2014 Otisco Lake Fish Community Report

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March 2017

Executive Summary

Otisco Lake is a 1,877 acre (760 hectare) eutrophic lake lying wholly within Onondaga County, near the city of Syracuse. It is the most easterly of the eleven Finger Lakes and is eighth in size. A Fish Community Survey was conducted on Otisco Lake during the summer and fall of 2014 following protocols outlined by Holst and Loukmas (2013). Multiple sampling gears consisting of fyke nets, standard inland gill-nets, a bag seine and a boat electrofisher were used during the survey. The survey was conducted to develop an overall picture of the fish community, to monitor the stocking programs for tiger musky (*Esox lucius* × *masquinongy)*, walleye (*Strizostedion vitreus*), and brown trout (*Salmo trutta*), and to fulfill the sampling required as part of the rotational sampling program for the Finger Lakes. Overall, 2,382 fish were caught or observed, representing 24 identified species. Yellow bullhead (*Ictalurus natalis*) was the only species collected that was not collected in past surveys. Bluegill *(Lepomis marcrochirus)* were the most numerous species with 667 caught, comprising 29% of the catch. The next most numerous species was white perch (*Morone americanus*) (n= 335, 14% of catch), followed by smallmouth bass (*Micropterus dolomieui*), (n=161, 7% of catch) and yellow perch (*Perca flavescens*), (n=145, 6% of catch). Besides smallmouth bass, other popular gamefish in the catch included largemouth bass (*Micropterus salmoides*), (n=92, 4% of catch), walleye, (n=71, 3% of catch), tiger musky, (n=12, 1% of catch) and brown trout (*Salmo trutta*) (n=1, 0.04% of catch).

Walleye gill net and electrofishing catch per unit effort (CPUE) was 5.9/net night and 4.8/hour, respectively. These CPUEs suggest that Otisco Lake has a moderate to abundant walleye population. Walleye showed good growth rates with walleye reaching the legal size of 18 inches between age-3 and age-4. Age-7 walleye were the most frequent collected. This 2007 year class of fish is believed to be from natural production, as no walleye were stocked by the department in 2007.

The twelve tiger musky caught ranged in length from 7.5 to 35.3 in (192 to 897 mm), with a mean length of 22.1 in (563 mm). Tiger musky tend to be difficult to collect with the gears used, so are most likely underrepresented in this survey. Tiger musky are an important part of the lake fishery, and currently the angler diary program targeted catch rate is the best measure of the fishery. Different sampling gears or methods should be used in the future to better obtain tiger musky data and to better monitor the fishery.

Only one brown trout was caught during the survey, a 16.1 in (410 mm) fish which was caught during the August gill netting. The late August water chemistry survey indicated there was only a very narrow band of water where temperatures were less than 65^{o} F and DO levels were at or above 4 ppm, considered the maximum temp and minimum DO for brown trout survival. 2014 was most likely another difficult year for brown trout survival in the lake.

Though bluegill were the most abundant species sampled, there is some concern that only 7 of the 667 collected were of the “preferred” length of 8 inches. Angler harvest

is the most likely cause for the lack of larger fish given growth rates were average, which indicates that stunting was not an issue. This pattern was also seen with some of the other panfish species such as pumpkinseed and yellow perch.

Continuation of the current stocking policies and special regulations for walleye, tiger musky, and brown trout for Otisco Lake is recommended. The apparent impacts of angler harvest on the panfish size structure suggests that a reduced creel rate of 25-day, be implemented for “sunfish,” which would include bluegill and pumpkinseed, as well as a 25-day limit for yellow perch. For all other species, continuation of the current sportfish regulations is recommended.

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Introduction

Lake Characterization

Otisco Lake is a 1,877 acre (760 hectare; Effler et al. 1984) water body lying wholly within Onondaga County, near the city of Syracuse, New York. It is the most easterly of the eleven Finger Lakes and is eighth in size. Otisco Lake is best characterized as eutrophic due to its chlorophyll *a*, water clarity and hypolimnetic dissolved oxygen levels (Callinan 2001). Otisco Lake is somewhat unusual, as far as Finger Lakes go, as it's divided by a causeway at its southern end and is essentially viewed as two distinct lake basins. The two basins are connected by a small channel in the causeway and water quality characteristics are very different between the two. The approximately 326 acre (132 ha) area south of the causeway has a maximum depth of 15 ft (4.6 m) and a mean depth of 6 ft (1.8 m; Chiotti 1980). The south basin does not stratify and is very turbid, mainly due to the lakes major tributary, Spafford Brook, entering the lake at this end. Secchi disk readings average 1.9 ft (0.58 m; NYSDEC unpublished data). The 1,552 acre (628 ha) main lake, north of the causeway, does stratify and has a maximum depth of 76 ft (23.1 m) and a mean depth of 34 ft (10.4 m; Chiotti 1980). The main lake is relatively clear compared to the turbid southern basin, with an average Secchi disk reading of 8.1 ft (2.5 m; NYSDEC unpublished data). The hypolimnion of the main lake, generally below 35 ft (10.7 m), becomes anoxic during the summer months with dissolved oxygen levels too low to sustain fish life. There are five major tributaries that enter the lake: Spafford Brook, Rice Brook, Amber Brook, Lader Creek and Van Benthuysen Brook. The outflow from the lake is the beginning of Ninemile Creek.

Lake Environment

The 5.4 mile (8.7 km) long lake is located at an elevation of 788 ft (240.2 m; Effler et al. 1984). The 13.4 mi (21.6 km) Otisco Lake shoreline is largely developed with year-round homes and cottages, especially along the east shore and the northern third of the west shore. An approximately 2.5 mi (4 km) section of the west shore is mostly undeveloped presumably due to the steep bank along that section of shoreline. The Otisco Lake watershed is 36 square miles (93.8 square km; Child et al. 1971). Land use in the watershed is approximately 42% agriculture, 33% forested land, and 9% scrub and shrub (Otisco Lake Watershed Committee 2014). Water retention time of the lake is estimated at 1.9 years (Schaffner and Oglesby 1978).

