to be important habitat for the Maritimes DU of Atlantic Sturgeon. The Minas Passage is considered important habitat for the migration of Atlantic Sturgeon in and out of the Minas Basin.

No Atlantic Sturgeon were captured during the extensive beach seine surveys of the lower Saint John River during the years 2000, 2001, and 2009. The shallow shoreline areas (< 2 m depth) of the river, therefore, do not appear to be used extensively by the species irrespective of substrate type, vegetation, salinity, or tidal amplitude. There have not been significant catches

of Atlantic Sturgeon reported from Research Vessel surveys or Observer records in waters greater than 50 m depth within the Bay of Fundy, or from any of the Shelf (e.g., submarine banks) and Shelf Slope ecosystems adjacent to the Canadian Maritime Provinces, though tagging suggests that there may be use of some areas outside of Bay of Fundy, possibly for overwintering. Aggregations of Atlantic Sturgeon detected in Scott's Bay and St. Mary's Bay, Nova Scotia need further investigation to determine their genetic origin and habitat use within those areas.

Residence Requirements

Residence is defined in SARA as a, "dwelling-place, such as a den, nest or other similar area or place, that is occupied or habitually occupied by one or more individuals during all or part of their life cycles, including breeding, rearing, staging, wintering, feeding or hibernating".

Current knowledge does not indicate any particular residence requirements for Atlantic Sturgeon.

Recovery Targets

Recovery targets are typically set with an abundance and a distribution component; however, other population characteristics may also be considered (DFO 2005; DFO 2011).

Given the lack of accurate information on the current and historical spawning stock biomass in the Saint John River, including potential changes over time, it is not possible to establish definitive recovery targets for this DU.

However, a potential medium-term recovery target could be, at a minimum, to maintain the current annual spawner abundance in the lower Saint John River of approximately 1,000-3,000 spawners, while supporting a population with a broad body size and age distribution for both sexes. Development of more accurate estimates of spawner abundance, spawning frequency, ages and the size-dependency of catchability of adult sturgeons with gill nets will greatly facilitate assessment of both progress toward and achievement of the recovery target.

A potential distribution target would be that all life history stages should be found in the Saint John River, with interannual appearances of multiple age classes within known marine foraging areas (e.g. the Minas Basin). A further consideration, contingent on the outcomes of future research, may be range expansion of spawning activity within the Maritime Provinces via introductions into areas where prior presence of spawning can be demonstrated, the Miramichi River, for example.

Threats

Threats to Individuals

The primary source of human-induced mortality of Saint John River Atlantic Sturgeon is the **commercial fishery**. Three licences are valid for the Saint John River/Harbour, and licence conditions restrict fishing to tidal waters of the counties through which the Saint John River flows. One licence is valid in Nova Scotia (Shubenacadie River). Removals via the fishery have been capped at 350 (175 males and 175 females) fish per year since 2011.

There is a **recreational fishery** for Atlantic Sturgeon in New Brunswick, and there are annual sturgeon angling tournaments on the Saint John River. The recreational fishery has a release

rate of approximately 98%, and survival of Atlantic Sturgeon that are released live is considered to be very high. Few (1-2 per year) Atlantic Sturgeon are captured in the angling tournaments.

There are currently two **Aboriginal fishing licenses** (Food, Social, and Ceremonial) that authorize Atlantic Sturgeon harvest in the Maritimes Region (Oromocto First Nation and the New Brunswick Aboriginal Peoples Council, NBAPC). There is a negotiated daily allocation of 10 Atlantic Sturgeon per day per person for NBAPC, but these licenses have reported minimal landings (< 5 in total) of Atlantic Sturgeons in the past five years. Only two Atlantic Sturgeon were reported landed in 2012.

