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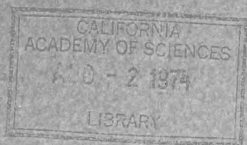
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No. 5

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THE SHORTRNOSE STURGEON, *ACIPENSER BREVIROSTRUM*, IN THE SAINT JOHN RIVER, NEW BRUNSWICK, CANADA, A RARE AND POSSIBLY ENDANGERED SPECIES



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Litho in Canada

The Shortnose Sturgeon, *Acipenser brevirostrum*, in
the Saint John River, New Brunswick, Canada,
a rare and possibly endangered species

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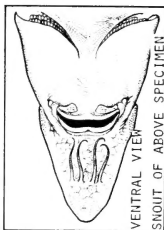
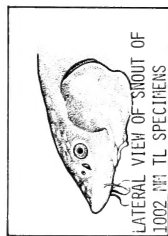
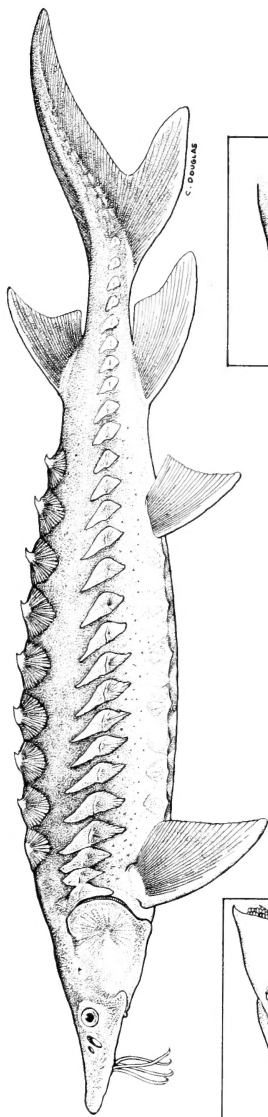
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FRONTISPIECE Drawing of specimen of shortnose sturgeon from the Saint John River, N. B. (NMC67-331) 560 mm in fork length and 636 mm in total length.

RÉSUMÉ

Description taxonomique de l'esturgeon à museau court, *Acipenser brevirostrum* LeSueur, 1818, du réseau fluvial de la rivière St-Jean, au Nouveau-Brunswick, donnant de nouveaux caractères d'identification. Renseignements sur la répartition géographique, la taille, la croissance et la pêche. Records nouveaux de longueur totale, 1353 mm, et de la pesanteur, 13.8 kg, du Nouveau Brunswick. Signes indiquant que cette population, la seule au Canada, est en régression. Recommandation des mesures de protection suivantes: réduction de la pollution, limitation de l'emploi de pesticides; augmentation à 14 pouces de la dimension minimale des mailles tendues des filets employés pour la pêche à l'esturgeon; présentation de statistiques distinctes sur les prises d'esturgeon à museau court et d'esturgeon noir, *A. oxyrinchus*, dans le réseau fluvial de la rivière St-Jean et programme de recherches pour déterminer l'importance numérique, le recrutement et les déplacements de cette espèce ainsi que l'emplacement des frayères et des zones d'alevinage.

INTRODUCTION

The shortnose sturgeon, *Acipenser brevirostrum* LeSueur, 1818 has been placed on the lists of rare and endangered species for the United States (Miller, 1972), Canada (McAllister, 1970), and the world (Miller, 1969). The shortnose sturgeon has been recorded from Atlantic coast drainages in the United States from Maine to Florida, but it has disappeared from many of these and the only viable population in the U.S. may be that in the Sheepscot River in Maine.

In Canada only one river system supports the shortnose sturgeon, the Saint John River system in southern New Brunswick. Its presence in the Saint John system has been briefly noted by Scott and Crossman (1959), Leim and Day (1959), Trites (1960), Gorham (1965), Leim and Scott (1966), Gorham (1970), McAllister (1970), and Meth (1973). Magnin (1963) presented data on age, length, and biology of 10 specimens from the Saint John near Fredericton. Vladykov and Greeley (1963) provided a key to the species of *Acipenser* in the western North Atlantic and a figure, description, and synonymy of the shortnose. Gorham (1971) published new records of specimens in the Saint John system and data on length and weight.

The present paper provides new information for a series of specimens from the Saint John system on distribution, length and weights. Ages are reported for 10 specimens. A taxonomic description of the Canadian population is given for the first time. Standard and new characters for a series of shortnose are compared with the sympatric Atlantic sturgeon, *Acipenser oxyrinchus oxyrinchus* Mitchell, 1814. The status of the shortnose is discussed.