Besides providing multiple recreational opportunities, Otisco Lake is an important source of public water for residents and businesses in the southern and central parts of the county and has a water use classification of AA. The Onondaga County Water Authority (OCWA) treats and delivers water from Otisco Lake. In 2014 approximately

17.5 million gallons per day, or 47.7% of OCWA's water, came from Otisco Lake (OCWA 2014).

Invasive Species

Invasive species of concern in the lake are water chestnut (*Trapa natans*), Eurasian watermilfoil (*Myriophyllum spicatum*), zebra mussels (*Dreisena polymorha*), quagga mussels (*Dreisena rostriformis*) and Asian clams (*Corbicula fluminea*). Zebra mussels were first sighted in the lake in 1997 (Otisco Lake Watershed Committee 2014). Quagga mussels have not been reported in the lake yet. Water chestnut was first discovered in Turtle Bay, northeast section of the lake, in 2006 (Otisco Lake Watershed Committee 2014). Water chestnut is being controlled in Turtle Bay by hand-pulling the plants during mid-July. This has been a cooperative effort between the Otisco Lake Preservation Association (OLPA), volunteers, and the New York State Department of Environmental Conservation (DEC), and appears to be controlling the spread of water chestnut in the lake. Asian clams were found in the lake in 2012, and by their size were assumed to have been in the lake since 2010 (Otisco Lake Watershed Committee 2014).

Fisheries Management

In the modern DEC statewide fisheries database (Release #50), fisheries surveys for Otisco Lake date back to 1977 (Appendix 1). Otisco Lake and its tributaries were included in the 1927 biological survey of the Oswego River system which was conducted by the State of New York Conservation Department (predecessor of the DEC). A list of fish species observed in Otisco Lake during that survey can be found in Appendix 2 (Greeley 1928). Long-term management evaluations include: an annual volunteer angler diary program, periodic fall walleye (*Strizostedion vitreus*) stocking assessments via night boat electrofishing in years that walleye are stocked, and Finger Lakes Standard Gang (FLSG) gill netting surveys that occur approximately every four years. Otisco was sampled seven times with FLSG's from 1977 to 2008. As of 2014, we will be changing over to the Standard Inland (SI) gill net for future gill netting surveys on Otisco Lake to make the data more comparable to other inland waterbodies. The angler diary program has been ongoing since 1979 on Otisco Lake and provides valuable information on the lake's sport fisheries. Angler diary reports can be viewed on the DEC web site at: http://www.dec.ny.gov/outdoor/27875.html

Special fishing regulations currently (2016) utilized in the management of the Otisco Lake fishery are as follows: tiger muskellunge (*Esox lucius x masquinongy*) minimum length of 36 inches (statewide is 30 inches), brown trout (*Salmo trutta*) minimum length of 12 inches (other Finger Lakes have 15-inch), and a walleye

minimum length of 18 inches and 3/day limit (statewide is 15-inch and 5/day). All other species are managed under statewide size, season, and creel limits.

Stocking History

A variety of fish species have been stocked in the lake by the DEC over the last 100 years (Table 1).There have also, more than likely, been numerous illegal stockings as new species of fish continue to appear in the lake. The main species that have been stocked in the lake are walleye, tiger musky and brown trout. The current (2016) stocking policy consists of an annual stocking of 2,400 two-year-old brown trout (12-14 in), 11,000 tiger musky (8-10 in), and a biennial maintenance stocking of 44,000 50-day fingerling walleye (1.5 in).

Current Fishery

Otisco Lake supports a warm water fishery with the target gamefish species consisting of walleye, smallmouth bass (*Micropterus dolomieui*), largemouth bass (*Micropterus salmoides*), tiger musky, and a coldwater fishery for brown trout. The panfish fishery is directed at bluegill (*Lepomis marcrochirus*), pumpkinseed (*Lepomis gibbosus*), black crappie (*Pomoxis nigromaculatus*), yellow perch (*Perca flavescens*), and bullhead. Connelly and Brown (2009) estimated the number of angler days for Otisco Lake in 2007 at 60,705 (Confidence limits ±23,603). Angler expenditures, based on the 2007 figure of $28.38 per trip (Connelly and Brown 2009) for Otisco Lake would be 1.7 million dollars (±669,853). No recent creel surveys have been done on the lake, but Chiotti (1979) found that shore, boat, and ice fishing accounted for 55, 38, and 7 percent, respectively, of the fishing effort in a survey conducted in 1978. The 2014 angler diary cooperator effort was 14% shore, 77% boat, and 7% ice fishing effort. As the angler diary program is aimed at gamefish only, this does not take into account the effort geared at panfishing on the lake and is, therefore, probably not representative of the whole fishery.

Walleye fishing is considered to be “very good” to “excellent” on Otisco by New York standards, with angler diary cooperator targeted catch rates from 1995 to 2014 averaging around 0.26 walleye per hour (0.15 standard deviation, SD). A catch rate of 0.10 to 0.25 walleye/h, is classified as good to very good walleye fishing, while anything over 0.25 walleye/h is excellent (Festa et al. 1987). It should be noted that the angler diary cooperators targeted catch rates are generally believed to be much better than that of an “average” Otisco Lake walleye angler. Angler diary cooperators targeting any warmwater gamefish during the same time period, had a mean catch rate of just 0.03 (SD = 0.05) walleye per hour. There is, most likely, only limited and highly variable natural reproduction of walleye in the lake due to the large numbers of alewives since alewives are a potential walleye fry predator (Brooking et al. 1998).

