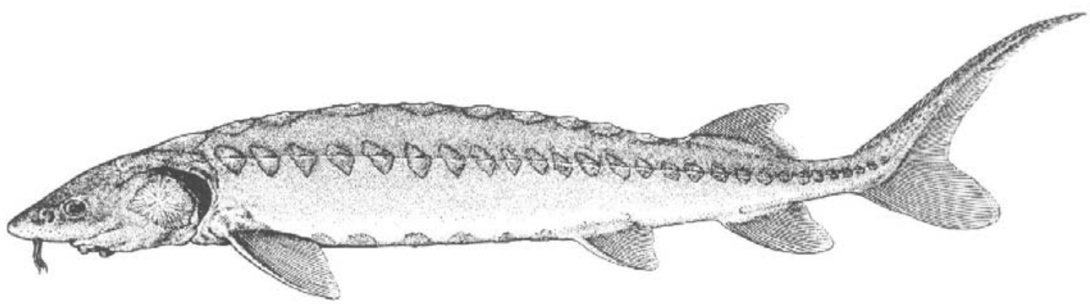
COSEWIC
Assessment and Update Status Report

on the

Shortnose Sturgeon
Acipenser brevirostrum

in Canada



SPECIAL CONCERN
2005

COSEWIC
COMMITTEE ON THE STATUS OF
ENDANGERED WILDLIFE
IN CANADA

COSEPAC
COMITÉ SUR LA SITUATION
DES ESPÈCES EN PÉRIL
AU CANADA

COSEWIC status reports are working documents used in assigning the status of wildlife species suspected of being at risk. This report may be cited as follows:

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Previous report:

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COSEWIC would like to acknowledge Matthew K. Litvak for writing the update status report on the shortnose sturgeon *Acipenser brevirostrum* prepared under contract with Environment Canada, overseen and edited by Bob Campbell, the COSEWIC Freshwater Fish Species Specialist Subcommittee Co-chair.

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Également disponible en français sous le titre Évaluation et Rapport de situation du COSEPAC sur l'esturgeon à museau court (*Acipenser brevirostrum*) au Canada – Mise à jour.

Cover illustration:
Shortnose sturgeon — Lateral view of spawning female (58 cm TL) from the Hudson River, N.Y. (after Vladykov and Greeley 1963).

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COSEWIC
Assessment Summary

Assessment Summary – May 2005

Common name
Shortnose sturgeon

Scientific name
Acipenser brevirostrum

Status
Special Concern

Reason for designation
This is an anadromous species restricted to a single river system in Canada where spawning fish require unhindered access to freshwater spawning sites; but the population may have been divided since 1967 by the Mactaquac Dam. These large, slow growing, late maturing fish are conservation dependent. There is some risk to the species through mortality from hydroelectric facilities, by-catch in alewife and shad fisheries, and poaching. However, there is no immediate threat that would lead to elimination of the population in a very short period of time.

Occurrence
New Brunswick

Status history
Designated Special Concern in April 1980. Status re-examined and confirmed in May 2005. Last assessment based on an update status report.

COSEWIC
Executive Summary

Shortnose Sturgeon
Acipenser brevirostrum

Species Information

Taxonomy--Class: Actinopterygii, Order: Acipenseriformes, Family: Acipenseridae, Genus: Acipenser, Species: brevirostrum. Common names—shortnose sturgeon, shortnosed sturgeon and little sturgeon and esturgeon à museau court (French). Maliseet name: buzgus. Description—Elongate body covered with scutes, cylindrical at the abdomen, heterocercal tail (upper lobe of tail is longer) and stiff paired fins. The mouth is ventral, inferior and is protrusible (extends like a tube). Four barbels hang approximately half way between tip of the snout and the mouth.

Distribution

There are 19 population segments of shortnose sturgeon along the east coast of North America from New Brunswick south to Florida. Its only known occurrence in Canada is in the Saint John River system, NB.

Habitat

The shortnose sturgeon spawns in fast flowing water over a boulder and gravel bottom. Adults overwinter in the lower sections of the river in deep holes that are under tidal influence. Little is known about the juveniles, but the mean size of juveniles decreases upriver suggesting younger fish utilize more upstream habitats.

Biology

Very little is known about the biology of shortnose sturgeon. They are a long-lived late maturing fish. The oldest recorded fish caught were 67 and 32 years for females and males, respectively. The heaviest specimen captured in the Saint John River was 23.6 kg with a fork length (length from tip of the snout to the fork in the tail) of 122 cm. Males are generally lighter than females at equivalent lengths. Growth rate of adults is between 490-540 g per annum. Males and females become reproductive at 11 and 13 years old, respectively. Females produce up to 200,000 eggs every three years. Eggs are demersal and adhesive. They spawn from mid-April to June. Survival through the early life history stages has been identified as the controlling factor for recruitment.

Population Sizes and Trends

A population estimated at 18,000 adults was determined during 1973-1977 for the St. John River. Recent work in the Kennebecassis River (location of an overwintering ground), a tributary of the Saint John River, produced an estimate of 2,000 adults. However, there is no current estimate for the complete lower estuary of the Saint John River. Aboriginal knowledge suggests that there has been a decline since the Mactaquac Dam was constructed in 1967.

Limiting Factors and Threats

The Mactaquac Dam prevents upstream spawning migration. The dam controls water flow, temperature and therefore habitat availability and quality. There is no existing mechanism to allow passage of shortnose sturgeon over this dam. The Saint John River system is a highly developed area with residential and industrial activities all impacting on water quality. Since these are long-lived fish, bottom dwelling fish and consume prey living in the sediment, they are vulnerable to contaminants in both sediments and prey items.

Special Significance of the Species

Shortnose sturgeon is one of 24 acipenserid species remaining in the world, and all are listed as species at risk, from Vulnerable through to Endangered by IUCN (International Union for Conservation of Nature and Natural Resources or IUCN -The World Conservation Union). It is one of five species of sturgeon that occur in Canada and only occurs in one location, the Saint John River, NB. Shortnose sturgeon was an important species to First Nations peoples and supported a commercial sturgeon fishery until size regulations were put in place.

Existing Protection or Other Status Designations

Shortnose sturgeon has been listed as Endangered by the Endangered Species Act in the United States since March 1967. It was listed as a species of Special Concern in Canada in 1980 (COSEWIC), although there is no recovery plan, DFO has a management team for this species. It has had IUCN Red Book Status since 1996, when it was assessed as Vulnerable, and is listed on Appendix 1 of CITES.

COSEWIC HISTORY

The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) was created in 1977 as a result of a recommendation at the Federal-Provincial Wildlife Conference held in 1976. It arose from the need for a single, official, scientifically sound, national listing of wildlife species at risk. In 1978, COSEWIC designated its first species and produced its first list of Canadian species at risk. Species designated at meetings of the full committee are added to the list. On June 5, 2003, the *Species at Risk Act* (SARA) was proclaimed. SARA establishes COSEWIC as an advisory body ensuring that species will continue to be assessed under a rigorous and independent scientific process.

COSEWIC MANDATE

The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) assesses the national status of wild species, subspecies, varieties, or other designatable units that are considered to be at risk in Canada. Designations are made on native species for the following taxonomic groups: mammals, birds, reptiles, amphibians, fishes, arthropods, molluscs, vascular plants, mosses, and lichens.

COSEWIC MEMBERSHIP

COSEWIC comprises members from each provincial and territorial government wildlife agency, four federal agencies (Canadian Wildlife Service, Parks Canada Agency, Department of Fisheries and Oceans, and the Federal Biodiversity Information Partnership, chaired by the Canadian Museum of Nature), three non-government members and the co-chairs of the species specialist and the Aboriginal Traditional Knowledge subcommittees. The Committee meets to consider status reports on candidate species.

DEFINITIONS
(NOVEMBER 2004)

Wildlife Species	A species, subspecies, variety, or geographically or genetically distinct population of animal, plant or other organism, other than a bacterium or virus, that is wild by nature and it is either native to Canada or has extended its range into Canada without human intervention and has been present in Canada for at least 50 years.
Extinct (X)	A wildlife species that no longer exists.
Extirpated (XT)	A wildlife species no longer existing in the wild in Canada, but occurring elsewhere.
Endangered (E)	A wildlife species facing imminent extirpation or extinction.
Threatened (T)	A wildlife species likely to become endangered if limiting factors are not reversed.
Special Concern (SC)*	A wildlife species that may become a threatened or an endangered species because of a combination of biological characteristics and identified threats.
Not at Risk (NAR)**	A wildlife species that has been evaluated and found to be not at risk of extinction given the current circumstances.
Data Deficient (DD)***	A wildlife species for which there is inadequate information to make a direct, or indirect, assessment of its risk of extinction.