Taxonomy

Sturgeons may be distinguished from other fishes by dorsal, lateral and ventrolateral rows of bony scutes on the body, the prolonged upper lobe of the caudal fin, and the 4 barbels on the underside of the snout.

The only sturgeon co-occurring with the shortnose in New Brunswick is the Atlantic sturgeon, *Acipenser o. oxyrinchus*. The following key summarizes the best characters for separating the two species in the Saint John River system.

Key to Sturgeons in New Brunswick

- 1 (2) Intestine dark. No enlarged bony plates between base of anal fin and lateral row of scutes, Fig. 1. Mouth width inside lips more than 3/5 of width of bony interorbit. Snout short and blunt, Fig. 2. Total length probably never exceeds 1370 mm (4½ feet)..... shortnose sturgeon, *Acipenser brevirostrum*
- 2 (1) Intestine light. 2-6 bony plates at least pupil-sized between anal base and lateral row of scutes, Fig. 1. Mouth width inside lips less than 3/5 of bony interorbit. Snout long and pointed, Fig. 2. Total length up to 4267 mm (14 feet)..... Atlantic sturgeon, *Acipenser o. oxyrinchus*

Shortnose sturgeon from the Saint John River system have not previously been described. Taxonomic characters are therefore presented for 32 male and female specimens ranging from 310 to 879 mm in fork length, and compared with 14 Atlantic sturgeon from 489 to 934 mm from the

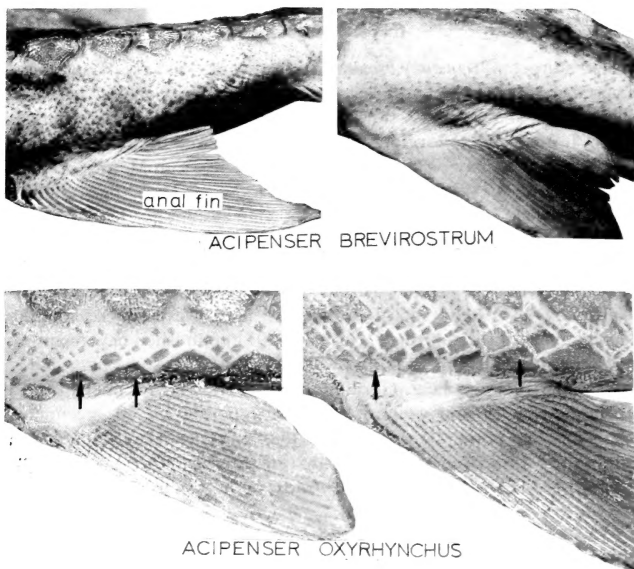


Fig. 1. Shortnose sturgeon, *Acipenser brevirostrum*, above; Atlantic sturgeon, *Acipenser o. oxyrinchus*, below. Note the normal-sized scales above the anal fin in the shortnose sturgeon and the small bony plates (arrows) in the Atlantic sturgeon.

Saint John drainage. For one character, supra-anal plates, a few additional specimens from the same drainage were examined. Frequencies for the different characters are listed for the two species in Tables 1 and 2 at the end of the paper.

The characters were determined as follows. Mouth width was measured as the lateral distance between the inside corners of the mouth. Snout length was measured from the tip of the snout to the anterior fleshy border of the orbit, head length from the tip of the snout to the posterior border of the opercular bone, and the interorbital width as the least bony width between the eyes. Total length was taken from the distance between vertical lines at the tip of the snout and the posterior tip of the dorsal lobe of the caudal fin in its natural position. Fork length was taken similarly but back to the distal edge of the caudal fin on the midline. The loss of the tip of the dorsal lobe of the caudal sometimes made total length an unreliable measurement.

All anal rays were counted; the anterior fulcrum was omitted. Counting was facilitated by scraping the rays with a scalpel to remove skin and mucus. Dorsal scutes were counted from the dorsal fin to the head excluding the scutes which interdigitated with the cranial plates. Lateral scutes were counted between the cleithrum and the base of the caudal fin. The smaller posterior lateral scutes were counted as long as they fell on the midline. The ventral or more properly ventrolateral

