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[Article]

Age, Growth, Relative Abundance, and Scuba Capture of a New or Recovering Spawning Population of Lake Sturgeon in the Lower Niagara River, New York

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Abstract.—The objective of our study was to collect age, growth, and catch-per-unit-effort information from a new or recovering population of lake sturgeon *Acipenser fulvescens* in the lower Niagara River, New York. From July 1998 through August 2000, we captured 67 lake sturgeon by use of gill nets, baited setlines, and scuba diving. Active capture by scuba divers (1.50 fish/h) was much more effective than passive capture with gill nets (0.07 fish/h) and setlines (0.06 fish/h). Eggs of Chinook salmon *Oncorhynchus tshawytscha* were more effective as setline bait than were alewives *Alosa pseudoharengus*, but neither bait differed in effectiveness from rainbow smelt *Osmerus mordax*. Ages of captured lake sturgeon ranged from 1 to 23 years; 47 of the 61 aged fish were younger than age 10. Strong relationships were found between weight, W, and length, L ($W = 0.0000005 \cdot L^{3.5564}$; $R^2 = 0.977$) and between L and age ($L = 394.05 \cdot \log_e[\text{age}] + 248.77$; $R^2 = 0.878$). The lake sturgeon population in the lower Niagara River is probably small relative to its historic abundance. This naturally reproducing population should remain listed as threatened by New York State, and commercial and recreational fisheries should remain closed so that the population can rebuild adult numbers and reproductive potential.

The lake sturgeon *Acipenser fulvescens* was abundant historically throughout eastern North America. In the lower Great Lakes, populations existed throughout Lakes Erie and Ontario, the upper and lower Niagara River, and the St. Lawrence River (Harkness and Dymond 1961; Priegel and Wirth 1977). Highly regarded for caviar and smoked flesh, they were harvested heavily from the Great Lakes, including a total harvest of nearly 431,000 kg during 1881–1890 in Lake Erie (MacNeill and Busch 1994). Since the crash of populations throughout the Great Lakes in the early 1900s, only small commercial and recreational fisheries have persisted in some states and provinces. For example, by the late 1960s, harvests in Lake Erie were 900 kg annually (MacNeill and Busch 1994).

Several factors contributed to the decline of lake sturgeon populations in the Great Lakes, but commercial overexploitation probably had the greatest impact. Industrial activity destroyed spawning habitats and polluted the water, while water diversions and dams blocked traditional spawning routes. These factors, coupled with the lake sturgeon's late age of maturity (12–22 years for males; 14–33 years for females) and periodic spawning (every 2–4 years for males; every 4–9 years for females) (Roussow 1957; Harkness and Dymond

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1961), created conditions for the species' rapid decline and slow recovery.

The lake sturgeon is now protected over much of its range, and there are efforts to preserve, enhance, or restore populations. The lake sturgeon is classified as threatened in New York and Pennsylvania and endangered in Ohio (Bouton 1994; Carlson 1995). Historical accounts indicate the existence of a healthy, naturally reproducing population that was large enough to support both commercial and recreational fisheries in the lower Niagara River until the early 1940s (August 1992; Carlson 1995). By 1950, lake sturgeon abundance in the river had declined so dramatically that the fishery collapsed and most people gave up efforts to catch them (Aug 1992).

Knowledge of lake sturgeon distribution, abundance, health, age, growth, and spawning habitats is vital for assessing the current status and feasibility for recovery of populations in the Great Lakes; however, little is known about what was once a large population of lake sturgeon in the lower Niagara River. The primary objectives of our study were to (1) collect age, growth, and catch-per-unit-effort (CPUE) data to begin the process of assessing the threatened population of lake sturgeon in the lower Niagara River and (2) evaluate the use of scuba divers to capture lake sturgeon.

FIGURE 1.—The study area used for lake sturgeon sampling in the Niagara River from Lewiston, New York, downstream to a section of Lake Ontario extending 5 km east, north, and west of the river's confluence with the lake.

