IRONDEQUOIT BAY FISH STOCK ASSESSMENTS 2005-2015

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ABSTRACT

Warm water fisheries assessments using standard gangs of gill nets were conducted in Irondequoit Bay in September of 2005, 2010, and 2015. In addition, a nighttime electrofishing survey was conducted in June 2009. The surveys were conducted to 1) assess the fish community; 2) determine the contribution of stocked fingerlings to the walleye *(Sander vitreus)* population; 3) estimate population characteristics of walleye, northern pike *(Esox lucius)*, yellow perch *(Perca flavescens),* and largemouth bass (*Micropterus salmoides)*, 4) compare fish community structure to statewide surveys; and 5) guide the development of appropriate management recommendations. From 2005 to 2015 overall gill net catch per unit effort (CPUE) increased and species dominance shifted from yellow perch to white perch (*Morone americana*). Walleye CPUE doubled, but the portion of legal sized fish declined during this time period. The walleye population is mainly sustained by stocked fingerlings, despite migratory spawning runs in Irondequoit Creek that could be producing fry that potentially recruit to adults. Survival and recruitment of the stocked fingerlings is good, but may be declining. Mean total lengths (TL) are above New York State (NYS) averages at all ages, and growth rates show an increasing trend. Mean TL of all walleyes declined from 2005 to 2015 because younger, smaller individuals, absent from the 2005 sample, were sampled in 2015. Walleye condition is near established standards. Even with declining survival, the fishing quality for Irondequoit Bay walleyes should be very good for several years. Northern pike relative abundance declined from 2005 to 2015. Most northern pike sampled during the period were legal size. Adult pike, while fast growing, are in below average condition in Irondequoit Bay. Yellow perch relative abundance in Irondequoit Bay remained nearly constant from 2005 to 2015. Survival of the 2004 to 2009 yellow perch year classes is generally very good. Growth and condition of yellow perch is good to fair, but showing a stable to slightly increasing trend. Competition with other species, namely very abundant white perch, may be a factor that explains fair yellow perch growth and condition in Irondequoit Bay. Yellow perch fishing in Irondequoit Bay has been outstanding in recent years. Relative abundance of white perch increased fourfold, while mean total length and relative weight declined from 2005 to 2015. This suggests that intraspecific competition due to high white perch abundance and interspecific competition with abundant yellow perch may hamper growth of both species. Rock bass *(Ambloplites rupestris)* and bluegill *(Lepomis macrochirus)* relative abundance in Irondequoit Bay appears to have been consistent, but low, from 2005 to 2015. Irondequoit Bay rock bass and bluegill exhibit good growth and are in good condition, which might be expected given the low abundance of these species. Largemouth bass relative abundance in Irondequoit Bay is average when compared to other New York State waters. The size quality is good, while growth and condition of largemouth bass is excellent in Irondequoit Bay. It is recommended that all current management actions be continued, walleye pond fingerlings be stocked every other year, the success of stocked walleye fingerlings be evaluated, and a fisheries management plan be developed for Irondequoit Bay.

INTRODUCTION

Irondequoit Bay is a large embayment (surface area 1,648 acres, or 667 ha) of Lake Ontario, located northeast of Rochester, New York. It is considered a moderately shallow, eutrophic bay with a maximum depth of 78 feet (23.8 m) and a mean depth of 22 feet (6.8 m). The Irondequoit Bay watershed covers an area of 113,670 acres (46,000 ha) in Monroe, Ontario, and a bit of Wayne Counties. The majority of the basin is drained by Irondequoit Creek (watershed area 97,610 acres, or 395 km^2), which feeds in to the south end of the bay (Bannister and Bubeck 1978). Extensive macrophyte beds cover approximately 50 percent of the bay's surface area. It is primarily a warm water fishery composed of walleye (*Sander vitreum*), northern pike (*Esox lucius*), smallmouth bass (*Micropterus dolomieu*), largemouth bass (*Micropterus salmoides*), pumpkinseed (*Lepomis gibbosus*) and bluegill sunfish (*Lepomis macrochirus*), yellow perch (*Perca flavescens*), white perch (*Morone americana*), gizzard shad (*Dorosoma cepedianum*), and brown bullhead (*Amerius nebulosus*). Because it is connected to Lake Ontario by a dredged channel, and because the bay lies between Lake Ontario and a major spawning tributary, Irondequoit Creek, migratory species such as chinook salmon (*Onchorynchus tshawytscha*), coho salmon (*Onchorynchus kisutch*), brown trout (*Salmo trutta*), and rainbow trout (*Onchorynchus mykiss*) are found in the bay at certain times of the year.

The Department of Environmental Conservation (DEC) Region 8 Fisheries Unit has intensively managed Irondequoit Bay for walleye. Intensive management includes stocking hatchery reared fingerlings and regulating the recreational harvest (18-inch (457 mm) minimum size, three per day creel limit). The experimental stocking of advanced walleye fingerlings from 1993 to 1998 (Appendix A) resulted in the restoration of a once-popular fishery to the bay. A plan for biennial plantings of walleye fingerlings began in 2001, but such fingerling stocking has taken place sporadically from 2003 to 2010. More recently, biennial walleye fingerlings were stocked consistently from 2011-2015. Northern pike, pumpkinseed and bluegill sunfish, and yellow perch are managed by regulating the recreational harvest under Lake Ontario regulations. Black bass (*Micropterus, spp.)* and black crappie (*Pomoxis nigromaculatus*) are managed by regulating the recreational harvest under statewide size and creel limits. A new bass fishing regulation was implemented on October 1, 2006, to allow an early, artificial lure only, catch and release season.

Past assessments of the Irondequoit Bay fish community include an electrofishing survey conducted in accordance with DEC standard sampling protocols (Green 1989) by the DEC Region 8 Fisheries Unit in 1990 (W. Abraham, NYSDEC, unpublished data), and a hoop net and electrofishing survey conducted in 2002 as part of a biological assessment of the bay by State University of New York (SUNY) at Brockport (Haynes, et al 2002). A cooperating angler warm water sportfish diary project was conducted during the open water season in 1985 (Lane 1988). The 1996 New York Statewide Angler Survey listed Irondequoit Bay as the 28th most fished water body in New York, generating an estimated 43,750 angler days of effort by 6,780 anglers (Connelly et al 1997). In 2007, it was the 33rd most fished water body in New York, generating an estimated 88,346 angler days of effort (Connelly and Brown 2009). An angler creel survey was conducted on Irondequoit Bay from 2007-2008 (Sanderson 2009). The survey estimated that anglers spent 71,000 angler hours of fishing effort during 15,800 daytime boat trips, and 93,000 angler hours during 20,200 daytime shore angler trips. Anglers also fished Irondequoit Bay at night for approximately 2,000 angler hours from 443 boat trips, and 1,400 angler hours from 314 shore angler trips. Anglers caught an estimated 610,000 yellow perch at a rate of 3.6 per angler hour, an estimated 18,000 largemouth bass were caught (0.11 per angler hour), and an estimated 229 walleyes (<0.01 per angler hour) were caught. A long-term monitoring program has been maintained on Irondequoit Bay for a number of limnological variables such as temperature, dissolved oxygen, nutrients, chlorophyll *a*, and zooplankton (Monroe County Health Dept. 2002, Beelick 1997, Klumb, et al 2001).

The DEC Region 8 Fisheries Unit conducted warm water fisheries assessments using standard gangs of gill nets in September of 2005, 2010, and 2015. In addition, an electrofishing survey was conducted in June of 2009. The surveys were conducted to 1) assess the fish community; 2) determine the contribution of stocked fingerlings to the walleye *(Sander vitreus)* population; 3) estimate population characteristics of walleye, northern pike *(Esox lucius)*, yellow perch *(Perca flavescens),* and largemouth bass (*Micropterus salmoides)*, 4) compare fish community structure to statewide surveys; and 5) guide the development of appropriate management recommendations. Also, an expanding double-crested cormorant (*Phalacrocorax auritus*) colony located on Snider Island along the western shore of the bay is causing some concern about their potential impact on warm water fish populations. This report describes the findings of these surveys and compares the results of the surveys with those done in October of 1990 (W. Abraham, NYSDEC, unpublished data). These data will be used to further refine management goals and objectives for the Irondequoit Bay fishery.

METHODS

DEC's Region 8 fisheries unit conducted warm water fisheries assessment surveys of Irondequoit Bay on September 13-16, 2005; September 21-23, 2010; and September 22-24, 2015 in accordance with DEC’s percid sampling manual (Forney et al. 1994), except that Region 8’s Finger Lakes standard gang gill nets were used as noted below. An electrofishing survey was conducted in accordance with DEC’s centrarchid sampling manual (Green 1989) on June 8-15, 2009. The surveys included collection of pertinent chemical and physical data and sampling of fish populations by gill netting and electrofishing.

The assessments utilized standard gangs of sinking, mono and multifilament gill nets that have been used by the Region 8 Fisheries Unit for fish community assessments in the Finger Lakes since 1985 (Abraham 1993). The nets are bottom set overnight, perpendicular or oblique to depth contours. Finger Lakes standard gang gill nets consist of six 50 ft. (15.2 m) long panels, 8 ft. (2.4 m) deep and ranging in size from 1.5 -5 inch (38 – 127 mm) stretch mesh. The net consisted of a 25 ft. (7.6 m) panel of 1 inch (25 mm) mesh on each end, and 50 ft. (15.2 m) panels of 1.5, 2.0, 2.5, 3.0, 4.0, and 5.0 inch mesh randomly placed between these panels for a net that is 350 ft. (106.6 m) in total length. Similar to Finger Lakes studies, Irondequoit Bay was delineated into 12 grids. Two nets were set overnight on each survey day, one net in each of a selected grid area. Nine total multifilament nets were set in 2005, and six total nets (one monofilament and one multifilament net each night) were set in 2010 and 2015. Net locations, depths, and soak times are given in Table 1 and shown on Figure 1. Chemical and physical data obtained immediately prior to each survey at the deepest portion of the bay, suggests that anoxia occurs at depths greater than 30 feet (9.1 m). Nets were set in mid afternoon at depths where dissolved oxygen was above 5.0 ppm, and lakeward of abundant vegetation near shore, and tended the following morning.

Electrofishing was conducted at night with either a Smith Root - SR-17 ft. Cataraft, 7.5 GPP electrofisher operating at 170 volts, 60 cycles per second pulsed D.C. and 6.5 amps or a Polarcraft shocker boat with Smith Root IVA electronics operating at 354 or 177 volts, 120 cycles per second pulsed D.C. and 5.5 amps, in depths generally less than 6 feet at various locations along the entire bay shoreline (Figure 1). Electrofishing electrode on time totaled 6.45 hours, during which 0.50 hours were spent targeting all fish species and 5.95 hours were spent targeting gamefish and percids (perch, walleyes) only.

All fish were separated by site and for gill nets, mesh size, identified by species, and measured for total length (TL, mm) and weight (g). Scales for age determination were taken from a sub sample of rock bass, pumpkinseed, bluegill, largemouth bass, smallmouth bass, black crappie and yellow perch. Scales were taken from all walleye and northern pike. During gill net surveys otoliths were taken, sex was determined, and stomach contents examined for all adult walleye. Scales were dried and pressed into acetate and otoliths were dried, cracked in half, “toasted” using an alcohol burner, mounted in clay, and a drop of immersion oil added. Ages were determined from magnification of scale impressions and mounted otoliths with a stereomicroscope.

Data were entered into the Bureau of Fisheries Statewide Fisheries Database and downloaded onto Lotus 1-2-3 and Microsoft Excel spreadsheets. Catch per Unit of Effort (CPUE=number of fish per overnight standard net set, expressed as number per net in this report), mean length at age, age and length structure, and size and condition indices were calculated. Age distribution was determined for sub sampled species by expanding known age fish to all fish collected using an age-length key.

Contribution of each walleye, yellow perch and largemouth bass year class to the fishery was measured using the sum of the catch per unit of effort (CPUE) from ages 2 and older. Age 2 fish of most year classes were large enough to contribute to fishing quality, although they would not have been legally harvestable in all cases. Year class contribution (YC contrib. x) provided an indicator of year class contribution to fishing quality:

$$\text{YC contrib.x} = \Sigma > \text{age2 CPUE YCx}$$

Survival and mortality estimates of walleye, yellow perch, and largemouth bass were made using catch curve methods described by Ricker (1975) and Miranda and Bettoli (2007). Instantaneous mortality (Z) from catch curve:

Z= (-) slope of ln CPUE vs. Age
S= Annual Total Survival: S = e-z (Ricker 1975)
A= Annual Total Mortality: A = 1-e-z (Ricker 1975)

Proportional stock density (PSD) compares, as a percent, the numbers of fish of quality size to those of stock size. Relative stock density (RSD) makes a similar comparison between numbers of preferred size fish to those of stock size. These size categories are quantified in New York as follows (Gabelhouse 1984):

	Size category in inches (mm)		
Species	Stock	Quality	Preferred
Largemouth bass	8 (200)	12 (300)	15 (380)
Smallmouth bass	7 (180)	11 (280)	14 (350)
Sunfish	3 (80)	6 (150)	8 (200)
Crappie	5 (130)	8 (200)	10 (250)
Rock bass	4 (100)	7 (180)	9 (230)
Walleye	10 (250)	15 (380)	20 (510)
Yellow perch	5 (130)	8 (200)	10 (250)
Northern pike	14 (350)	21 (530)	28 (710)

PSD and RSDp are numerical descriptions of length frequency data and are calculated as:

$$PSD = \frac{\text{Number of fish} \geq \text{min. quality length}}{\text{Number of fish} \geq \text{min. stock length}} \times 100$$

$$RSDp = \frac{\text{Number of fish greater than or equal to preferred size}}{\text{Number of fish greater than or equal to stock size}} \times 100$$

Values of PSD and RSD range from 1 to 100. Given representative samples of a population, stock density indices can provide insight or predictive ability about population dynamics (Anderson 1980, Gabelhouse 1984, Anderson and Neumann 1996). However, PSD/RSD values may be influenced by the fact that some species may not be vulnerable to gill net capture at stock sizes.

Relative weight (Wr) is a refinement of the relative condition concept, given by the equation:

Wr = (W/Ws) X 100,

where W is the weight of an individual and Ws is a length-specific standard weight predicted by a weight-length regression constructed to represent the species. The form of the Ws equation is:

$$\text{Log } 10(Ws) = a' + b \times \log10(TL),$$

where a' is the intercept value and b is the slope of the log10(weight)-log10(length) regression equation and L is the maximum total length of the fish. Fish with a Wr close to 100 are in balance with their food supply, whereas fish with values below 85 are underweight and may be too abundant for their food supply. On the other end, fish with Wr above 105 are more plump than necessary, reflecting an overabundant food supply. (Flickinger et al. 1999, Anderson and Neumann 1996, Blackwell et al. 2000).

Growth rate (G) was calculated for walleye, yellow perch, and largemouth bass as the slope of the linear regression line of natural log (ln) mean TL_{age} versus age by year class (Chrisman and Eckert 1998). This is a population rate rather than a true (or individual) rate as defined by Ricker (1975) in that it does not account for possible differential mortality of fast growing fish. Mean total length at ages 2 and 7 (walleyes); age 4 (yellow perch), and age 5 (largemouth bass) were used to provide a point index of recent growth conditions and did not require following a year class for several years. The age at which walleye mean total length exceeds 18 inches (457 mm) and largemouth bass mean total length exceeds 12 inches (305 mm) provides an indication of the age at which these species are reaching the legal minimum length.

Qualitative comparisons of CPUE, survival, mean length at age, age and length structure, and size, condition, and growth indices are made between survey years.

RESULTS

Species Composition and Abundance

Overall gill net CPUE increased from 153.6 fish per net to 357.8 fish per net from 2005 to 2015 (Table 2). Between 2005, 2010, and 2015, 27, 24, and 25 species of fish, respectively, have been collected from Irondequoit Bay during gill net assessments and 16 species were collected electrofishing in 2009 (Table 3). Thirty-four total species have been documented, including nine gamefish, nine panfish, and sixteen non-game species. Notably, a lake sturgeon (*Acipenser fulvescens*), a NYS threatened species, was caught in 2005, and no smallmouth bass were caught in gill nets or by electrofishing.

Walleye

From 2005 to 2015, Irondequoit Bay walleye relative abundance, as measured by the mean number caught per net, increased from 9.3 per net to 19.7 per net (Figure 2, Tables 2 and 4). At the same time, the portion of the walleye catches that were legal sized (≥18 in (457mm)) declined from 85% to 53% (Figure 3). The majority of walleyes ranged in size from 14 in (356 mm) to over 24 inches (610 mm) in (Figure 4). 2015 was the only year that walleyes less than 14 in (356 mm) were sampled in gill nets, while no walleyes less than 16 in (406 mm) were collected in gill nets in 2005. In 2010, more walleyes greater than 23.5 in (597 mm) were sampled than the other years. Size quality, while impressive, declined from 2005 to 2015, as PSD declined from 100 to 92 and RSDp declined from 43 to 27 (Table 5). The range of walleye ages increased from 2005 to 2015. In 2005 walleye ages ranged from 2 to 11 years, in 2010 walleye ages ranged from 2 to 15 years, and in 2015 walleye ages ranged from 0 to 19 years (Figure 5). Using the sum of CPUE of ages 2 and older as an index of the contribution of a year class to fishery quality, the data show that 1996, 2008, 2011, and 2013 are strong year classes (Table 4, Figure 6). Walleye annual survival (ages 2 through 16) by year class is greater than 70%, but shows a variable downward trend from the 1995 to the 2008 year classes (Figure 7). The mean total length at age of male and female walleyes were above NYS averages for all years (Figure 8). The mean TL of all walleyes declined from 20 in (508 mm) in 2005 to 17 in (432 mm) in 2015 (Figure 9a). The mean TL of age 2 walleyes remained consistent at 17-17.5 in (432-445 mm) (Figure 9b) and mean TL of age 7 walleyes was variable from 2005 to 2015 (Figure 9c). Growth rate (G), expressed as the slope of the ln mean TL vs age (ages 2-16) regression line, of the 2008 year class was the highest of the data set. Overall walleye growth shows an increasing trend (Figure 10). Condition of walleyes was near standard for all years (Figure 11). There was little change in walleye mean Wr from 2005 to 2015 (Figure 12).

Northern Pike

Relative abundance of northern pike in Irondequoit Bay declined from 2005 (CPUE=2.20/net) to 2010 (CPUE= 1.17/net) to 2015 (CPUE=0.67/net, Table 2, Figure 13). Most of the northern pike in 2005, 2009, and 2010 were legal size (≥22 in (559 mm)), while only half (two of four) of the northerns sampled in 2015 were legal sized (Figure 14). Larger northern pike were caught in years prior to 2015 (Figure 15). PSD values were consistent at 95-100 from 2005-2010, and declined to 67 in 2015 (Table 5). RSDp values declined from 2009 (83) to 2015 (0). The 2005 northern pike sample had the widest range of ages, ranging from age 2 to age 7. All northern pike in 2009 were age 4 or 5; in 2010 they were age 3 and 4; and in 2015 they were age 1, 3, and 4 (Figure 16). Mean TL of all northern pike was consistent at 27 to 30 in (686 – 762 mm) from 2005 to 2010 and declined to 20 in (508 mm) in 2015 (Figure 17). Condition was below standard and mean Wr of northern pike was generally below 100 for all years (Figures 18 and 19).