Black bass fishing is also considered good on Otisco by New York standards, with cooperator targeted catch rates for legal bass (≥12 in) generally at or above the New York mean of 0.26 legal bass/h (Green et al. 1986).

Tiger musky fishing is also considered good with cooperator catch rates from 1995 to 2014 averaging 0.09 fish/h (SD = 0.06). Data on catch rates are lacking for tiger muskies, but angler diary program catch rates of muskellunge from the St. Lawrence River averaged 0.04 fish per hour (Farrell et al. 2006). Creel survey data for Chautauqua Lake have average muskellunge catch rates of 0.05 fish per hour (McKeown and Einhouse 2000). While a creel survey of eight Wisconsin lakes had a range of 0.01 to 0.05 muskellunge per hour with a mean of 0.4 (Hanson 1988). The Otisco Lake angler success rate for tiger musky appears to be above these renowned muskellunge fisheries. Tiger muskellunge are hybrids (a cross between muskellunge and northern pike) and sterile; the fishery is supported entirely by stocking.

Though limited because of summer stratification, the lake also supports a cold water fishery for brown trout. Brown trout are raised and stocked by Carpenters Brook Fish Hatchery (Elbridge, NY). Otisco Lake has limited ability to support trout through the summer and generally begins to stratify in early June. Unfortunately, by mid-August, oxygen in the colder waters of Otisco Lake, in and below the thermocline, becomes nearly absent. This makes for difficult conditions for brown trout survival until the lake begins to mix in mid-September. This is not a new phenomenon, as Greeley (1928) noted, *"The deeper water is unfit for fish habitation, at least during the summer; because of the scarcity of oxygen."*

Angler Access

There is currently one DEC angler access site on the west side of the lake by the causeway that provides car top boat and shore access. Onondaga County has a park located on the east side, near the north end of the lake, adjacent to Turtle Bay. This site provides access for shore and ice fishing, and for launching of car top boats. Ice fishing and shore access is also found along the east side at the north end but no formal parking area exists. There are two private marinas with launches located on the east side of the lake, one on either side of the causeway, which provide trailered boat access for a fee (Figure 1). The DEC continues to try to acquire and develop a trailered launch site on the lake.

Survey Rationale

Otisco Lake was chosen for a Lake Fish Community Survey for a number of reasons: it receives heavy fishing pressure and it is an important Central New York fishery for walleye, tiger musky, black bass and panfish, and a comprehensive fish community survey has not been conducted since the 1930's. It was also chosen because it was next in line for sampling as part of the rotational Finger Lakes sampling

plan for DEC Region 7 Fisheries. Lastly, the current stocking policies and fishing regulations for walleye, tiger musky and brown trout needed to be evaluated.

Methods

Water Chemistry

Surface water temperature, dissolved oxygen (DO), pH and conductivity were recorded on June 11, 12, and 16th, and on September 23 and 24th, 2014; a YSI Professional Plus model meter was used for each. A temperature profile was done with a temperature probe at two sites on August 25th, one in 4.6 m (15 ft) and one in 15.2 m (50 ft) of water. A temperature and DO profile was done on August 26th in 17.4 m (57 ft) of water in the northern (main lake) basin; a YSI Professional Plus model meter was used. A Secchi disk reading was also measured in the main lake on August 26, 2014.

Fyke Nets

Fyke net sampling was done following protocol outlined in the Lake and Pond Fish Community Survey Protocols manual (Holst and Loukmas 2013). Two fyke nets were set on the nights of June 12, 13 and 17th, for a total of six net nights. Five nets were set in the main lake and one was set south of the causeway (Figure 2).The fyke nets used were modified fykes consisting of a sinking trap and lead. All netting was ½ in (13 mm) bar knot-less nylon, with black asphalt-type coating. The leads measure 100 ft (30 m) long and 3 ft (0.91 m) high. The trap consists of two rectangular and four circular frames each spaced 24 in (0.6 m) apart. The first two rectangular frames at the entrance measure 3 × 6 ft (0.9 x 1.8 m) and have a center brace. Mesh trap material hangs vertically and tapers from the upright members of the first frame to the center bracing of the second leaving a 4 in (102 mm) diameter curtain-like opening. The four proceeding circular hoops are 30 in (0.77 m) in diameter. An internal mesh funnel, which tapers down, runs between the first and third hoops. The cod end has a purse-string closure. Nets were set perpendicular to shore in 1 to 5 feet of water and were fished for an average of 20.5 hours (range of 17.9 to 21.8 hours).

Collected fish were identified to species, and lengths (mm) and weights (gm) were taken. Due to electronic scale malfunction, no weights were taken for sites 1 and 2. For white perch (*Morone americanus*), rock bass (*Ambloplities rupestris*), pumpkinseed, bluegill, yellow perch, black crappie, white crappie (*Pomoxis annularis*), largemouth bass and smallmouth bass, scale samples were collected from five individual fish per 10 mm size increment. Age structure of the un-aged sample of fish was estimated based on the frequency of known age fish in each 10 mm size increment.

Gill Nets

Gill net sampling was done following protocol outlined in the Lake and Pond Fish Community Survey Protocols manual (Holst and Loukmas 2013). A total of 10 DEC Standard Inland (SI) gill nets were set, 3/night, on August 26th and 27th, and 4/night on the 28th (Figure 2). The standard gill net is 6 ft (1.8 m) deep with six 25 ft (7.6 m) monofilament netting panels of 1.5, 2.0, 2.5, 3.0, 3.5 and 4 in (3.8, 5.1, 6.4, 7.6, 8.9, and 10.2 cm) stretched mesh for a total length of 150 ft (45.7 m) of net. Nets were set on bottom perpendicular to shore, with the exception of one site (site 5, south of the causeway) where the net was set in the middle (deepest water) parallel to shore. Nets were set to cover a depth range from 10 ft (3 m) to 35 ft (10.7 m), with the exception of site 5, where the depth was 3 m (10 ft) throughout. Gill nets were fished for a mean of 20 hours (range 18.4 to 20.9 hours).