Study Area

The Niagara River is a 58-km waterway that connects Lakes Erie and Ontario (Figure 1). The river passes through a heavily populated, industrialized region, which includes the major cities of Buffalo and Niagara Falls, New York, and Niagara Falls, Ontario, and it forms the international border between the United States and Canada. In New York State, the Niagara River drains 3,680 km^2 of Northern Appalachian Plateau and lakeshore lowlands (NYSDEC 1997). The river discharges over 5,000 m^3/s, which represents about 80% of the water flowing into Lake Ontario (Hayashida et al. 1999). The upper and lower portions of the Niagara River are separated by the Niagara Falls, a natural falls over 50 m high, located about 18 km from the river's confluence with Lake Ontario. Both Canada and the USA operate hydropower facilities on the Niagara River, and their operations influence discharge in the lower river.

Lake sturgeon were sampled in the lower Niagara River (the last 15 km of the river below Niagara Falls) from Lewiston, New York (43°09′00″N, 79°03′00″W), to the river's confluence with Lake Ontario at Youngstown, New York (43°16′00″N, 79°04′00″W). Sampling focused on two back-eddy environments: one in the vicinity of Queenston, Ontario, and another just downstream from Joseph Davis State Park, USA (Figure 1).

Methods

We captured lake sturgeon from July of 1998 through August of 2000. We tried to capture and tag equal numbers of suspected juveniles (<1,000 mm) and adults (>1,000 mm) by using different sampling methods (gill nets, setlines, scuba).

Lake sturgeon sampling.—We sampled primarily with gill nets and setlines at depths of 7.5–12.0 m. Experimental monofilament gill nets (38 m long; 5–20-cm stretch mesh) targeted smaller fish, while larger, single-mesh nets (46 m long; 25-cm stretch mesh) targeted larger fish. Fast current and floating debris in the main river often caused nets to fish ineffectively, so gill nets were set mainly at the downstream ends of eddies, at the ''edge'' where the tail end of the slow eddy current met with the faster current of the main river.

We constructed setlines according to the methods of Thomas and Haas (1999). Twenty-five dead baits (alewives *Alosa pseudoharengus*, rainbow smelt *Osmerus mordax*, or eggs of Chinook salmon *Oncorhynchus tshawytscha*) were set at 3-m intervals across a 75-m section of rope weighted and buoyed at both ends.

Teams of two to three scuba divers captured lake sturgeon at night from 2200 to 0100 hours during August of 1998 and June and July of 1999. Diving was done at night because during preliminary studies, more lake sturgeon were observed at night than during the day. As divers drifted with the current, fish were located with 300-W lights. We believe that the bright light temporarily disoriented or immobilized the fish, making them vulnerable to capture. Nylon-mesh landing nets were used to capture fish. If a fish was too large for the net, a duck decoy bag was placed over the net and fish for transport to the surface.

Fish processing and tagging procedures.—After capture, lake sturgeon were placed in an aerated holding tank on the boat, transported to a holding pen located along shore, and allowed to recover for 1–2 h. Total length (TL) and weight were measured to the nearest millimeter and gram, respectively. A 10-mm section of hard ray at the proximal end of the pectoral fin immediately adjacent to the articulate knuckle was removed and retained for later age analysis (Cuerrier 1951; Rossiter et al. 1995). A Monel cattle ear tag or disk tag (depending on the amount of tissue available) was attached to the base of the dorsal fin.

Internal sexing of some fish ($>$1,200 mm TL) was attempted in the field. A 25–50-mm incision was made on the ventral surface of the fish to expose the gonads in order to determine sex and state of maturity (Bruch et al. 1999). After examination, the incision was treated with an antiseptic and sutured. After processing and tagging, fish were placed back into the holding pen for 1 h to recover before release.

Age interpretation.—Pectoral fin ray samples were dried, cut, and mounted on microscope slides. Cross sections were cut with a jeweler's saw and mounted, three per slide, by use of Crystal Bond clear glue. Fine-grit sandpaper was used to smooth and thin the cross sections until translucent so that annuli could be seen. Cross sections were viewed under a dissecting microscope. Three or four people interpreted each sample, and the resulting ages were averaged to estimate the age of each fish.

Data analysis.—By use of multiway analysis of variance (MANOVA) followed by Tukey's honestly significant difference (HSD) test and Kruskal–Wallis nonparametric analysis of variance (Statistix 2003), the CPUE (number of lake sturgeon caught/h of fishing) was compared among capture methods (experimental and 25-cm gill nets, setlines with different baits, scuba diving), seasons (spring, summer, fall), and years (1998, 1999, 2000). Catch-per-unit-effort data were transformed ($\log[x + 1]$) before analysis, but nontransformed data are presented below.