Yellow Perch

Irondequoit Bay yellow perch relative abundance has remained relatively constant (CPUE=53/net – 61/net) from 2005 through 2015 (Table 2, Figure 20). Yellow perch of nearly all TL size and age groups were caught in all years (Figures 21 and 22). Size quality, as measured by PSD, of yellow perch sampled in 2005 (35) was similar to 2009 (31), increased in 2010 (70), and declined in 2015 (57, Table 5). Using the sum of

CPUE of ages 1 and older as an index of the contribution of a year class to fishery quality, the data show that the 2004 through 2009 year classes are strong (Figure 23). Yellow perch annual survival (ages 1 through 7) by year class is greater than 50% (Figure 24). Yellow perch TL at age is above NYS averages for all ages in all years sampled (Figure 25). In 2015, mean TL of all yellow perch declined from levels observed in 2005-2010 (Figure 26a), while the mean TL of age 4 yellow perch increased from 2005 (8.27 in (210 mm) to 2015 (9.68 in (246 mm), Figure 26b). Growth rate (G), expressed as the slope of the ln mean TL vs age (ages 1-7) regression line, of all year classes was generally stable (average = 0.17). Overall yellow perch growth shows an insignificant slight declining trend (Figure 27). Condition of yellow perch was below standard for all years (Figure 28). There was little change in yellow perch mean Wr from 2005 (85) to 2010 (87) and a slight increase in 2015 (92, Figure 29).

White Perch

White perch CPUE increased four-fold from 2005 (45/net) to 2010 (184/net) and increased slightly in 2015 (216/net; Table 2, Figure 20). Only two white perch were caught electrofishing in 2009, suggesting that electrofishing isn't an efficient method of sampling this species in Irondequoit Bay. White perch of nearly all size groups were caught in all years, and ranged from 3 to 14 in (76-356 mm) (Figure 30). The 2005 white perch sample was the only sample where scales were collected and aged. Ages ranged from young-of-year to seven. Few age 3 were caught and age 4 white perch dominated the catch (Figure 31). Mean total length at age was calculated for the 2005 sample (Figure 32). Mean TL of white perch averaged approximately 8.5 in (216 mm) from 2005-2015 (Figure 26a). Condition of white perch in Irondequoit Bay is good, but mean Wr declined slightly from 2005 (99) to 2015 (91, Figure 29), and total length vs weight was near standard in all years (Figure 33).

Rock Bass, Pumpkinseed, and Bluegill

Rock bass abundance was similar (CPUE=1.8/net) in all years Irondequoit Bay was sampled while bluegill CPUE appeared to be variable from 2005 (1.0/net) to 2015 (0.3/net). Very few pumpkinseed were sampled in either gill nets or electrofishing (Table 2, Figure 34). Eighty percent of the rock bass sampled in 2005 were less than 6 in (152 mm) and in 2015, 80% were greater than 6 in (152 mm) (Figure 35). Rock bass size structure was poor in 2005 (PSD=13) and improved by 2015 (PSD=78). Bluegill PSDs varied, but generally averaged about 60 (Table 5). Age distributions are shown on Figure 36. Rock bass growth increased, while bluegill growth was steady from 2005 to 2015. Mean TL at age for both species were above NYS averages (Figure 37). Rock bass and bluegill condition in Irondequoit Bay was near standard in most years, but both were below standard in 2010 (Figure 38). Rock bass and bluegill relative weights were good in all years (>100) except 2010 (84 and 89, respectively, Figure 39).

Largemouth bass

A total of only seven largemouth bass were caught in gill nets from 2005 to 2015 (Table 2), while 132 (CPUE=20.5/hr.) were caught electrofishing in 2009 (Table 3). Total lengths of largemouth bass in Irondequoit Bay ranged from 4 to 20 in (102-508 mm) in 2009 (Figure 40). One third of the sample was between 13 and 15 in (330-381 mm) and 46% were legal sized ($\geq$12 in (305 mm)). PSD was 65.4 and RSDp was 14.1 (Table 5). All ages of largemouth bass were represented in the 2009 sample. One half (51%) of the catch was less than age 2 (Figure 41). Survival as estimated with the spring 2009 data using a catch curve is 84% (Figure 42). Mean total length of ages 1-4 were above NYS averages, while ages 5-8 were at NYS averages (Figure 43). Condition of largemouth bass less than 14.75 in (375 mm) in Irondequoit Bay was near standard and condition of largemouth bass greater than 14.75 in (375 mm) was below standard (Figure 44). Relative weights of largemouth bass less than 7 in (178 mm) were very high (107-140), most likely due to weighing errors. The average relative weight of largemouth bass greater than 7 in (178 mm) was 103 (Figure 45).

DISCUSSION

Species Composition and Abundance

White perch dominated the gill net catches from 2005 to 2015, averaging one half of the catch over that period. Although yellow perch was the next most abundant species in the 2005-2015 gill net catches, averaging 22% of the catch during that period, the portion of the catch made up of yellow perch declined from 38% of the catch in 2005 to 15% of the catch in 2015. Together white and yellow perch made up 68%, 72%, and 75% of the 2005, 2010, and 2015 catches, respectively. The third most abundant species was walleye, whose abundance averaged 5% of the catch during the 2005-2015 period. Gizzard shad abundance increased from 0.5% to 6% of the catch during the 2005 to 2015 period, and was the third most abundant species in the 2015 survey. Quillback (*Carpiodes cyprinus*) was the third most abundant species in 2005, making up 8% of the catch. Quillback abundance declined to only 2% of the 2015 catch. Largemouth bass dominated the electrofishing catch (61%), followed by yellow perch (8%), and bluegill (6%).

Walleye

Walleye relative abundance doubled from 9 per net to 20 per net from 2005 to 2015. Although there are differences in net specifications, it is assumed that size selectivity of the Region 8 Finger Lakes standard gang gill net is similar to the statewide standard percid sampling gill net. The statewide percid sampling manual (Forney et al. 1994) suggests that catch rates of over 5 walleyes per standard net (150 ft. long, 6 ft. deep monofilament, with 25 ft. panels of 1.5, 2.0, 2.5, 3.0, 3.5, 4.0 inch mesh) may indicate abundant populations. Irondequoit Bay walleye abundance seems to be on par with walleye abundance in other area water bodies. Using the Region 8 Finger Lakes standard gang gill nets, Sanderson (2015) reported the September walleye gill net CPUE of nearby Port Bay was 0.5 per net night in 2012, Sanderson (2017) reported the walleye CPUE of Conesus Lake averaged about 15 per net night (range 33/net to 8/net) from 1991 to 2014, Hammers (2010) reported a CPUE of 19.5 walleyes per net night, and Austerman and Hammers (2012) reported 17.8 walleyes per net night from Honeoye Lake in September of 2003 and 2008, respectively.

Consistent annual walleye fingerling stockings from 1993 to 1998 contributed to the adult walleye abundance in the bay between 2005 and 2015. Sixty-nine percent of the 2005, 17% of the 2010, and 2.5% of the 2015 walleye gill net catches were from these year classes. The increase in abundance observed in the 2005 to 2015 surveys can be explained by good recruitment of large numbers of walleye pond fingerlings stocked from 2003 to 2015, and especially from the 2008 year class, when a portion of the stock included advanced fingerlings. Consistent biennial stockings from 2011 to 2015 contributed to the increase in abundance from 2010 to 2015.

The 2003 year class was well represented (13%) in the 2005 walleye catch as age 2. This was the only year that walleye fingerlings were stocked between 1999 and 2007. Seventeen percent of the 2005 walleye catch may be of wild origin, because many age 4 and 5 walleyes were caught and no walleyes were stocked into Irondequoit Bay in 2000 or 2001. Survival of the 2001 year class appears to have been good, as 4% of the 2010 walleye catch was from this year class as age 9. The 2008 year class, when 19,000 pond fingerlings and 5,400 advanced fingerlings were stocked, dominated the 2009 electrofishing (73%) and the 2010 gill net walleye catches (60%). This year class was also strongly represented in the 2015 gill nets making up almost 8% of the walleye catch. Thirty-six thousand walleye pond fingerlings were stocked each year in 2011, 2013, and 2015. These year classes made up 25%, 39%, and 10% of the 2015 walleye catch. Fifteen percent of the 2015 walleye sample was age 1 (2014 year class). These may be wild fish, as no walleyes were stocked in 2014. They may also be mis-aged fish from either the 2013 (age 2) or 2015 (age 0) year classes, when 36,000 pond fingerlings were stocked each of those years. Hammers (2010) and Austerman and Hammers (2012) have observed similar difficulty in aging scales from walleyes collected from Honeoye Lake. Marking all future walleye fingerlings stocked into the bay with an Oxytetracycline (OTC) mark would confirm ages and help to evaluate stocked versus wild fish in future gill net assessments.

Although there is evidence of natural reproduction of walleyes in Irondequoit Bay, walleye abundance appears to be strongly related to the number of stocked fingerlings. It appears that predation on walleye fry by alewives and other abundant predators such as white perch, sunfish, and largemouth bass and interspecific competition between alewives, yellow perch, and white perch and walleye fry for zooplankton prey may hamper fry survival in Irondequoit Bay. Schiavone (1983) suggested reduced survival of young-of-year walleye or stocked walleye fingerlings occurred in water bodies with extensive predators including bass and crappie. High bass populations have also been associated with poor walleye survival in other lakes (Brooking et al. 2002; Sass et al. 2004; Benike 2006). High bass and sunfish abundance in Irondequoit Bay may be impeding walleye survival. White perch have been known to prey on walleye eggs (Schaeffer and Margraf 1987).

Using the sum of CPUE of ages 2 and older as an index of the contribution of a year class to fishery quality, the highest ranking year class was 2008, followed by 2013 and 2011. The low ranking year classes originated in the mid 2000's, and as expected, higher year class contribution occurred during years when large numbers of pond or advanced fingerlings were stocked. Annual survival (ages 2 through 16) by year class is greater than 70%, but is perhaps trending downward. Despite this downward trend, walleyes are relatively abundant in Irondequoit Bay. Since walleye stocking was sporadic during the period of 1999 to 2007, and because surveys were conducted at 5 year intervals, there is not a lot of data to contribute to these calculations, and they should be viewed with caution.

The total length and age structure of the walleye catch has increased in range from 2005 to 2015. In 2005, few walleyes less than age 7 and none less than 16 in (400 mm) were caught, because walleye fingerlings hadn't been stocked between 1999 and 2002 and there was little natural recruitment during those years. Walleyes of all ages and size groups were caught in 2010 and 2015, suggesting that once more consistent biennial stocking resumed in 2008, successful survival of fingerlings occurred.

With the caveat that gill net catches can exhibit size selectivity against smaller fish (Forney et al. 1994), the size quality of walleye sampled using gill nets from Irondequoit Bay from 2005 to 2015 is excellent (PSD 92-100; RSDp 27-43). The highest PSD and RSDp were observed in 2005 when the catch contained no stock to quality sized fish (10–15 in (250-379 mm)), which would be expected with little stocking and natural recruitment. The lowest value of PSD and RSDp occurred in 2015 when the gill net catch had many more smaller (less than 15 in. (380 mm)) age 0 and age1 fish in the sample than the other sample years, suggesting that larger fish had died out and several recent stockings occurred. By comparison, Conesus Lake walleye PSD values ranged from 82.5-100 (mean 88) and RSDp values ranged from 26-73 (mean 44) from 1991 to 2014. The highest PSD and RSDp were observed in 2001 when the catch contained no fish smaller than quality size (15 in. (380 mm)) and younger than age 5. The lowest value of PSD and RSDp occurred in 1994 when the gill net catch was dominated by smaller (less than 17.75 in. (450 mm)) age 2 and 3 fish (Sanderson 2017). Honeoye Lake walleye PSD values ranged from 36-95 and RSDp values ranged from 2-8 from 1997 to 2008 (Austerman and Hammers 2012).

The overall growth of walleye in Irondequoit Bay is excellent, as the mean total length at each age of male and female walleyes in the Bay are generally above New York State (NYS) averages (Forney et al. 1994). The decline in mean TL of all walleyes from 2005 to 2015 can be explained by the fact that no walleyes less than 16 in (400 mm) were caught in 2005 and that increasing numbers of smaller size groups were caught in the 2010 and 2015 samples, all related to increasingly consistent stocking and little natural reproduction over the time frame. Mean total length at age 2 and 7 are convenient indices of walleye growth which provides information at each sample year. Growth of age 2 Irondequoit Bay walleyes has been consistent over the sampling period, as mean total length of combined male and female age 2 walleyes has remained between 17 and 17.5 in (432-445 mm) from 2005 to 2015. Combined male and female mean total length at age 7 increased from 20 inches (508 mm) in 2005, to 23 inches (584 mm) in 2010, then declined slightly to 22 inches (560 mm) in 2015. Growth of Irondequoit Bay walleyes compares favorably to other Region 8 waters. In Port Bay, Sanderson (2015) reported age 2 walleyes averaged about 16 in (400 mm) in September from 1989 to 2012. In Conesus Lake, Sanderson (2017) found age 7 walleyes averaged about 22 in (560 mm) in September from 1991 to 2014. In Honeoye Lake, Hammers (2010) found similar growth rates, with age 7 walleye averaging 21.5 in (547 mm) in September 2003. However, Austerman and Hammers (2012) found that age 7 walleyes in Honeoye Lake declined to an average of 16 in (409 mm) in September 2008. As discussed earlier, this decline is more likely related to more accurate walleye age determinations made with otoliths vs scales.

The growth rate (G) of Irondequoit Bay walleyes, expressed as the slope of the ln mean total length vs. age (ages 2-19) regression line, was generally lowest in the 1996 and 1997 year classes and highest for the 2008 year class. Although there was wide variation in growth rates among year classes, there was an increasing trend in growth rates over the sampling period.

Walleye condition from 2005 to 2015 was good, as Irondequoit Bay walleye are at standard weights established in Blackwell et al. (2000). Mean relative weights ranged from 97 in 2005, to 98 in 2010, to 96 in 2015. Relative weights of longer than preferred size (above 20 inches (510 mm)) fish were near or above standard (100) for most years sampled. The smaller, less than preferred size, fish were in somewhat poor condition- generally below 100. A shift from zooplankton and invertebrates to alewife, gizzard shad, white and yellow perch predation likely comes as juvenile walleye grow and mature. During field sampling, ample fatty tissue was observed in the body cavity of adult walleyes. Examination of adult walleye stomach contents confirmed that they are feeding on a mixed forage base of alewives, gizzard shad and yellow perch. These observations are similar to walleyes in Port Bay and Conesus Lake, where alewives provide an abundant prey base and relative weights of larger walleyes are well above 100 (Sanderson 2015, 2017). In contrast, mean relative weight of most size groups of Honeoye Lake walleye from 2003 to 2008 were less than 100 and examination of stomach contents revealed that sunfish made up the majority of the Honeoye Lake walleye diet (Hammers 2010, Austerman and Hammers 2012).

The below standard condition of smaller Irondequoit Bay walleyes between 2010 and 2015 could be density dependent impacts of interspecific competition for food from a growing walleye population. The below standard relative weights of quality to preferred sized (15-20 in, 380-509 mm) walleyes could also be a sign that alewife prey may not be providing the same energy because they are now slightly smaller, as mean total length and condition of alewives in Irondequoit Bay appears to have declined. However, no specific forage base surveys have been conducted to determine alewife or other forage species densities relative to walleye abundance. Despite the poor condition shown by juvenile walleyes, larger than preferred sized (>20 in, 510 mm) adults have remained in excellent condition. There appears to be no shortage of prey for adult walleye in the bay, as it appears that abundant alewives, gizzard shad, white and yellow perch provide adequate alternative food sources.

In summary, the walleye population of Irondequoit Bay in 2005 was composed of an abundance of larger, older fish in excellent condition. By 2015, the population increased and included a wider range of sizes and ages of fish exhibiting good growth rates and condition. Migratory spawning runs in Irondequoit Creek could be producing fry that potentially recruit to adults. However, the bay's walleye population is mainly sustained by stocking hatchery raised fingerlings. Although survival has declined, relative abundance is high. Because of aforementioned discrepancies of scale ages among readers, walleye production, age, and growth analyses for these surveys should be viewed cautiously. The current management objective for Irondequoit Bay is to restore walleye as a major fishery (Woltmann 2003, Stewart et al. 2017). Festa et al. (1987) suggested stocking be terminated if natural reproduction is successful or survival of stocked fingerlings is negligible. A conclusion about natural reproduction needs further investigation and accurate aging techniques applied. While they are growing somewhat slower and in somewhat poor condition, survival and recruitment of the stocked fingerlings appears to be good. The current objective for walleye in Irondequoit Bay should remain the same, with the ultimate goal of restoring walleye as a self-sustaining fishery. NYSDEC recommends the current stocking rate of 20 pond fingerlings/acre per every other year be continued to maintain existing walleye populations and increase the abundance of adult spawning stock. Fishing quality for Irondequoit Bay walleyes should remain very good for several years. However, as it appears that anglers are not targeting or catching this abundant walleye population (Sanderson 2009), walleye fishing opportunities in the Bay should be promoted.

Northern Pike

Although few were sampled, Northern pike gill net CPUE declined from 2005 to 2015. One third of the 2005 Irondequoit Bay northern pike catch was from the 2002 year class sampled as age 3. Despite appearing as an apparent strong year class, fish from the 2002 year class were not caught in subsequent sample years. Notwithstanding possible scale aging errors, this year class appears to have disappeared by 2010. In the 2005 gill net sample, pike ages ranged from 2 to 7. In the 2009 electrofishing sample they were age 4 and 5, in the 2010 gill nets, they were age 3 and 4, and in the 2015 gill nets they were ages 1-4. The decline in Irondequoit Bay northern pike relative abundance could be due to a decline in survival past age 5. The exact reasons for poor survival are unknown. It is unlikely that fishing mortality is a primary reason. During the 2007-2008 fishing season, northern pike made up only 0.22% of the total catch, but was 7% of the warm water gamefish catch. The high release rate of legal sized northerns and the fact that none were caught through the ice suggests that Irondequoit Bay anglers value northern pike more as a sport fish rather than as a food fish (Sanderson 2009). A possible contributor might be periodic disease infestations. During the 2009 electrofishing survey, two northern pike with red sores and lesions on their bodies were caught and submitted to the Cornell University Aquatic Animal Health Program for diagnosis. The pike were found to have a *Trichodina* infestation and suspected esox lymphosarcoma (NYSDEC files case FPL2009-017).

Little can be said about Irondequoit Bay northern pike growth from 2005 to 2015, as small sample sizes prevented calculation of mean total length at age 4. Only one 26 inch (661 mm), age 4 fish was captured in 2005 and only one 25.4 inch (645 mm) age 4 fish was caught in 2015. Northern pike in Irondequoit Bay appear to be growing at a comparatively good rate, because since 2001, age 4 northern pike in the St. Lawrence River Thousand Islands area have averaged below 23.6 inches (600 mm) in total length (McCullough and Gordon 2012). Northern pike in Irondequoit Bay do not grow as fast as pike in Conesus Lake, where they averaged 27.1 in (688 mm) at age 4 from 1991 to 2014 (Sanderson 2017). Except for 2 sublegal (<22 inches (560 mm)) northerns that were caught in 2015, nearly all pike sampled from 2005 to 2015 were of legal size, although gear selectivity could account for this. Irondequoit Bay northern pike grow to legal size by age 3.

Nearly all northern pike sampled from 2005 to 2015 were quality sized. Size structure has recently declined, as only about 29% of the northerns sampled in 2010 and none in 2015 were preferred size. Irondequoit Bay northern pike are in below average condition, with weights below the standard weight established in Blackwell et al. (2000) and relative weights over all years, particularly 2010, are below 100 for most size groups.

Northern pike in Irondequoit Bay appear to be declining in abundance perhaps due to poor survival. Adult pike, while moderately fast growing, are in well below average condition. The reason for poor northern pike condition is confusing, because prey abundance in the bay appears to be good. White suckers, known as a preferred northern pike prey item, are abundant in Irondequoit Bay, averaging 3% of the gill net catch from 2005-1015.