Collected fish were identified to species, and lengths (mm) and weights (gm) were taken. For tiger musky, white perch, rock bass, pumpkinseed, bluegill, largemouth bass, smallmouth bass, white crappie, black crappie, yellow perch, walleye, and brown trout, scale samples were collected from five individual fish per 10 mm size increment. Otoliths were also collected from walleye to aid in age determination. Age structure of the un-aged sample of fish was estimated based on the frequency of known age fish in each 10 mm size increment.

Typically, Otisco Lake has been sampled with Finger Lakes Standard Gang gill nets (FLSG). The FLSG is 8 ft (2.4 m) deep with 50 ft (15.2 m) multifilament netting panels of 1.5, 2.0, 2.5, 3.0, 4.0 and 5.0 in (3.8, 5.1, 6.4, 7.6, 10.2, and 12.7 cm) stretched mesh set at up to 10 standard locations. These panels are placed in random order with 25 ft (7.6 m) panels of 1.0 in (2.5 cm) netting placed at each end, for a total net length of 350 ft (106.7 m). To accommodate for the difference in gear size, fish per square foot (fish/ft^2) of net was used to compare the catch per unit effort (CPUE) between the 2008 FLSG netting and 2014 SI netting. Each FLSG is 2,800ft^2 so the five net nights fished in 2008 totaled 14,000ft^2 of net while the 2014 SI netting effort totaled 9,000ft^2 (900 ft^2 × 10 nets). It should be noted that a direct comparison is not possible given the differences in mesh sizes of the two net types.

Bag seine

Bag seine sampling was done following protocol outlined in the Lake and Pond Fish Community Survey Protocols manual (Holst and Loukmas 2013). On September 23rd six sites around the lake (Figure 2) were seined using a 50 × 4 ft (15.2 m x 1.2 m) bag seine. All mesh was ¼ in (6.4 mm) square and the center bag dimension was 4 × 4 × 4 ft (1.2 × 1.2 × 1.2 m). The fixed pole method, which consists of fully extending the seine perpendicular from shore then pivoting around the entry point, was used when sampling.

Collected fish were identified to species or family, and individual lengths (mm) were taken for larger fish. Smaller fish were counted and only the minimum and maximum lengths of each species were recorded.

Electrofishing

Electrofishing sampling was done following protocol outlined in the Lake and Pond Fish Community Survey Protocols manual (Holst and Loukmas 2013). Otisco Lake was electrofished over the two nights of September 23rd and 24th, for a total of 2.5 hours of "on-time." Ten sites (Figure 2) were fished, eight in the northern basin (main lake) and two in the southern basin. A Smith-Root model SR-18 electrofishing boat was used with the boat hull as a cathode and two six-dropper umbrella arrays, extended 6 ft (1.8 m) in front of the boat, as anodes. The unit was configured to deliver 240 volts and 6.5 amps of half-wave direct current (DC) at 120 pulses per second. Shocking started one-half hour before sunset and sampling was conducted along the shoreline in 1 to 5 ft (0.30 m to 1.5 m) of water. The crew consisted of a driver and two netters. All 10 runs were 15 minute "all-fish" runs. During these all-fish runs attempts (within reason) were made to collect every fish that was shocked, with one exception: adult common carp (*Cyprinus carpio*). Large carp were not collected as they occupy too much space in the live well. The number of carp observed and the size range were recorded for each site.

Collected fish were identified to species, and lengths (mm) and weights (gm) were taken. For bluegill, pumpkinseed, white perch, black crappie, white crappie, rock bass, largemouth bass, smallmouth bass, walleye, and tiger musky, scale samples were collected from five individual fish per 10 mm size increment. Age structure of the un-aged sample of fish was estimated based on the frequency of known age fish in each 10 mm size increment.

Five tiger musky were Floy tagged before being released. Floy tags were placed at the posterior base of dorsal fin. Tiger musky were tagged to help collect more biological information such as dispersal, growth rates, and catch rates. Also, as an added benefit, an angler catching and reporting a tagged fish may be more interested in becoming a diary cooperator.

Fish Indices

Indices used to assess the quality of the fish populations in Otisco Lake included electrofishing catch rates, gill net catch rates, fyke net catch rates, growth rates, proportional stock density (PSD), relative stock density (RSD), and relative weight (Wr). PSD is expressed as the percentage of the stock that is of "quality" size; and RSD is expressed as the percentage of the stock that is of "preferred" size (Anderson 1980). Wr is an index of condition that compares the actual weight with a standard weight for fish of the same length (Anderson 1980). Abundance estimates for largemouth and

smallmouth bass were derived from regression equations based on fall nighttime electrofishing catch rates from Green (1980). Walleye and yellow perch abundance estimates were derived from mean growth rates at age-4, electrofishing and gill net catch rates from Forney et al. (1994). Shannon's index was used for species diversity, evenness and richness (Shannon and Weaver 1949). All data collected during this survey was recorded on standard NYSDEC Bureau of Fisheries forms and entered into Statewide Fisheries Database.

Results and Discussion

Water Chemistry

Otisco Lake is a high productivity water with conductivity ranging from 331 to 773 conductivity-per-centimeter (µmho/cm) during the survey (Table 2). Secchi disk reading was 8 ft (2.4 m) in the main lake in late-August. The lake was stratified during that time with a surface temperature of 74^{o} F, and at 40 ft (12.2 m) the temperature was 53^{o} F. Dissolved oxygen (DO) levels from the surface to 35 ft (10.7 m) ranged from 9.7 to 3.1 parts per million (ppm) and from 40 ft (12.2 m) to the bottom it was ≤1 ppm (Figure 3).