Power functions ($Y = aX^b$; Microsoft Excel, version 97) were used to fit least-squares trend lines to weight versus length and length-at-age data. Quality of growth was assessed on the principle that a value of the exponent b less than 3.0 represents fish that become less rotund as length increases (low-quality growth) and a value of b greater than 3.0 represents fish that become more rotund as length increases (high-quality growth; Anderson and Gutreuter 1983).

Results

Catch per Unit Effort

From late July 1998 through August 2000, we caught 67 lake sturgeon (including four recaptures). The majority (77%) was captured in Peggy's Eddy or in the Queenston Drift (Figure 1). Diving was performed during four nights totaling 7 h of sampling, compared to 2,541 h for gill nets (132 nights) and 2,460 h for setlines (94 nights) (Table 1). In general, larger fish were captured in the gill nets; however, there was a broad, overlapping range of fish sizes across all gears (Figure 2). Setlines and 25-cm gill nets caught lake sturgeon that averaged near 1,100 mm TL, whereas experimental gill nets and divers caught fish with an average length near 800 mm TL (Table 2; Figure 2). With two exceptions, all lake sturgeon captured were longer than 700 mm (Figure 2).

Lake sturgeon were captured on all four dives but in only 21 gill-net sets and 17 setline sets. Excluding zero catches, the CPUE of scuba divers (1.50 fish/h) was much higher ($P < 0.0001$) than that of gill nets (0.07 fish/h) and setlines (0.06 fish/h) (Table 1). Although the CPUE appeared to be higher in 1998 than in other years (Table 1), when adjusted by MANOVA for gears and seasons the CPUE in 1998 (our initial, learning year) was lower than those in the other years ($P = 0.028$). There were no differences in CPUE among the spring, summer, and fall seasons ($P = 0.269$; Table 1), and no lake sturgeon were captured during 12 sampling nights in March (winter) of 2000. We suspect that movement and feeding were minimal during

TABLE 1.—Mean (CPUE; SEs in parentheses) for lake sturgeon captured in the lower Niagara River, 1998–2000. Footnotes report significance levels for statistical tests comparing CPUE of gears, type of gill net, setline bait, year, and season.

Comparison	Fish caught	All sets: Number of sets	All sets: Hours fished	All sets: CPUE (fish/h)	Nonzero-catch sets: Number of sets	Nonzero-catch sets: Hours fished	Nonzero-catch sets: CPUE (fish/h)
Gears[a]							
Divers	10	4	7	1.500 (0.397)	4	7	1.500 (0.397)
Gill nets[b]	30	132	2,541	0.012 (0.003)	21	421	0.072 (0.009)
Experimental	6	24	341	0.018 (0.006)	6	87	0.071 (0.004)
25-cm stretch mesh	24	108	2,200	0.010 (0.003)	15	334	0.073 (0.01)
Setlines	27	94	2,460	0.011 (0.003)	17	575	0.058 (0.012)
Setline baits[c]							
Rainbow smelt	4	19	403	0.011 (0.005)	4	75	0.054 (0.005)
Alewives	14	50	1,529	0.006 (0.002)	9	425	0.033 (0.007)
Chinook salmon eggs	9	19	371	0.025 (0.013)	4	75	0.119 (0.034)
Other		6	157				
Years[d]							
1998	7	21	357	0.105 (0.065)	5	48	0.442 (0.228)
1999	26	102	1,819	0.050 (0.029)	17	271	0.302 (0.165)
2000	34	107	2,832	0.011 (0.003)	20	683	0.058 (0.011)
Seasons[e]							
Spring	39	131	3,149	0.021 (0.010)	23	676	0.118 (0.056)
Summer	21	74	1,358	0.073 (0.040)	16	271	0.339 (0.175)
Fall	7	13	243	0.029 (0.018)	3	56	0.126 (0.047)
Winter		12	259				

[a] Diver capture CPUE was greater than gill-net and setline CPUEs (df = 2). All sets: F = 783.95, $P < 0.0001$; nonzero-catch sets: F = 157.76, $P < 0.0001$.

[b] Experimental gill-net CPUE did not differ significantly from 25-cm gill-net CPUE (df = 1; two-tailed normal approximations of U-test statistics). All sets: P = 0.158; nonzero-catch sets: P = 0.508.