Yellow Perch

Although yellow perch relative abundance remained nearly constant from 2005 to 2015, the portion of the gill net catch made up of yellow perch greatly declined from 38% in 2005 to 18% in 2010, and in 2015, yellow perch made up 15% of the gill net catch. This change can be attributed to the large increase of the portion of the gill net catch made up of white perch (see the next section, below). Yellow perch relative abundance in Irondequoit Bay greatly exceeds that of Port Bay and Honeoye Lake. Using Region 8's Finger Lakes standard gang gill nets, yellow perch CPUE in Port Bay was 19.0 per net-night in 2012 (Sanderson 2015) and Honeoye Lake averaged 9.5 perch per net-night from 1997 to 2008, except 2004 when CPUE was 4.0 per net- night (Hammers 2010, Austerman and Hammers 2012).

The 2010 gill net yellow perch sample was dominated by fish between 9 and 12 in. These fish were probably the dominant 6 to 8 in perch caught in the 2009 electrofishing sample and the 4 to 5 in fish that were most numerous in the 2005 gill net yellow perch sample. These fish are from the strong 2001, 2004, and 2005 year classes. Fifty percent of the 2009 electrofishing sample were age 3 and 31% of the 2010 gill net sample was age four, suggesting the 2006 year class was also strong. During a year-long recreational fishing survey of Irondequoit Bay in 2007-2008, Sanderson (2009) found that fishing for yellow perch was extremely popular and productive. Ninety-three percent of the total estimated catch and 95% of the total estimated harvest was yellow perch. Data from the 2005 gill net survey suggests good 2001 and 2004 yellow perch year classes and these fish would have been ages 6 and 3 in 2007, providing an excellent fishery of approximately 12 and 7 in perch. The overall yellow perch estimated catch rate of 3.6 fish per hour (2.41 open water, 5.39 ice) and the overall directed effort catch rate of 7.3 fish per hour (8.63 open water, 5.39 ice) in Irondequoit Bay in 2007-08 exceeds the catch rates found in adjacent Lake Ontario bays and nearby inland water bodies with popular yellow perch fisheries (Sanderson 2009, 2010, 2014).

Survival of the 2004 to 2009 yellow perch year classes is generally excellent, greater than 50%. Estimated survival ranged from 56% in the 2005 gill net sample to 68% in the 2010 and 2015 gill net samples.

Growth of yellow perch is generally good and showing an increasing trend in Irondequoit Bay. From 2005 to 2015, yellow perch mean TL was above NYS averages for all ages. The New York State Percid Sampling Manual suggests that at a high growth rate, yellow perch would be 8.5 in (215 mm) at age 4 (Forney et al. 1994). From 2005 to 2015 Irondequoit Bay yellow perch average age 4 TL was mostly above this rate, ranging from 7.8 to 9.7 in (199 - 246 mm) and shows and increasing trend from 2005 to 2015. Yellow perch mean TL at age 4 in Port Bay was 8.1 in (206 mm) in 2012 (Sanderson 2015) and in Honeoye Lake ranged from 9 to 9.5 in (231-241 mm) from 1997 to 2008 (Hammers 2010, Austerman and Hammers 2012). Based on relative weight (Wr) and Fulton condition factor (K), yellow perch were in the poorest condition in 2005 and in best condition in 2015. Since yellow perch relative weights were below 100 for most all size groups and sample years and below standard weights established by Blackwell et. al (2000), Irondequoit Bay yellow perch are in overall less than desirable condition. Relatively low Wr would suggest intraspecific competition due to high yellow perch abundance. Hammers (2010) and Austerman and Hammers (2012) also found yellow perch in Honeoye Lake to have relative weights below 100 for most all size groups for all of the years sampled. They thought that an increase in intraspecific competition due to an increase in yellow perch abundance from 2003 to 2008, may be a factor for the poor condition of yellow perch in Honeoye Lake.

Competition with other species, namely very abundant white perch, may also be a factor that explains poor yellow perch growth and condition in Irondequoit Bay. Parrish and Margraf (1990) hypothesized that white perch compete with native yellow perch for zooplankton. They determined that growth rates of yellow perch had declined since the invasion of white perch in Lake Erie, especially in the western basin.

White Perch

In 2005, yellow perch made up a greater portion of the gill net catch than white perch. In 2010 and 2015, white perch made up a far greater portion of the gill net catch than yellow perch – making up more than one half the total catch. Relative abundance of white perch increased fourfold, while mean total length and relative weight declined from 2005 to 2015. This suggests that intraspecific competition due to high white perch abundance and interspecific competition with abundant yellow perch may hamper growth of both species. Parrish and Margraf (1990) and Prout et al. (1990) demonstrated significant diet overlap between young of year white perch and yellow perch, especially for *Daphnia pulex*. Prout, et al. (1990) also thought that competitive interactions between young white and yellow perch appeared to be asymmetric, because the ability of large cohorts of yellow perch to collapse *Daphnia pulex* populations has greater effect on white perch growth than large cohorts of white perch have on yellow perch growth. It is interesting to note that relative abundance of both walleye and white perch increased dramatically over the sampling period. This is contrary to the dynamic displayed between walleye and white perch in Chautauqua Lake, where white perch abundance increased markedly when walleye abundance was low and then declined as walleye abundance increased (McKeown 2002, Legard 2015).

Rock Bass, Pumpkinseed, and Bluegill

Since few pumpkinseed were caught, little can be said for this species and will not be discussed. Rock bass relative abundance in Irondequoit Bay appears to have been consistent from 2005 to 2015. However, Irondequoit Bay rock bass gill net CPUE's (1.8/net) are much lower than gill net CPUE's from Lake Ontario near Pultneyville (19.2 - 6.4/net; Sanderson 2012) and Conesus Lake, (6.0-0.4 /net; Sanderson 2017). Only 2 rock bass were caught during the 2009 electrofishing survey (0.8/hr.). This is much lower than the catch rate of the lower third percentile from spring night electrofishing surveys from the NY Statewide Fisheries Database (Brooking et al. 2017). Irondequoit Bay bluegill gill net CPUE's (2.17 – 0.33/net) are similar to Port Bay (2.3/net, Sanderson 2015), but much lower than gill net CPUE's from Conesus Lake, (46.0-9.4 /net; Sanderson 2017). The bluegill catch rate during the spring 2009 electrofishing survey was similarly low (4.8/hr.) and is much lower than a fall survey in Port Bay (377/hr., Sanderson 2012) and the catch rate of the lower third percentile from spring night electrofishing surveys from the NY Statewide Fisheries Database (Brooking et al. 2017). Low abundance of panfish species has resulted in few anglers targeting and catching them in Irondequoit Bay. Fishing for panfish (which included rock bass and bluegill) in Irondequoit Bay made up only 2% of the boat fishing and 3% of the boat fishing effort during a 2007 creel survey. Rock bass, pumpkinseed, and bluegill estimated catch rates were 0.02, 0.06, and 0.05 per hour, respectively (Sanderson 2009). Although sampled with gill nets, the 2015 rock bass PSD (78) was above the average PSD from fall night electrofishing surveys from the NY Statewide Fisheries database of 25 (Brooking et al. 2017). This comparison should be looked at with caution, because gill nets tend to under sample the smaller size groups. Bluegill size structure indices from the spring 2009 electrofishing survey falls above NY averages (PSD=58, RSDp=8.3). The mean stock density index values from spring night-time electrofishing for bluegill in NY waters from the NY Statewide Fisheries Database are PSD=38 and RSDp=5. Irondequoit Bay bluegill mean stock density index values fall within the upper third percentiles from these night electrofishing surveys (Brooking et al. 2017). Irondequoit Bay rock bass and bluegill exhibit good growth and are in good condition, which might be expected given the low abundance of these species.

Largemouth bass

Largemouth bass abundance in Irondequoit Bay is average when compared to other New York State waters. The spring 2009 electrofishing CPUE of 21/hr. is slightly higher than electrofishing catch rates that were calculated from 222 lakes for largemouth bass (mean ± SD = 17 ± 19/hr., range: 0 – 114/h; Perry et al. 2014). However, the Irondequoit Bay largemouth bass CPUE, falls below the overall mean CPUE (39/hr.), but within the middle third percentile (13-45/hr.) from spring night electrofishing surveys from the NY Statewide Fisheries Database (Brooking et al. 2017). CPUE's for spring age-1, stock, quality, and preferred size groups also fall within these ranges.

The size quality of Irondequoit Bay largemouth bass is good (PSD=65, RSDp=14). PSDs were determined for 42 lakes for largemouth bass (mean ± SD = 55 ± 24, range: 2 – 93) and the mean (±SD) RSDp for largemouth bass was 19 ± 14 (Perry et al. 2014). The mean stock density index values from spring night-time electrofishing for largemouth bass in NY waters from the NY Statewide Fisheries Database are PSD=57 and RSDp=24. Irondequoit Bay largemouth bass mean stock density index values fall within the middle third percentiles from these night electrofishing surveys (Brooking et al. 2017).

With high to average largemouth bass PSD (i.e., 40-70), high bluegill PSD (i.e., 20-60), and abundance of each species low, the largemouth bass population in Irondequoit Bay might be considered to be in balance with the bluegill population (Gabelhouse 1984, Green 1989, Brooking et. al 2017). Exploitation and recruitment are expected to be low, and growth rate is expected to be high for both bass and sunfish (Brooking et al. 2017). Results of a 2007 recreational fishery survey on Irondequoit Bay confirms that largemouth bass exploitation is low. Even though the largemouth bass directed effort catch rate was excellent (0.80/hr.), 94% of all largemouth bass caught were released, and 42% of the released bass were legal sized (Sanderson 2009). Growth of largemouth bass is excellent in Irondequoit Bay. Mean total length at all ages are above NYS averages (Perry et al. 2016) and mean relative weight is near or above 100 for all size categories. Similar high abundance, excellent growth, condition (Sanderson 2015) and angler catch rates (Sanderson 2014) were reported for largemouth bass in nearby Port Bay.

Although smallmouth bass are vulnerable to gill nets and electrofishing, the fact that none were caught during the sampling period is confounding. Sanderson (2009) estimated that 554 were caught by anglers in 2007-2008, suggesting that smallmouth bass abundance is relatively low in Irondequoit Bay.

RECOMMENDATIONS

1. Continue the current statewide and special Lake Ontario angling regulations for Irondequoit Bay, particularly those that provide additional protection for walleyes and northern pike.

2. Continue stocking 36,000 pond fingerling walleyes every other year. If possible, mark fish with OTC to help with age determination and to help determine the contribution of natural reproduction.

3. Use data collected during standard gang gill netting (see recommendation 5) to monitor the relative survival and contribution of stocked walleye fingerlings to the Irondequoit Bay walleye population.

4. Continue the annual Cooperating Angler Diary Program, which is particularly useful for tracking smallmouth and largemouth bass, which are less vulnerable to gill net sampling gear. Recruit more cooperating angler diary keepers. Develop a means for anglers to directly enter fishing and catch information electronically perhaps via internet or smart phones.

5. Continue to monitor the warmwater fish community, and walleye, smallmouth bass, northern pike, yellow perch, and alewife population characteristics via region 8 Finger Lakes standard gang gill nets at five year intervals, next scheduled for September 2020. Continue using otoliths to age walleye from gill nets. Begin to use otoliths to age smallmouth bass and yellow perch from gill net surveys, or anal spines to age yellow perch. Continue to examine stomach contents of walleye and smallmouth bass from gill net surveys

6. Continue periodic night time electrofishing surveys for additional warmwater fish community information, particularly young of year and juvenile smallmouth bass and all ages of largemouth bass. The last survey was conducted in 2009. The next survey is scheduled for June 2019 and should be conducted in accordance with the recently finalized bass sampling manual (Brooking et al. 2019).

7. Continue to observe walleye and northern pike spawning runs in Irondequoit Creek and wetlands. Remove any observed barriers to fish migration. Inventory and rate the quality of suitable walleye and northern pike spawning habitats.

8. Develop a management plan for the Irondequoit Bay fishery by December 2020. Seek public input into the development of the plan objectives. Plan objectives should consider the existing fish community, realistic use projections, and current angling patterns. Population size structure indices and catch rates of quality and preferred sized fish should be emphasized in the objectives.

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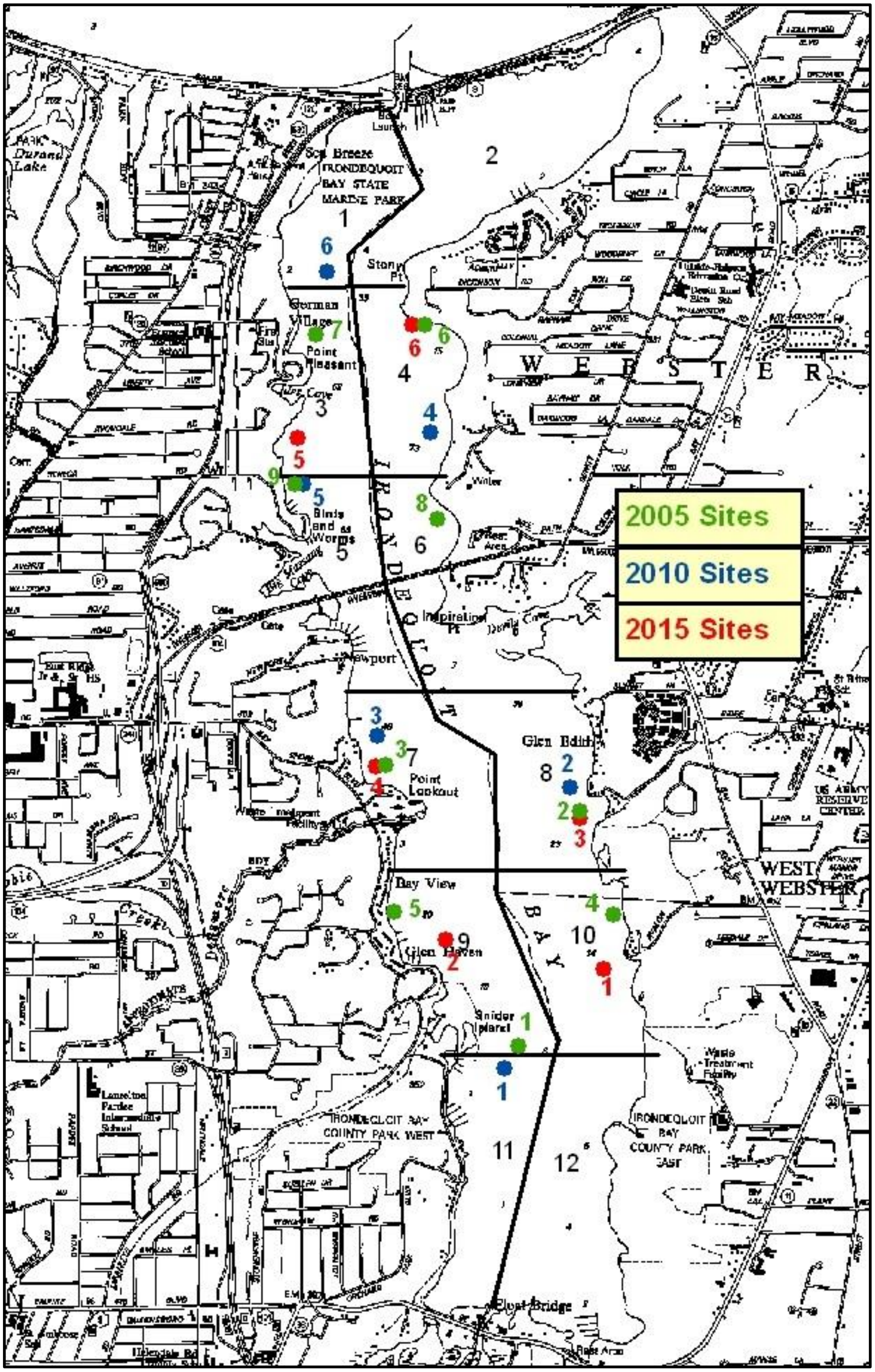

Figure 1. Irondequoit Bay showing sampling grids and gill net sampling locations.

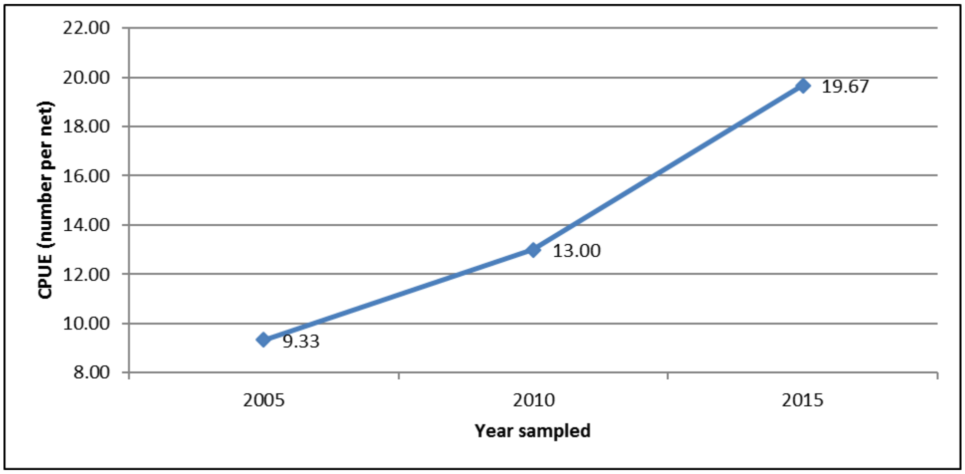

Figure 2. Index of abundance of walleyes sampled with gill nets in Irondequoit Bay from 2005 to 2015.

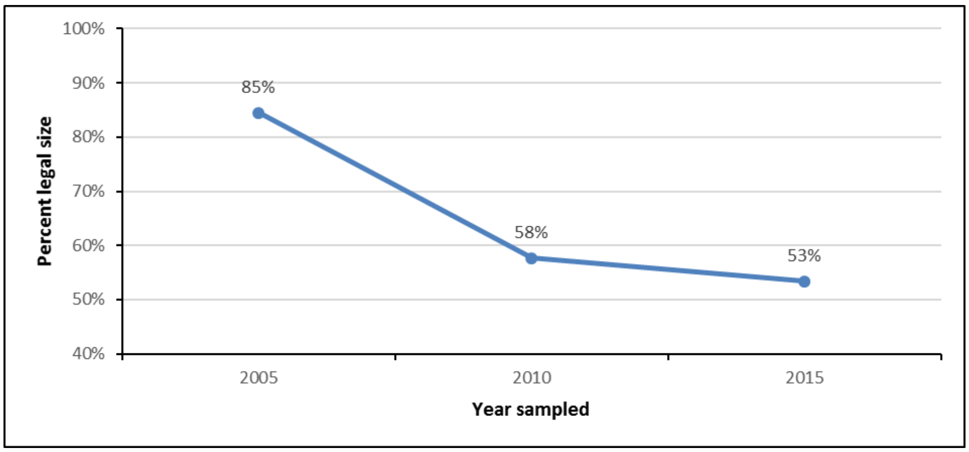

Figure 3. Percent of collected walleyes that were legal size or larger in Irondequoit Bay from 2005 to 2015.

