

First Occurrence of Chain Pickerel (*Esox niger*) in Ontario: Possible Range Expansion from New York Waters of Eastern Lake Ontario

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In this paper, we document the first Chain Pickerel (*Esox niger*) collected in Ontario and the first on the northwestern side of the St. Lawrence River in Canada. The fish was caught by a local commercial fisherman in April 2008. Since 2008, five additional specimens have been caught and are also documented here: three in 2009 and two more through spring 2010. All individuals were mature adults in robust condition. The appearance of Chain Pickerel in the Ontario waters of eastern Lake Ontario and the upper St. Lawrence River may signal an expansion in the range of this species from New York state waters.

Key Words: *Esox niger*, Chain Pickerel, range expansion, Ontario, Lake Ontario, St. Lawrence River.

The Chain Pickerel (*Esox niger*) is a small to medium-sized member of the pike family (Esocidae). The species prefers warm water, usually inhabits sluggish streams and heavily vegetated lakes, and is a top predator in the fish community (Scott and Crossman 1973). Its native range is primarily the Atlantic coastal plain on the east side of the Allegheny-Appalachian Mountains in the eastern United States. Introductions and range expansions have resulted in a distribution that now extends west of the Allegheny-Appalachian Mountains (Coffie 1998).

The Canadian distribution of the Chain Pickerel includes Quebec (south of the St. Lawrence River and east of Montreal), southern New Brunswick, and Nova Scotia. Its status is Not at Risk in Canada (COSEWIC 1997*; Coffie 1998). The species is not native to New Brunswick or Nova Scotia, and its native status in Quebec seems uncertain (Coffie 1998). Previous reports of Chain Pickerel in Canadian waters of Lake Ontario are considered by Scott and Crossman (1973); and Coffie (1998) to be in error. The historical observation in question was made in 1908, and no confirmed observations of this species have been documented until now. In this paper, we document the first occurrence of Chain Pickerel in Canadian waters of eastern Lake Ontario and the upper St. Lawrence River.

Chronology and Locations of Occurrences

The following chronology documents the occurrences of six Chain Pickerel captured between 25 April 2008 and 10 May 2010 and submitted to the Glenora Fisheries Station of the Ontario Ministry of Natural Resources in Picton, Ontario. Detailed capture, biological and morphometric, and meristic information for these fish is reported in Table 1. Six additional anecdotal reports (fish not physically examined by the authors) are also noted (Table 2). These occurrences represent the first documented Chain Pickerel records in the province of Ontario.

Fish 1

On 25 April 2008, a commercial fisher caught an “unusual pike” while fishing for Yellow Perch (*Perca flavescens*) with gill net gear (57-mm mesh size) near the mouth of Parrotts Bay in the lower Bay of Quinte, Lake Ontario (Figure 1). The fish was submitted (frozen) to the Glenora Fisheries Station on 28 April 2008. The golden, chain-like markings on the flanks of the fish (Figure 2) suggested that the fish was a Chain Pickerel, and this was confirmed by submandibular pore count of 8 (4 on each side), branchiostegal ray counts of 6 + 8 (total 14, ceratohyal + epihyal) on the left side and 6 + 9 (15) on the right side, and prominent vertical subocular bars (Holm et al. 2009). Upper and lower halves of both cheeks and opercula were fully scaled.

The fish appeared to have a fresh Sea Lamprey (*Petromyzon marinus*) wound (skin not broken, diameter of wound 18–20 mm) on the right side just above the pelvic fin. The first fish was not examined internally, but eggs running freely from the body after partial thawing indicated that it was a mature female. These eggs were counted ($n = 724$) and weighed (4.48 g), and an estimate of fecundity thus determined (Table 1). Also caught in the same gill net were Yellow Perch, White Sucker (*Catostomus commersoni*), Northern Pike (*Esox lucius*), Rock Bass (*Ambloplites rupestris*), Longnose Gar (*Lepisosteus osseus*), and Walleye (*Sander vitreus*). This was the first Chain Pickerel observed at the Glenora Fisheries Station, which has been monitoring the local fish community and fisheries since the 1950s.

Fish 2

On 16 September 2009, a single Chain Pickerel was caught near Wolfe Island during a routine fish community index gill netting survey in the Thousand Islands area of the upper St. Lawrence River. This survey has been conducted biennially by Ontario Ministry of Natural Resources staff since 1987. The fish was caught

TABLE 1. Vital statistics for six Chain Pickerel (*Esox niger*) from Canadian waters of the eastern Lake Ontario/upper St. Lawrence River region. The first two fish were subsequently delivered to the Royal Ontario Museum (ROM catalogue numbers indicated). All fish were mature; the degree of gonad development is indicated. Capture locations are illustrated in Figure 1.

