

The Muskellunge, *Esox masquinongy*, Distribution and Biology of a Recent Addition to the Ichthyofauna of New Brunswick

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The Muskellunge, *Esox masquinongy* has invaded the Saint John River of New Brunswick in the last decade. Introduced as fingerlings into a small lake in the river system in the Province of Quebec, the fish moved downstream, increasing the species' range and abundance. At least 60 fish have been collected in New Brunswick since 1988, most at hydroelectric dams in the upper and middle stretches of the river. A limited summer and winter fishery for Muskellunge has developed in a lake in the northwestern part of the province. Lengths-at-age suggest that the river fish are growing rapidly. The oldest fish was VI+. Some fish of both sexes appear to mature at age III+. The presence of young-of-the-year fish and the condition of the gonads indicate that spawning has occurred and that the muskie is capable of establishing self-sustaining local populations in the river.

Key Words: Muskellunge, *Esox masquinongy*, introduced exotic, distribution, occurrence, age and growth, Saint John River, New Brunswick.

Distributional records of fish species in New Brunswick list Chain Pickerel (*Esox niger*), introduced in the late 1800s, as the only esocid in the province (Scott and Crossman 1959; Gorham 1970). However, within the past decade Muskellunge (*Esox masquinongy*) have appeared in provincial waters. The species had not been previously documented in the Atlantic region (Scott 1967; Scott and Crossman 1973). Canadian distribution is restricted to the lakes and rivers of southern Quebec, Ontario, and eastern Manitoba. This paper reports on the recent occurrence and distribution of muskies in New Brunswick.

Discussions with fisheries officers, commercial fishermen, and fishery biologists suggest that the Muskellunge has so far invaded only the Saint John River Basin, a river system shared with the province of Quebec and the state of Maine. The occurrence of this fish in Maine and New Brunswick stems from the stocking of fingerlings in Lac Frontière, a small Quebec lake located in the headwaters of this watershed.

The Saint John River Basin

The 696 km long Saint John River flows through southeastern Quebec, northern Maine and western New Brunswick. Fifty-one percent of the 55 160 km² drainage area lies within New Brunswick (Figure 1). The river, from its source at Little Saint John Lake, Maine drops 482 m in elevation to the marine Bay of Fundy in New Brunswick. The river is influenced by tides in its lower 130 km but during high water discharges a considerable amount of water accumulates affecting river stages further upstream. Flooding is a

characteristic phenomenon in the drainage basin (Anonymous 1972). The main stem of the river upstream from Fredericton has been extensively developed for hydro-electric power generation with dams at Mactaquac, Beechwood and Grand Falls. The river flows through a mainly forested (85%) watershed with a diversity of peaks, valleys, lakes, swampy plains, broad flood plains and rugged highlands. There are five large sub-drainages within the watershed.

Stocking History

Lac Frontière, Quebec, is a 107 ha headwater lake on the Northwest Branch of the Saint John River located near the Maine border. In 1970, fisheries personnel of Quebec Ministry of Environment and Wildlife stocked 3000 Muskellunge fingerlings in the lake, followed by another 1000 each in 1971, 1972 and 1973 and 250 in 1979 (Basley 1986*). A self-sustaining population has been established there. This presumed sedentary fish soon moved downstream into Maine waters of the Saint John River system. Angler catches in 1984 and fish collection efforts by the Maine Department of Inland Fisheries and Wildlife in 1984, 1985 and 1986 confirmed that young-of-year and yearling Muskellunge were utilizing the river system to increase range and abundance. Since 1987 a sport fishery for this species has developed in Baker Lake, Maine about 58 km south of Lac Frontière (Johnson 1987*, 1994*).