* Formerly described as “Vulnerable” from 1990 to 1999, or “Rare” prior to 1990.
** Formerly described as “Not In Any Category”, or “No Designation Required.”
*** Formerly described as “Indeterminate” from 1994 to 1999 or “ISIBD” (insufficient scientific information on which to base a designation) prior to 1994.

Environment Canada / Environnement Canada
Canadian Wildlife Service / Service canadien de la faune

Canada

The Canadian Wildlife Service, Environment Canada, provides full administrative and financial support to the COSEWIC Secretariat.

Update
COSEWIC Status Report

on the

Shortnose Sturgeon
Acipenser brevirostrum

in Canada

2005

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SPECIES INFORMATION

Name and classification

Taxonomy

Class:	Actinopterygii
Order:	Acipenseriformes
Family:	Acipenseridae
Genus:	*Acipenser*
Species:	*Acipenser brevirostrum*
Scientific name:	*Acipenser brevirostrum* (LeSueur 1818)
Common name:	English - shortnose sturgeon French - esturgeon à museau court Maliseet - buzgus
Other names:	Little sturgeon (Saint John River, NB), pinkster and roundnoser (Hudson River, NY), bottlenose or mammose (Delaware River), salmon sturgeon (Carolinas), soft-shell or lake sturgeon (Altamaha River)

Description

External anatomy: The body is elongate and cylindrical in the abdomen and tail but somewhat depressed anterior of the pectoral girdle (Figure 1). This is a heavily armoured fish with five rows of bony scutes (also called plates or bucklers), an inferior elongated protrusible wide mouth, four barbels anterior to mouth on the ventral surface of the rostrum, small eyes, and spiracles. The head is somewhat short and highly variable in shape among specimens and fish age; it is more prominent in younger fish. The caudal peduncle is narrow, with the dorsal fin posterior of the paired pelvic fins. The caudal fin is heterocercal with a prominent long upper lobe and a short, broad lower lobe. The pectoral fins are a large and fixed. The first pectoral fin ray is thick and ossified. The body has no scales but has minute denticles.

Figure 1. Lateral view of adult shortnose sturgeon.

Internal anatomy: The skeleton is cartilaginous with the exception of the bones of the skull, jaws, and pectoral girdle. The notochord is unconstricted (Schmitz 1998). They possess a swim bladder that is joined to the esophagus (physostomous), which is muscular and acts like a crop or gizzard to crush invertebrates. The intestine has a spiral valve similar to that of sharks and rays (Class Chondrichthyes) (ladykov and Greeley 1963)

Meristics: They possess 22-29 gill rakers on first arch, 38-42 rays on the caudal fin, 19-22 rays on the dorsal fin, 8-13 dorsal scutes, 22-23 lateral scutes, 7-11 ventral scutes, at least two plates between the dorsal and caudal fulcrum, and usually one or two rows of pre-anal fin plates (Vladykov and Greeley 1963; Scott and Crossman 1973).

Colour: The colour is variable; there is usually a darker mottled chain pattern on the dorsal surface of the head region over an olive brown or green background. Lateral surfaces are lighter moving ventrally, with the ventral surface white in colour (Figure 1). Dorsal scutes are lighter brown. Lateral, ventral, and pre-anal scutes have a yellow tinge. Leading edges of fins are lighter and sometimes white.

Discrimination from Other Sturgeon: Atlantic sturgeon (*Acipenser oxyrhynchus*) is most often found in association with shortnose sturgeon, as is the case in the Saint John River system. Mature adults are easily distinguished by size, as Atlantic sturgeon are much larger than shortnose sturgeon. The largest recorded Atlantic sturgeon was caught on the Saint John River; it was 4.59 m and weighed 364.9 kg (Vladykov and Greeley 1963). When juvenile Atlantic sturgeon are caught with similar-sized juvenile and adult shortnose sturgeon, discrimination between species can be made using the following characters: 1) proboscis (snout) of the young Atlantic sturgeon is much longer and more tapered than that of the shortnose sturgeon (Figure 2); 2) relative mouth size of the shortnose sturgeon (>62% of the interorbital width) is larger than that of the Atlantic sturgeon (<55% of the interorbital width) (Figure 2); 3) 19-22 anal fin rays are present in shortnose sturgeon, whereas there are 25-30 anal fin rays present in Atlantic sturgeon; and, 4) 19-22 dorsal fin rays are present in shortnose and

Figure 2. Views of mouths of juvenile shortnose (left) and Atlantic sturgeon (right). Shortnose sturgeon mouths are relatively larger than Atlantic sturgeon when compared to interorbital width.

38-46 for Atlantic sturgeon (Vladykov and Greeley 1963; Scott and Crossman 1973; Scott and Scott 1990). Gorham and McAllister (1974) indicated that the presence of bony plates above the anal fin in Atlantic sturgeon and absence on the shortnose sturgeon could be used as a potential key for species identification; however, it is sometimes lacking in Atlantic sturgeon samples and is, therefore, not recommended. Atlantic sturgeon adults tend to lose the point on their snout as they age and their head shape becomes more similar to the shortnose sturgeon. This causes confusion for recreational anglers that hook the larger Atlantic sturgeon making them think that they have caught a large shortnose sturgeon. However, these fish are much larger than a shortnose sturgeon and have different fin ray counts.

Ontogeny: Shortnose sturgeon larvae are approximately 7-11 mm long, total length at hatch (Buckley and Kynard 1981). Larvae possess a large yolk-sac (Figure 3) with a yolk plug in the spiral valve, which is released when feeding begins. They are viewed as direct developers and do not experience a metamorphic stage. They resemble the juvenile/adult form at approximately 20-25 mm in total length (Bain 1997).

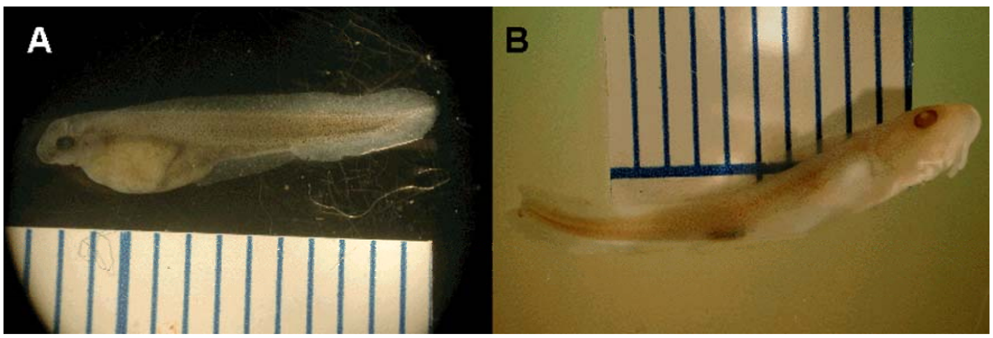

Figure 3. A) young recently hatched shortnose larva. B) older yolk-sac larva clearly showing yolk plug in spiral valve. Divisions on the rulers are mm.

Designatable units

The only known population in Canada occurs in the Saint John River, NB.

DISTRIBUTION

Global range

Nineteen distinct shortnose sturgeon population segments have been identified along the eastern coast of North America (National Marine Fisheries Service 1998), from Florida to New Brunswick (Figure 4). Populations range from 100 (adults) in the Merrimack River, Massachusetts, to ~38,000 (individuals) in the Hudson River, NY (National Marine Fisheries Service 1998; Table 1).

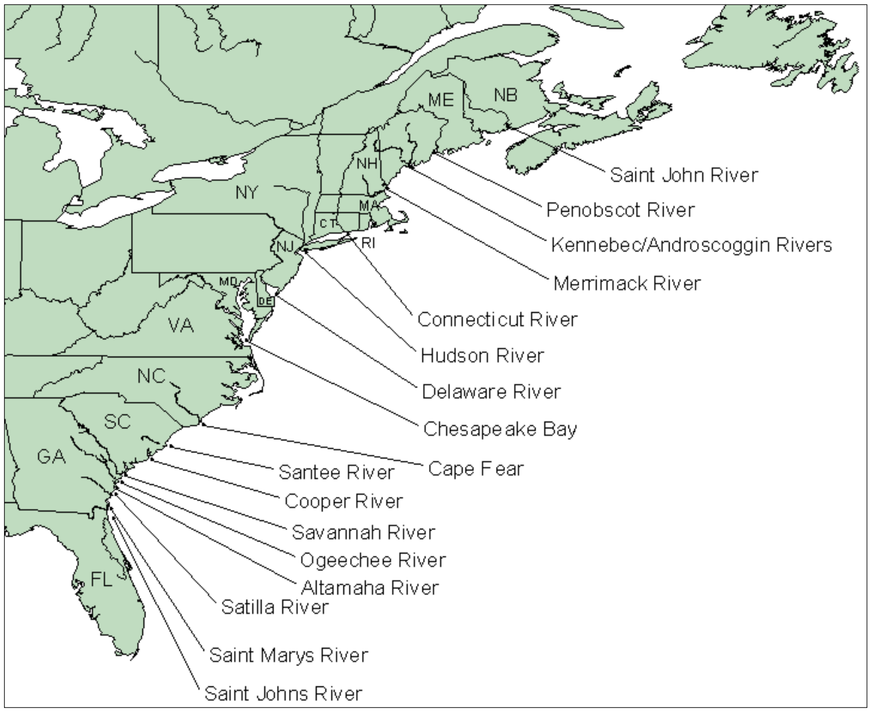

Figure 4. Global distribution.