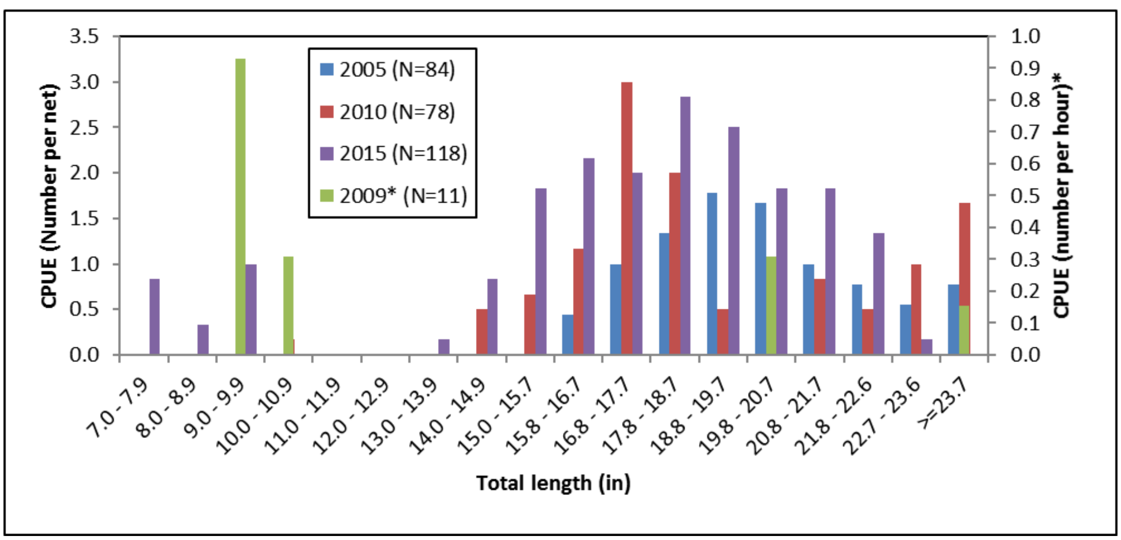

Figure 4. Number of collected walleyes per net and per hour in one-inch total length categories in Irondequoit Bay from 2005 to 2015.

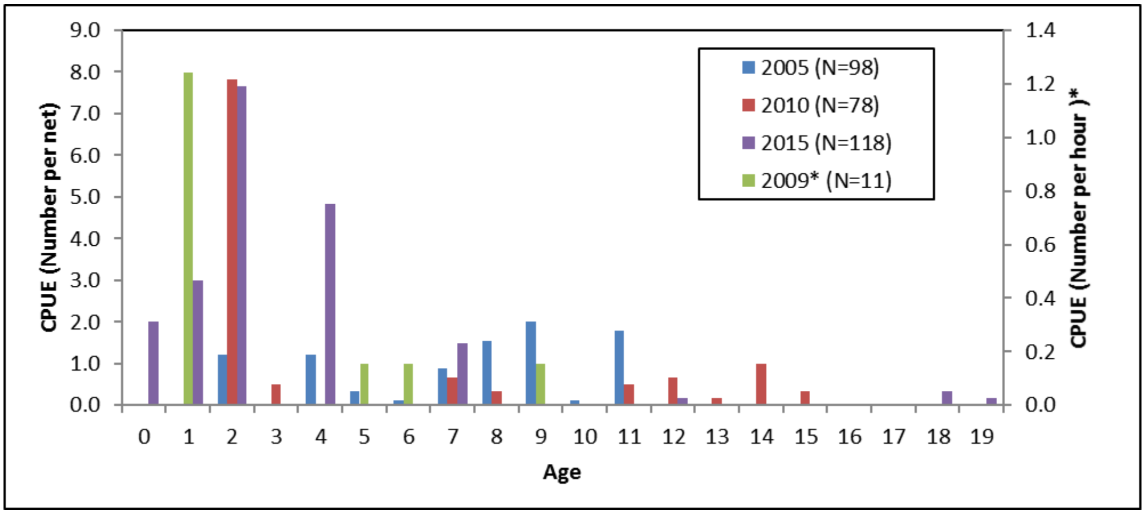

Figure 5. Age distribution of walleyes per net and per hour sampled in Irondequoit Bay from 2005 to 2015.

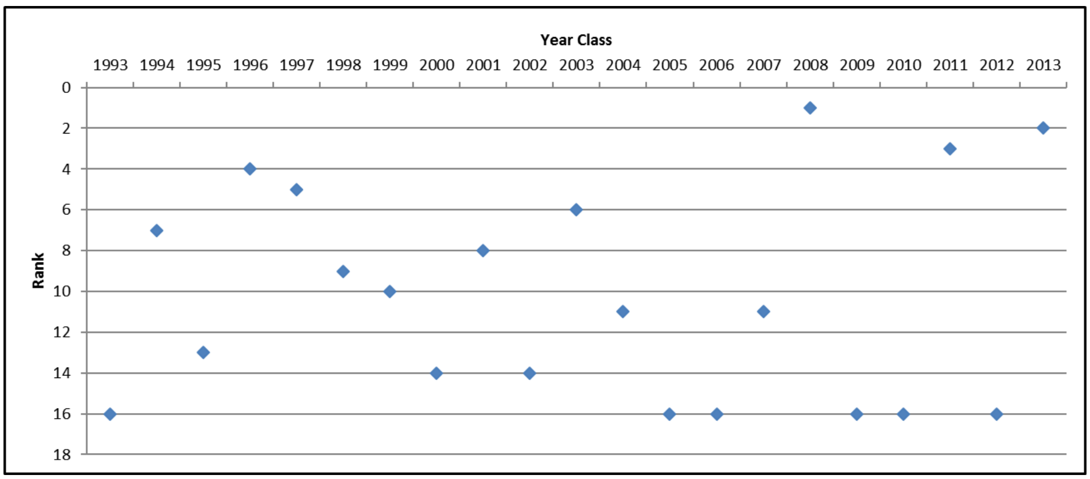

Figure 6. Contribution of Irondequoit Bay walleye year-classes age 3-16.

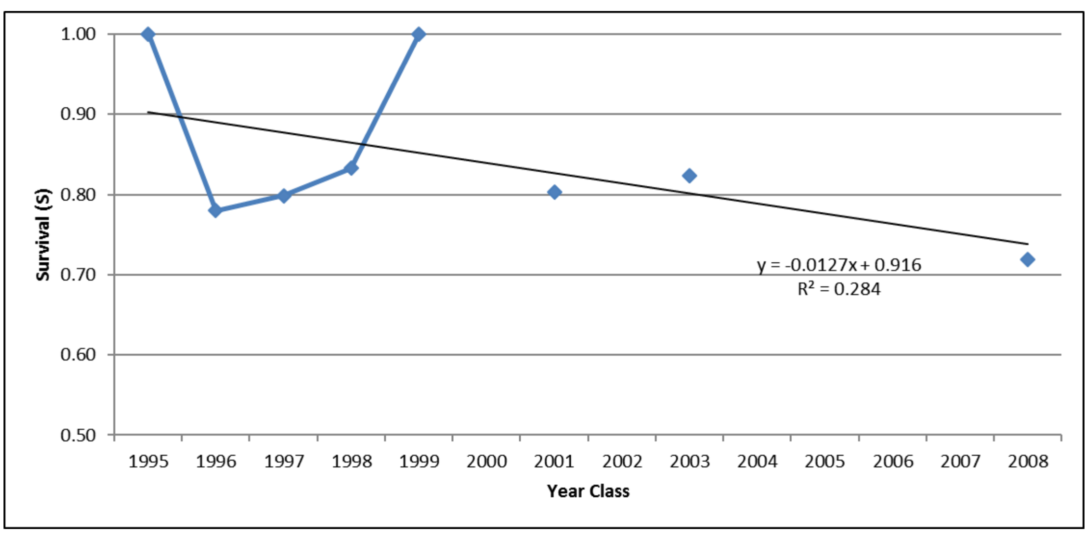

Figure 7. Annual survival of year class of Irondequoit Bay walleyes age 3-13.

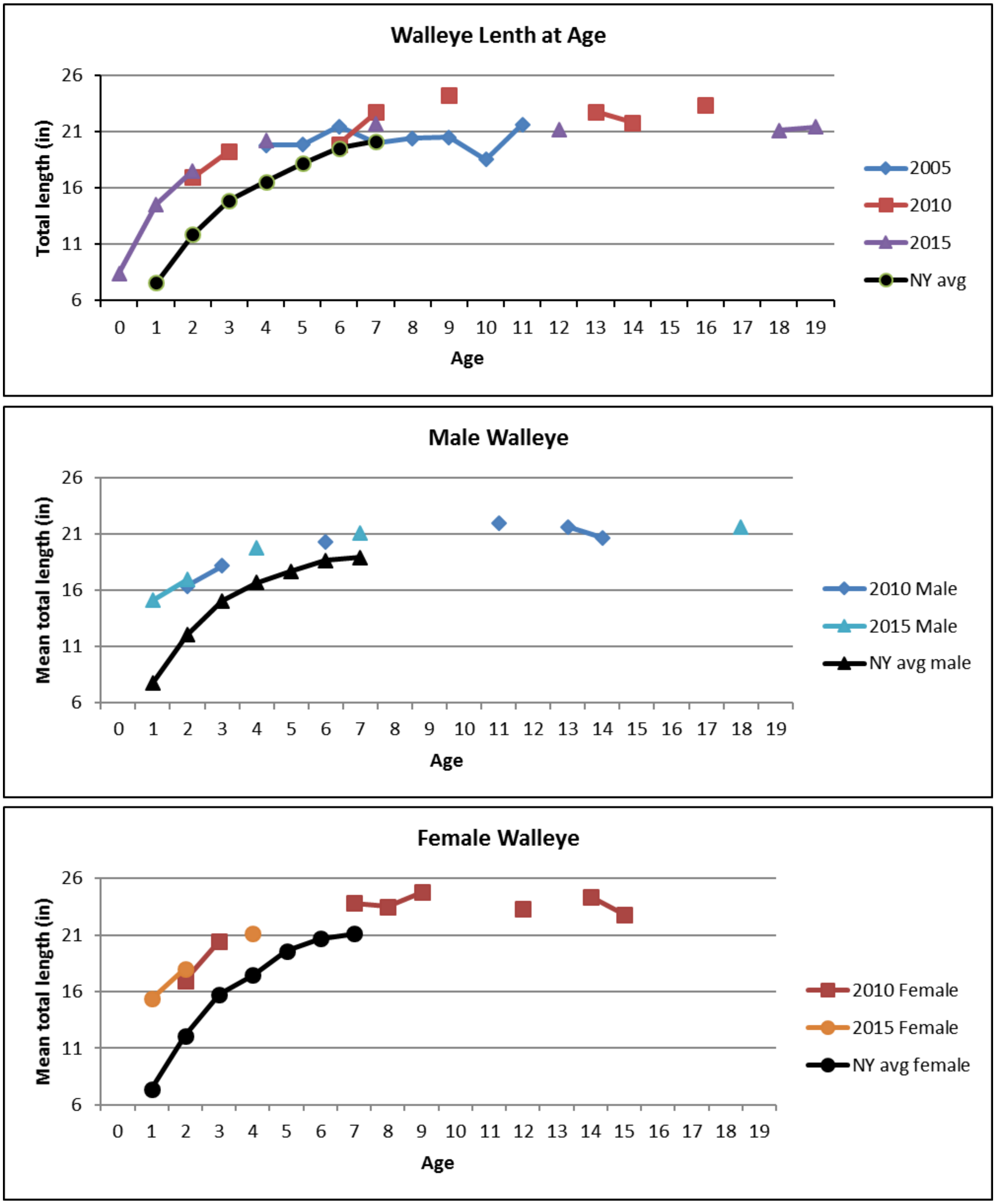

Figure 8. Mean total length at age of walleyes sampled from Irondequoit Bay from 2005 to 2015.

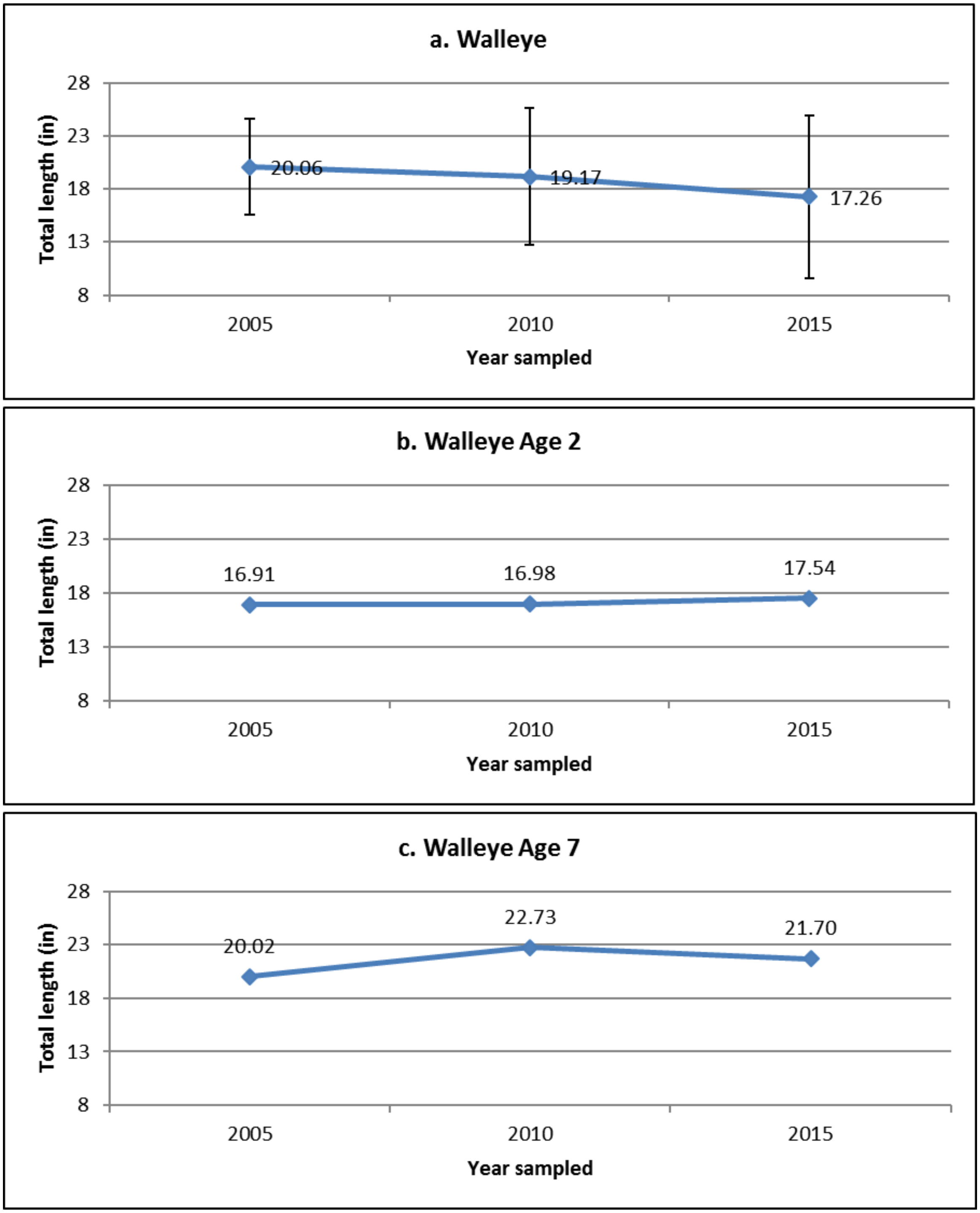

Figure 9. Mean total length of walleyes sampled from Irondequoit Bay from 2005 to 2015.

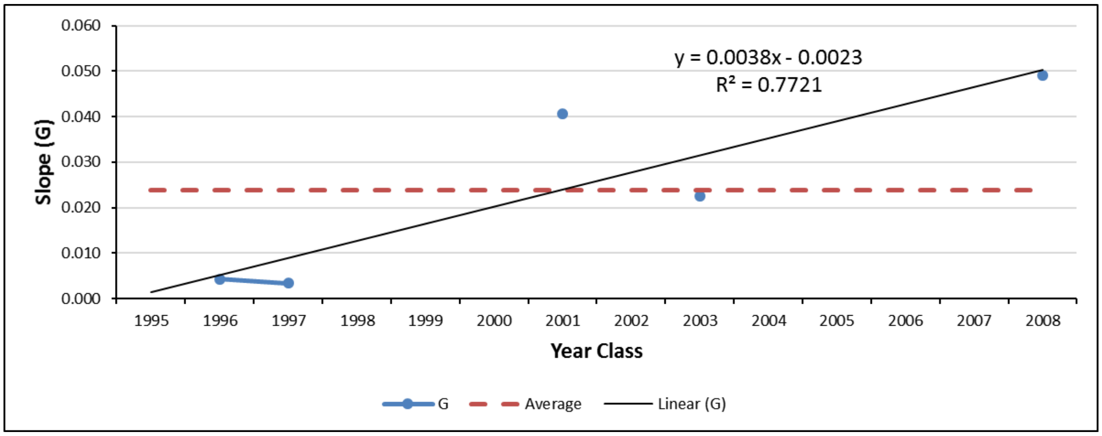

Figure 10. Growth rate of Irondequoit Bay walleyes age 2-19.

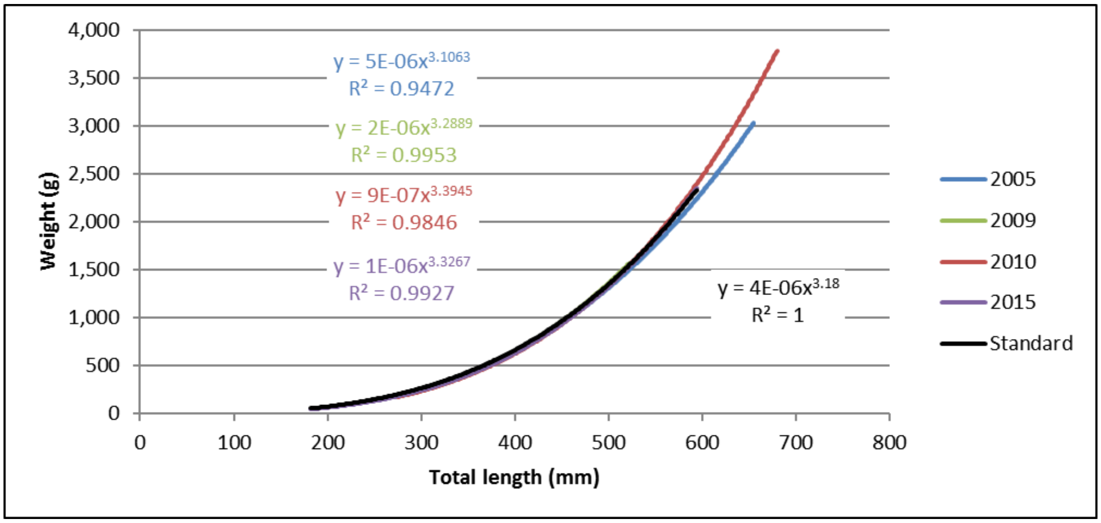

Figure 11. Total length vs. weight of walleyes sampled from Irondequoit Bay from 2005 to 2015.

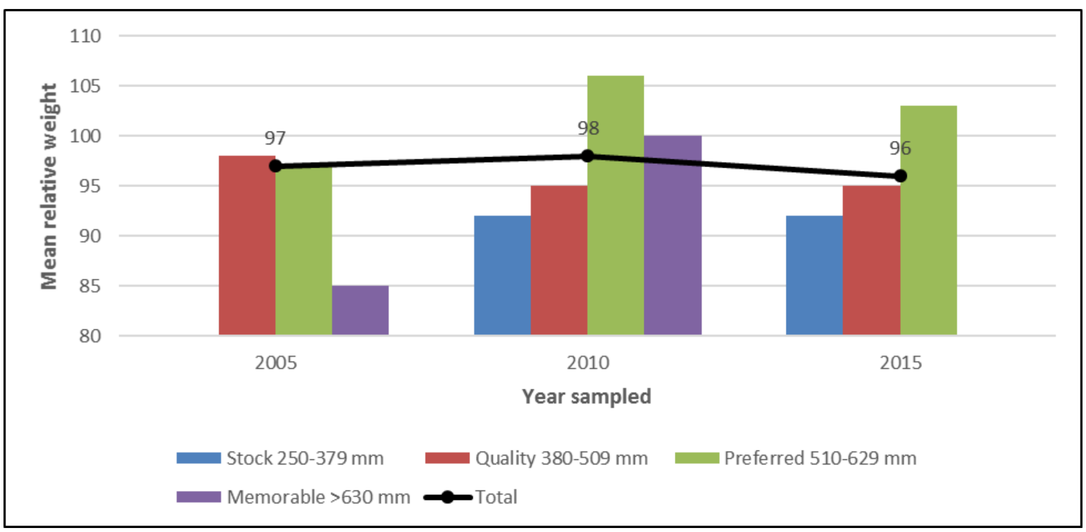

Figure 12. Relative weight by size group categories of walleye sampled from Irondequoit Bay from 2005 to 2015.