*See Documents Cited section

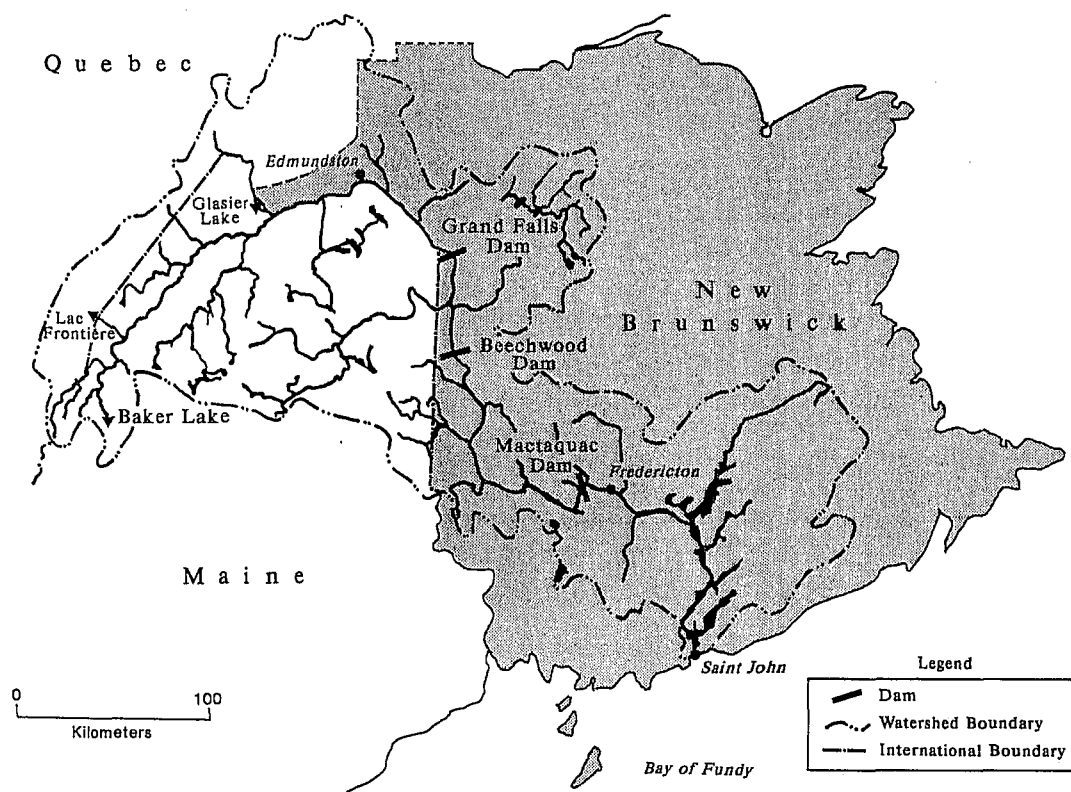


FIGURE 1. Map of the Saint John River watershed showing locations associated with Muskellunge distribution.

Occurrence and Distribution in New Brunswick

The first Muskellunge reported in New Brunswick was caught in June 1988 on the main stem of the Saint John River at the Mactaquac Dam fish collection facility operated by Canada Department of Fisheries and Oceans (Figure 1). Since then at least 47 of the more than 60 fish from the river have been collected at this facility. Sixteen of these fish have been deposited in the collections of the New Brunswick Museum, Saint John (NBM 1137, 1153-1168). Nineteen were caught at the dam in 1996. Nine were caught in the fish trap at the Beechwood Dam further upriver (Figure 1) between 1993 and 1997. Large, unidentified esocids, some in excess of 5 kg were recorded since 1990 at Beechwood which also caught the smaller Chain Pickerel. Two young-of-the-year were captured by seining and at least three more were angled. All sampled fish were collected from June to October. Biennial totals of 1, 4, 12, 12 and 29 fish taken in the Saint John in the last decade suggest an increase in numbers of some magnitude in the upper and middle stretches of the river. Very

few muskies have been reported downstream from the Mactaquac Dam.

Glasier Lake, located on the Maine-New Brunswick border, has produced muskellunge for both winter and summer angling since 1992 (E. LeBlanc, personal communication). About 6 to 12 fish in the 7 to 11 kg range are taken each winter while summer angling produces about 30 to 40 fish in the 7 to 15 kg range.

Biological Data and Discussion

Lengths and/or weights were recorded for 46 Muskellunge collected from 1988 to 1997. Excluding two young-of-the-year, Muskellunge total length varied from 496 to 1040 mm (Table 1), and weight from 725 to 9100 g. Sixty-eight percent of 44 fish were between 600 and 850 mm.