Table 1. List of population segments identified by the National Marine Fisheries Service (1998).

Distinct Population Segments	Rivers Inhabited by Shortnose Sturgeon
Saint John	Saint John River (New Brunswick, Canada)
Penobscot	Penobscot River (Maine)
Kennebec System	Sheepscot, Kennebec, and Androscoggin Rivers (Maine)
Merrimack	Merrimack River (Massachusetts)
Connecticut	Connecticut River (Massachusetts and Connecticut)
Hudson	Hudson River (New York)
Delaware	Delaware River (New Jersey, Delaware, Pennsylvania)
Chesapeake Bay	Chesapeake Bay, Potomac River (Maryland and Virginia)
Cape Fear	Cape Fear River (North Carolina)
Winyah Bay	Waccamaw, Pee Dee and Black Rivers (South Carolina, North Carolina)
Santee	Santee River (South Carolina)
Cooper	Cooper River (South Carolina)
“ACE” Basin	Ashepoo, Combahee and Edisto Rivers (South Carolina)
Savannah	Savannah River (South Carolina, Georgia), and hatchery stocks
Ogeechee	Ogeechee River (Georgia)
Altamaha	Altamaha (Georgia)
Satilla	Satilla River (Georgia)
St. Marys	St. Marys River (Florida)
St. Johns	St. Johns River (Florida)

Canadian range

In Canada, the shortnose sturgeon is found only in the Saint John River system in NB, including the Kennebecasis River, a tributary to the Saint John (Figure 5).

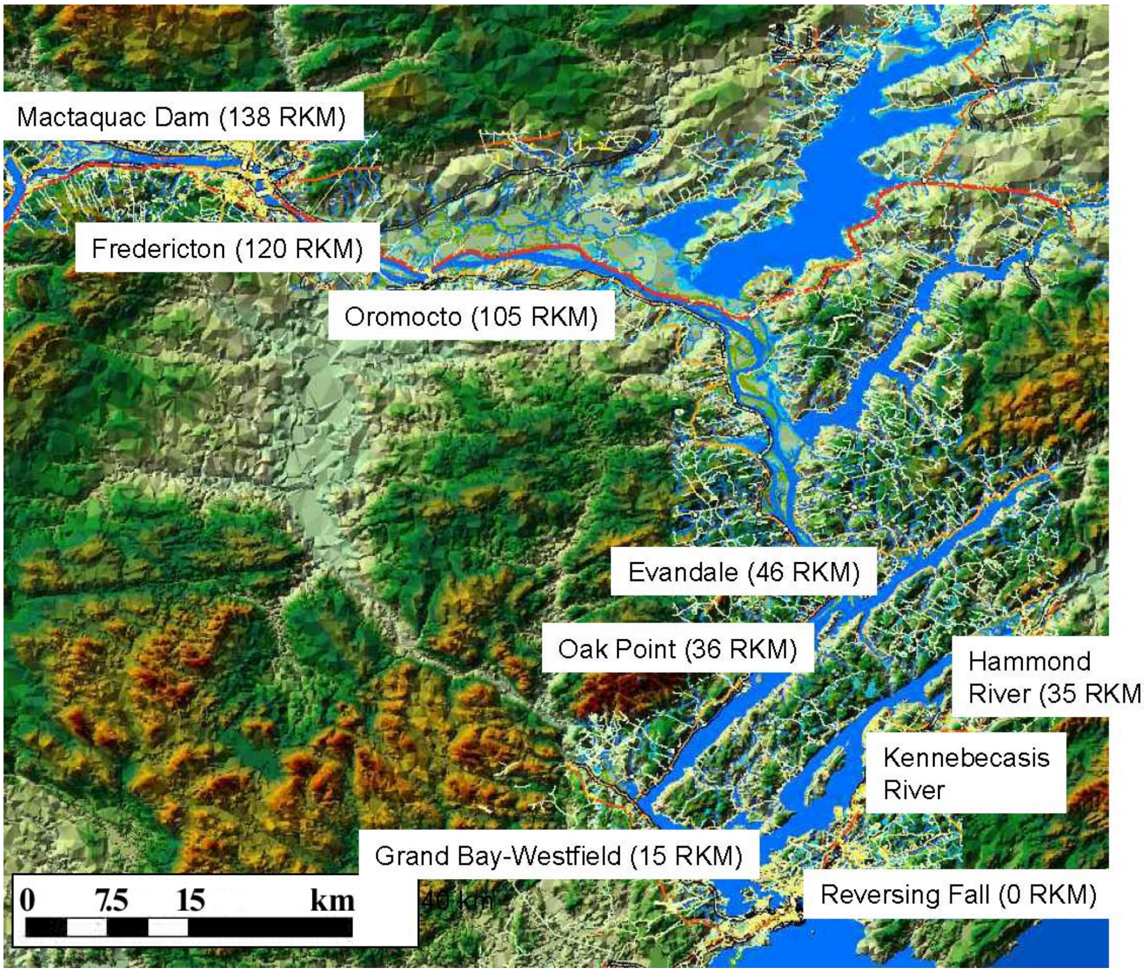

Figure 5. Lower Saint John River system. RKM represents distance in km from mouth of river.

HABITAT

Habitat requirements

Shortnose sturgeon has been described as anadromous (Kynard 1997). In their southern range they are estuarine and anadromous but in the more northern regions they are freshwater amphidromous, residing in the estuary rather than the open sea (Kieffer and Kynard 1993). In the Saint John River adults are found both in freshwater and areas under tidal influence (Dadswell 1979; Dadswell 1984; Dadswell *et al*. 1984). They have been caught along the coast, but this is a rare occurrence (Dadswell *et al*. 1984). They are generally restricted to brackish and freshwater sections of their natal rivers. Shortnose sturgeon can also be landlocked and may occur above the Mactaquac Dam at RKM 145 (RKM = river kilometre distance from mouth of estuary) on the Saint John River. However, no work has been conducted to determine if this is the case and if such a segment of the population still exists. Tagging and sonic tracking research on the lower Saint John River population below the dam suggests that fish remain in their natal river and estuary (Dadswell 1979; Litvak and associates [unpublished data]). This is similar to results of studies on US populations (Buckley and Kynard 1985; Hall *et al*. 1991; Kieffer and Kynard 1993; O'Herron *et al*. 1993; Kynard 1997).

Overwintering habitat is thought to occur in either the lower reaches of the Saint John River in deep, saline sites (~10 ppt) or further upriver if they are to spawn that spring (Dadswell 1979) (multi-stage spawning migration see below). Sites further upriver are under tidal influence, and although the salinity is low, salt is still present (~10 ppm). Kynard (1997) suggested that shortnose sturgeon adults in reproductive condition are widely separated from those adults that will not spawn the following spring. However, Litvak and associates (unpublished data) found, through sonic tracking of tagged fish, that many of the fish that overwinter in the lower reaches of the Saint John River still undergo spawning migration in the spring.

Spawning is thought to occur in areas with high flow rates (also see reproduction section below). Flow rates for spawning in the US populations range between 0.4 to 1.0 m/s and are generally over gravel and/or boulder substrate and at temperature of 8^{o}C-13^{o}C (Buckley and Kynard 1985; Kieffer and Kynard 1996; Kynard 1997; National Marine Fisheries Service 1998; Litvak and associates unpublished data). However, little work has been conducted on the Saint John River population's spawning habitat, as it has not been clearly identified.

Dadswell (1979) reported that the youngest juvenile fish caught on the Saint John River was 2 years old. There are no recorded captures of year 0 and 1 fish and, therefore, no information on young juvenile habitat use on the Saint John River is currently available. Dadswell (1979) did catch older juveniles. He classified juveniles as those fish under 45 cm fork length. He found that they were distributed in the riverine habitat from Oak Point (RKM 36) to Fredericton (RKM 120), but were concentrated between Evandale (RKM 46) and Oromocto (RKM 105) (Figure 5). Mean size of juveniles was smaller in the upper reaches compared with downriver (Dadswell 1979). Bain (1997) suggested that juveniles reside ahead of the salt-water wedge in the Hudson River, NY.