[c] All sets: there were no significant differences in CPUE among Chinook salmon eggs, alewives, and rainbow smelt (Kruskal–Wallis statistic = 1.930, df = 2, P = 0.587); nonzero-catch sets: Chinook salmon egg CPUE was greater than alewife CPUE, but neither differed significantly from rainbow smelt CPUE (Kruskal–Wallis statistic = 10.001, df = 2, P = 0.007).

[d] CPUE in 1998 was less than in 1999 and 2000 (df = 2). All sets: F = 3.46, P = 0.033; nonzero-catch sets: F = 3.98, P = 0.028.

[e] There were no significant differences in CPUE among spring, summer, and fall (df = 2). All sets: F = 1.79, P = 0.150; nonzero-catch sets: F = 1.36, P = 0.269.

this time because of cold water temperatures (4–5°C). Excluding zero catches, there was no difference in CPUE between experimental and 25-cm gill nets (both 0.07 fish/h; P = 0.508; Table 1), but there were differences among baits used with setlines (P = 0.007; Table 1). Chinook salmon eggs (0.12 fish/h) were more effective than alewives (0.03 fish/h), but neither bait differed from rainbow smelt (0.05 fish/h) in terms of CPUE.

Growth and Length at Age

The weight–length relationship (R^2 = 0.977) from 62 lake sturgeon predicted weight to increase at approximately 3.6 the power of length; Niagara River lake sturgeon became much more rotund as length increased (Figure 3). There was also a strong, positive linear relationship (R^2 = 0.913) between girth and length (girth = 0.4361 × length), and girth increased at a slightly higher rate at lengths above 1,400 mm (Hughes 2002). Ages of captured lake sturgeon ranged from 1 to 23 years, but 47 of the 61 aged fish were less than 10 years old (Table 2; Figure 4). The asymptotic growth curve (R^2 = 0.878) predicted a rapid increase in length during the first 10 years of life and gradual slowing thereafter (Figure 5).

Discussion

Catch per Unit Effort

Because of frequent fouling of gill nets and setlines with drifting aquatic vegetation, which led to ineffective fishing that resulted in zero catches, we believe the exclusion of zero catches from the analysis was justified. However, except for a lack of differences in CPUE among baits, the inclusion of zero catches produced no statistical differences in the results reported above. Both analyses are summarized in Table 1.

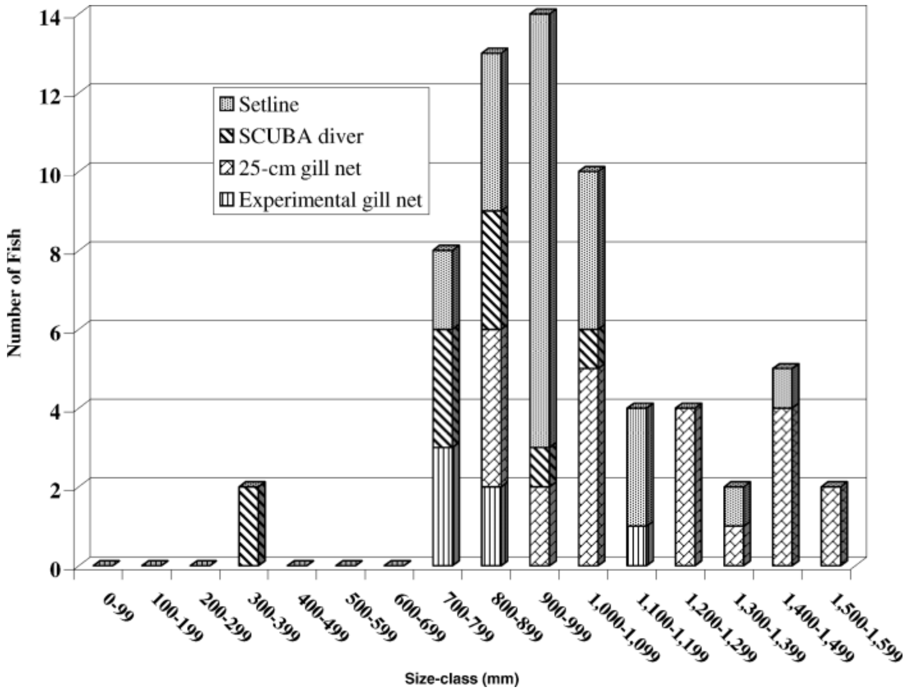

FIGURE 2.—Length distribution of lake sturgeon (n = 67) captured by four sampling methods (setline, scuba diver, 25-cm gill net, and experimental gill net) in the lower Niagara River, New York, 1998–2000.