	Fish					
	1	2	3	4	5	6
Source	commercial fisher	Ministry of Natural Resources	commercial fisher	commercial fisher	commercial fisher	commercial fisher
Gear	gill net	gill net	hoop net	hoop net	hoop net	hoop net
Latitude	44.208	44.234	44.198	44.198	44.187	44.187
Longitude	-76.698	-76.283	-76.368	-76.368	-76.625	-76.625
Date of capture	25 April 2008	16 September 2009	2-12 April 2009	2-12 April 2009	30 April 2010	10 May 2010
Date sampled	28 April 2008	14 October 2009	10 March 2010	10 March 2010	4 May 2010	14 May 2010
ROM catalogue no.	86559	86560	n/a	n/a	n/a	n/a
Total length (mm)	454	581	571	594	579	564
Fork length (mm)	420	536	527	553	534	521
Round weight (before processing or removal of any part) (g)	762	1465	1233	1169	1243	1138
Sex	female	male	male	male	male	male
State of maturity	ripe and running	gonad developing	gonad fully developed	gonad fully developed	gonad spent	gonad spent
Fecundity (eggs g ⁻¹)	162	-	-	-	-	-
Submandibular pores						
Left	4	5	4	4	4	4
Right	4	4	4	4	4	4
Branchiostegal rays						
Left	6,8	6,9	5,9	6,8	6,9	6,8
Right	6,9	6,9	5,9	5,8	6,9	5,9

TABLE 2. Anecdotal reports of captures of Chain Pickerel (*Esox niger*). Note that a photograph was provided with reports iii and vi. Round weights are approximate.

	Report					
	i	ii	iii	iv*	v	vi
Source	commercial fisher	angler				
Gear	hoop net	rod and reel				
Latitude	44.187	44.156	44.091	44.286	44.200	43.987
Longitude	-76.625	-76.898	-77.306	-76.265	-76.345	-77.002
Date of capture	Spring 2009	March 2010	21 March 2010	March/April 2010	3 May 2010	19 June 2010
Photograph provided	no	no	yes	no	no	yes
Round weight (before processing or removal of any part) (g)	1200	1200	1200	<75	675	1200
Number of fish	1	1	1	4-6	1	1

* Note: Fisher reported a total of 4-6 fish caught in the leader (1 ¼ inch mesh) of a hoop net in late March and early April.

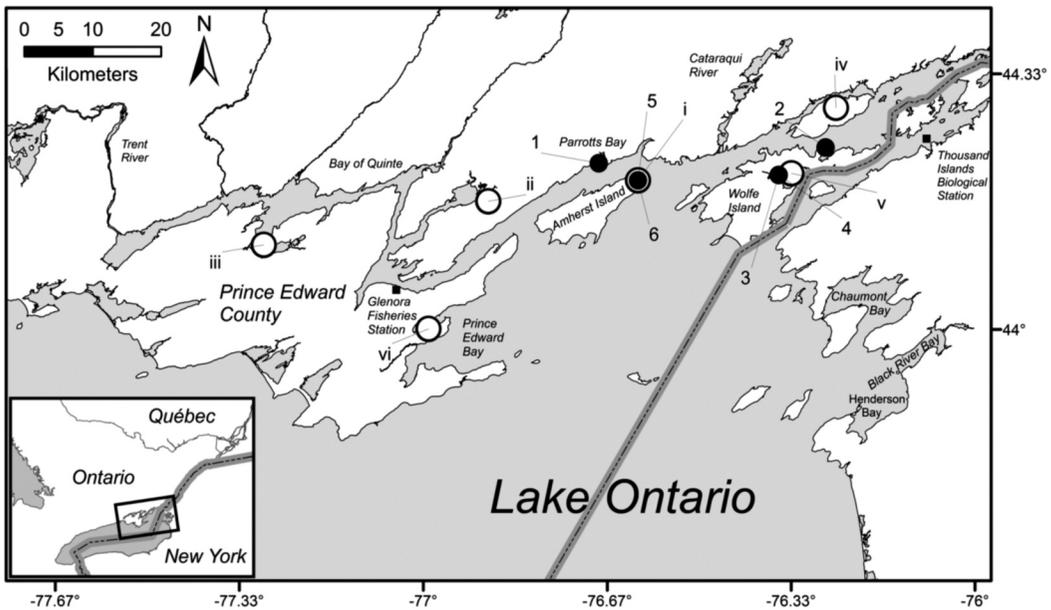


FIGURE 1. Map of eastern Lake Ontario and the upper St. Lawrence River showing occurrences of Chain Pickerel (*Esox niger*) (1 = confirmed, i = anecdotal), as described in tables 1 and 2. Note that anecdotal occurrences iii and vi included a photograph. The Glenora Fisheries Station (Ontario Ministry of Natural Resources) and the Thousand Islands Biological Station (State University of New York College of Environmental Science and Forestry) are also shown.

in the 102-mm mesh panel of a gang of gill net consisting of 10 mesh sizes ranging from 38 to 152 mm (approximately 13-mm intervals). Also caught in the same gill net gang were Yellow Perch, Brown Bullhead (*Ameiurus nebulosus*), Rock Bass, White Sucker, Northern Pike, and Largemouth Bass (*Micropterus salmoides*). The net was located in water 4.8 m deep, and the water temperature and secchi depth readings were 20.4°C and 5.0 m, respectively.