Trends

Construction of the Mactaquac Dam in 1967 limited spawning in the river above the dam. Urban development, forestry, agricultural and industrial practices contribute to siltation and pollutant loads in the river (see Limiting Factors). Despite efforts to alleviate the effects of such practices on the contaminant load, the situation is stable at best and the overall habitat trend probably continues to be one of decline, although there is no documented evidence to support habitat trends. In the past, late summer die-offs of sturgeon and other species have been noted in eutrophic areas of the estuary that were choked with vegetation. It has been assumed that such events are caused by oxygen depletion due to vegetative blooms resulting from elevated nutrient loads (Dadswell *et al.* 1984).

In general, water quality of the river has improved over the last 30 years due to investments in water treatment by the industries and municipalities along its banks (Fredericton Angler's Club 1994, 1995; M. Toner, New Brunswick Department of Natural Resources, Fredericton, NB, personal communication 2005).

Protection/ownership

The shortnose sturgeon falls under the jurisdiction of the Department of Fisheries and Oceans. Under the Canada/New Brunswick Recreational Fisheries MOU, sturgeon remains a federal responsibility. Although no specific legislation is in place for protection of the habitat, general protection is available under Habitat sections of the Fisheries Act. Although the river *per se* is a navigable body of water and thus falls under public ownership, lands along the river are largely under private control. DFO is currently (2004) developing a Maritimes sturgeon conservation working group with representation from government, academia and environmental non-government organizations (NGOs) (R. Bradford, personal communication).

A licence under the Fishery Regulations is required to retain shortnose sturgeon for any purpose. A licence is also required for transfer to a rearing facility, to release them into fish habitat or for interprovincial transport.

BIOLOGY

General

Although under threat of extirpation and/or extinction throughout most of their ranges, very little is known about the biology of sturgeons, and shortnose sturgeon is no exception. The first record of the shortnose sturgeon's occurrence in the Saint John River was in 1957 (Liem and Day 1959). Prior to their identification, they were "unknowingly" caught in the sturgeon fishery on the Saint John River and classified as a sturgeon in fishery statistics. Dadswell (1979) conducted the definitive work on this species in the 1970s. Litvak's students at the University of New Brunswick, Saint John Campus, are currently updating and adding to this information.

Like other sturgeon, the shortnose sturgeon is long-lived. The oldest fish caught on the Saint John River population was a 67-year-old female (Dadswell 1979). Sturgeons are generally aged by counting the alternating translucent (winter) and opaque (summer) annuli of a cross-section through the "bony" first pectoral fin ray (Cuerrier 1951). Aging shortnose and other sturgeon species is key to their management and protection; however, until recently aging sturgeon has been a destructive technique. Fortunately a non-destructive version has been developed (Collins and Smith 1996), providing an opportunity to determine ages of representatives of the current population in the Saint John River (Crossman and Litvak unpublished data).

The largest recorded specimen caught on the Saint John River, prior to recent studies, was a female fish weighing 23.6 kg with a fork length of 122 cm (Dadswell 1979). Since that time 3 fish that were longer than this record have been captured (Litvak, unpublished data). The length-weight relationship for this population has not changed much in 25 years (Dadswell 1979), and the relationship between weight (W) and fork length (FL) has been determined to be Log_{10} W = 3.21 (Log_{10} FL) –5.45 (df=1, 2889, p<0.0001, r^2=0.99) and Log_{10} W = 3.11 (Log_{10} FL) – 5.36 (df=1, 858, p<0.0001, r^2=0.87), respectively (Figure 6; Litvak, unpublished data). Both these relationships suggest an allometric relationship between weight and length; i.e., larger fish are relatively heavier than smaller fish.

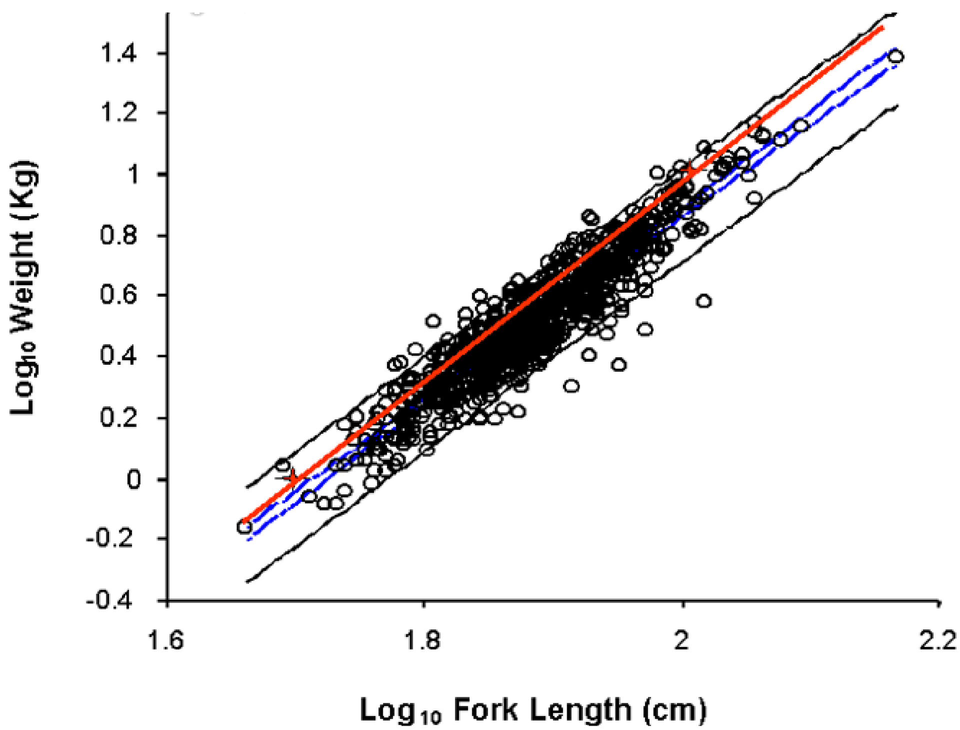

Figure 6. Weight length (blue line) for shortnose sturgeon caught in the lower Saint John River, 1998-2002, with 95% confidence limits (black lines). Red line represents overlay of Dadswell's (1979) relationship for 1973-1977.

Dadswell (1979) found no difference in weight between males and females at similar sizes. The sex of 40 adults was determined (Litvak, unpublished data) as 14 females and 26 males. The weight-length relationship was used to determine if the fish were in comparable condition to the population weight-length relation and to determine if sexual dimorphism exists in terms of weight. A t-test of residual differences from the weight length regression indicated that males were significantly lighter than females at an equivalent length (df 38; $p<0.05$). Although there appear to be no external characters developed to date to determine the difference between the sexes, it appears that shortnose sturgeon is sexually dimorphic in terms of weight. This suggests that there may be other dimorphic characters that could allow us to identify gender in the field.

Dadswell (1979) estimated growth rates from 106 tagged recaptured fish. During this period shortnose sturgeon were found to gain 490 grams per year (1.32 g/day). Shortnose sturgeon in the Saint John River (1998-2002) had an average annual mean weight gain of 540 g (gaining 1.48 g per day $\pm$1.2 SE) or a specific growth rate (following Ricker 1975) of 0.017% ± 0.067 per day (Litvak, unpublished data). Von Bertalanffy growth curves based on adult fork length and age were determined for females and males of the Saint John population to be $W_t(\text{female})=24.8(1-e^{-0.042(t-0.8)})^3$ and $W_t(\text{males})=13.9(1-e^{-0.063(t-.51)})^3$, respectively (Dadswell 1979).

The size distribution of the species caught during 1998-2002 (Litvak unpublished data) suggests that we should revisit the 122 cm (48”) size limit put on sturgeon caught in this river system because there will be fish that will exceed this restriction (Figure 7).