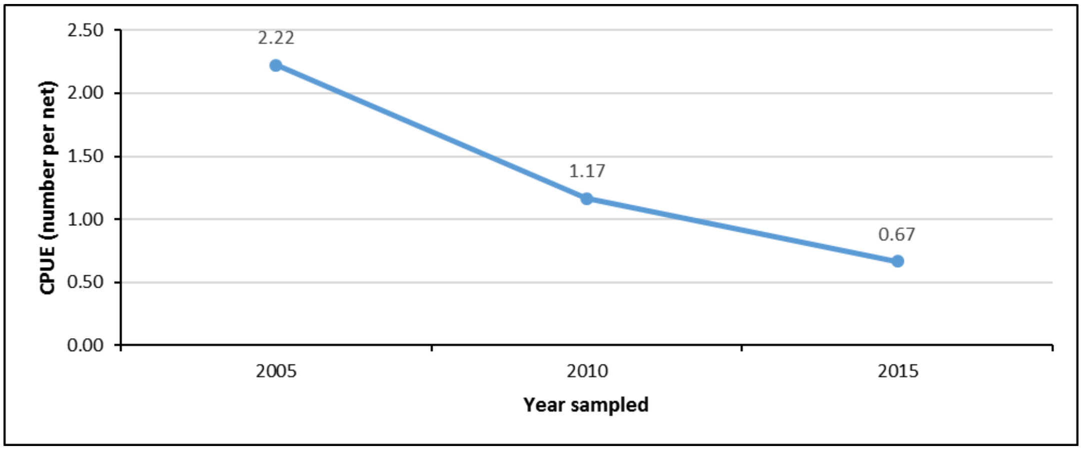

Figure 13. Index of abundance of Northern pike sampled in gill nets in Irondequoit Bay from 2005 to 2015.

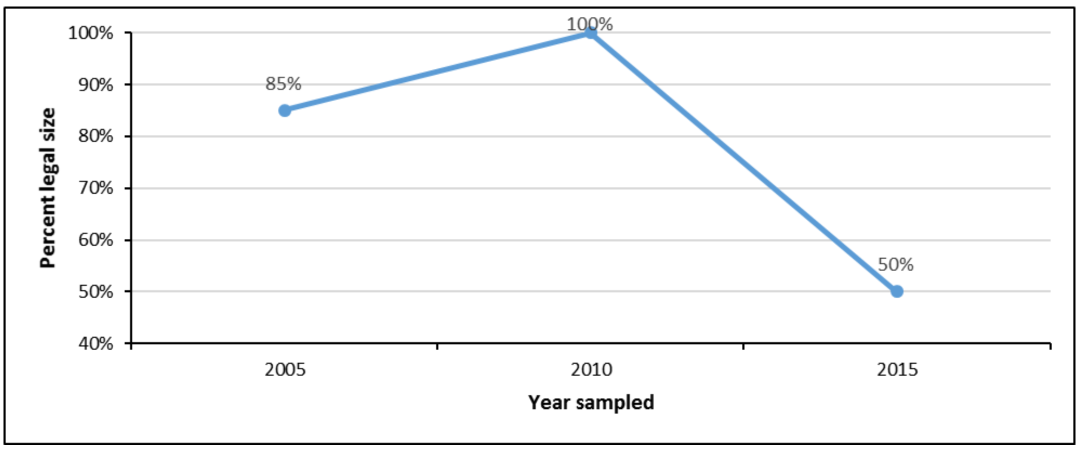

Figure 14. Percent of collected Northern pike that were legal size or larger in Irondequoit Bay from 2005 to 2015.

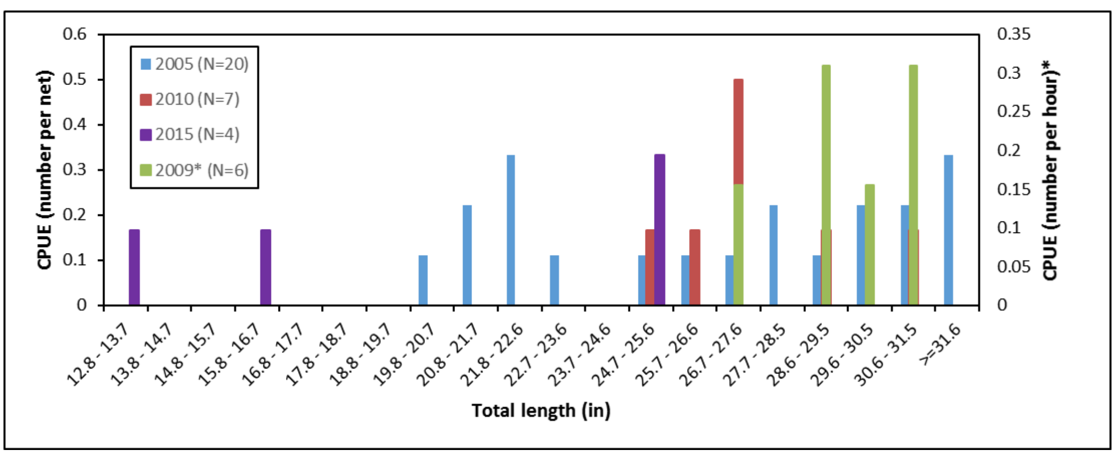

Figure 15. Number of collected Northern pike per net and per hour in one-inch total length categories in Irondequoit Bay from 2005 to 2015.

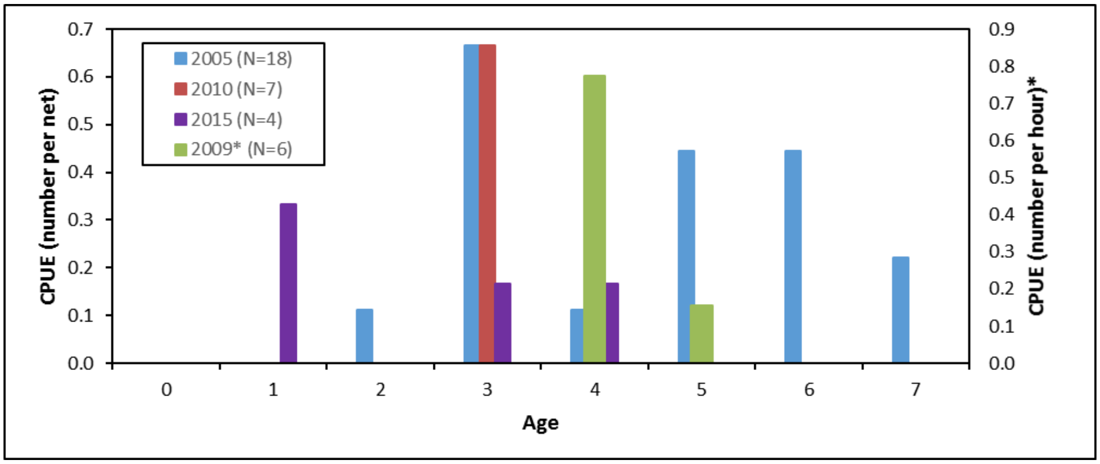

Figure 16. Age distribution of Northern pike per net and per hour sampled in Irondequoit Bay from 2005 to 2015.

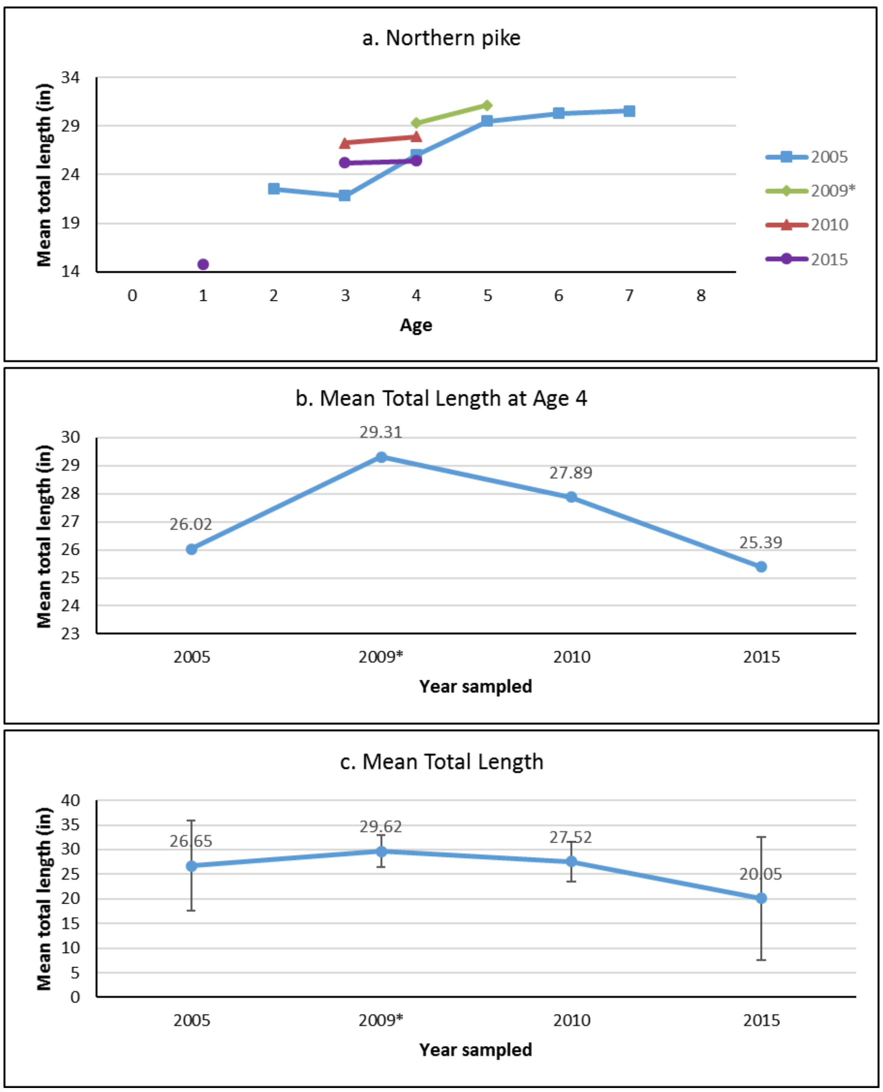

Figure 17. Mean total length at age (a. and b.) and mean total length (c.) of Northern pike sampled in Irondequoit Bay from 2005 to 2015.

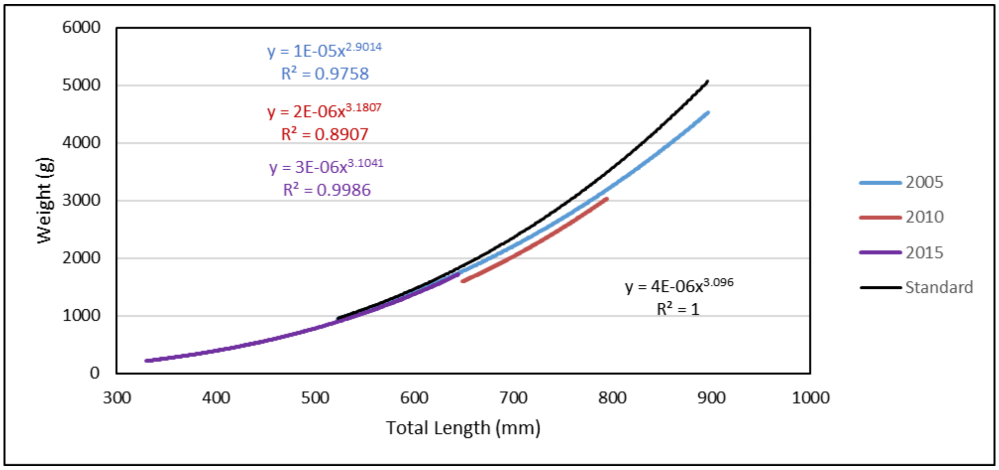

Figure 18. Total length vs. weight of Northern pike sampled in Irondequoit Bay from 2005 to 2015

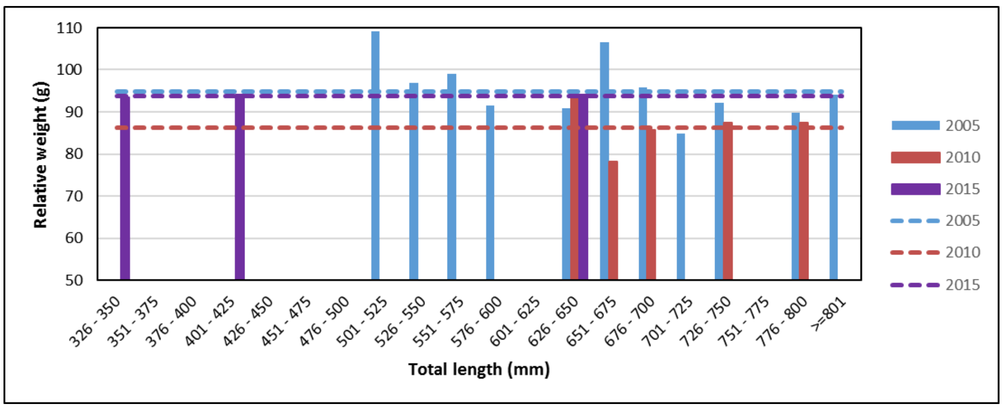

Figure 19. Relative weight of collected Northern pike by one-inch total length categories in Irondequoit Bay from 2005 to 2015.

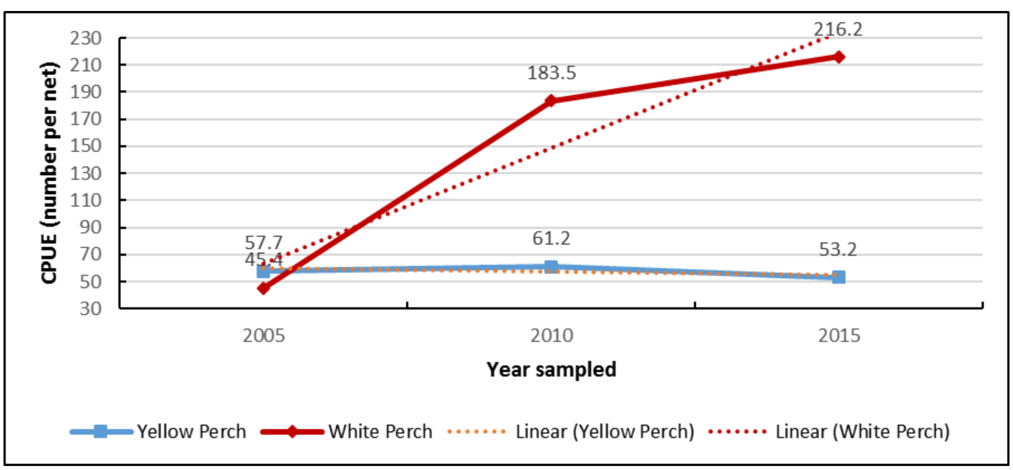

Figure 20. Index of abundance of yellow perch and white perch sampled in Irondequoit Bay from 2005 to 2015.

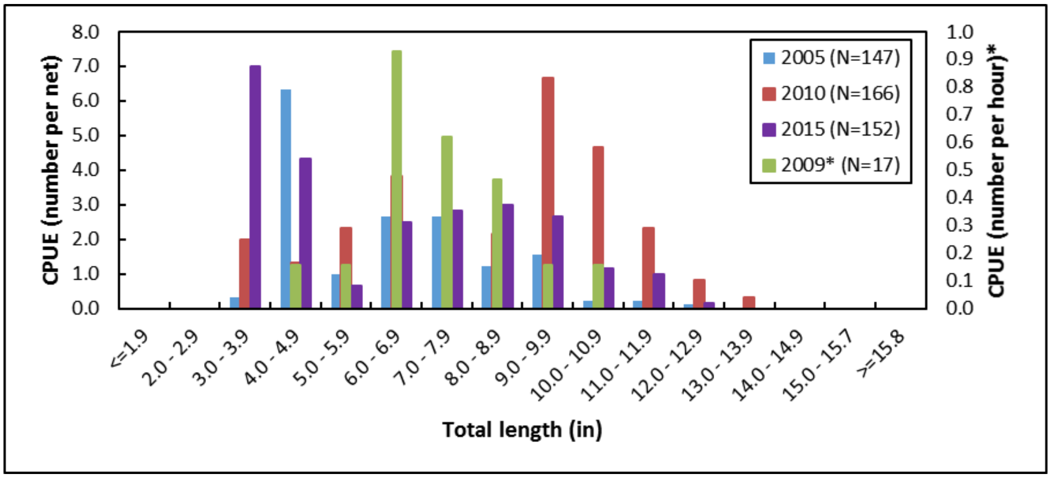

Figure 21. Number of collected yellow perch per net and per hour in one-inch total length categories in Irondequoit Bay from 2005 to 2015.

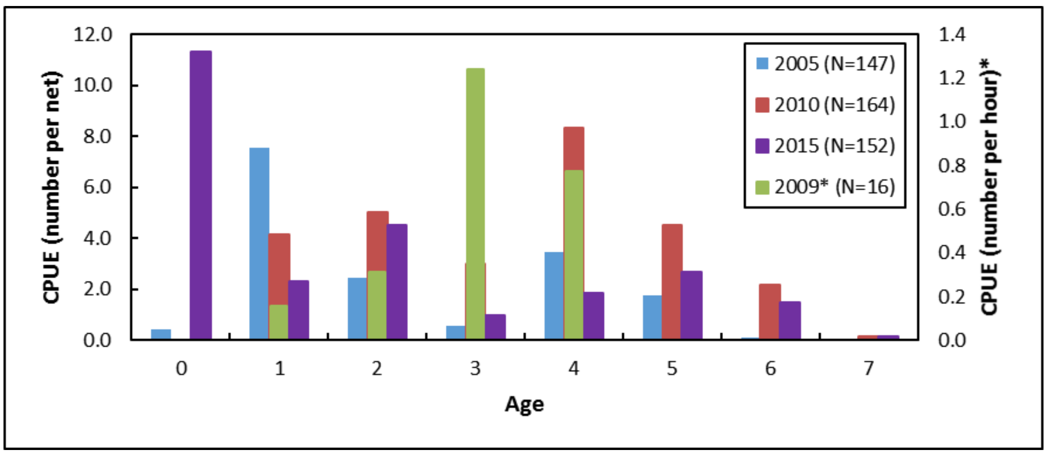

Figure 22. Age distribution of yellow perch per net and per hour sampled in Irondequoit Bay from 2005 to 2015.

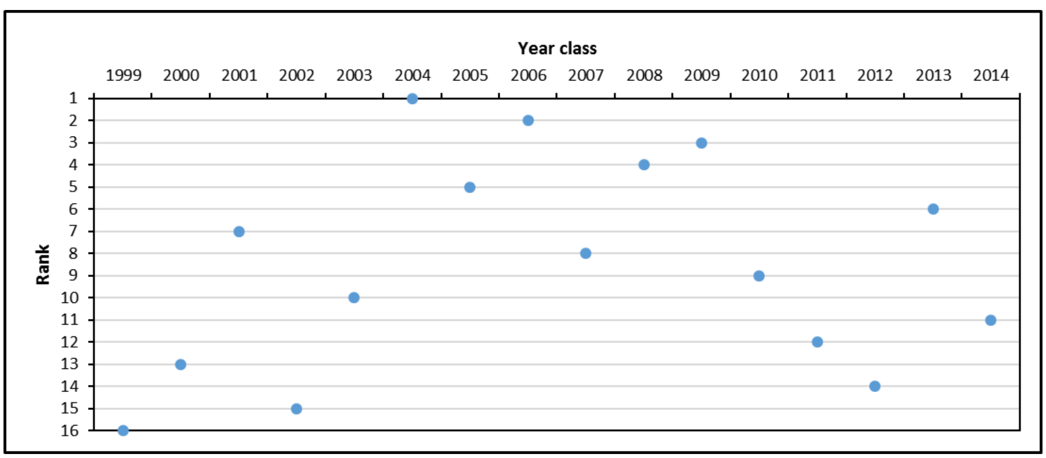

Figure 23. Contribution of Irondequoit Bay yellow perch year-classes age 1-7.