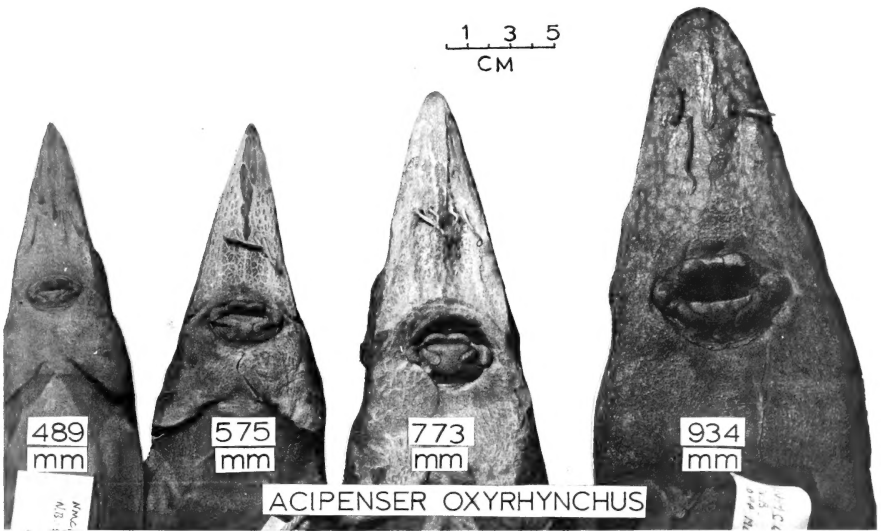


Fig. 2. Shortnose sturgeon, *Acipenser brevirostrum*, above; Atlantic sturgeon, *Acipenser o. oxyrinchus*, below. Note the relatively shorter, blunter snout and the wider mouth in the shortnose sturgeon (fork lengths of each indicated in mm.).

scutes were counted between the pectoral and pelvic fin origins. The postdorsal scutes which lie just behind the dorsal fin and the preanal scutes which lie in front of the anal fin and immediately behind

the anus were recorded as single or paired. The enlarged supra-anal plates, Fig. 1, probably formed through fusion of scales, are found above the base of the anal fin and below the lateral series of scutes in the Atlantic sturgeon. In the shortnose sturgeon only small scales are found in this position.

Authors have used two spellings for the species name of the shortnose sturgeon, *Acipenser brevirostrum* and *Acipenser brevirostris*. The former is the spelling used in the original description by LeSueur and is correct, the species name being treated as a nominative singular noun in apposition to the generic name.

Distribution

The shortnose sturgeon is found in drainages of the Atlantic coast of North America from Big Lake George of the St. Johns River drainage, Putnam County, Florida (Vladykov and Greeley, 1963) north to the Saint John River of both King, Queen's, Sunbury, and lower York counties, southern New Brunswick. There are a few marine records for the United States but the available evidence suggested to Bigelow and Schroeder (1953) that the shortnose was not as regularly migratory as the Atlantic sturgeon. Magnin (1963), on the basis of growth, inferred that the shortnose is essentially a freshwater species.

The only records of the shortnose after 1950 are for: 1951 and 1952 in the Connecticut River near Hadley, Massachusetts (Vladykov and Greeley, 1963), 1970 in the Hudson River, New York (Koski et al 1971), 1971 and 1972 in the Sheepscot River, Maine (Fried and McCleave, 1973) and up to 1973 in the Saint John River system, N.B. Although its occurrence is probably more widespread than this, it has been extirpated in many of its native rivers (Miller, 1969). For no river is there any current information on spawning success or on the recruitment of young fish into the population.

The distribution in the Saint John River system, N.B. is shown in Fig. 3. The shortnose sturgeon is known there from Pamdence (Meth, 1973) in the lower Saint John to Fredericton (Magnin, 1963) 65 miles upstream and in the intervening tributary Kennebecasis and Belleisle bays, French Lake in Sheffield Parish (record based on photo), Washademoak Lake, and Grand Lake. Adults have been taken there in every month of the year in contrast to the Atlantic sturgeon where specimens exceeding three feet are seldom taken in the lower Saint John during winter (one of 40 and another of 48 inches were taken in the mouth of Kennebecasis Bay, 19 February 1973). Most of the 17 sites of capture are located where the river or tributary is .5-3.2 km (1/2-2 miles) wide. Depths of capture is sunken gillnets varied from 3-18 m (10-60 feet), but most were 9-18 m (40-60 feet). Long Reach is tidal. According to Rogers (1940) the limit of salt water is the mouth of Belleisle Bay. There are records from Public Landing, Purdy's Point and Westfield from Long Reach but none seawards in N.B. According to Trites (1960) the upper 10 metres of Long Reach is usually fresh but occasionally has a salinity of 15PPT. Deeper waters usually have salinities of 10 to 20PPT. Trites reported trawling shortnose at salinities exceeding 15PPT in Long Reach. Downstream where salinities tend to be higher there are records only of Atlantic sturgeon, none of shortnose. For May-June, August and December the temperatures of the upper 10 metres in Long Reach are 12-14°C, 16-18°C, and 0-1°C, and for 11-40 metres for the same periods 5-12°C, less than 16°C, and 2-9°C respectively. The depth and distributional information is based on specimens and reports obtained through the kind co-operation of commercial fishermen fishing sturgeon, gaspereau, striped bass, American eel, and Atlantic salmon.