Species Collected

Overall, 2,382 fish were caught or observed, representing 24 identified species. During seining, two *Cyprinidae* were only identified to family, and 192 young of the year (YOY) bluegill and pumpkinseed sunfish were also only identified to family, *Centrarchidae* (Table 3). Note, these Centrarchids were not used in the overall catch of bluegill or pumpkinseed. The 24 identified species collected were 65% of the historic species list of 37 species (Appendix 1). And was greater than the 18 species reported by Greeley (1928) (Appendix 2). Shannon Diversity index was 2.38 and Shannon based evenness was 0.74. A Fish Community survey conducted on Seneca Lake in 2014 and 2015 had a species richness of 41 fish species, a Shannon diversity index of 2.20 and a Shannon based evenness of 0.59 (Amy Mahar, personal communication). Though species richness was less for Otisco Lake, diversity and evenness was greater. Yellow bullhead (*Ictalurus natalis*) was the only new species to be collected in 2014. Bluegill were the most numerous species with 667 caught, 29% of catch. The next most numerous species was white perch (n= 335, 14% of catch), followed by smallmouth bass, (n=161, 7% of catch) and yellow perch, (n=145, 6 % of catch). Besides smallmouth bass, the other popular gamefish catch was comprised of largemouth bass, (n=92, 4% of catch), walleye, (n=71, 3% of catch), tiger musky, (n=12, 1% of catch) and brown trout (n=1, 0.04% of catch).

With the four different gears used, it was interesting to see that 19 of the 24 species represented were captured with electrofishing gear (79%), 18 species with gill

net (75%), 15 species with fyke net (63%) and 9 species (plus two families) with the bag seine (46%; Table 3). Brown trout was the only species that were captured in just one gear type (gill net).

Bluegill

The bluegill mean fyke net, gill net and electrofishing catch per unit effort (CPUE) was 59.7 fish per net night (fish/net night) (SD = 60), 3.4/net night (SD = 2) and 114/per hour (fish/h; SD = 23), respectively

The overall bluegill PSD was 45 for all gear types combined. It should be noted that size selectivity of gears was different; the fyke net PSD was 50 (n=348 stock size), gill net PSD 62 (n=34 stock size) and electrofishing PSD was 40 (n=264 stock size). A PSD of 20 to 60 would represent a balanced bluegill population (Anderson 1985). Though the PSD falls within the balanced population range, only seven of the bluegill collected were of the "preferred" size of ≥8 in and none were of either "memorable" (≥10 in for bluegill) or "trophy" (≥12 in for bluegill) size (Table 4). In 2014, bluegill in the 5-inch range (126 to 151 mm) were most abundant (Figure 4). The resulting RSD_8 was only 1. A balanced population should have an RSD_8 range of 5 to 20 (Anderson 1985). This low RSD_8 may indicate an overabundant bluegill population or a high harvest rate of preferred, memorable or trophy sized bluegills. Bluegills were on the light side with a mean Wr of 90 (SD = 11), which supports the above suggesting an overabundant population. The Wr index uses a range of 95 to 105 as the benchmark for fish in good condition (Pope and Kruse 2007). Bluegill had average growth rates by New York standards (Green 1989; Figure 5). So, bluegill do not appear to be "stunted" at this time. Many definitions of stunting exist, but Heath and Roff (1987) define stunting as a population with drastically reduced growth rates.

Though Wr weights were low, growth rates were average, indicating that stunting is not causing the lack of larger fish in the population. Although formal angler harvest data does not exist, high angler harvest is believed to be the reason for the lack of large bluegills. The higher PSD and RSD values in 2008 versus 2014 (Table 5) may, perhaps, be reflective of lower angling pressure, particularly ice fishing pressure, in the winters preceding the survey. While ice conditions for Otisco Lake aren't available, ice data from the Whitney Point Crappie Derby website indicates that safe ice existed for relatively short periods in the three ice fishing seasons preceding the 2008 survey. Anecdotal evidence from a DEC staff member who has a history of fishing the north end of the lake indicates that larger sunfish were abundant throughout the winter of 2012/13 but became scarce during the long ice-fishing season of 2013/14 in the face of high ice fishing activity (Daniel Bishop, personal communication). This sentiment was also expressed to Region 7 Fisheries staff by other anglers.

White Perch

White perch were the second most abundant species in the survey and had mean fyke net, gill net and electrofishing CPUEs of 21.3/net night (SD = 24), 18.6/net night (SD = 15) and 8.4/h (SD = 4), respectively. White perch were the most abundant species collected during the 2008 FLSG netting, and the 2014 SI netting CPUE of 0.021/ft^2 was comparable to the 2008 FLSG CPUE of 0.022/ft^2 (Table 6). White perch were on the thin side with a mean Wr of 87 (SD = 6). White perch PSD was 88 and RSD_{10} was 56, indicating the current population has a large proportion of "keeper" size fish. Seventy-one of the white perch collected were of preferred size (≥10 in), three of memorable size (≥12 in); but no trophy size (≥15 in) were collected (Table 4). White perch in the 8 to 9 inch (204 to 253 mm) range accounted for 66% of the catch (Figure 6), and on average, are reaching 8 in (204 mm) at age 5 (Figure 7).

Not as popular with anglers as yellow perch, white perch make up a considerable part of the lakes fish community and appear to be an untapped resource by anglers. This lack of popularity and harvest with Central New York anglers may explain why they were one of the few "panfish" to have PSD and RSD values that indicate a population with a large proportion of "keeper" size panfish.