Fish 3 and 4

On 9 March 2010, two Chain Pickerel that had been kept frozen for approximately one year since their original capture some time between 2 and 12 April 2009 were turned in by a local commercial fisher. The two fish had reportedly been caught on a single day, but it is not known whether they were caught in the same hoop net. The fish were submitted to staff at the Glenora Fisheries Station after a presentation by JAH alerted commercial fishers to the presence of Chain Pickerel in the area. Also caught during this same time period were Yellow Perch, Black Crappie (*Pomoxis nigromaculatus*), Northern Pike, sunfish (likely Pumpkinseed, *Lepomis gibbosus*), and White Perch (*Morone americana*).

Fish 5 and 6

These two Chain Pickerel were caught at the east end of Amherst Island by a local commercial fisher, the first on 30 April and the second on 10 May 2010.

The fish were caught on different dates but in the same hoop net set at the same location. Also caught with these Chain Pickerel were Brown Bullhead, American Eel (*Anguilla rostrata*), and redhorse (*Moxostoma* spp.).

Other possible occurrences

Anecdotal reports of additional Chain Pickerel have also been received: one in 2009 and five in 2010. Two of these reports included photographs of the fish (a total of 4–6) over several weeks, while the remaining five reports involved single fish (Table 2). Three occurrences were from the same general area as the six fish documented above. The other three were distributed more widely to the west and north (Prince Edward Bay and Bay of Quinte, Lake Ontario) of the original occurrences.

Five of these six possible occurrences were reported taken by commercial hoop net fishers and one was reported taken by angling (Table 2). With the exception of the 4–6 small individuals (report number IV in Table 2), the size range of the fish was similar to the sizes of the six fish documented above (Table 1). Identification of juvenile esocids based on general appearance can be difficult because the colour pattern of juveniles is different from that of adults of the same species. The colour pattern of the juvenile Chain Pickerel is similar to the juvenile Northern Pike, but differs in having fully scaled gill covers and fewer than 10



FIGURE 2. Photograph of the first documented Chain Pickerel (*Esox niger*) in the province of Ontario, caught on 25 April 2008 near Parrotts Bay, Lake Ontario (see Fish 1 in Table 1). Inset photo shows possible Sea Lamprey wound on the right side of the fish.

pores on the underside of the lower jaw. The juvenile Chain Pickerel differs from the juvenile Grass Pickerel (*Esox americanus vermiculatus*) and the juvenile Red-fin Pickerel (*E. a. americanus*) in having 14–17 rays in each gill membrane (Holm et al. 2009). Although it is tempting to conclude that Chain Pickerel are now successfully reproducing in the area, additional confirmed observations of juvenile fish are required.

Discussion

Where did these Chain Pickerel come from? Coffie (1998) suggested that Chain Pickerel could potentially make their way west, from the Eastern Townships of Quebec, up the St. Lawrence River to Lake Ontario. Although Chain Pickerel records are common in the Eastern Townships, intensive fish surveys in the lower St. Lawrence River during the 1970s, 1990s, and 2000s revealed only two Chain Pickerel, possibly misidentified, in the St. Lawrence River proper, both below Montreal.

It seems very unlikely that a natural movement of the Chain Pickerel from the lower St. Lawrence River to the international sector has occurred to date (Pierre Dumont, Ministère des Ressources naturelles et de la Faune du Québec, personal communication, 7 February 2011). Furthermore, extensive commercial and government index fishing throughout the Ontario waters of the St. Lawrence River did not reveal any Chain Pickerel prior to the present work (Ontario Ministry of Natural Resources, unpublished data). Similarly, exten-

sive and long-term sampling by the New York State Department of Environmental Conservation and by the State University of New York (SUNY) College of Environmental Science and Forestry (Thousand Islands Biological Station) targeting adult and young-of-the-year esocids in New York waters of the upper St. Lawrence River has not yet shown any evidence of Chain Pickerel on the south side of the river to date (Farrell et al. 2007; New York State Department of Environmental Conservation 2010*; J. Farrell, SUNY College of Environmental Science and Forestry, personal communication, 3 February 2011).