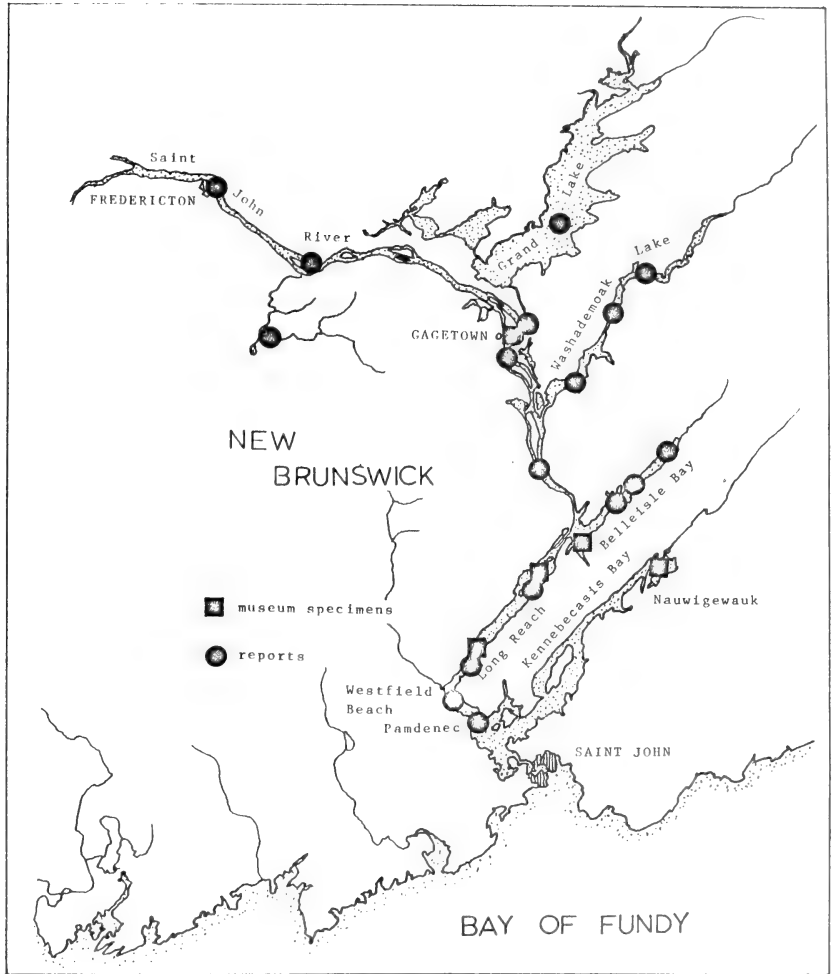


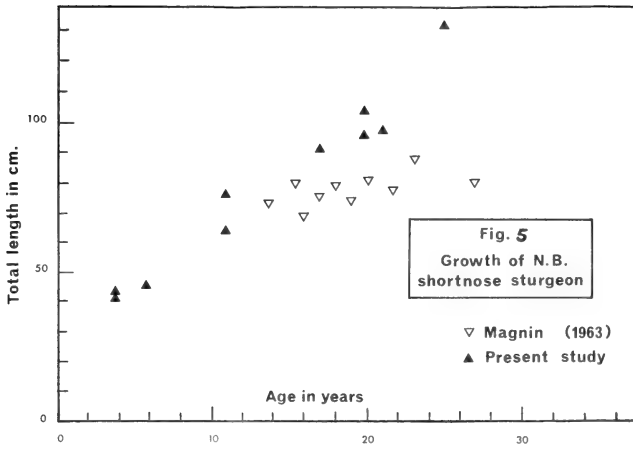
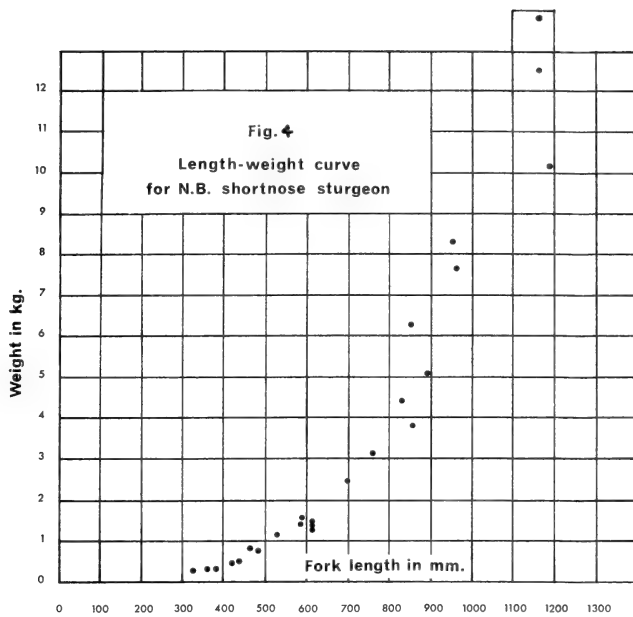
Fig. 3. Distribution of the shortnose sturgeon, *Acipenser brevirostrum*, in the Saint John River system in southern New Brunswick. We do not have the precise location for the Fredericton and Grand Lake records.