Yellow Perch

The yellow perch mean fyke net, gill net and electrofishing CPUEs were 2.3/net night (SD = 4), 6.8/net night (SD = 9) and 25.2/h (SD = 12), respectively. The 2014 gill netting CPUE of 0.0076/ft^2 was much greater than the 2008 FLSG CPUE of 0.0009/ft^2 (Table 6). Yellow perch were somewhat lean with a mean Wr of 80 (SD = 7). Wrs were similar throughout the season with mean June, August and September Wrs of 80 (SD = 7), 79 (SD = 6) and 82 (SD = 8), respectively. Yellow perch PSD was 46 indicating the current population has small proportion of "keeper" size fish although this PSD does fall into the accepted range of 30 to 60 (Anderson and Weithman 1978) for a balanced population. Only six of the yellow perch collected were of preferred size (≥10 in; RSD_{10} = 5), one was memorable size (≥12 in) and no trophy length (≥15 in) perch were caught (Table 4). Yellow perch in the 8 inch (204 to 227 mm) size range were most common (Figure 8). Yellow perch growth was at or above average, by New York standards (Forney et al. 1994), with mean length at age above the New York mean for ages 2-4, and equal to the state mean for ages 5 and 6 (Figure 9). Forney et al. (1994) used length at age 4 as a predictor of yellow perch abundance where populations with the smallest fish at age 4, 7.1 in (180 mm), are indicative of high population abundance and large fish, 8.5 in (215 mm), are indicative of low abundance. The average size of age 4 yellow perch in this survey (7.8 in; 199 mm) fell in the middle of this range.

Age-4 yellow perch were the most abundant year class in the sample (Figure 10). Electrofishing catch rates of >50 yellow perch/h and gill net catches of >5 perch/net suggest that yellow perch abundance is high (Forney et al. 1994). From electrofishing and gill net CPUE and mean length at age, it would appear that yellow perch abundance is moderate to high in Otisco Lake. Given the good growth rates of the fish sampled, the relatively small proportion of yellow perch ≥ 9 in (228 mm) may be a sign of moderate to high angler exploitation.

Rock Bass

Rock bass mean fyke net, gill net and electrofishing CPUEs were 1.3/net night (SD = 1), 1.3/net night (SD = 2) and 42.8/h (SD = 18), respectively. Rock bass in the seven inch range (177 to 202 mm) accounted for 31% of the catch (Figure 11). The resulting PSD was 48 and RSD_9 was 7. As with the other "sunfish", no memorable or trophy size rock bass were collected (Table 4). Rock bass were in good condition with a mean Wr of 94 (SD = 8). Rock bass were slow growing with mean length at age below the New York mean for all ages (Figure 12).

Pumpkinseed

Pumpkinseed mean fyke net, gill net and electrofishing CPUEs were 10.3/net night (SD = 9), 0.9/net night (SD = 1) and 20.4/h (SD = 7), respectively. The PSD was 35 and the RSD_8 was only 0.8. If we assume pumpkinseed stock density ranges are similar to bluegill, then the PSD falls within the balanced range of 20 to 60. The RSD_8, however, falls well below the range of 5 to 20. No pumpkinseed was of memorable (≥10 in) or trophy size (≥12 in; Table 4). Pumpkinseed in the 4 to 5 inch range (101 to 150 mm) were most numerous (Figure 13). Pumpkinseeds were in good condition with a mean Wr of 95 (SD = 9). Pumpkinseeds had average growth rates by New York standards (Green 1989; Figure 14).

Mean length at age and Wr would suggest that pumpkinseeds are not stunted and that the lack of larger sized fish, as with the bluegill, is most likely due to angler harvest.

White Crappie

White crappie are a relative new comer to the fishery and were first documented in a DEC survey in 2001. As there was no "official" stocking of white crappie, it's unclear how they entered the fishery; most likely by an illegal introduction. All white crappie were collected south of the causeway, which isn't surprising as that is the area of the lake with the most turbid water. White crappie can tolerate considerable turbidity (Smith 1985) and tend to be more abundant than black crappie in these environments. Fyke net, gill net and electrofishing CPUEs were 8.3/net night (SD = 14), 0.1/net night (SD = 0.3), and 3.2/h (SD = 3), respectively. The combined PSD was 69, which just falls out of the range of 30 to 60 for a balanced population (Gablehouse 1984), but indicative of a population with many "keeper" sized fish. The RSD_{10} was 44, also indicative of a population with a high proportion of "keeper" fish. White crappie in the 10 inch range (255 to 228 mm) were most abundant, followed by 7 inch fish (180 to 187 mm; Figure 15). There were 27 white crappie of the preferred length (≥10 in), 11 were of memorable length (≥12 in) and no trophy length (≥15 in) were collected (Table 4). White crappie were thin with a mean Wr of only 83 (SD = 8) but had average growth rates. The mean

length at age was near the New York mean (Green et al. 1993) for most ages, with most reaching legal size (≥9 in) around age 4 (Figure 16).

Looking strictly at catch rates of white crappie south of the causeway provides a better frame of reference for their abundance. Catches in this area averaged 26.5/fyke net night, 1.0/gill net night, and 16.0/h of electrofishing. The fyke and electrofishing catch rates suggest a relatively high population density south of the causeway. For comparison, Whitney Point Reservoir, which generally has supported an exceptional population of white crappie, had a mean SI gillnet catch rate of 15.7/night in 14 years of sampling and a mean Oneida trap net catch rate of 24.4/night in 10 years of sampling from 1984 to 2009 (NYSDEC unpublished data).

Casual staff observations of fishing pressure in the area south of the causeway from various times of the year would suggest that fishing effort is light relative to other areas of Otisco Lake. The presence of a high percentage of legal white crappie is likely a function of the low fishing pressure south of the causeway. Nonetheless, given their apparent moderate to high density and with the high percentage of legal length fish in the population, white crappie could become a more important part of the panfish fishery as anglers become aware of their abundance south of the causeway.