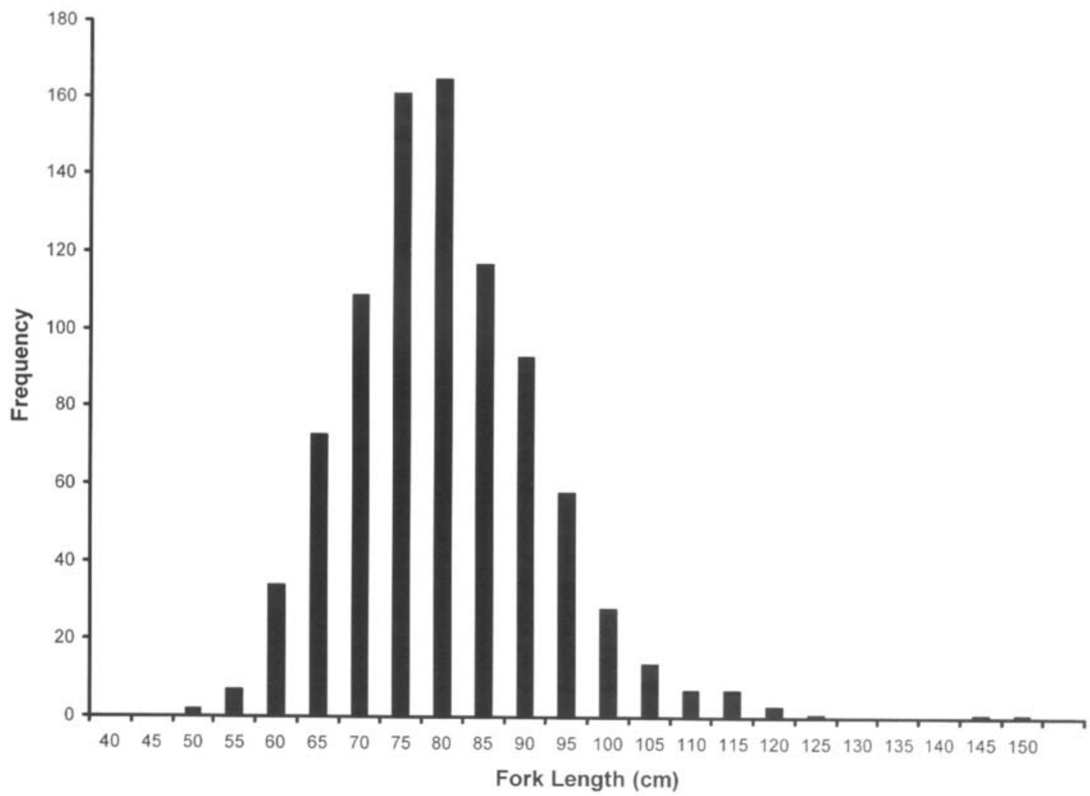

Figure 7. Fork length frequency distribution of shortnose sturgeon caught in the Saint John River, 1998-2002. The current size limit for capture is 122 cm.

Reproduction

Eggs — Shortnose sturgeon is a highly fecund, iteroparous fish, producing many demersal and adhesive eggs (27,000-208,000; Dadswell 1979). Egg production is directly related to female size; each female on average produces 11,600 eggs per kg of fish (Dadswell 1979). Eggs are black to brown and are approximately 3.5 mm in diameter at release and expand to 4 mm after fertilization and adhesion to the substrate (Kynard 1997). There are only anecdotal accounts of spawning behaviour in captivity and none in the wild.

Sperm — There have been two studies on the fine ultrastructure of shortnose sturgeon sperm (Dilauro *et al.* 1999, 2000). They used transmission electron microscopy to provide a description of shortnose sturgeon sperm. The cell is comprised of an acrosome, head region, midpiece and single flagellum. The sperm body is 9.71 µm long (acrosome + nucleus + midpiece) and the length of the flagellum is 37 µm. Based on this description of the sperm, they suggested that shortnose sturgeon is more closely related to white sturgeon (*A. transmontanus*), lake sturgeon (*A. fulvescens*), and stellate sturgeon (*A. stellatus*) than to the Atlantic sturgeon (Dilauro *et al.* 1999, 2000).

Brown and Litvak (2004) have examined the swimming behaviour and performance of shortnose sturgeon and Atlantic sturgeon sperm. Spermatozoa collected were activated and their movement, including mean average and mean maximum speed, path linearity and motility, were all observed and recorded over a five–minute time period. Mean average speed (SNS 212 $\mu m s^{-1}$ vs. ATL 137 $\mu m \cdot s^{-1}$) and mean maximum speed (SNS 372 $\mu m \cdot s^{-1}$ vs. ATL 268 $\mu m\, s^{-1}$) differed significantly between species, as did motility. Mean path linearity did not differ significantly between species or times. Shortnose sturgeon sperm maintained motility for a longer period of time than did the Atlantic sturgeon. These observations shed light on male sturgeon spawning capabilities, suggesting that male promiscuity among shortnose and Atlantic sturgeon may be more pronounced than previously thought.

Reproductive Event — Reproductive adults in the Saint John River, like other populations, undergo a spawning migration in the spring. These spawning migrations occur when the river temperature reaches 8-9^{o}C. Dadswell (1979) originally suggested that shortnose sturgeon would spawn between Oak Point and Fredericton in the Saint John River and in the Kennebecasis River. This was given credence by the capture of 3 larvae at the Oromocto shoals at RKM 120 (Taubert and Dadswell 1980). However, no eggs and larvae have been caught in the Kennebecasis River. He later suggested that another spawning site was between Fredericton and the Mactaquac Dam (Dadswell 1984). Kynard (1997) suggested that they probably spawn at or near the Mactaquac Dam, as almost every other shortnose sturgeon population that occurs on large dammed rivers spawns at the first river blockage. Recently, sonic tagged shortnose sturgeon have been tracked to just below the Mactaquac Dam (RKM 145; Litvak, unpublished data) as Kynard (1997) hypothesized. These fish were tagged the previous fall, overwintered in the Kennebecasis River, a tributary in the lower reaches of the Saint John River, and traveled rapidly upstream during the spring. From 1998 to

2002 14 larvae have been caught using a towed and weighted bongo net at this location. In 2003, using a different system, hundreds of eggs and larvae have been caught, all within 5 km of the dam (Litvak lab, unpublished data). Dadswell (1979) suggested that shortnose sturgeon spawn from mid-May to mid-June. Litvak (unpublished data) using Hardy and Litvak's (2004a) data on the effect of temperature on growth of shortnose sturgeon to back-predict date of hatch and timing of reproduction found that shortnose sturgeon, during the four-year study, started spawning in April, earlier than had previously been recorded.

Shortnose sturgeon may vary in their pre-spawning migrations (Kieffer and Kynard 1993). Kieffer and Kynard (1993) suggested 3 patterns: 1) a short 1-step migration done in the spring only a few weeks before spawning; 2) a long 1-step migration done in the late winter/early spring before spawning; and, 3) a short 2-step migration composed of a longer fall migration putting the fish closer to the spawning habitat for overwintering and then a short migration as in 1) (Kieffer and Kynard 1993). Dadswell (1984) suggested that shortnose sturgeon spawned in deepwater channels and that they engage in two-step spawning migration-strategy 3). Litvak (unpublished data) using sonic tags has only seen fish employ strategy 2) but this may be a reflection of the segment of the Saint John River population that was studied.

Dadswell (1979) suggested that adults remain upriver until a 2-3°C decline in the fall stimulates a downstream migration. Kynard (1997) indicated that adults disperse downriver after spawning. Litvak (unpublished data) has found that sonically tagged spawning fish have used both strategies in the Saint John River.

Sex Ratio — The sex ratio in the Saint John River is approximately 2:1, females to males (Dadswell 1979). The oldest male recorded from the Saint John River was 32 years old (Dadswell 1979). This finding, in conjunction with samples of juveniles indicating a 1:1 ratio of females to males, suggests that males do not live as long as females (Dadswell 1979). Males and females become reproductive, on average at 11 and 13 years of age respectively, later than southern populations; the average, age of adults is in the neighbourhood of 21 years (Dadswell 1984). Little information exists on spawning periodicity. However, it has been suggested that females spawn less frequently, once every 3-5 years and males every other year (Dadswell 1979). In the more southern populations, they tend to spawn more often (Dadswell *et al.* 1984). Males from the Saint John River held in captivity do produce semen annually (P. Soucy, Canadian Caviar, personal communication 2003).

Spawning periodicity and annual egg production — Dadswell (1979) hypothesized that 1/3 of the Saint John River female population spawned each year and that there were 12,000 females producing on average 94,000 eggs each, which provides annual production of approximately 3.76×10^9 eggs per year. Since there are less than 20,000 adults in the river, this high number of eggs suggests the importance in determining the factors that control survival during early life history.

Survival

Sturgeons have a large body size, a tough leathery skin, and bony scutes that provide protection from predation during the juvenile and adult stages. Early life mortality in sturgeon is not well researched or understood, yet is most likely the most important determinant of year-class strength. Recent elasticity analysis suggests that for three species of North American sturgeon (Atlantic, white and shortnose sturgeon) population dynamics are most sensitive to changes in survival during the first few years of development (Gross *et al.* 2002). As indicated previously, if 3.76×10^9 eggs are produced per year and yet we do not capture many juveniles, the major bottleneck to recruitment must be during these early life stages.