Several studies have assessed lake sturgeon populations and the capture efficiency of different gears (Seyler 1997; Thomas and Haas 1999; D. M. Carlson et al., poster on lake sturgeon populations and recovery programs presented at the Fourth International Sturgeon Symposium, 2001; Caswell 2003). Carlson et al. (poster, 2001) reported that CPUEs of 1.5 fish/gill-net-night in Lake St. Francis (St. Lawrence River) and 0.2–0.5 fish/gill-net-night in the Grasse River, New York, indicated moderate and low abundance of lake sturgeon, respectively. Assuming an 18-h set, our gill nets in the Niagara River caught an average of 0.18–1.26 lake sturgeon per night (including and excluding zero catches, respectively). In the Groundhog River in northeastern Ontario, a river where lake sturgeon abundance is thought to be extremely low (Seyler 1997), lake sturgeon CPUE

TABLE 2.—Length, weight, and age of lake sturgeon captured in the lower Niagara River, 1998–2000.

Variable and method	Mean	SD	Minimum	Maximum
Length (mm)				
Diver capture	745	241	311	1,021
Gill net (experimental)	844	159	705	1,141
Gill net (25 cm)	1,173	240	821	1,573
Setlines (all baits)	997	155	773	1,436
Weight (kg)				
Diver capture	3.3	1.8	0.2	6.3
Gill net (experimental)	4.2	3.8	1.6	11.8
Gill net (25 cm)	14.6	10.0	3.3	35.9
Setlines (all baits)	7.3	5.5	2.4	28.2
Age (years)				
Diver capture	5	2	1	7
Gill net (experimental)	5	2	3	9
Gill net (25 cm)	13	6	5	23
Setlines (all baits)	7	3	4	17

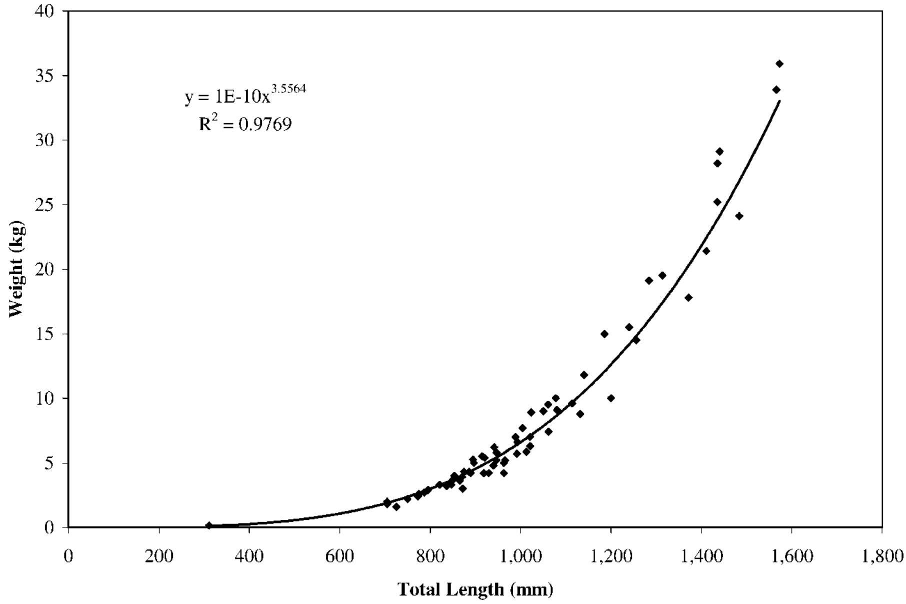

FIGURE 3.—Relationship between weight (kg) and total length (mm) of lake sturgeon (n = 67) captured by means of setlines, gill nets, and scuba diving in the lower Niagara River, New York, 1998–2000.

was 0.132–0.312 fish/net-hour (90-m-long nets consisting of six 15-m panels; mesh size = 50–305 mm). Our nets (38- and 46-m-long nets; mesh size = 50–250 mm) caught 0.01–0.07 fish/net-hour. Therefore, our gill-net CPUE is consistent with a hypothesis of very low lake sturgeon abundance in the lower Niagara River.