Black Crappie

Unlike white crappie, all black crappie were caught north of the causeway. This, too, is not surprising, as that area of the lake has less turbidity and black crappie prefer clearer water conditions than white crappie (Smith 1985). Black crappie were caught throughout the main lake and the fyke net, gill net, and electrofishing CPUE's were 0.83/net night (SD = 1), 1.1/net night (SD = 2) and 4.0/h (SD = 1), respectively. Black crappie abundance appears low, but black crappie can often be difficult to collect and are often underrepresented in sampling. Black crappie in the 10 inch (228 mm) range were most frequent (Figure 17). The PSD was 100, which is likely a reflection of the small sample size (n = 26). As with white crappie, this falls out of the range of 30 to 60 (Gablehouse 1984) for a balanced population but is indicative of a population with many "keepers." Ten of the crappie were of the preferred length of 10 inches (RSD_{10} = 48) but no memorable (≥12 in) or trophy (≥15 in) length black crappie were collected (Table 4). Black crappie were in better condition than the white crappie, with a mean Wr of 94 (SD = 7). Black crappie were reaching the legal size (≥9 in) at age 4; this is equal to the New York mean (Green 1989; Figure 18). Though not as abundant as some of the other panfish, black crappie are an important part of the fishery with dedicated anglers that target them during the ice fishing season and in the early-spring.

Smallmouth Bass

Smallmouth bass mean fyke net, gill net and electrofishing CPUEs were 0.17/net night (SD = 0.4), 6.4/net night (SD = 5) and 36.4/h (SD = 8), respectively. The 2014 SI

netting CPUE of 0.0071/ft^2 was slightly greater than the 2008 FLSG CPUE of 0.0065/ft^2 (Table 6). For smallmouth bass ≥10 in (254 mm), the average electrofishing catch was 2.4/h (SD = 1), which is below the statewide average of 4/h (SD = 8; Perry et al. 2014). According to Green (1989), this catch rate yields a first order density estimate of 1.2 smallmouth bass ≥10 in (254 mm) per acre, which indicates a moderate bass population density. However, the CPUE for smallmouth bass <10 in (254 mm) was 34/h (SD = 8), which yields a first order density estimate of 9.7/acre. This is well above the >4.0/acre that suggest high abundance (Green 1989). So, smallmouth bass abundance in Otisco Lake is most likely moderate to high.

The combined PSD from all gears was 58 and the RSD_{14} was 43. This PSD is similar to the statewide mean of 56 (SD = 24; Perry et al. 2014), and just falls within the balanced population range of 30 to 60 (Anderson and Weithman 1978). Fifteen of the smallmouths were of memorable size (≥17 in) and one was trophy size (≥20 in; Table 4). Bass in the 6 inch (152 to 175 mm) size range were most common (Figure 19). Smallmouth were in good condition with a mean Wr of 95 (SD = 8). Growth of smallmouth bass was average, by New York standards (Green 1989), with bass reaching legal size (≥12 in) between ages 4 and 5 (Figure 20). Age 2 bass collected during the fall electrofishing survey had a mean length of 8.5 in (216 mm; SD = 23 mm) which is just below the statewide average of 8.97 in (228 mm; Perry et al. 2014).

It would appear from PSD, Wr and mean growth rates that the smallmouth bass population is well balanced in Otisco Lake. Almost twice as many smallmouth bass were collected during the survey than largemouth bass (161 to 92). However, on average, Otisco Lake angler diary cooperators typically catch similar numbers of both species (unpublished data) as indicated by the five year mean catch from 2010 to 2014 being equal (119 each). Though smallmouth bass appear to be more abundant than largemouth bass, they may be more difficult for anglers to target and catch in Otisco Lake than largemouth bass.

Largemouth Bass

Largemouth bass mean fyke net, gill net and electrofishing CPUEs were 0.33/net night (SD = 0.5), 0.50/net night (SD = 1) and 25.6/h (SD = 5), respectively. The electrofishing CPUE for largemouth bass ≥10 in (254 mm), was 12.4/h (SD = 2.9), which falls below the statewide mean of 17/h (SD = 19; Perry et al. 2014). According to Green (1989), this catch rate yields a first order density estimate of 3.8 largemouth bass ≥10 in per acre, which suggests a low population density. The CPUE for largemouth bass <10 in (254 mm) was 13.2/h (SD = 3.4), which yields a first order density estimate of 4.7/acre. This density estimate also suggests low abundance (Green 1989).

The combined PSD was 44 which falls within the balanced population range of 40 to 70 suggested by Anderson (1980). While this PSD is below the statewide average of 55 (SD = 24; Perry et al. 2014) it is not concerning. Ten bass captured were of

preferred length (≥15 in), one was of memorable length (≥20 in), but no trophy length (≥25) largemouth were collected (Table 4). The RSD_{15} was 19, which also falls within the balanced population range of 10 to 40 suggested by Anderson (1980), and is equal to the statewide mean RSD_{15} of 19 (SD = 14; Perry et al. 20014). Largemouth bass in the 2-inch (51 to 62 mm) size range were most abundant (Figure 21). Largemouth bass were in fair condition with a mean Wr of 90 (SD = 7). The Wr during the fall electrofishing survey was 91 (SD = 7), which is well below the statewide mean Wr of 103 (SD = 8) for largemouth bass captured in the fall (Perry et al. 2014). Mean length at age was slow by New York standards, with largemouth bass reaching legal size (≥12 in) during their 6^{th} growing season at age 5; the statewide mean is during their 5^{th} growing season at age 4 (Green 1989; Figure 22).