Size and Growth

Our smallest specimen was one of 368 mm in total and 318 mm in fork length (14½ and 12½ inches); it weighed 260 grams (9 ounces). The longest specimen was a female taken 18 June 1971 by Mr. Hugh Cunningham at Nauwigewauk, 1295 mm in total and 1156 mm in fork length (51 and 45½ inches); it weighed 12.4 kg (27 lb. 5½ ounces). Fried and McCleave (1973) announced a new record of total length for the species of 1181 mm but they overlooked Gorham's (1971) report of the 1295 mm specimen. On June 6, 1973 however, a specimen measuring 1257 mm in total and 1162 mm in fork length (49½ and 45¾ inches) and weighing 13.8 kg (30 lb., 8 ounces) was caught and on June 8 a specimen 1353 in total and 1194 in fork length (53¼ and 47 inches) and weighing 10.1 kg (22 lb, 2¾ oz) were caught in Kennebecasis Bay near Darlings Island, Nauwigewauk by Hugh Cunningham. The next largest specimen in our collections is one of 1090 mm (43 inches) in total length. Mr. Cunningham, a reliable veteran fisherman, states that over the years that he was taken many shortnose four feet (1219 mm) or more in length with an estimated weight of 40 lb. (18 kg).

The weight-length relationship of the shortnose sturgeon based on our data from the Saint John River system is shown in Fig. 4. Comparing this curve with Magnin's (1963a) Fig. 21 and 22 for the Atlantic sturgeon, one finds that the shortnose is heavier for a given length. However the Atlantic sturgeon ultimately attains a much larger size-14 feet and 811 pounds, one from Saint John River at Middle Island, near Maugerville, N.B. (Vladykov and Greeley, 1963). It is apparent that shortnose sturgeon lose weight during the winter months. This is borne out by the weights taken and from information obtained by fisherman who describe the sturgeon as 'looking thin during the winter.'

Ages were obtained from 10 specimens by counting the rings in a basal section of the first pectoral fin ray dipped in glycerine. Our data are combined in Fig. 5 with those of Magnin (1963) to show the growth in length of Saint John River system shortnose sturgeon. We have used total length to make our measurements comparable with these of Magnin. The oldest specimen, one of Magnin's, is 27 years old.



Reproduction

In the Hudson River male shortnose mature at a size of about 52 cm (20 inches) in their fifth year, females at about 56 cm (24 inches) in their sixth year. Spawning has been reported in April for the Hudson River (Vladykov and Greeley, 1963).

Little is known of spawning in the Saint John River system. David Gorham, commercial fisherman, reports that the shortnose is found in about 40 feet (12.2 m) of water, seldom shallower, in winter, but that in spring and early summer it moves into shallower water. The dates of capture that we have seem to suggest that the shortnose moves up towards the heads of Kennebecasis and Belleisle Bays and perhaps up the Saint John River in April, May, and June. The eggs of a large and moderate-sized females taken at Nauwigewauk June 18, 1971 were bright yellow with no sign of darkening. Sturgeon fishermen of the lower Saint John River state that some shortnose sturgeon may be ripe or running in June while others may go on until late August or early September. In summer the roe becomes dark in colour, a condition typical of ripeness in sturgeons. Additional study is required to determine the time and place of spawning.

The Fishery

According to the New Brunswick Fishery Regulations a fisherman must have a sturgeon licence to fish for sturgeon. The licence costs one dollar. Gill nets used in the sturgeon fishery must have an extension (stretched) mesh of not less than 13 inches (330 mm). Sturgeon of less than 4 feet (1219 mm) from the tip of the snout to the end of the tail must not be fished for, caught or killed. Shortnose and Atlantic sturgeons are not distinguished in the regulations nor in the catch statistics. Sturgeon fishing is closed during the month of June.