We sampled primarily with setlines by the end of May each year because drifting algae and submergent vegetation made gill netting less effective

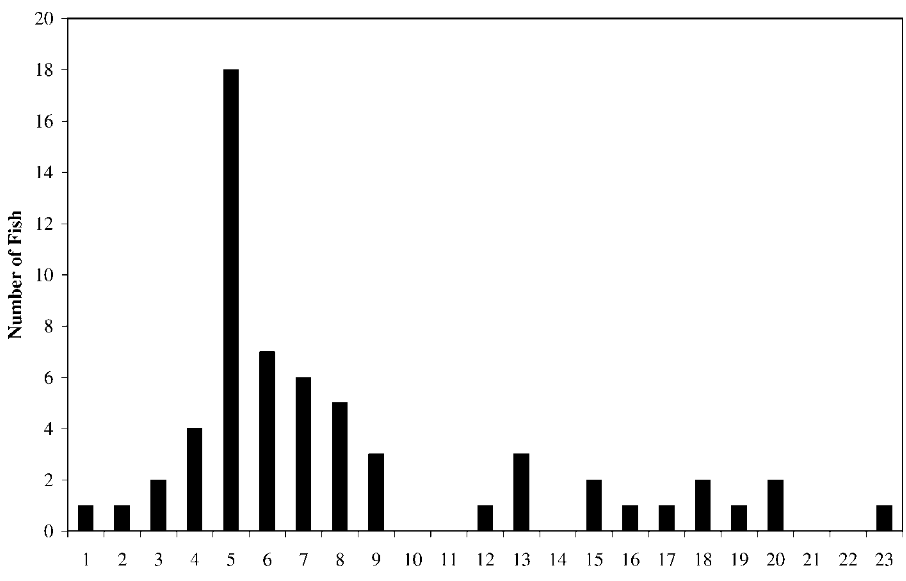

FIGURE 4.—Age distribution of lake sturgeon (n = 61) captured by use of setlines, gill nets, and scuba diving in the lower Niagara River, New York, 1998–2000.

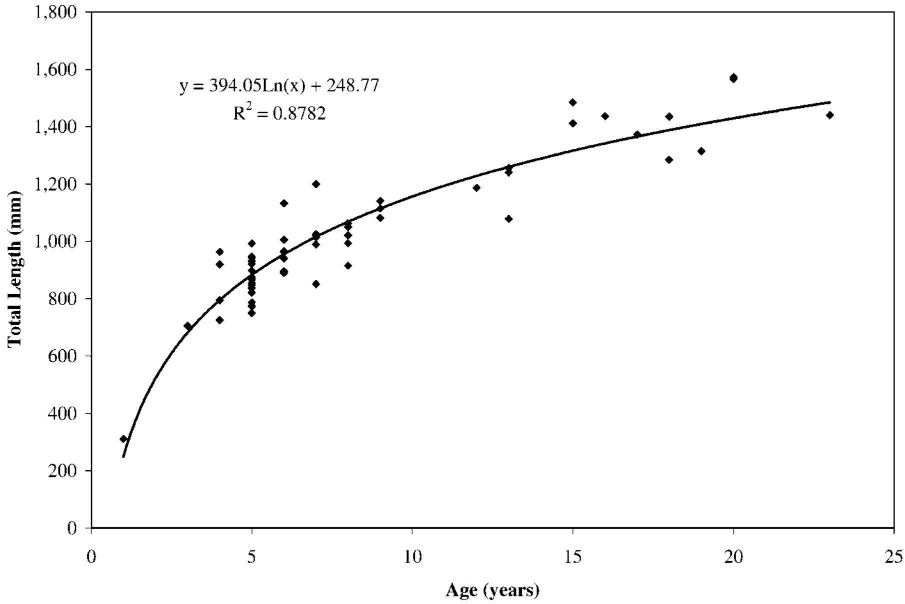

FIGURE 5.—Relationship between age and total length (mm) of lake sturgeon (n = 61) captured by means of setlines, gill nets, and scuba diving in the lower Niagara River, New York, 1998–2000.