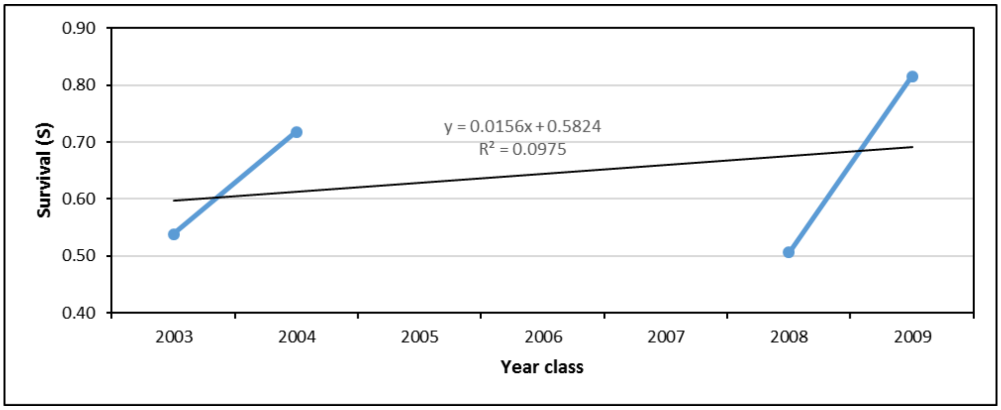

Figure 24. Annual survival of year classes of Irondequoit Bay yellow perch age 1-7.

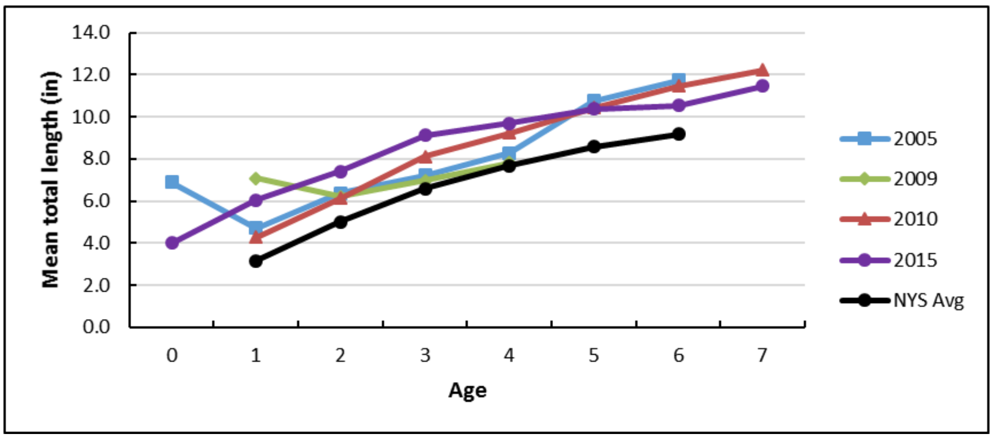

Figure 25. Mean total length at age of yellow perch sampled in Irondequoit Bay from 2005 to 2015.

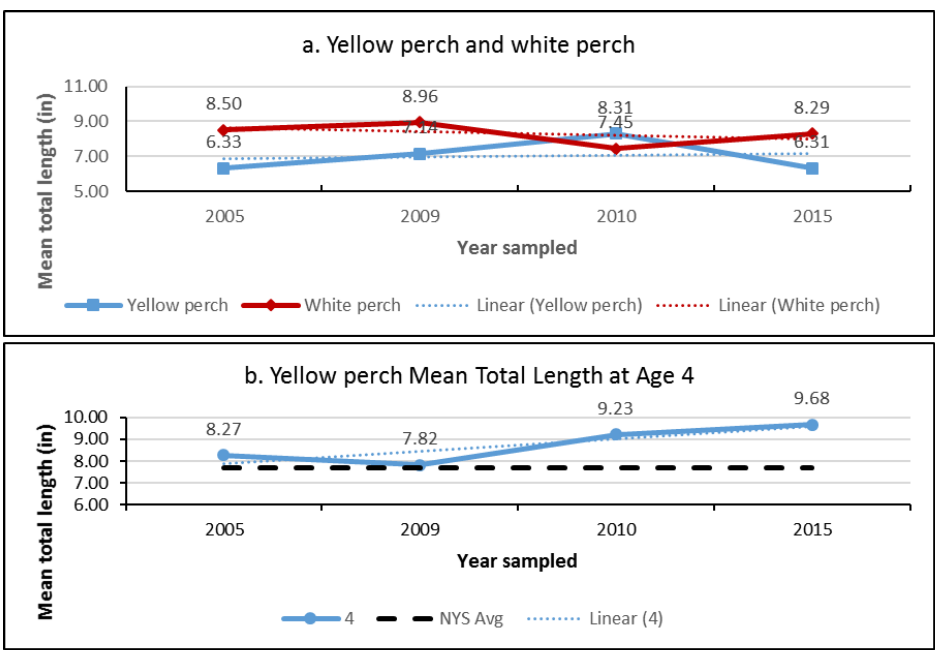

Figure 26. (a.) Mean total length of yellow perch and white perch and (b.) mean total length of age 4 yellow perch sampled in Irondequoit Bay from 2005 to 2015.

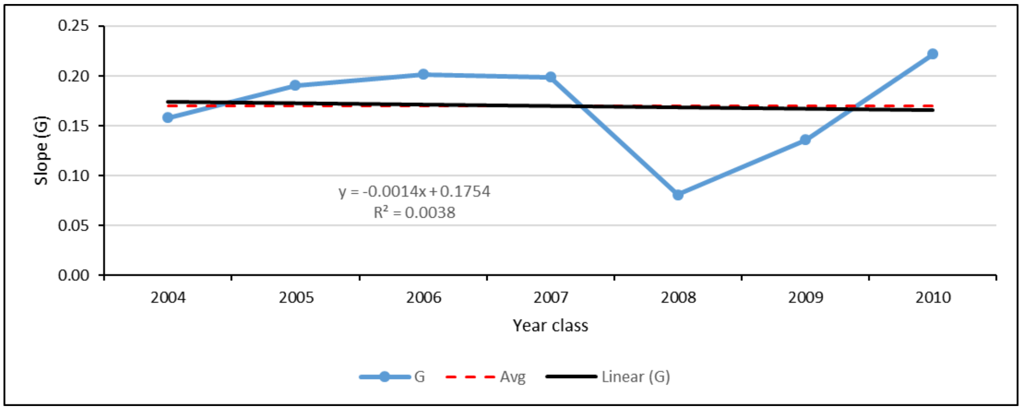

Figure 27. Growth rate (G) of Irondequoit Bay yellow perch age 1-7.

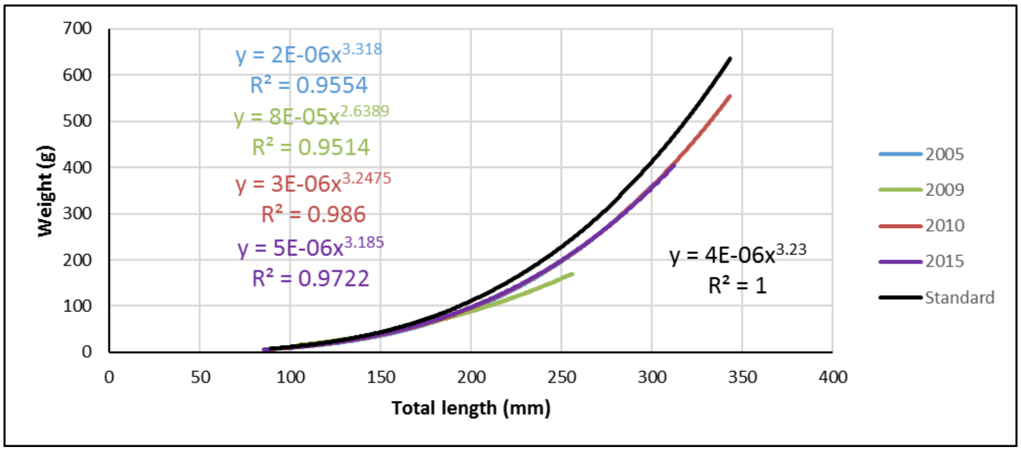

Figure 28. Total length vs weight of yellow perch sampled in Irondequoit Bay from 2005 to 2015.

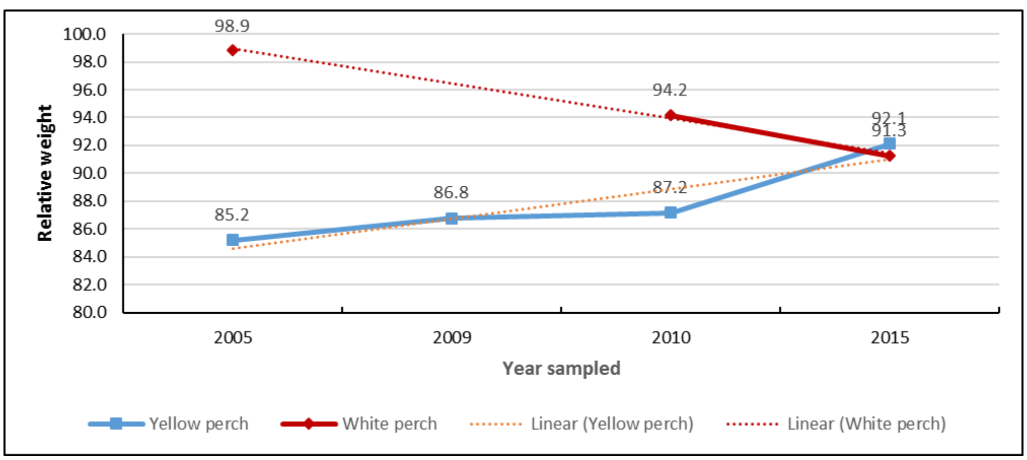

Figure 29. Mean relative weight of yellow perch and white perch sampled in Irondequoit Bay from 2005 to 2015.

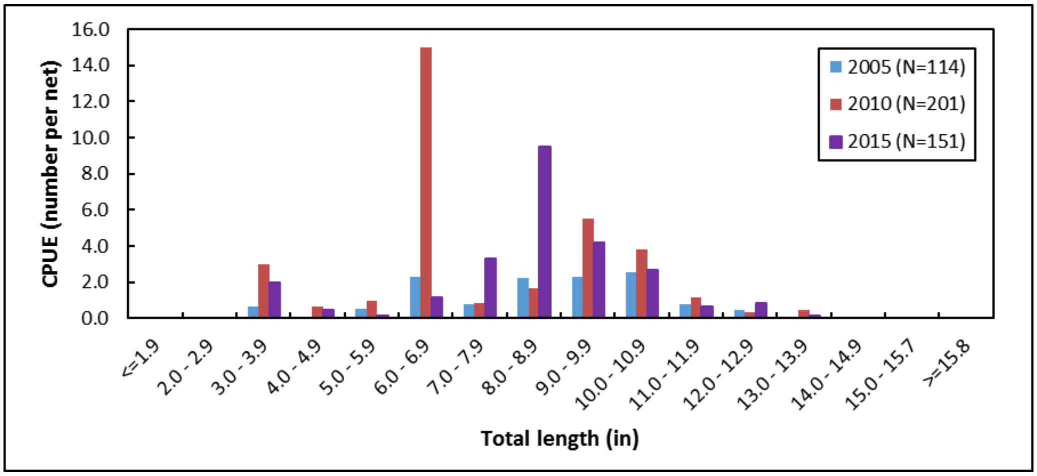

Figure 30. Number of collected white perch per net in one-inch total length categories in Irondequoit Bay from 2005 to 2015.

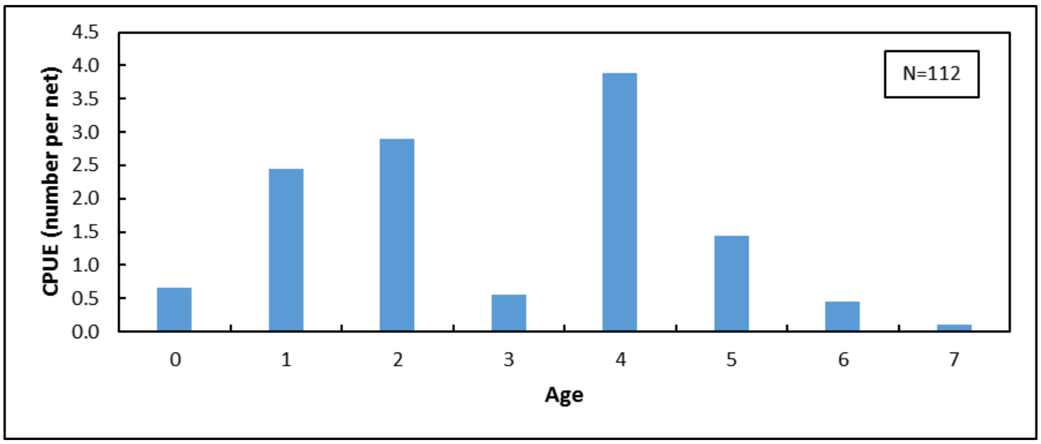

Figure 31. Age distribution of white perch sampled from Irondequoit Bay in 2005.

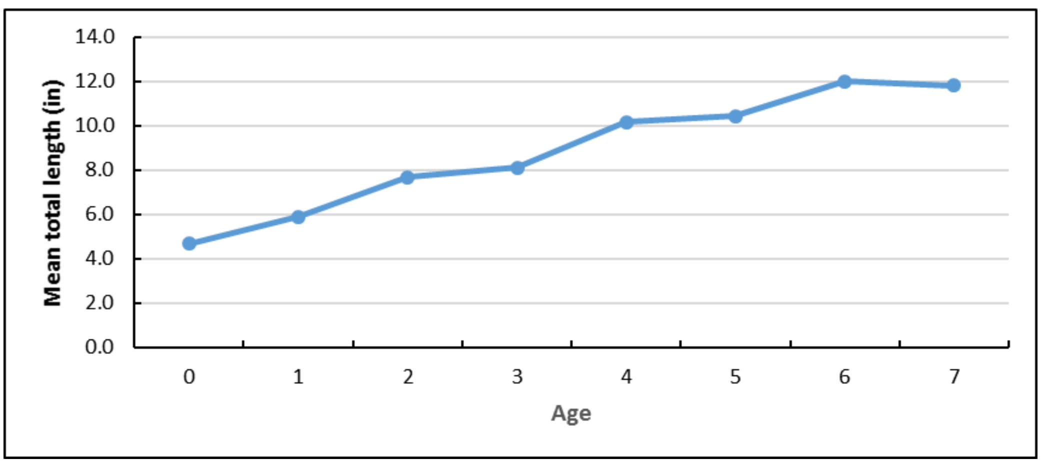

Figure 32. Mean total length at age of white perch sampled from Irondequoit Bay in 2005.

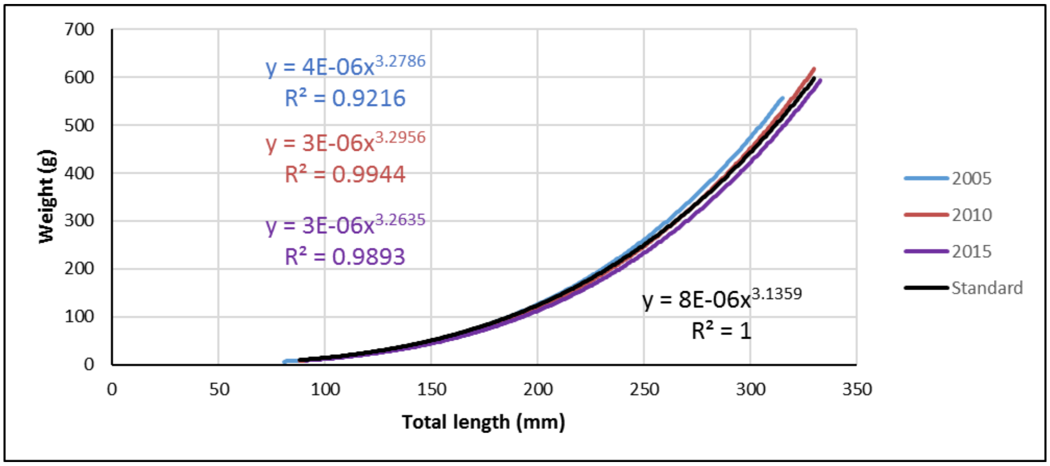

Figure 33. Total length vs. weight of white perch sampled in Irondequoit Bay from 2005 to 2015.

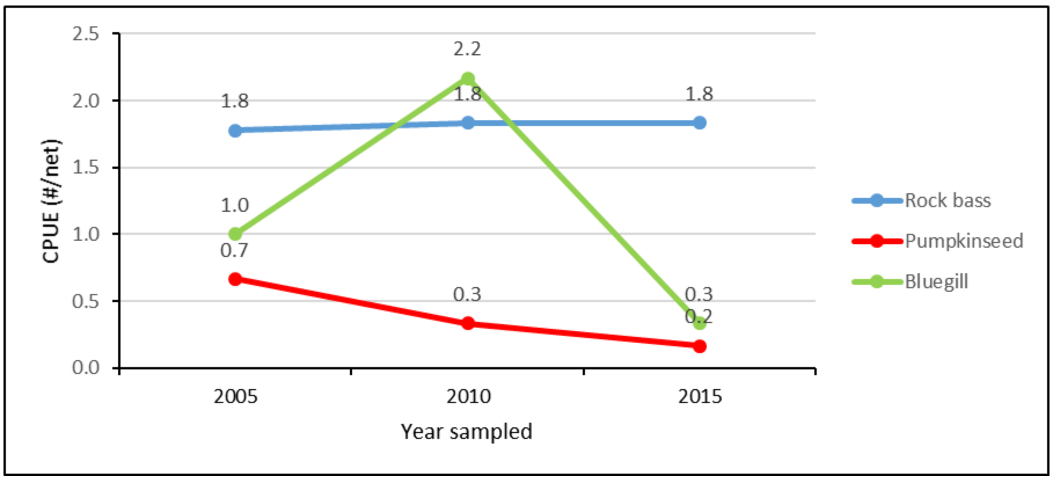

Figure 34. Index of abundance of panfish species sampled in Irondequoit Bay from 2005 to 2015.