There is one active Atlantic Sturgeon aquaculture facility in New Brunswick. Some Atlantic Sturgeon have been authorized by DFO to be caught and retained for **aquaculture** purposes (i.e., breeding). Removals were 16 fish in 2002 and 20 fish in 2003. The number of wild Atlantic Sturgeon spawned for aquaculture purposes was 30, 31, 24, and 32 for the years 2007 to 2010. All fish were returned to the wild after having been spawned. Removals for aquaculture purposes since 2011 have been counted against the annual harvest limit of 350 fish, even if the fish were subsequently returned to the wild after having been spawned. In total seven females and 12 males captured under a commercial licence were returned to the wild in 2011. One female and four males were removed for aquaculture purposes in 2012 and then returned to the wild.

It is prohibited to retain Atlantic Sturgeon captured as **bycatch** in other fisheries, but rates of incidental capture and mortality are not well known. Some fisheries, notably set gillnet fisheries (for gaspereau and shad), do carry a relative high risk of mortality for incidentally captured Atlantic Sturgeon as they occur in Atlantic Sturgeon habitat. The level of incidental capture and mortality in these fisheries is not known, but there are indications that it is potentially high, particularly within the Saint John River and Harbour, relative to other sources of mortality. Mandatory reporting of Atlantic Sturgeon (quantity and sex) caught as bycatch in these fisheries, and independent verification of bycatch and bycatch mortality rates are necessary in order to determine the potential severity of this threat to the species.

Illegal harvest of Atlantic Sturgeon is not considered to be a threat. Enforcement is considered to be effective at minimizing retention of bycatch and illegal harvest.

The **Annapolis Tidal Generating Station** is known to be a source of mortality for Atlantic Sturgeon in the Bay of Fundy; however, the number of individuals reported to be killed each year is low (<5) with 11 mortalities having been reported since about 1985. The proportion of these that are from the Saint John River is not known.

There are no reports of Atlantic Sturgeon mortalities from the **Mactaquac Dam hydroelectric facility** on the Saint John River. However, there have been anecdotal reports of Atlantic Sturgeon becoming trapped in gate wells located at the base of the dam.

Oil and gas development proposed for the Gulf of St. Lawrence was identified as a potential threat in the COSEWIC report. However, because catches from this area are infrequent and low when reported, oil and gas developments are not considered to be a threat to Maritimes DU Atlantic Sturgeon at this time.

Threats to Habitat

Water quality in the lower Saint John River is considered to be sufficient for Atlantic Sturgeon use, and it is not considered to have changed significantly in the last 20 years. A concern for

entrapment of alewife and blueback herring in human-made ponds along the wetlands of the lower Saint John River (e.g. impoundments for waterfowl during spring and fall flooding and subsequent water level recessions) may also be relevant to other species such as Atlantic Sturgeon.

Atlantic Sturgeon are known to feed extensively on marine worms; thus, any **fisheries on food supplies**, such as the commercial fisheries within the Bay of Fundy for bloodworms, may have a potential impact on the prey of Atlantic Sturgeon and may be destructive to Atlantic Sturgeon habitat.

Mitigation and Alternatives

A maximum of 350 Atlantic Sturgeon (50:50 sex ratio) can be taken annually in the commercial fishery in the Bay of Fundy, the fishery is subject to gear and effort restrictions. There are presently four commercial licence holders for this area. Three licences are valid for the Saint John River/Harbour, and licence conditions restrict fishing to tidal waters of the counties through which the Saint John River in New Brunswick flows. One licence is valid for one county in the Province of Nova Scotia through which the Shubenacadie River flows. All sturgeon licenses are terminal (i.e. they cannot be transferred to another individual), and the licenses cease to exist if/once the license holders leave the fishery.

Atlantic Sturgeon may only be fished commercially with gill nets having a minimum mesh size of 330 mm (13 inches), which has been implemented to reduce the catch of juvenile sturgeon and prevent bycatch of other species. A complementary maximum mesh size limit could increase escapement of larger bodied mature females. In addition, an increase in the minimum legal size could be implemented.

The commercial fishing season is presently closed during the month of June to protect spawning adults. This represents about one third of the spawning season (which typically occurs annually from the end of May to August). This seasonal closure could be modified, if necessary, to protect a greater proportion of the spawning biomass.