(Hughes 2002). Using methods nearly identical to ours, Caswell (2003) caught 0.11 lake sturgeon/setline-day in the Detroit River, and Thomas and Haas (1999) caught 1.25 fish/setline-night in the St. Clair River. However, Thomas and Haas focused on a known spawning assemblage. Groups of spawning fish were not conclusively identified in the lower Niagara River (Hughes 2002), so it was unlikely that our sampling was influenced by dense concentrations of fish. Therefore, our setline catches (0.01–0.06 fish/h; 0.18–1.08 fish per 18-h set; including and excluding zero catches, respectively) are consistent with a hypothesis of low lake sturgeon abundance in the lower Niagara River.

The efficiency of setlines may depend on matching the bait to the natural food sources available to lake sturgeon. Both alewives and rainbow smelt, which enter the lower Niagara River seasonally, caught lake sturgeon in our study. Prompted by local anglers who reported lake sturgeon bycatch while fishing for salmon in the fall, we baited setlines with Chinook salmon eggs. This technique produced the highest CPUE for setlines during the study. Lake sturgeon probably focused on eggs as Chinook salmon from Lake Ontario made their spawning runs up the river. In a similar study on the Detroit River that compared bait alternatives to the round goby *Neogobius melanostomus*, Caswell (2003) found that pickled squid (a nonnatural food source) was as effective as local fish in baiting lake sturgeon.

We developed an effective method for capturing lake sturgeon by use of scuba divers. Numerous studies (McCleneghan and Houk 1978; Helfman 1983; James et al. 1987; Dibble 1991; Jackson et al. 1997; Anderson and Carr 1998; Mueller 2003) have used scuba divers to capture fish or to assess relative abundance (typically through transect surveys), but the use of scuba divers to capture lake sturgeon (especially larger, adult fish) is not common. During studies on Lake Winnebago, Wisconsin, Kempinger (1996) captured age-0 (29–281 mm) lake sturgeon by snorkeling with dip nets. We were able to capture 311–1,021-mm lake sturgeon by means of scuba.

Although our use of scuba diving to capture lake sturgeon was limited, catch rates were 23 times higher for diving (CPUE = 1.5 fish/h) than for gill nets and setlines (CPUE = 0.065 fish/h) (Table 1). Diving was generally a more effective method for capturing smaller (<1,000 mm TL) lake sturgeon; the capture and handling of large fish were difficult with the gear used in this study. Diving also required greater logistical effort (e.g., done at night, large crew size). In contrast, gill nets and setlines caught larger fish (>1,000 mm TL) and were generally less labor intensive. We suggest that scuba diving, despite its logistical disadvantages, is an efficient method for sampling lake sturgeon less than 1,000 mm in length.

Length, Weight, and Age

The most numerous lake sturgeon in our samples were those 800–1,000 mm long (Figure 2). These sizes were also the most common in 1998–1999 reports of angler-caught lake sturgeon in the Niagara River (Lowie et al. 2000). We captured only two lake sturgeon smaller than 700 mm TL, but this probably reflects the selectivity of the sampling gear more so than the absence of smaller size-classes in the river. Divers reported a fairly even distribution of size-classes less than 700 mm TL. The largest captured lake sturgeon measured 1,573 mm TL and weighed 35.9 kg. However, both anglers and divers have reported 1,520–1,830-mm lake sturgeon.

Lake sturgeon in the lower Niagara River grow longer and heavier than fish of the same age in the Lake Huron basin (Hill and McClain 1999). Seasonal die-offs of rainbow smelt and alewives from lakes Erie and Ontario, as well as an abundance of salmon eggs and carcasses in the fall, appear to provide ample food supplies for lake sturgeon in the lower Niagara River.

Overall, the rate of increase in length for the Niagara River lake sturgeon slows after the first 10 years (at about 1,100 mm; Figure 5); however, weight continues to increase exponentially for fish over 1,000 mm TL (at about 7 years; Figure 3). Similarly, Priegel and Wirth (1977) found that lake sturgeon in Lake Winnebago grew to 1,016 mm in 8 years, but then grew only another 254 mm (to 1,270 mm) by age 15. Threader and Brousseau (1986) also reported a noticeable decline in the rate of growth in length at approximately 8 or 9 years of age for lake sturgeon in the Moose River, Ontario. Tagging studies in Michigan revealed individual annual growth rates of 0–38 mm for 1,220–1,320-cm fish over 10 years of age (Baker 1980). The growth pattern described above is typical for lake sturgeon (Classen 1944).