Eggs grown in hatcheries are susceptible to fungal infections (Litvak personal observation). They have to be coated with Fuller's earth to prevent clumping. Eggs are then reared in MacDonald jars and provided a flow of 3 l/min. In spite of this process, eggs still do get fungal infections. However, there is little evidence of fungus from field collections of eggs. Kynard (1997) cites his personal observation of 8% mortality of eggs at the Connecticut River spawning site was due to fungus infections.

Starvation has been identified as an important determinant in year class formation in many r-selected fishes. Larval fish survival and recruitment is potentially conditioned by the match of larvae with prey fields in time and space; referred to as the "match-mismatch" hypothesis (Cushing 1972). Hardy (2000) examined growth and starvation resistance of larval shortnose sturgeon in response to delayed feeding. They found starvation affected growth and survival, yet despite the degree of starvation, larvae were able to resume growth and experience high survivorship following feeding. Specific growth rates of dry weights were highest in the longest food deprived feeding groups, directly following feeding, suggesting a possible compensatory mechanism may exist in response to starvation. A point-of-no-return (PNR) of 56% was reached 41 d post-fertilization, which is long compared to many other r-selected fish species. This work suggests that starvation, depending on food availability, may not be a major determinant of early life history survival, suggesting that future work should focus on mortality from predation.

To develop strategies to protect sturgeon species, we need to better understand the basic biology and ecology of their early life history stages (Smith *et al.* 2002). Low survival of juvenile sturgeon may affect long-term health of sturgeon populations and may be indicative of a recruitment bottleneck (Gross *et al.* 2002; Smith *et al.* 2002). Despite the importance of juvenile sturgeon stages, large gaps remain in our knowledge of their basic biology and ecology.

Physiology

Temperature effects — Shortnose sturgeon growth rates vary inversely with latitude; fish from northerly populations grow more slowly than fish from southern populations (National Marine Fisheries Service 1998). This has been related to a temperature effect rather than a population trait. Hardy and Litvak (2004b) reared shortnose sturgeon and Atlantic sturgeons at different temperatures (13, 15, 18, 21^{o}C) after hatch and measured yolk utilization rate and efficiency, maximum standard length, survival and development of escape response. Newly hatched Atlantic sturgeon, were smaller in size, more efficient at utilizing yolk (incorporating yolk to body tissue) and reached developmental stages sooner than shortnose sturgeon reared at the same temperatures (13 and 15^{o}C). Within each species, decreasing temperature delayed yolk absorption, escape initiation, time to reach maximum size, and time to 100% mortality. However, yolk utilization efficiencies and the size of larvae were independent of rearing temperature for both species. These results suggest that even as temperature drives metabolic processes to speed up development, these two species are still extremely efficient at transferring yolk energy to body tissues. The lower efficiencies experienced by larval shortnose may reflect difference in yolk quality between the two species or higher conversion efficiencies in the Atlantic sturgeon. The ability of both of these species to develop successfully and efficiently under a wide range of temperatures may provide a competitive advantage over more stenothermic species and may explain their persistence through evolutionary time.

Salinity tolerance — Jarvis (2001) examined the effect of salinity on growth of shortnose sturgeon grown in culture. They grew juveniles (mean weight, 273 g) at four salinities (0, 5, 10, and 20 ppt) for 10 weeks at 18^{o}C. Weight gain and feed conversion rate (FCR) decreased with increasing salinity. Fish reared at 0 parts per thousand showed significantly more weight gain and greater FCR than the fish raised at all other salinities. Fish reared at 20 parts per thousand exhibited the poorest growth.

Exercise physiology — Kieffer *et al*. (2001) examined the physiological responses to exercise of Atlantic sturgeon and shortnose sturgeon. They measured the rates of oxygen consumption and ammonia excretion in both species and a variety of physiological parameters in both muscle (e.g. lactate, glycogen, pyruvate, glucose and phosphocreatine concentrations) and blood (e.g. osmolality and lactate concentration) in juvenile shortnose sturgeon following 5 min of exhaustive exercise. In both species, oxygen consumption and ammonia excretion rates increased approximately twofold following exhaustive exercise. Post-exercise oxygen consumption rates decreased to control levels within 30 min in both sturgeon species, but post-exercise ammonia excretion rates remained high in Atlantic sturgeon throughout the 4 h experiment. Resting muscle energy metabolite levels in shortnose sturgeon were similar to those of other fish species, but the levels decreased only slightly following the exercise period and recovery occurred within 1 h. Under resting conditions, muscle lactate levels were low (<1 mumol g(-1)) but they increased to approximately 6 mumol g(-1) after exercise, returning to control levels within 6 h. Unlike similarly stressed teleost fish, such as the rainbow trout (*Oncorhynchus mykiss*), plasma lactate levels did not increase substantially and returned to resting levels within 2 h. Plasma osmolality was not significantly affected by exercise in shortnose sturgeon. Taken together, these results suggest that shortnose and Atlantic sturgeon do not exhibit the physiological responses to exhaustive exercise typical of other fish species. They may possess behavioural or endocrinological mechanisms that differ from those of other fishes and that lead to a reduced ability to respond physiologically to exhaustive exercise.

Oxygen — Collins *et al*. (2000) suggested that deterioration in water quality is affecting nursery production of juveniles and that low oxygen levels in particular in these nurseries may be a recruitment bottleneck. However, southern populations occur in rivers with higher river temperatures, and therefore, lower oxygen concentrations and this may not be as big a problem in Canada. Secor and Nicklitschek (2001) suggested that absence or reduced populations of both shortnose and Atlantic sturgeon were a result of low oxygen levels. They also hypothesized that the apparent recovery of shortnose sturgeon in the Hudson River is due to a return to normoxia in that river. To clarify this issue for the Saint John River shortnose sturgeon population, Kieffer's lab at UNB is currently examining required oxygen level.

Movements/dispersal

Early life history dispersal —Yolk sac larvae of the shortnose sturgeon are photonegative and seek cover (Kynard and Horgan 2002). Shortnose sturgeon from the Hudson and Connecticut rivers migrated over a 3-day period (Kynard and Horgan 2002) after yolk-sac absorption. They also suggest that shortnose sturgeon may engage in a two-step migration during the early life history stage: 1) a brief active/passive larval movement, and 2) an active early juvenile downstream migration to nursery areas.

Juvenile dispersal — Juvenile sturgeon usually move upstream during the summer months and downstream in the fall and winter (Dadswell *et al*. 1984; Hall *et al*. 1991). Tracking work, using ultrasonically tagged juvenile sturgeon (<56 cm) in the Savannah River, showed that shortnose sturgeon did engage in summer migrations in response to river temperatures (Collins *et al*. 2000). They moved upriver when temperatures exceeded 22^{o}C and moved downriver into the Savannah Harbour when temperatures were below this threshold. They did not observe any diel migrations during this study.

Adult Movements *based on genetic approaches* (please see reproduction section for a discussion of spawning migrations)—Dadswell *et al.* (1984) and Kynard (1997) both suggested that adults do move, although infrequently, out of their natal rivers and that this may be a way for gene flow between populations. Although there was a higher probability of out migration in the northern populations, gene flow was viewed as low compared to other "anadromous" species (Grunwald *et al.* 2002; Quattro *et al.* 2002). They suggest that all segments should be managed as discrete populations. Their data also indicate that the Saint John population has been largely reproductively isolated over a long period and may be more genetically distinct from the nearest US population than any other populations, even those compared at the extremes of the US range. This information suggests that the potential for a rescue effect from adjacent populations is low. Additionally, all shortnose sturgeon population genetic structure examined by both Grunwald *et al.* (2002) and Quattro *et al.* (2002) did not exhibit genetic bottlenecking.

Nutrition and interspecific interactions

Sturgeons are bottom suctorial feeders. Shortnose sturgeon juveniles feed mainly on crustaceans and insects, and the adults in the lower Saint John estuary mainly eat molluscs, particularly *Mya arenaria* a soft-shelled clam (Dadswell 1979; Pottle and Dadswell 1979; Dadswell *et al.* 1984).

There is potential for competition for food between shortnose and Atlantic sturgeon, particularly during the juvenile stages (Bain 1997). Analysis of gut contents of juvenile shortnose and Atlantic sturgeon captured in the Saint John River system by Pottle and Dadswell (1979) revealed that common food organisms were found in the crop and gizzard of both species. These fishes occur sympatrically throughout most of their distributions, and are thought to use common areas as juveniles; however, until recently, little work has been conducted on the potential for interspecific interactions (see behaviour section below), other than anecdotal evidence suggesting they will form dominance hierarchies (Kynard and Horgan 2002). These differences may affect their distribution and food resource usage in the wild.