Forty fish were aged using scales, with confirmation in some cases using cleithra. The oldest fish was VI+ (Table 1). The Muskellunge in the Saint John River appear to be large fish for their age but within size limits reported for the species (Carlander 1969). The only other sample of measured fish in the watershed is from Baker Lake, Maine (Johnson 1987*; S.

TABLE 1. Average size of 40 Saint John River Muskellunge, by age group, caught in New Brunswick, 1988 - 1997.

Age	Sample Size	Mean Total Length (mm)		Mean Weight (g)	
		Mean	Range	Mean	Range
0+	1	291	-	-	-
I+	0	-	-	-	-
II+	4	583	496-622	1432	725-1680
III+	17	708	638-826	2759	1850-3700
IV+	13	780	689-934	3835	2540-6275
V+	3	907	841-960	6032	5300-6622
VI+	2	998	955-1040	8512	7924-9100

Roy, personal communication). Comparable lengths-at-age from Maine, 1988 to 1991, show that New Brunswick river muskies are growing faster than Maine lake fish, or those from the St. Lawrence River (Figure 2). However, the values for Maine angled lake fish may not be entirely comparable to New Brunswick river fish obtained by a variety of methods (mostly traps) for the years 1988 - 1997. Additionally, small sample sizes, seasonal distribution of sampling efforts and sexually dimorphic growth complicate the comparisons. But the considerable growth difference is noteworthy. The more rapid growth in younger river Muskellunge compared to lake fish has also been noted elsewhere (Harrison and Hadley 1979).

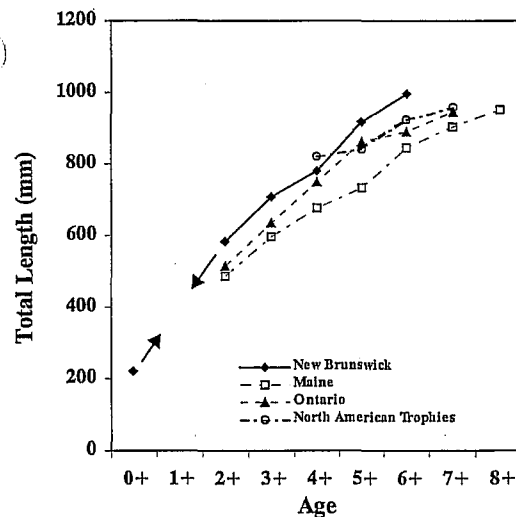


FIGURE 2. Age at growth of Muskellunge from the Saint John River, New Brunswick, 1988-1997 and growth comparisons with populations from Baker Lake, Maine (S. Roy, personal communication), St. Lawrence River, Ontario (Scott and Crossman 1973), and North American trophy fish (Casselman and Crossman 1986).

The river fish are also heavy for their length (Figure 3). We compared length-weight relationships of New Brunswick Muskellunge to those calculated for trophy fish from North America (Casselman and Crossman 1986). New Brunswick fish, on average, weighed 11.5% more than the trophy fish for the same lengths. This above average weight may be partially attributable to samples collected in summer and fall only when fish are in prime condition. The lack of intra-specific competition based on the low numbers of Muskellunge in the watershed and the abundance of forage may also explain some of the increase in weight.

The gonads of 36 Muskellunge were visually examined; 13 were females and 6 were males, with the rest classified as unknown or immature. The smallest mature female and male were 791 and 731 mm respectively. Some fish of both sexes were maturing at age III+. The condition of the gonads and the presence of young-of-the-year fish indicate that spawning has occurred and the Muskellunge is capable of establishing self-sustaining local populations. Spawning sites, low-lying marshy areas and weedy backwaters inundated by spring floods are typical habitats in this river, especially in the lower stretches.