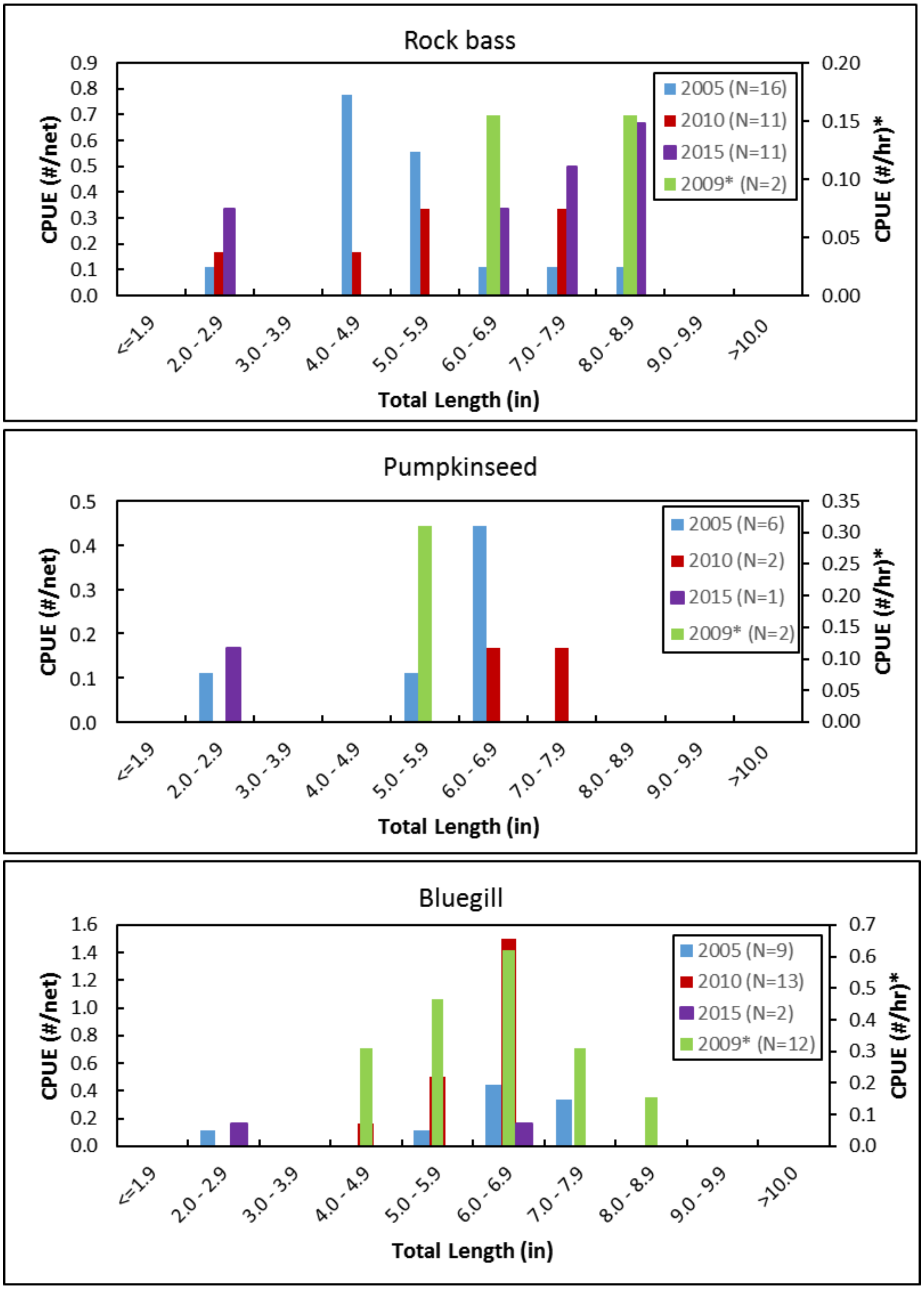

Figure 35. Number of collected panfish species per net and per hour in one-inch total length categories in Irondequoit Bay from 2005 to 2015. Note scale difference.

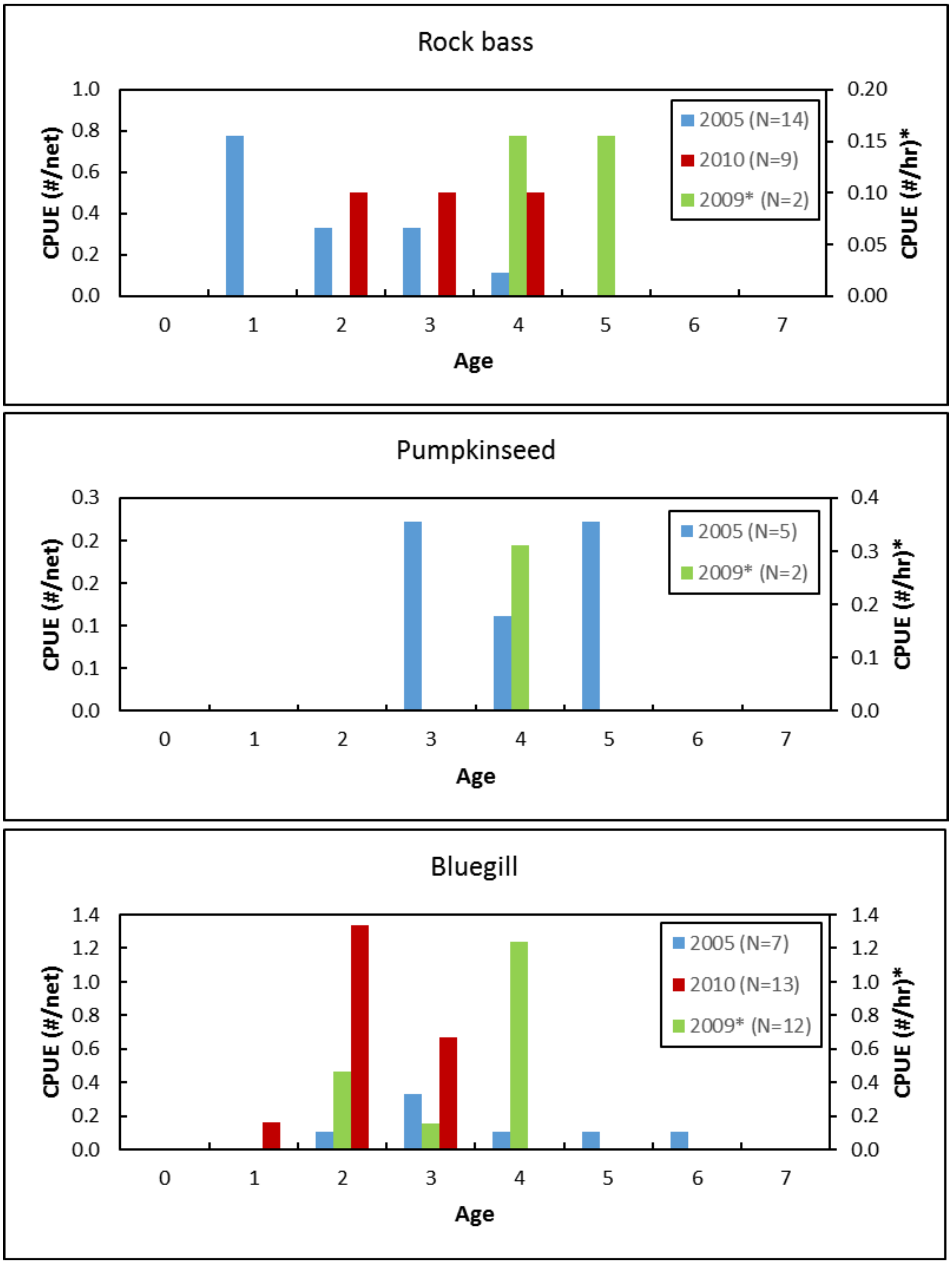

Figure 36. Age distribution of panfish species per net and per hour sampled in Irondequoit Bay from 2005 to 2015. Note scale difference.

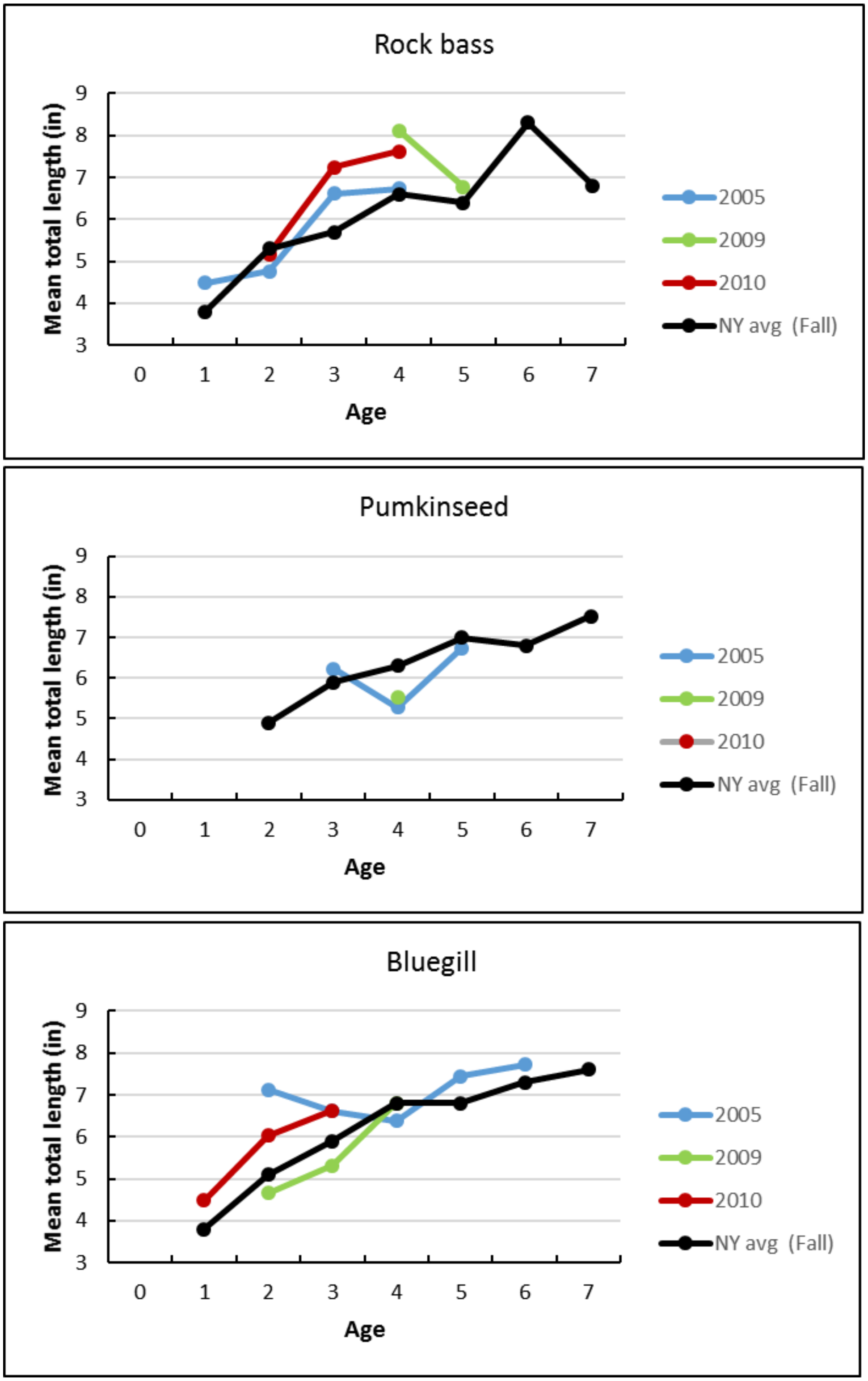

Figure 37. Mean total length at age of panfish species sampled in Irondequoit Bay from 2005 to 2015.

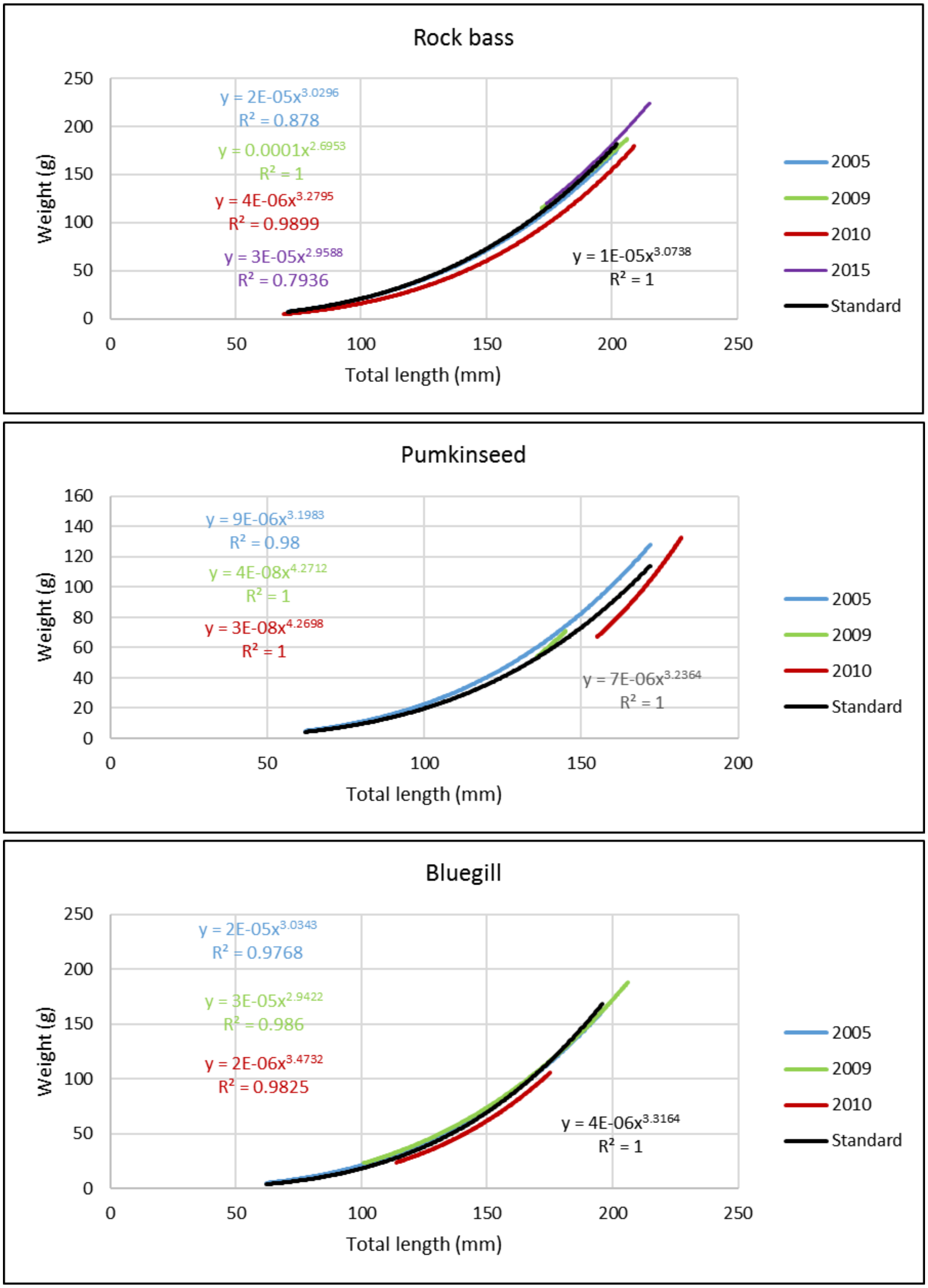

Figure 38. Total length vs. weight of panfish species sampled in Irondequoit Bay from 2005 to 2015.

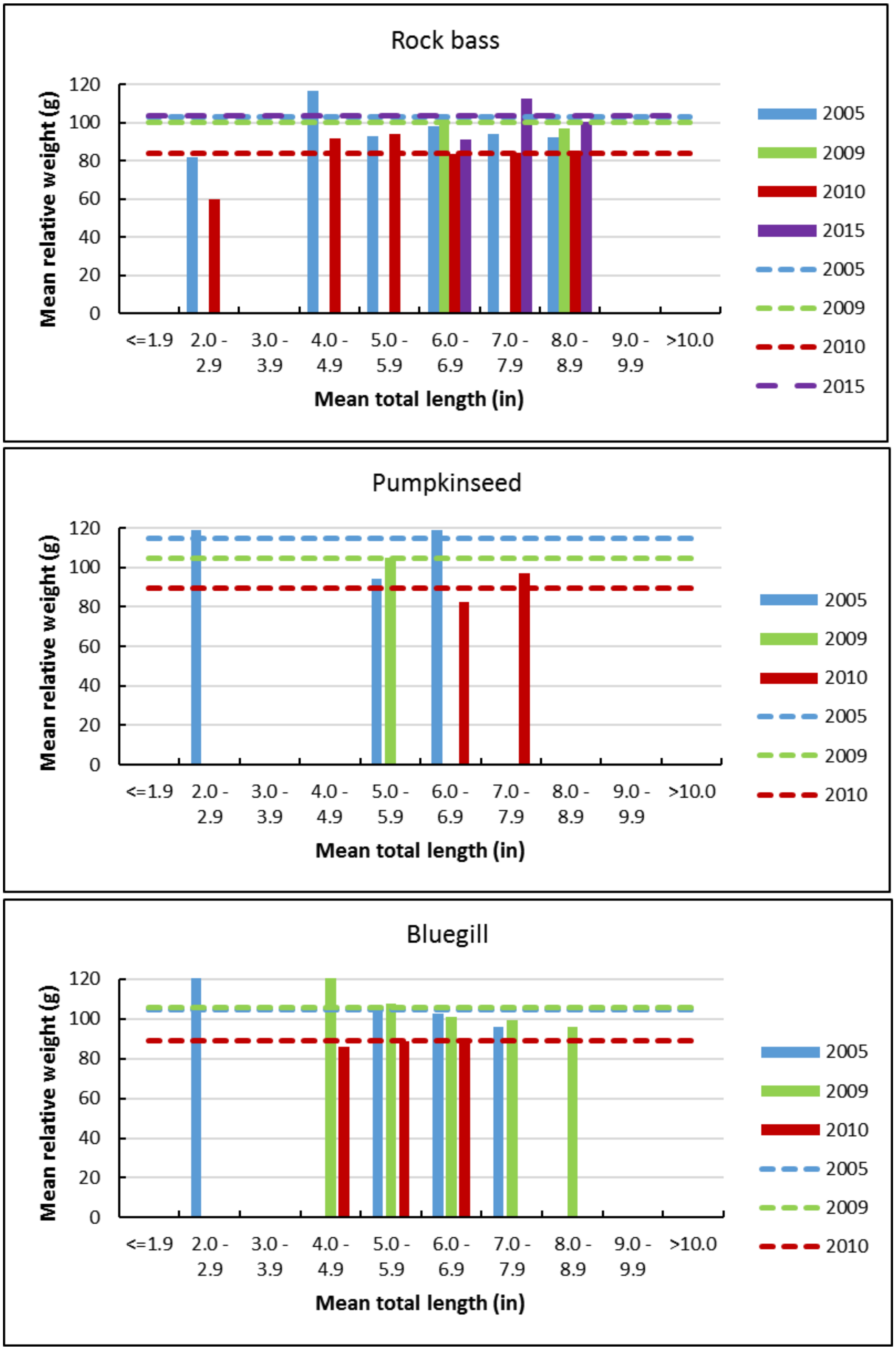

Figure 39. Relative weight of collected panfish species by one-inch total length categories in Irondequoit Bay from 2005 to 2015.

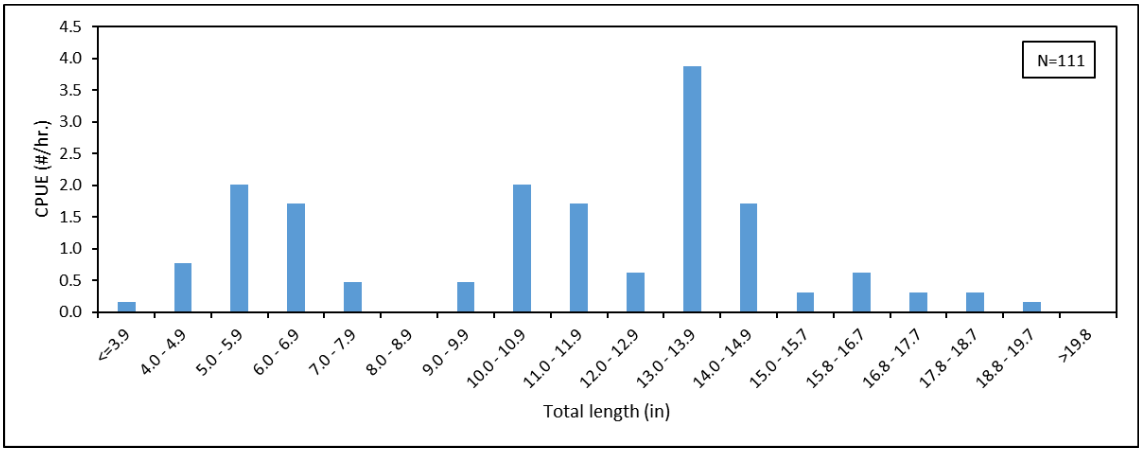

Figure 40. Number of collected largemouth bass per hour in one-inch total length categories from Irondequoit Bay in 2009.