One fisherman in the lower Saint John River system caught and kept 321 Atlantic and 2 shortnose sturgeon with a total processed weight of about 5550 pounds (2517 kg) from July 1 to September 15 using 3 gill nets each 180 feet long and 20 to 25 feet deep. Other undersized shortnose and Atlantic sturgeon were caught but not kept.

A sturgeon, when netted, processed and iced (icing costs 13 cents per pound of sturgeon) brings approximately 42 cents a pound to the fisherman and \$2.50 to the retailer on the American market. Processing reduces the weight of an Atlantic sturgeon from 100 pounds to 60 pounds or even less. A 4 foot (1219 mm) shortnose sturgeon weighing 20 pounds in the round might therefore be expected to weigh at most 14 pounds when dressed. The roe may bring over four dollars a pound. The roe of the shortnose sturgeon is preferred by dealers in both United States and Canada.

Salmon fishermen, who were not interested in sturgeon on a commercial basis, were troubled by them getting into and damaging their salmon nets. The more polite name for the shortnose sturgeon in this area is the 'little sturgeon'.

Status

The shortnose has disappeared over much of its range in the United States. The denser population and greater degree of industrialization threaten its continued existence there. It has been placed on the threatened list for Connecticut, Delaware, Maryland, Massachusetts, New Jersey, New York, and Pennsylvania and is regarded as endangered at the national level.

In Canada the shortnose sturgeon is limited to a portion of a single river system. According to Nature Canada (1973) the Saint John River is badly polluted by pulp and paper mills, vegetable processing plants, and raw municipal sewage. Pollution is especially bad at Edmunston, Florenceville, and from Westfield down to the city of Saint John. Between Edmunston and Grand Falls

the dissolved oxygen level frequently approaches zero. These changes may be serious for bottom feeding fishes like sturgeons. However there does not seem to be evidence of gross pollution between Mactaquac and Westfield.

Each year a fair number of shortnose sturgeon are gill netted and the species is more common than previous evidence would have suggested. Because of the size of the shortnose sturgeon, the 13 inch stretched mesh regulation in the sturgeon fishery prevents large numbers of shortnose being caught and minimum size limit in few being kept, although many are still entangled because of their scutes. Others were or are caught in the smaller meshed gillnets set for Atlantic salmon and gaspereau. Sturgeon under four feet and those caught by fishermen without a sturgeon licence must, by law, be released. But in some cases sturgeon die in the nets before they can be released. Some of those released alive probably suffer a higher mortality rate.

Checking with fishermen operating several types of gear including eel traps and chain pickerel nets in the Saint John River system has failed to turn up any specimens shorter than 310 mm standard length which would be 1 to 2 years old, but one of 150 mm was reported in Kingston Creek near Belleisle Bay in late December or early January. We are unable to state whether reproduction has been unsuccessful in recent years and the population being fished consists largely of older individuals, or whether the various gear are not right or not properly placed to take young specimens.

In any case the continued existence of the shortnose sturgeon is in doubt. It is important to save the Saint John River population because it is the only Canadian population, it is restricted in area, and the northernmost for the species. Its continued survival in the United States is by no means certain. It may be noted that protective measures for the white sturgeon, *Acipenser transmontanus* have resulted in a quadrupling of the 1966-70 catch, 143,000 lbs, over the 1961-65 catch, 31,000 lbs (64,900 as opposed to 14,070 metric tons, Hart, 1973). Protection can be effective. Protective measures for the shortnose are warranted until we have assurance of reproductive success.

Recommendations for Protection

Measures have been taken to abate pollution in the Saint John River but there remains much to do especially from Edmunston to Mactaquac dam. Support to municipalities should be continued for the construction of sewage treatment plants adequate for present and future needs. It should be ensured that established industries are engaged in adequate pollution abatement programs and that proper pollution control facilities are built into new industrial plants. The use of pesticides affecting the bottom fauna should be restricted.

Consideration might be given to raising the minimum stretched mesh size of gillnets used in the sturgeon fishery from 13 to 14 inches. The new mesh size could be phased in to avoid increased cost to the fisherman. Catch statistics should distinguish the shortnose and Atlantic sturgeon for the Saint John River system fishery in New Brunswick.