If competitive ability varies within and among fish species, growth may be affected as more aggressive individuals or species may acquire a larger portion of available food (Beacham 1993; Cutts *et al.* 1998; McCarthy 2001). Giberson (2004) found that, when juvenile shortnose and Atlantic sturgeon are grown together, the presence of Atlantic sturgeon suppresses foraging activity and growth rates of shortnose sturgeon. Giberson (2004) examined the importance of food availability on growth rate and change in coefficient of variation (CV) in weight of juvenile Atlantic and shortnose sturgeon grown in mixed and single species groups. Eighteen floating cages were each stocked with four sturgeons, either in single species or mixed species groups. Tanks were randomly chosen to be fed at either a high (3% body weight per day [BW/d]) or low (1% BW/d) food availability level. Atlantic sturgeon held in mixed and single species treatment groups exhibited significantly higher specific growth rates (SGR %/d) than shortnose sturgeon at both food availability levels. Shortnose sturgeon held in mixed species treatment groups had significantly lower growth rates than those held in single species groups at both food levels. Atlantic sturgeon growth rates were unaffected by the presence of shortnose sturgeon at both high and low food availability levels. Species, food availability (1 or 3% BW/d) and treatment group (mixed or single species) significantly affected the change in CV of weight. In mixed species groups shortnose sturgeon and Atlantic sturgeon fed at a 1% BW/d food level exhibited a larger change in CV than single species groups fed at a 3% BW/d food level. These results suggest that Atlantic sturgeon, an apparently superior competitor, may put pressure on shortnose sturgeon when either habitat or food is limited.

Behaviour/adaptability

Although sturgeons are one of the most primitive groups of the ray-finned fishes (Bemis *et al.* 1997), they may have a more complex system of social behaviours and interactions than previously thought. The juvenile stage of the sturgeon life history is particularly important because survival at these stages directly affects the number of individuals that are recruited into the adult population (Gross *et al.* 2002; Smith *et al.* 2002). Therefore, as indicated in the previous section, an understanding of if and how shortnose and Atlantic sturgeon partition resources is important. Giberson (2004) paired

Atlantic and shortnose sturgeon in contest competition experiments. They found that Atlantic sturgeon were the first to start foraging, and had more foraging events. Even when paired with a larger shortnose sturgeon, Atlantic sturgeon started foraging earlier and initiated more foraging events.

Shortnose sturgeon appear to be social fish. They exhibit shoaling behaviour a few days after hatching (Litvak personal observation). This shoaling behaviour only exists when there is a flow; larvae form tight well-spaced schools to swim against the current. This schooling behaviour breaks down when there is no flow. Scuba diving observations of adults in the wild suggest that they also exhibit shoaling behaviour (Levi Sabatis, Oromocto First Nation, personal communication).

There is other strong, but unusual evidence to suggest that adult shortnose sturgeons are extremely social and may even exhibit pairing. Dadswell (1979) made the interesting observation that when groups of tagged fish were recaptured using a gill net they were often recaptured with fish in the same order as the initial capture. The probability that pairs of fish would be recaptured together and removed from the gill net in the same order by chance is extremely low. Students working in Litvak's lab have also made the same observation.

As mentioned previously, an understanding of the mechanisms for partitioning resources between Atlantic and shortnose sturgeon is important. Generally, it has been viewed that if shortnose and Atlantic sturgeon partition their resources it is based on the preference for regions of different salinity (National Marine Fisheries Service 1998). However, Giberson (1999) developed an angular flume to provide individual sturgeon with a choice of different flow rates. In all instances, shortnose sturgeon chose to swim in higher flows than did the Atlantic sturgeon. This suggests that, although the two species may "appear" to partition their resources by choosing habitats of slightly different salinity, this choice may actually be based on flow preference as well.

These fish are relatively easy to rear in the lab and would be excellent candidates for re-introduction if necessary. Broodstock can be manipulated with hormone injections (LHRHa) to produce gametes following Conte *et al.* (1988). Fertilized eggs are incubated in MacDonald jars until hatch. Routine survivorship of egg to juveniles in the laboratory is over 70% (Litvak, unpublished data) and larvae are easily weaned onto prepared diets. It appears fairly straightforward to raise them in captivity, but ultimate success of a captive breeding program is unknown.

POPULATION SIZES AND TRENDS

There have been two population estimates on the Saint John River, both below the Mactaquac Dam, but a significant portion of the Saint John River above the dam has not been studied. Dadswell (1979) estimated an adult population of 18,000 ($\pm$30%) in the lower Saint John River in the period 1973-1977. Litvak and associates are in the middle of a population estimate (1998 to present) focusing largely on the Kennebecasis River.

Using a Jolly-Seber open population estimation technique (Krebs 1999) they found 2,068 fish with upper and lower 95% confidence limits to be 11,277 and 801, respectively, in this tributary to the Saint John River (Litvak, unpublished data). They (Litvak, unpublished data) calculated the survival rate (Φ; ratio of number of marked animals at the start of sample t+1 to the number of marked animals at the end of sample t) of this population to be 0.05. The survival rate corrects for all accidental deaths or removals at time t. Emigrations are counted as deaths. Dilution rate (λ), an estimation of the addition rate to the population, was calculated to be 6.3. This dilution rate includes both additions by birth and immigration. A minimum dilution rate of 1.0 indicates that there are no additions to the population. Preliminary estimates suggest the population in the Kennebecasis River is highly variable. This may be a result of immigration and emigration from other tributaries of the Saint John River. At this time the estimates of Dadswell (1979) and Krebs (1999) are not comparable because of differences in methodology, timing and location of the surveys; however, current studies being conducted by Litvak and associates will include consistent methodology in all tributaries to better determine population trends.

Based on anecdotal information, and personal observation of elders of the Oromocto First Nations, representatives from the Oromocto First Nation's fisheries technician team (Levi Sabattis, Harold Paul and Brian Paul) indicated that there is a general sense among the elders that there has been a decrease in numbers of shortnose sturgeon over the past thirty years. They linked the decrease to the presence of the Mactaquac Dam. However, there is hard evidence to suggest any trend in either direction.

There is a fish lift at the Mactaquac Dam that has been in place since the dam's construction in 1967. Shortnose sturgeon have never been caught in this fish lift as its intake is only 1.8 m deep over a water depth of 12.8 m (Rod Price, Project Manager for the Mactaquac Fishway).

No information is currently available for shortnose sturgeon presence and/or abundance above the Mactaquac Dam.

LIMITING FACTORS AND THREATS

There is no directed commercial harvest of shortnose sturgeon. Only fish over 122 cm (48") can be kept when caught by recreational anglers (Department of Natural Resources and Environment [DNRE] Recreational Fishing Guidelines). However, by-catch from other anadromous fisheries on the east coast and targeted poaching probably exist throughout its range (Dadswell 1979; Collins *et al.* 1996; Kynard 1997). The extent of illegal fishing and markets is not known, but is thought to be significant (NatureServe 2004).

In the Saint John River, shortnose sturgeon are caught incidentally by gaspereau (*Alosa pseudoharengus*), and shad (*A. sapidissima*) commercial fishers (Litvak, personal observation). Fish are most often released "unharmed." However, they are very vulnerable to capture during their spring spawning migration, which is coincident with the gaspereau runs. Some evidence does suggest that capture and release during spawning migrations may interrupt spawning and cause abandonment of migrations (National Marine Fisheries Service 1998).

To date, there has been little work on the effect of contaminants on shortnose sturgeon and none on the Saint John River population. However, considering their long life span, and that they are benthic predators, there is great potential for bioaccumulation of heavy metals and other toxicants (Dadswell 1979). Kocan *et al.* (1993) did study the effects of coal tar leachate (PAHs) on embryo and larval development. This exposure resulted in extremely high mortality within 18 days.

The Saint. John river is dammed at 4 main locations: Grand Falls, Tobique, Beechwood, and Mactaquac. The damming of major rivers in North America has had an extremely negative impact on anadromous species. Hydroelectric dams may reduce shortnose habitat by altering river flows and/or temperature required for spawning and incubation of eggs (National Marine Fisheries Service 1998). In almost all of the shortnose sturgeon populations, dams block the passage of fish upriver and therefore confine spawning activities below this point (Kynard 1997). This leaves all of the early life stages vulnerable to changes in river conditions controlled by dam operations. However, we have no historic evidence that sturgeon went further upstream than the Mactaquac and there have been no studies of the effect of the dam on sturgeon spawning below the dam, though flow and temperature are potential concerns on shortnose sturgeon ontogeny.