Regulations prohibit the retention or possession of Atlantic Sturgeon <120 cm in total length, which is the presumed length at first maturity, in both commercial and recreational fisheries. Retention of incidentally caught Sturgeon in other river and coastal commercial fisheries is prohibited by regulations.

Population Projections

A population model for the Maritimes DU of Atlantic Sturgeon continues to be developed, and it is not possible to project future biomass with any certainty at the current time. However, given the broad age composition of the population, the large number of Saint John River juveniles and sub-adults that have been observed in the Minas Basin, under current conditions, it is expected that the population will continue to persist at approximately current levels in the short to medium term (5-10 years), and the Maritimes DU of Atlantic Sturgeon is not considered to be at risk of extinction within the next generation.

Allowable Harm

The total number of Atlantic Sturgeon that are removed from the Maritimes population DU each year is not accurately known. Authorized removals by the commercial fishery vary annually and have been capped and controlled since 2011. However, using the average weight of individuals

collected in 1998 and 1999 (33.6 kg), the approximate number of fish that have been removed by the commercial fishery is estimated to have been approximately 400 Atlantic Sturgeon per year since 1965. Fewer fish have been retained by the commercial fishery in the past 10 years than the historical average. There are reported to be up to five removals of Atlantic Sturgeon in the Annapolis Basin each year (killed in the turbine). Total annual removals in recent years, therefore, appears to have been <500 juveniles and adults combined. This estimate may require revision once bycatch mortality rates in gill net based fisheries like those that occur in Saint John Harbour are better understood.

There is no evidence that the average annual reported landings from 1965-2002 of 12.6 mt, or approximately 400 fish (based on length and weight data collected in 1998/1999), has resulted in any significant changes to the observed relative abundance, size structure, or estimated age structure of Atlantic Sturgeon in the Saint John River, but ongoing review may be warranted.

Given existing information, total removals that are within the average historical harvest levels are predicted to be sustainable for the short-term (i.e. five years). If the annual removals from recreational fisheries, Aboriginal fisheries, and incidental mortality combined are assumed to be approximately 50 fish, this would suggest a sustainable commercial harvest level of 350 fish (maximum) for the commercial fishery in the Saint John River. This proposed sustainable harvest level is based on a number of assumptions that should be re-evaluated as new information becomes available. The sex ratio of this harvest should remain at 50:50 to minimize potential conservation concerns.

Sources of Uncertainty

Catchability differs between male and female spawners.

There is incomplete reporting of marked and unmarked fish in some years.

Gillnet selectivity results in unequal catchability among the spawning population, which differs between sexes.

Spawning frequency for male and female sturgeon is not known

Potential exists for unequal catchability resulting from behavioural (social) factors intrinsic to Atlantic Sturgeon.

The quantity of Atlantic Sturgeon captured as bycatch in the gaspereau and shad fisheries.

Improving the understanding of demographic factors contributing to genetic diversity of the population.

SOURCES OF INFORMATION

This Science Advisory Report is from the January 15-16, 2013, Recovery Potential Assessment for Atlantic Sturgeon (Maritimes DU). Additional publications from this meeting will be posted on the Fisheries and Oceans Canada (DFO) Science Advisory Schedule as they become available.

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APPENDIX A: Summary of Threats to, and Rating of Effects on, Recovery and/or Persistence of Maritimes DU Atlantic Sturgeon.