A research project on the shortnose sturgeon should be supported.¹ Included in it should be a tagging program to determine the size of the population(s) and movements. Care should be taken to use methods that will not increase mortality, e.g. traps instead of gillnets. The recruitment of young sturgeons into the population(s) and the age structure should be determined. A search for the spawning and nursery grounds should be made so that they can be suitably protected. A few specimens should be sampled for stomach and pesticide residue analysis.

¹ Dr. M. Dadswell of the Huntsman Marine Laboratory, Brandy Cove, N.B. has begun an investigation of the shortnose sturgeon.

Summary

A taxonomic description including new diagnostic characters is given for the shortnose sturgeon, *Acipenser brevirostrum* LeSueur, 1818 in the Saint John River system, New Brunswick. Information on the distribution, size, growth, and fishery is presented. New records of total length 1353 mm and weight, 13.8 kg, for the species are provided from New Brunswick. Evidence is reported suggesting that this population, the only one in Canada, may be endangered, and even if not the American ones certainly are. The following measures are recommended for its protection: pollution abatement, pesticide restrictions, increase in minimum stretched mesh size for nets in the sturgeon fishery to 14 inches, presentation of separate catch statistics for the shortnose and Atlantic sturgeons in the Saint John system, and a research program to determine food, population size, recruitment, age structure, and movement, as well as the location of the spawning and nursery grounds.

Acknowledgements

The co-operation of the following commercial fishermen is gratefully acknowledged, Hugh Cunningham, Elmer Dixon, David Gorham, Sanford Henderson, and Raymond Tippetts. Dr. R.E. Balch supplied a record from French Lake, Sheffield Parish, Sunbury County. J.W. Carroll, Associate Director, Conservation and Protection, Department of Environment, supplied information on regulations. Dr. Fred F. Meth, Department of the Environment, Ottawa generously permitted access to his manuscripts on the ecology of the Saint John River basin and commented on the present study. Charles G. Gruchy, National Museum of Natural Sciences and Dr. Etienne Magnin, Université de Montréal, kindly criticized the manuscript. Charles H. Douglas drew the graphs and the frontispiece, Miss Jennifer Lewis the map.

Table 1. Frequencies of Body Proportions and Mensties in *Acipenser* from the Saint John River System, N.B.

	24	27	28	31	32-35	36-39	40-43	44-47	48-51	52-55	56-59	60-63	64-67	68-71	72-75	77	Mean	Standard Deviation	
Mouth width x 100	24	27	28	31	32-35	36-39	40-43	44-47	48-51	52-55	56-59	60-63	64-67	68-71	72-75	77			
Snout length																			
<i>Acipenser brevirostrum</i>								1	1	7	8	6	2	3	3	1	60.06	7.72	
<i>Acipenser o. oxyrinchus</i>	8	5	1														27.71	2.84	
Mouth width x 100	47	50	51	54	55-58	59-62	63-66	67-70	71-74	75-78	79-82	83-86	87-90						
Interorbital width							1	4	6	12	4	1	4						
<i>Acipenser brevirostrum</i>																			
<i>Acipenser o. oxyrinchus</i>	6	2	6														53.07	4.05	
Snout length x 100	37	38	39	40	41-42	43-44	45-46	47-48	49-50	51-52	53-54	55-56							
Head length							6	5	3										
<i>Acipenser brevirostrum</i>																			
<i>Acipenser o. oxyrinchus</i>	2	4	6	7													44.03	3.33	
Number of Lateral scales	23	24	25	26	27	28	29	30	31	32	33	34							
<i>Acipenser brevirostrum</i>																			
<i>Acipenser o. oxyrinchus</i>	2	2	4	9	4	3	3	0	3	1	0	1					27.06	2.61	
Number of Gill rakers	15	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32			
<i>Acipenser brevirostrum</i>																			
<i>Acipenser o. oxyrinchus</i>	1	1	2	3	4	2	0	0	1	1	4	3	5	6	5	2	1	27.62	2.53
Number of anal rays	18	19	20	21	22	23	24	25	26	27									
<i>Acipenser brevirostrum</i>																			
<i>Acipenser o. oxyrinchus</i>	2	4	9	8	4	2	3										20.81	1.61	
Number of pelvic rays																			
<i>Acipenser o. oxyrinchus</i>																	24.93	1.27	

Table 2. Frequency of Scute Characters and Intestine Colour in *Acipenser* from the Saint John River System, N.B.