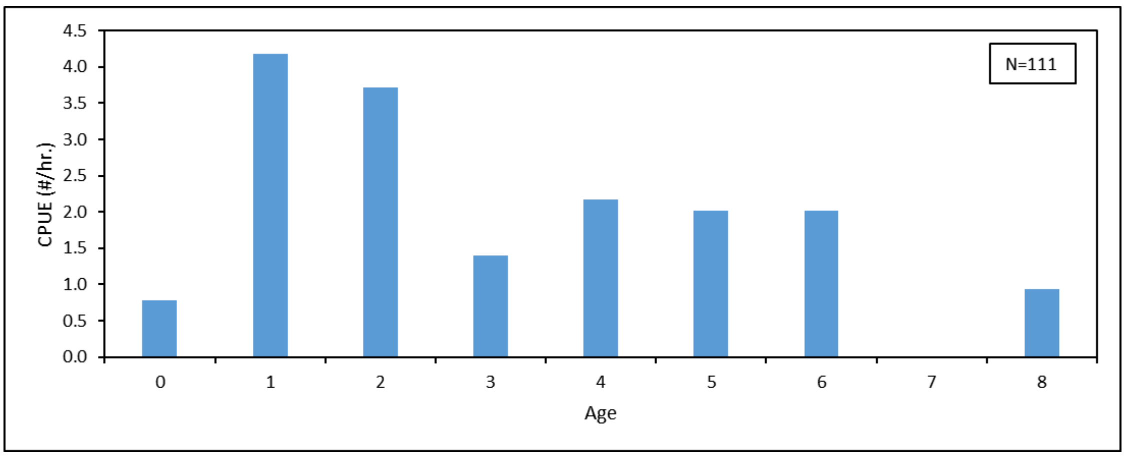

Figure 41. Age distribution of largemouth bass per hour sampled from Irondequoit Bay in 2009.

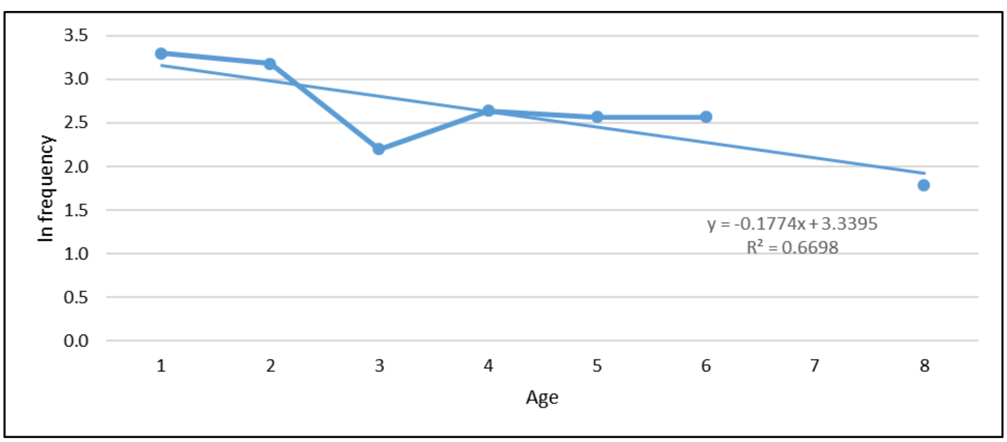

Figure 42. Mortality rate of Irondequoit Bay largemouth bass estimated from 2009 electrofishing age data.

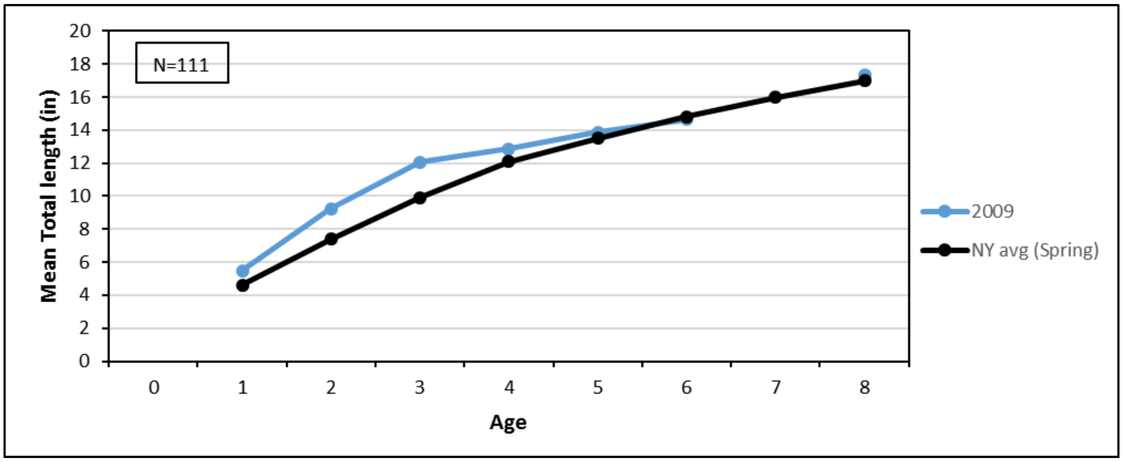

Figure 43. Mean total length at age of largemouth bass sampled from Irondequoit Bay in 2009.

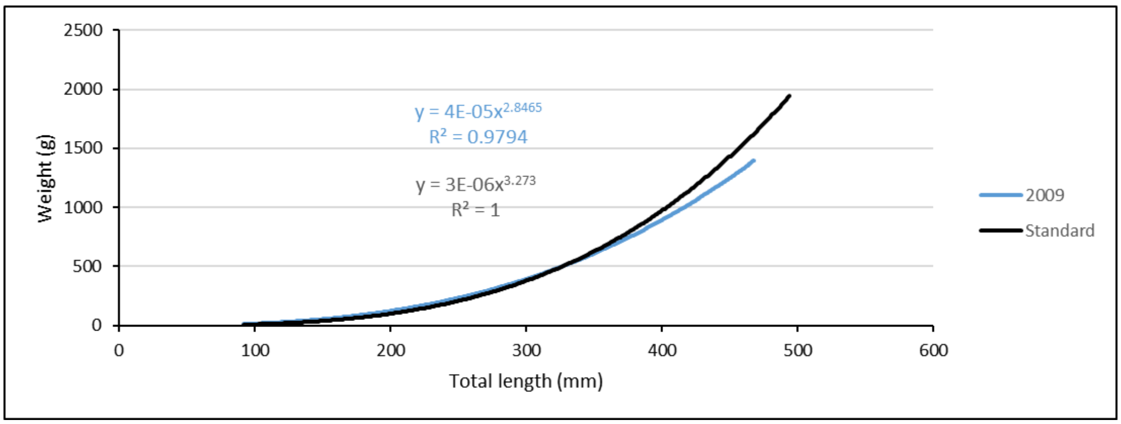

Figure 44. Total length vs. weight of largemouth bass sampled from Irondequoit Bay in 2009.

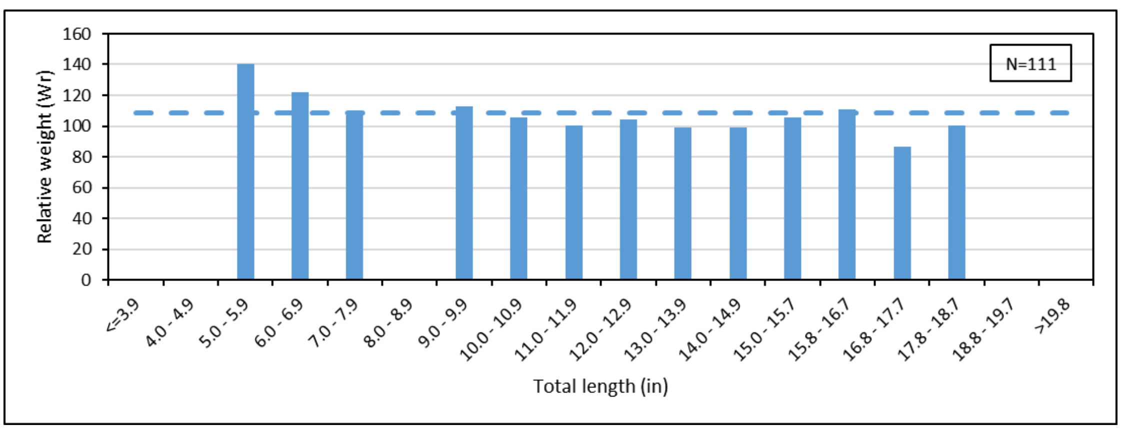

Figure 45. Relative weight of collected largemouth bass by one-inch total length categories from Irondequoit Bay in 2009.

Table 1. Location of gill net sets in Irondequoit Bay in September from 2005 to 2015.

Site	Date	NYTME	NYTMN	Time Fish (hr)	Min Depth (ft)	Max Depth (ft)
			2005			
01	9/13/2005	294871	4784952	19.5	15.0	20.0
02	9/13/2005	295210	4786193	19.6	16.0	16.3
03	9/13/2005	294102	4786477	20.0	17.7	22.3
04	9/14/2005	295354	4785684	19.1	16.0	21.0
05	9/14/2005	294183	4785676	19.1	18.0	23.6
06	9/15/2005	294355	4788804	20.2	16.0	23.0
07	9/15/2005	293755	4788779	20.3	17.0	25.0
08	9/16/2005	294430	4787768	20.0	19.0	25.0
09	9/16/2005	293674	4787952	20.0	18.0	25.0
			2010			
01	9/21/2010	294759	4784855	19.1	12.0	14.0
02	9/21/2010	295115	4786340	19.0	14.0	35.0
03	9/22/2010	294109	4786621	19.2	16.5	40.5
04	9/22/2010	294383	4788222	19.5	12.0	74.2
05	9/23/2010	293701	4787955	19.2	15.0	30.0
06	9/23/2010	293844	4789084	19.0	12.0	22.0
			2015			
01	9/22/2015	295310	4785385	19.8	13.0	20.5
02	9/22/2015	294465	4785539	19.8	15.0	32.0
03	9/23/2015	295185	4786187	19.5	12.0	23.0
04	9/23/2015	294109	4786462	19.0	12.0	20.0
05	9/24/2015	293672	4788202	19.3	12.0	28.0
06	9/24/2015	294290	4788808	19.0	14.0	40.0

Table 2. Catch and catch per unit effort (CPUE) of gill nets set in Irondequoit Bay in September from 2005– 2015.

	2005 (GN)			2010 (GN)			2015 (GN)			2005-2015 (GN)		
Species	#	%	#/net	#	%	#/net	#	%	#/net	#	%	#/net
Minnow & Carp Family	1	0.1%	0.11							1	0.0%	0.05
Sucker Family	2	0.1%	0.22							2	0.0%	0.10
Lake Sturgeon	1	0.1%	0.11							1	0.0%	0.05
Longnose Gar	8	0.6%	0.89				30	1.4%	5.0	38	0.7%	1.81
Alewife	12	0.9%	1.33				40	1.9%	6.7	52	0.9%	2.48
Gizzard Shad	7	0.5%	0.78	106	5.2%	17.67	121	5.6%	20.2	234	4.2%	11.14
Chinook salmon							1	0.0%	0.2	1	0.0%	0.05
Rainbow trout							1	0.0%	0.2	1	0.0%	0.05
Brown Trout	1	0.1%	0.11	4	0.2%	0.67	5	0.2%	0.8	10	0.2%	0.48
Northern Pike	20	1.4%	2.22	7	0.3%	1.17	4	0.2%	0.7	31	0.6%	1.48
Goldfish				1	0.0%	0.17				1	0.0%	0.05
Common Carp	1	0.1%	0.11	2	0.1%	0.33	1	0.0%	0.2	4	0.1%	0.19
Golden Shiner	2	0.1%	0.22	3	0.1%	0.50				5	0.1%	0.24
Spottail Shiner	17	1.2%	1.89	24	1.2%	4.00	42	2.0%	7.0	83	1.5%	3.95
Spotfin Shiner				43	2.1%	7.17				43	0.8%	2.05
Quillback	107	7.7%	11.89	33	1.6%	5.50	42	2.0%	7.0	182	3.3%	8.67
White Sucker	77	5.6%	8.56	20	1.0%	3.33	63	2.9%	10.5	160	2.9%	7.62
Golden Redhorse				5	0.2%	0.83	2	0.1%	0.3	7	0.1%	0.33
Black Bullhead	1	0.1%	0.11							1	0.0%	0.05
Brown Bullhead	5	0.4%	0.56	107	5.3%	17.83	2	0.1%	0.3	114	2.1%	5.43
Channel Catfish	8	0.6%	0.89	7	0.3%	1.17	15	0.7%	2.5	30	0.5%	1.43
Brook silverside							4	0.2%	0.7	4	0.1%	0.19
White Perch	409	29.6%	45.44	1,101	54.3%	183.50	1,297	60.4%	216.2	2,807	50.5%	133.67
White Bass	1	0.1%	0.11	2	0.1%	0.33	1	0.0%	0.2	4	0.1%	0.19
Rock Bass	16	1.2%	1.78	11	0.5%	1.83	11	0.5%	1.8	38	0.7%	1.81
Green Sunfish	1	0.1%	0.11							1	0.0%	0.05
Pumpkinseed	6	0.4%	0.67	2	0.1%	0.33	1	0.0%	0.2	9	0.2%	0.43
Bluegill	9	0.7%	1.00	13	0.6%	2.17	2	0.1%	0.3	24	0.4%	1.14
Largemouth Bass	2	0.1%	0.22	1	0.0%	0.17	4	0.2%	0.7	7	0.1%	0.33
Black Crappie				19	0.9%	3.17				19	0.3%	0.90
Yellow Perch	519	37.6%	57.67	367	18.1%	61.17	319	14.9%	53.2	1,205	21.7%	57.38
Walleye	84	6.1%	9.33	78	3.8%	13.00	118	5.5%	19.7	280	5.0%	13.33

Table 2.
Continued

Freshwater Drum	18	1.3%	2.00	67	3.3%	11.17	14	0.7%	2.3	99	1.8%	4.71
Round Goby	47	3.4%	5.22	3	0.1%	0.50	7	0.3%	1.2	57	1.0%	2.71
												264.52
Total	1,382	100.0%	153.56	2,026	100.0%	337.67	2,147	100.0%	357.8	5,555	100.0%	
# species	27			24			25			34		
# nets	9			6			6			21		

Table 3. Catch and Catch per Unit Effort (CPUE) from electrofishing in Irondequoit Bay in June 2009.

	2009 (EF)		
Species	#	%	#/hr
Longnose Gar	9	4%	1.40
Bowfin	6	3%	0.93
Gizzard Shad	1	0%	0.16
Northern Pike	6	3%	0.93
Goldfish	5	2%	0.78
Golden Shiner	4	2%	0.62
Brown Bullhead	4	2%	0.62
Brook Silverside	2	1%	0.00
White Perch	2	1%	0.31
Rock Bass	2	1%	0.31
Pumpkinseed	2	1%	0.31
Bluegill	12	6%	1.86
Largemouth Bass	132	61%	20.47
Black Crappie	1	0%	0.16
Yellow Perch	17	8%	2.64
Walleye	11	5%	1.71
Total	216	100%	33.49
# species	16		

Table 4. Year class, number of walleye stocked, and walleye gill net catch (#/net) in Irondequoit Bay in September from 2005 to 2015 and from electrofishing (#/hr.) in June 2009.

			Year Sampled															
	Number		2005				2009				2010				2015			
Year Class	stocked		Age	Number	%	CPUE	Age	Number	%	CPUE	Age	Number	%	CPUE	Age	Number	%	CPUE
1993	36,000		12	0	0.0%	0.00	16				17	0	0.0%	0.00				
1994	36,000		11	16	19.3%	1.78	15				16	0	0.0%	0.00				
1995	36,000		10	1	1.2%	0.11	14				15	2	2.6%	0.33				
1996	36,000		9	18	21.7%	2.00	13				14	6	7.7%	1.00	19	1	0.8%	0.17
1997	36,500		8	14	16.9%	1.56	12				13	1	1.3%	0.17	18	2	1.7%	0.33
1998	34,000		7	8	9.6%	0.89	11				12	4	5.1%	0.67	17	0	0.0%	0.00
1999			6	1	1.2%	0.11	10	0	0.0%	0.00	11	3	3.8%	0.50	16	0	0.0%	0.00
2000			5	3	3.6%	0.33	9	1	9.1%	0.16	10	0	0.0%	0.00	15	0	0.0%	0.00
2001			4	11	13.3%	1.22	8	0	0.0%	0.00	9	3	3.8%	0.50	14	0	0.0%	0.00
2002			3	0	0.0%	0.00	7	0	0.0%	0.00	8	2	2.6%	0.33	13	0	0.0%	0.00
2003	36,000		2	11	13.3%	1.22	6	1	9.1%	0.16	7	4	5.1%	0.67	12	1	0.8%	0.17
2004			1	0	0.0%	0.00	5	1	9.1%	0.16	6	3	3.8%	0.50	11	0	0.0%	0.00
2005							4	0	0.0%	0.00	5	0	0.0%	0.00	10	0	0.0%	0.00
2006							3	0	0.0%	0.00	4	0	0.0%	0.00	9	0	0.0%	0.00
2007							2	0	0.0%	0.00	3	3	3.8%	0.50	8	0	0.0%	0.00
2008	19,116						1	8	72.7%	1.24	2	47	60.3%	7.83	7	9	7.6%	1.50
2008	5,400	A					1				2				7			
2009											1	0	0.0%	0.00	6	0	0.0%	0.00
2010															5	0	0.0%	0.00
2011	36,000														4	29	24.6%	4.83
2012															3	0	0.0%	0.00
2013	36,000														2	46	39.0%	7.67
2014															1	18	15.3%	3.00
2015	36,000														0	12	10.2%	2.00
				83		9.22		11		1.71		78		13.00		118		19.67

Table 5. Proportional stock density (PSD) and relative stock density (preferred, RSDp) of fish species caught in gill net sets in Irondequoit Bay in September from 2005 to 2015 and from electrofishing in June 2009.

	2005	2009	2010	2015
		PSD (Quality)		
Rock bass	13.3	50.0	50.0	77.8
Pumpkinseed	80.0	0.0	100.0	
Bluegill	87.5	58.3	69.2	100.0
Largemouth bass	100.0	65.4	0.0	100.0
Black Crappie		0.0	21.1	
Yellow perch	34.9	31.3	70.3	57.1
Walleye	100.0	60.0	94.9	92.4
Northern Pike	95.0	100.0	100.0	66.7
		RSD (Preferred)		
Rock bass	0.0	0.0	0.0	0.0
Pumpkinseed	0.0	0.0	0.0	
Bluegill	0.0	8.3	0.0	0.0
Largemouth bass	0.0	14.1	0.0	0.0
Black Crappie		0.0	15.8	
Yellow perch	5.8	6.3	33.8	16.7
Walleye	42.9	60.0	34.6	26.7
Northern Pike	45.0	83.3	28.6	0.0

Appendix A. Irondequoit Bay walleye stocking history.

Stocking Date	Number	Size (in)
1993	36,000	2.0
1994	36,000	1.75
1995	36,000	2.0
1996	36,000	2.0
1997	36,500	1.5
1998	34,000	2.0
1999	None	--
2000	None	--
2001	None	--
2002	None	--
2003	36,000	2.0
2004	None	--
2005	None	--
2006	None	--
2007	None	--
2008	24,516	2.0 - 5.0
2009	None	--
2010	None	--
2011	36,000	2.0
2012	None	--
2013	36,000	1.5
2014	None	--
2015	36,000	1.5