In contrast, in the nearby New York waters of eastern Lake Ontario, Chain Pickerel abundance has increased in some areas (i.e., Chaumont Bay, Black River Bay, and Henderson Bay). Chain Pickerel have likely dispersed to these eastern Lake Ontario embayments from the upper reaches of the Black River basin, where the species is common (R. Klindt, New York State Department of Environmental Conservation, personal communication, 31 July 2010). Chain Pickerel are also common in Oneida Lake in the Finger Lakes area of New York State, and movement via the Oneida and Oswego rivers to southeastern Lake Ontario is also plausible (J. R. Jackson, Cornell University Biological Field Station, personal communication, 8 February 2011).

Given the present documented distribution of Chain Pickerel in Ontario waters, it seems most likely that the origin of this new Canadian population is the New

York waters of eastern Lake Ontario. Genetics studies to investigate this hypothesized origin and to examine the degree of hybridization (e.g., with Northern Pike) would be beneficial (see Crossman and Buss 1965; Casselman et al. 1986).

Three other members of the esocid family are native to this area of Lake Ontario. Two, the Muskellunge (*Esox masquinongy*) and Northern Pike, are larger bodied than the Chain Pickerel, and one, the Grass Pickerel, has a smaller body than the Chain Pickerel. All are specialized top predators in the fish community. Northern Pike have shown long-term trends of decline in the Thousand Islands area of the upper St. Lawrence River (Ontario Ministry of Natural Resources 2010*) and New York waters of eastern Lake Ontario (New York State Department of Environmental Conservation 2010*). The upper St. Lawrence River Muskellunge population experienced significant die-offs in 2005 and 2006 related to viral hemorrhagic septicemia (VHS) (ScienceDaily 2007*). These events may have opened niche space for the invading Chain Pickerel. The Grass Pickerel also appears to be expanding its distribution and abundance (J. Farrell, SUNY College of Environmental Science and Forestry, personal communication, 3 February 2011).

The establishment of the Chain Pickerel in this area could have an impact on the other esocids and other piscivores in the fish community that have similar habitat requirements, such as Largemouth Bass. Ecosystem changes to eastern Lake Ontario (especially the Bay of Quinte) following the arrival of zebra and quagga mussels (*Dreissena* spp.), such as clearer water, more aquatic vegetation, and increased abundance of near-shore prey fish species (e.g., Pumpkinseed Sunfish and Bluegill Sunfish, *Lepomis macrochirus*), may favour these ambush, sight-feeding piscivores (Hoyle et al. *in press*).

The appearance of Chain Pickerel in the eastern Lake Ontario and upper St. Lawrence River region may signal a northwestern expansion of the species' range. Mandrak (1989) concluded that Chain Pickerel would invade Ontario from the south under a climate warming scenario. Indeed, Casselman (2002) reported a significant increase in water temperatures in eastern Lake Ontario and the Bay of Quinte over the last 50 years. The Chain Pickerel is adapted to warm water and heavily vegetated, nearshore habitats. For this reason, the St. Lawrence River and the vast open waters of Lake Ontario may represent somewhat of a physical barrier to the expansion of the Chain Pickerel from the south. Having now bridged this barrier, the species appears to be dispersing rather quickly in Ontario waters and it may now be relatively uninhibited in continuing its expansion north into Ontario via the Catarqui River-Rideau Canal and Trent-Severn waterways, east down the St. Lawrence River, and west around Prince Edward County toward north-central Lake Ontario. Dispersal further west along the north

shore of Lake Ontario may be more difficult because that shoreline is largely devoid of warm, vegetated waters. Presumably, continued range expansion to the north would eventually be limited by water temperature regime. Climate warming in this region of southern Ontario would potentially favour the persistence of Chain Pickerel at the northern edge of its expanded range.

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ADDENDUM

Since the acceptance of this paper the following eight additional Chain Pickerel records have been documented. All fish were caught by commercial fishers in hoop net gear.

TABLE 1. Chain pickerel caught in Ontario, 2011.

	Fish							
	1	2	3	4	5	6	7	8
Latitude	43.951	44.200	43.969	44.187	44.218	44.187	44.187	44.187
Longitude	-77.296	-76.345	-77.001	-76.625	-76.546	-76.625	-76.625	-76.625
Date of capture	16-Sep-10	14-Apr-11	27-Apr-11	2-May-11	7-May-11	13-May-11	13-May-11	13-May-11
Total length (mm)	575	636	435	535	615	647	625	506
Fork length (mm)	548	591	407	511	574	598	584	467
Round weight (g)	1381	2023	573	1357	1640	2009	1568	936
Sex	F	F	M	F	M	M	F	M