Age interpretation of the lake sturgeon captured in this study revealed that the majority of fish were less than 10 years old (Figure 4), including a large number ($n = 18$) of 5-year-old fish. Only one fish was more than 20 years old. Our data indicate that there is a relatively high abundance of juvenile lake sturgeon in the Niagara River. Since the age of first spawning varies greatly for lake sturgeon (Roussow 1957; Harkness and Dymond 1961), it is difficult to assess how many, if any, of the fish less than 10 years old were sexually mature. Attempts were made to externally determine the sex and maturity of several fish, but with little success. Internal examination was only performed on larger fish (>1,000 mm TL) suspected to be adults, but no fish were sexed successfully by the method used (fish on its back, small ventral incision). Three fish, all measuring over 1,200 mm, were sexually mature males, as indicated by the release of milt during processing. The ages of these fish were estimated to be 13, 13, and 17 years.

Considering that lake sturgeon live 50–100 years, the age structure observed in the lower Niagara River suggests a pioneering population composed mostly of young fish. Also, the Niagara River fish are notably younger for their sizes than other populations of lake sturgeon in the Great Lakes (Auer 1999; L. Mohr, Ontario Ministry of Natural Resources, personal communication; G. Kornely, Wisconsin Department of Natural Resources, personal communication). However, examination of pectoral fin rays to determine age is greatly dependent on individual interpretation of annuli, and we cannot ignore potential errors of interpretation. It is possible that we might have read only thick postspawning annuli and missed the very narrow prespawning annuli (Roussow 1957; Rossiter et al. 1995; L. Mohr, personal communication). To reduce possibilities for error, three or four individuals with varying backgrounds and levels of experience examined our pectoral fin ray samples. Despite some discrepancies, interpreters generally agreed on lake sturgeon ages within 1–2 years, so we are reasonably confident about our age estimates.

Current Status of the Lower Niagara River Lake Sturgeon Population

Anecdotal accounts from the 1940s suggest that the lower Niagara River lake sturgeon population was already below its historic peak at that time. However, the population in the 1940s was probably higher than the population today. One fisherman told of catching ''as many as 36 sturgeon on night lines in a couple, three days'' (Aug 1992), which indicates that catch rates 60 years ago (conservative estimate of CPUE greater than 1 fish/night) were higher than those seen today. By the 1950s, lake sturgeon catches in the lower Niagara River had faded (Aug 1992), and until the early 1990s there were very few reported sightings or catches. From 1980 to 1994, there were only two confirmed captures of lake sturgeon in the lower Niagara River (Carlson 1995).

Reports of incidental catches in the lower Niagara River increased dramatically after the mid-1990s, especially after the creation of the U.S. Fish and Wildlife Service's (USFWS) Lake Sturgeon Sighting Program in 1994 (Lowie et al. 2000). In both 1998 and 1999, more than 20 lake sturgeon (primarily ≤ 91 cm) were caught incidentally by anglers in less than a 2-month period (Lowie et al. 2000). It cannot be determined whether this increase in reported catches can be attributed to increased angler awareness (i.e., due to the sighting program) or to a resurgence of the lake sturgeon population. It is interesting to note that the size structure of angler-caught fish from 1998 to 1999 (Lowie et al. 2000) is consistent with that of the fish captured in our study, as the majority of fish measured less than 1,000 mm.

Management Recommendations

Our data provide evidence of a new or recovering population of lake sturgeon in the lower Niagara River. The presence of ripe males and many juvenile year-classes, including age-1 fish (Figure 4), indicates that successful spawning and recruitment now occur in the river. In addition, our data indicate that growth rates of lower Niagara River lake sturgeon are equivalent to, or perhaps better than, growth rates reported for other Great Lakes populations. However, it is evident from our CPUE data, anecdotal accounts of anglers, and other studies in the Great Lakes basin that lake sturgeon abundance in the Niagara River remains low compared to historic abundance.

Our results and the generally low recruitment potential of long-lived, periodically spawning lake sturgeon suggest that the population in the lower Niagara River should continue to be listed as threatened by the New York State Department of Environmental Conservation and that commercial and recreational fisheries should remain closed. Further studies to estimate year-class abundances (especially ages 1–4) should be undertaken to better understand the population structure of lake sturgeon in the lower Niagara River and the potential threats to population recovery and health. Finally, while we recognize the severe logistical constraints, we believe that sampling should be conducted upstream of the power facilities on the lower Niagara River to establish whether lake sturgeon populate those habitats.

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