There are a number of industrial activities on the Saint John River. There is a large forestry industry with 5 pulp and paper mills. The Saint. John River valley is home to one of maritime Canada's most productive agriculture industries which includes 4 potato-processing plants. Raw sewage from towns along the river, including the city of Saint. John, flows directly into the river. Pulp mills, agriculture and forestry all contribute directly or indirectly to contaminant loads in the river, and accidental discharges of toxins or other pollutants could have dire consequences for Canada's only population of shortnose sturgeon. Low oxygen levels are known to be caused by eutrophication related to pulp mill, silviculture, agriculture and sewer discharges (Dadswell *et al.* 1984, NatureServe 2004). Increased summer water temperatures exacerbate the situation as they lead to lower dissolved oxygen content.

Despite the reference to the Saint John River as being "highly industrialized" and with several cities on it, we should keep in mind that this is by New Brunswick standards. The large majority of the watershed is forested. There are three cities on the Saint John: greater Fredericton is roughly 80,000, greater Saint John (at and around the mouth of the river, rather than on the river proper) is approximately 125,000, and the population of Edmunston is just over 20,000. There are numerous small towns along this river, but all municipalities now have sewage treatment. These treatment plants have overflow mechanisms, but they have rarely been used. A percent of the sewage from the city of Saint John gets into the mouth of the estuary without being treated, but is this not the same scenario as it was some years ago (M. Toner personal communication 2005).

Accidental introduction of exotic species such as white sturgeon (*Acipenser transmontanus*) or lake sturgeon (*Acipenser fulvescens*) by aquarium enthusiasts or aquaculturalists could potentially threaten the existing population (NatureServe 2004). Introduction of disease through aquaculture operations is also a potential threat.

SPECIAL SIGNIFICANCE OF THE SPECIES

Shortnose sturgeon is one of 24 remaining acipenserid species, all of which are either listed as Vulnerable through to Endangered by IUCN. It is one of five species of sturgeon that occur in Canada. The Saint John River population is the shortnose sturgeon's only occurrence in Canada and its most northern population. It was exploited commercially, but is now protected by a general size regulation for all sturgeon on this river; all sturgeon under 122 cm (48") must be released. It is viewed as a distinct population (Grunwald *et al.* 2002; Quattro *et al.* 2002).

EXISTING PROTECTION OR OTHER STATUS DESIGNATIONS

Shortnose sturgeon has been listed as Endangered by the Endangered Species Act in the United States since March of 1967. The National Marine Fisheries Service generated a Final Recovery Plan for the US in 1998. The species was listed as Special Concern in Canada in 1980 and there is no recovery team. DFO is developing a Maritimes sturgeon conservation working group with representation from government, academia, and ENGOs (Rod Bradford, DFO, personal communication). It has had IUCN Red Book Status since 1996 when it was assessed as Vulnerable because it: 1) has had a reduction in area of occupancy, extent of occurrence and/or quality of habitat; 2) is severely fragmented; 3) is subject to continued decline in area, extent and/or quality of habitat and number of locations or subpopulations. It is listed under Appendix 1 of CITES (Convention on the International Trade Endangered Species) and Appendix 1 of the Wild Animal and Plant Protection and Regulation of the International and Interprovincial Trade Act (WAPPRIITA), which controls the interprovincial movement of any product of the species. It is also protected by a size limit of 122 cm (48") minimum fork length for recreational fishing on the Saint John River. This corresponds to the length of the largest recorded specimen (122 cm), which means there is virtually no retention of shortnose sturgeon either in the recreational or commercial fishery. Further, in order to retain shortnose sturgeon a person requires a licence under the *Fishery (General) Regulations* to fish for scientific, educational, research, or public library display purposes (i.e., these are the only purposes for which removal of the fish would be permitted). A licence under the same *Fishery (General) Regulations* would also be required to transfer shortnose sturgeon to a rearing facility, to release them into fish habitat, or to transport fish between provinces.

NatureServe ranks are: global rank (GRank)—G3 (locally in a restricted range) and in NB (SRank.NB) is S2 (rare throughout its range in the province or may be vulnerable to extirpation due to rarity or other factors (NatureServe 2004).

TECHNICAL SUMMARY

***Acipenser brevirostrum* (Lesueur 1818)**
Shortnose Sturgeon — Esturgeon à museau court
Range of Occurrence in Canada: Saint John River, NB

Extent and Area Information	
• *extent of occurrence (EO)* [estimated from figure 5]	< 500 km^2
• *specify trend (decline, stable, increasing, unknown)*	Decreased since 1967 (area above the Mactaquac Dam no longer accessible)
• *are there extreme fluctuations in EO?*	No
• *area of occupancy (AO)* [estimated from figure 5]	< 200 km^2
• *trend*	Decreased since 1967
• *are there extreme fluctuations in AO?*	No
• *number of extant locations*	1
• *trend in # locations*	Stable
• *are there extreme fluctuations in # locations?*	No
• *habitat trend*	Unknown
Population Information	
• *generation time (average age of parents in the population) (indicate years, months, days, etc.)*	21 years
• *number of mature individuals (capable of reproduction) in the Canadian population (or, specify a range of plausible values)*	Unknown but ~18,000 in 1977
• *total population trend: specify declining, stable, increasing or unknown trend in number of mature individuals*	Unknown, but possibly declining
• *if decline, % decline over the last/next 10 years or 3 generations, whichever is greater*	Unknown
• *are there extreme fluctuations in number of mature individuals (>1 order of magnitude)?*	No
• *is the total population severely fragmented (most individuals found within small and relatively isolated (geographically or otherwise) populations between which there is little exchange)?*	Only one location in Canada; but may be more than one spawning location. Genetics information suggests that there is little migration between rivers
• *list each population and the number of mature individuals in each* • However, with a 2:1 ♀:♂ sex ratio the number of females becomes limiting, if ⅓ spawn each year then the effective number of adults is 4,000 ± 30%, and using the precautionary principle the lower end of the estimate should be taken.	18,000 ± 30%
• *trend in number of populations*	Stable
• *are there extreme fluctuations in number of populations?*	No
Threats (actual or imminent threats to populations or habitats)	
- incidental by-catch in the alewife and shad fisheries and poaching - habitat loss and degradation through damming and impoundments - habitat degradation resulting from urban, agricultural and industrial activities	
Rescue Effect (immigration from an outside source)	Low
• *does species exist elsewhere (in Canada or outside)?*	Yes
• *status of the outside population(s)?*	Endangered
• *is immigration known or possible?*	Possible but unlikely

• *would immigrants be adapted to survive here?*	Unknown
• *is there sufficient habitat for immigrants here?*	No
Quantitative Analysis	**Not Applicable**

Existing Status
Nature Conservancy Ranks (NatureServe 2004)
Global – G3
National
US – N3
Canada NNR
Regional
US: CT – S1, DC – SX, FL – S1, GGA – S2, ME – S3, MD – S1, MA – S1, NH – SH, NJ – S3, NY – S1, NC – S1, PA – S1, RI – S1S2, SC – S3, VA – SX

Canada: NB – S2

U.S. Endangered Species Act – Endangered 1967
AFS – Threatened 1989
IUCN
Vulnerable
CITES
Appendix **I**
Wild Species 2000 (Canadian Endangered Species Council 2001)
Canada - NR
NB – 3
COSEWIC
Special Concern 1980, 2005

Status and Reasons for Designation*

Status: Special Concern	**Alpha-numeric code:** Meets the criterion for Threatened D2, but designated Special Concern because there are no immediate threats.
Reasons for Designation: This is an anadromous species restricted to a single river system in Canada where spawning fish require unhindered access to freshwater spawning sites; but the population may have been divided since 1967 by the Mactaquac Dam. These large, slow growing, late maturing fish are conservation dependent. There is some risk to the species through mortality from hydroelectric facilities, by-catch in alewife and shad fisheries, and poaching. However, there is no immediate threat that would lead to elimination of the population in a very short period of time.	
Applicability of Criteria **Criterion A** (Declining Total Population): Not applicable, evidence of decline is equivocal and not quantified. **Criterion B** (Small Distribution, and Decline or Fluctuation): Not applicable, although the area of occupancy is < 500 km^2, and the species is known from only one location in Canada, there is no evidence of continuing decline or extreme fluctuations in the area of occupancy, extent or quality of habitat, or number of mature individuals. **Criterion C** (Small Total Population Size and Decline): Not applicable, it may qualify as threatened under C, if only spawning females are taken into consideration, and there is some evidence of past decline associated with habitat loss. However, there is no evidence to support continuing decline in excess of 10% over the next three generations. The population may have been fragmented since 1967 by construction of the Mactaquac Dam. **Criterion D** (Very Small Population or Restricted Distribution): Met criteria for D2 with one location, present in only one river. **Criterion E** (Quantitative Analysis): Not applicable, no data for analysis.	

*COSEWIC has requested a re-assessment within 5 years.

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