	Level of Concern	Extent	Occurrence	Frequency / Timing	Severity	Causal Certainty	Mitigation / Alternatives
Threats to Individuals							
Commercial Fishery	High	Saint John River	Historical / Current / Anticipated	Annual: May, July-August	Mortality of up to 350 adults per year (175 males, 175 females)	High	Existing: Cap on maximum annual removals. June closure of the fishery to protect spawners. Minimum size of 120 cm Total Length (TL). Minimum gillnet mesh size of 330 mm (13”). Potential: Reduce allowable number of removals; varied close times to protect fish; change size limits.
Recreational Fishery	Low	Saint John River, and other rivers in the DU	Historical / Current / Anticipated	Annual: May - December	Mortality unknown, but expected to be low (<5 per year) (juveniles)	High	Existing: Minimum length of 120 cm TL. Potential: Introduce bag limits; change minimum body size.
FSC Fishery	Low	Saint John River, and other rivers in the DU	Historical / Current / Anticipated	Annual	Mortality unknown, but expected to be low (<5 per year)	High	Existing: Limits on communal harvests. Potential: Reduce harvests.
Aquaculture Removals	Low	1 facility on the Saint John River	Current	Annual: May, July-August	Some temporary and some permanent removals, all are counted against annual harvest cap of 350 fish	High	Existing: Removals counted against annual harvest cap.
Bycatch in Other Fisheries	High	Saint John Harbour and throughout the DU	Historical / Current / Anticipated	Continuous	Incidental mortality: Low-High depending upon the fishery	High	Existing: All incidentally captured Atlantic Sturgeon must be released by condition of licence. Potential: Change fishing practices (gear types, soak times, set locations and season), as required.
Annapolis Tidal Generating Station	Medium	Annapolis Basin	Historical / Current / Anticipated	Continuous	Mortality unknown, but expected to be low (<5 individuals per year)	High	Existing: Fish passage via a fish way and when flood gates are opened to fill the headpond. Potential: Enhanced fish passage; acoustic deterrence.
Mactaquac Dam Hydroelectric Facility	Low		Historical / Current / Potential	Continuous	Retention in gate wells Mortality thought to be low but potential to interfere with life-history functions	Medium	Existing: None

	Level of Concern	Extent	Occurrence	Frequency / Timing	Severity	Causal Certainty	Mitigation / Alternatives
Instream Tidal Power	Low for pilot projects		Potential	Continuous Minas Passage, and other locations within the Bay of Fundy	Expected to be low	Medium	Potential: Siting criteria; engineering design.
Threats to Habitat							
Water Quality	Low		Potential	Continuous Lower Saint John River	Expected to be low	High	Existing: Compliance with existing water quality guidelines and regulations.
Marine Worm Harvest	Medium		Historical / Current / Potential	Seasonal	Potentially significant	Medium	Existing: Minimum harvestable size; area closures. Potential: Changes in harvestable size; fallowing of sites.

APPENDIX B: Summary of the Biophysical Functions, Features, Attributes and Location of Known Important Habitat for Atlantic Sturgeon in the Maritimes DU.

Geographic Location	Life-Stage	Function	Features	Attributes
Lower Saint John River (Mactaquac to Reversing Falls)	Adults	Staging	Interface/confluence between two rivers, other locations	Unknown, but may be related to depth
		Spawning (June-August)	Firm substrate (e.g. rock, gravel, clay)	Primary: Oxygen – prefer well flushed Sediment type – firm Secondary: Salinity Turbidity Depth Temperature – warmer (~15-22°C) than shortnose, but further work required
		Overwintering	Comprehensive information is not available. Specimens have been captured under ice in Belleisle Bay.	Unknown
	Juveniles (1-5 years)	Overwintering / Feeding / Growth	In areas of deep water (e.g. 10-15 m for overwintering) Food availability	Primary: Prey (unknown) Likely other characteristics that are not known Depth >2 m
Saint John River Estuary (below the reversing falls)	Adults/ Juveniles / Sub-adults	Migration (May-September)	Bottleneck	Primary: Sufficient water flow
Minas Basin	Juveniles / sub-adults	Feeding (May-October)	Tidal Flats / Food Availability	Primary: Prey: marine worms and other benthic invertebrates Substrate: sandy/silt
Minas Passage	Juveniles / Sub-adults/ Adults	Migration	Bottleneck	Indications that they may use southern portion more often, though further investigation may be required.

THIS REPORT IS AVAILABLE FROM THE:

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