Stomach contents were examined in 36 Muskellunge. Fish remains were evident in 10 of the stomachs, 22 were empty and 4 had insect and vegetation remains. Since most of these muskies were caught and held in traps before processing the empty stomachs were not unexpected. It is interesting to note that a 731 mm muskie had fed on a 274 mm Alewife (*Alosa pseudoharengus*), one 861 mm muskie had ingested a 233 mm White Perch (*Morone americana*) and one 934 mm muskie had consumed a 450 mm White Sucker (*Catostomus commersoni*). The Saint John River is rich in forage fish that could be used by Muskellunge. Their primary diet will likely consist of Yellow Perch (*Perca flavescens*), White Suckers and cyprinids but they probably can feed on most fish species depending on opportunity and habitat overlap. Sport fish such as Atlantic Salmon (*Salmo salar*), Brook Trout

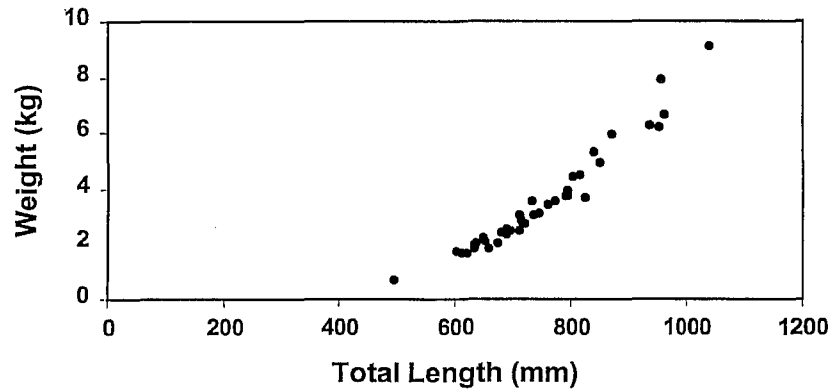


FIGURE 3. Length - weight relationship of Muskellunge from the Saint John River, New Brunswick, 1988-1997 (n = 41).

(*Salvelinius fontinalis*), and Smallmouth Bass (*Micropterus dolomieu*) are all found in this renowned salmon river. Chain Pickerel, a significant predator of newly stocked salmon and sea run smolts in some Maine lakes (Barr 1962; Warner et al. 1968), is probably an important forager on salmon smolts in the Saint John River (Washburn and Gillis 1991*). A much larger esocid, the Muskellunge could exert additional pressure on the survival of the already depleted salmon and Brook Trout stocks in the river. However, the muskie is not immune to predators as the young are prey for many species including Yellow Perch, Smallmouth Bass and sunfishes (Scott and Crossman 1973).

Muskellunge appear to adjust their foraging patterns to optimize catch. These patterns are associated with seasonal changes in environmental conditions (Miller and Menzel 1986). After spring spawning, the fish tend to behave as searching predators, as evidenced by relatively high levels of activity with extensive movements to various habitats. By late summer, the fish exhibit behavioral characteristics of a sedentary ambush predator. It is therefore assumed that downstream movements of Muskellunge from the upper Saint John River are more likely to have occurred during spring and summer.

Typical riverine habitat of the Muskellunge is deeper waters along the edge of weed beds on rocky shoals (Scott 1967) or slow stretches with submergent and emergent vegetation (Scott and Crossman 1973). Areas downstream of the Mactaquac Dam, including the Grand Lake Meadows and the Oromocto River system, are examples of this type of habitat that already support thriving Chain Pickerel populations. Although no muskies have been reported in these lower stretches of the Saint John River, the areas should provide good habitat as the fish continue to move downstream.

It is doubtful that New Brunswick anglers can

effectively deplete the Muskellunge population in the Saint John River. Muskellunge populations in Escanaba Lake, Wisconsin, for example, did not exhibit trends in reduced annual harvest or population density during years with no size limits, season, or bag limits (Hoff and Serns 1986). Unrestricted angling probably cannot control population size.

The introduction of a large exotic predatory fish, such as the Muskellunge, into one of the few remaining southern salmon rivers on the eastern seaboard occurred without the knowledge of the New Brunswick government. It represents only one of the many such incidents seen throughout North America that can have a negative impact on aquatic ecosystems. In detailing the potential impacts of such introduced species, Crossman (1991) notes that at best many are a mixed blessing.

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