Species	Number of Dorsal Scutes									Mean	Standard Deviation
	6	7	8	9	10	11	12	13			
<i>Acipenser brevirostrum</i>		1	2	5	10	10	3	1		10.22	1.29
<i>Acipenser o. oxyrhynchus</i>			1	9	4					9.21	.58
Species	Number of Ventral Scutes									Mean	Standard Deviation
	1	2	12	14	3						
<i>Acipenser brevirostrum</i>	1	2	12	14	3					8.50	.88
<i>Acipenser o. oxyrhynchus</i>			5	3	4	2				9.21	1.12
Species	Double Postdorsal Scutes		Enlarged Supra-anal Plates								
	Present	Absent	Present	Absent							
<i>Acipenser brevirostrum</i>	6	26	1	50							
<i>Acipenser o. oxyrhynchus</i>	13	1	19	0							
Species	Double Preanal Scutes		Intestine Colour								
	Present	Absent	Dark	Light							
<i>Acipenser brevirostrum</i>	7	25	32	0							
<i>Acipenser o. oxyrhynchus</i>	14	0	1	13							

References

- Bigelow, H.B. and Schroeder, W.C.
(1953). Fishes of the Gulf of Maine. U.S. Fish Wildlife Service Bulletin 53(74):1-577.
- Fried, S.M. and McCleave, J.D.
(1973). Occurrence of the shortnose sturgeon (*Acipenser brevirostrum*), an endangered species, in Montsweag Bay, Maine. J. Fish. Res. Bd. Canada 30(4):563-564.
- Gorham, S.W.
(1965). Notes on fishes from the Browns Flat area, Kings County, New Brunswick. Canadian Field-Nat. 79(2):137-142.
(1970). Distributional checklist of the fishes of New Brunswick. The New Brunswick Museum, Saint John, 32 pp.
(1971). The shortnose sturgeon, *Acipenser brevirostrum*, an endangered species in New Brunswick? Museum Memo, New Brunswick Museum 3(2):13-15.
- Hart, J.L.
(1973). Pacific fishes of Canada. Fish. Res. Bd. Canada Bull. (180):1-740.
- Koski, R.T., Kelley, E.C. and Turnbaugh, B.E.
(1971). A record-sized shortnose sturgeon from the Hudson River. N.Y. Fish Game J. 18(1):75.
- Leim, A.H. and Day, L.R.
(1959). Records of Uncommon and unusual fishes from eastern Canadian waters, 1950-1958. J. Fish. Res. Bd. Canada 16(4): 503-514.
- Leim, A.H. and Scott, W.B.
(1966). Fishes of the Atlantic coast of Canada. Fish. Res. Bd. Canada Bull. (155):1-485.
- Magnin, E.
(1963). Notes sur la répartition, la biologie et particulièrement la croissance de l'*Acipenser brevirostris* Le Sueur 1817. Naturaliste Canadien 90(3):87-96.
(1963 a). Recherches sur la systématique et la biologie des Acipenséridés *Acipenser sturio* L., *Acipenser oxyrinchus* Mitchill, *Acipenser fulvescens* Raf. Ann. Stat. Centr. Hydrobiologie Appl. Paris. Tome 9:1-242.
- McAllister, D.E.
(1970). Rare and endangered Canadian fishes. Canadian Field-Nat. 84(1):5-8.
- Meth, F.F.
(1973). Ecology of the Saint John River Basin. VII. Catalogue of middle and upper basin fish species for the Sain John River Basin Board. Canada, Department of Environment, Fisheries Service, Halifax. 45 pages & maps.
- Miller, R.R.
(1969). Pisces. Freshwater fishes. Vol. 4. Red data book. International Union for Conservation of Nature and Natural Resources Survival Service Commission. Morges, Switzerland (unpages--looseleaf).

(1972). Threatened freshwater fishes of the United States. *Trans. Amer. Fish Soc.* 101(2):239-252.

Nature Canada

(1973). Cleaning up the Saint John River is slow-moving work. Vol. 2(1):41.

Rogers, Harold M.

(1940). Occurrence and retention of plankton within the estuary. *J. Fish. Res. Bd. Canada* 5(2):164-171, 2 fig.

Scott, W.B. and Crossman, E.J.

(1959). The freshwater fishes of New Brunswick: a checklist with distributional notes. *Contrib. Roy. Ont. Mus.* (51):1-37.

Trites, R.W.

(1960). An oceanographical and biological reconnaissance of Kennebecasis Bay and the Saint John River estuary. *J. Fish. Res. Bd. Canada* 17(3):377-408, 16 fig.

Vladykov, V.D. and Greeley, J.R.

(1963). Order Acipenseroidi. pp. 24-60. *In* *Fishes of the Western North Atlantic. Part 3. Memoir Sears Foundation for Marine Research* (1):1-630.

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