The PSD and RSD show a balanced largemouth bass population, and targeted angler diary catch rates for legal size (≥12 in) typically equal or exceed the NYS average of 0.26/hour (Green et al.1986). There is some concern over the low Wr and slow growth rates. Though not as abundant as smallmouth bass, which is most likely due to the prime largemouth habitat being limited to the north and south ends of the lake. While the majority of the shoreline, which drops off relatively quickly, along the east and west sides of the lake provide more suitable habitat for smallmouth bass. Largemouth bass are an important part of the Otisco Lake fishery and their population dynamics in the lake may require future research.

Walleye

Walleye gill net and electrofishing CPUEs were 5.9/net night (SD = 5) and 4.8/h (SD = 2), respectively; no walleye were collected with fyke nets. The CPUE for gill netting is above the 5/net that would suggest high abundance, while the 4.8/h electrofishing CPUE is just below the 5/h that also suggest high abundance of walleye (Forney et al. 1994). Angler diary targeted catch rates from 1995 to 2014 averaged 0.26 walleye/h (SD = 0.15), which is above the 0.25 walleye/h catch rate that Forney et al. (1994) suggest for high walleye abundance. These indices suggest that the Otisco Lake walleye population density is most likely moderate to high. The 2014 SI netting CPUE of 0.0064/ft^2 was greater than the 2008 FLSG CPUE of 0.0045/ft^2 (Table 6). PSD was 90 and RSD_{20} was 37. Anderson and Weithman (1978) suggest a balanced walleye population has a PSD range of 30 to 60; no RSD_{20} is given. So, the Otisco Lake walleye population would appear to be unbalanced. However, Forney et al. (1994) suggest that PSDs used to assess “population balance” may be misleading when applied to percids, as they often have dramatic differences in recruitment among years.

No YOY were captured, which was not surprising as no walleye were stocked in 2014. Ages of captured walleye ranged from 2 to 22. As expected, there was a difference in age estimates between scale and otolith aging methods, with the most

disparity occurring in the older aged fish (Table 7). Scales are generally reliable for determining walleye ages up to age-7 (Forney et al. 1994).

Walleye growth rates were good with average length at age above the state average for all ages except age-7, which was just below (Figure 23). Walleye are reaching the legal size of 18 inches, on average, between age 3 and 4. Walleye in the 19-inch (484 to 507 mm) size range were most frequent (Figure 24). Sampled walleye were also in very good condition with a mean Wr of 106 (SD = 16).

It has generally been assumed that little to no successful natural reproduction occurs in Otisco Lake because of the presence of a large population of alewife. However, age data from both the 2014 and 2008 sampling events suggest that more wild walleye are present than previously assumed. In 2014, age-7 walleye were the most abundant age class in the sample followed by age-6 (Figure 25). Interestingly, the age-7 walleye would have been spawned in 2007, a year in which no walleye were stocked by NYSDEC. This implies that significant natural reproduction of walleye occurred in Otisco Lake in 2007. Further evidence of natural reproduction comes from the 2008 FLSG gill netting in which age-7, 8, and 9 walleye were caught (Figure 26). These fish would have been from the 1999, 2000 and 2001 year classes, years in which no walleye were stocked by NYSDEC into Otisco Lake. It should be noted that these walleye were only scale aged since no otoliths were taken in 2008.

Further evidence of natural reproduction comes from analysis of otoliths of YOY walleye captured between 2009 and 2013. Walleye stocked in these years were marked with oxytetracycline (OTC). A random sample of YOY walleye collected during fall electrofishing surveys from those years were sent to Cornell University for OTC verification (n=48). Microscopic examination of the otoliths revealed OTC marks on just 69% of the sample (personal communication with Tom Brooking, Cornell). While some OTC marks were almost certainly missed it's likely that some of the fish were of wild origin. Though natural reproduction is most likely highly variable and limited, Otisco Lake does appear to produce a strong year class of wild walleye on occasion as evident by the 2007 year class.

Walleye are an important part of the lake fishery, although they can often be difficult for "average" anglers to catch in the lake. No walleye were stocked in 2014, as part of a new stocking approach which calls for a biennial, rather than an annual, maintenance stocking of 44,000 50-day fingerling walleye. This policy was implemented to allow better use of the limited statewide supply of walleye fingerlings and will allow more waters around the state to be stocked on an every other year basis. Since most walleye fisheries typically have good survival of YOY only once every 2-4 years we anticipate that this stocking scenario will continue to sustain a high quality walleye fishery in Otisco Lake, especially given the wild contribution that appears to be occurring. To help monitor this new policy the department will continue to conduct standard fall walleye electrofishing surveys, south of causeway in all years that walleye

are stocked and whenever feasible in those years when they are not. In years that stocking occurs, a minimum acceptable population estimate of 890 YOY walleye (2% survival rate based on 44,000) will be used to gauge the “success” of that year’s stocking. If the YOY walleye population estimate falls below the target range we will recommend that Otisco Lake be listed as a top priority water for walleye stocking the following year. This will potentially help to offset a known poor recruitment year and reduce the likelihood of having multiple, successive years of poor recruitment. Unless survival of stocked fish was exceptionally high (≥10%) the previous year, stocking of surplus walleye fingerlings into Otisco Lake will be requested in any of the off years.

Tiger Musky

Twelve tiger musky were caught during the survey, of which only three were recently stocked fish. Traditional sampling methods like electrofishing and netting have, generally, not been successful in evaluating tiger musky stocking success in most waters (Festa 1989). Tiger musky tend to be difficult to collect with the gears used, so they are most likely underrepresented in this survey. Tiger musky gill net and electrofishing CPUEs were 0.4/net night (SD = 0.7) and 3.2/h (SD = 1), respectively; no tiger musky were collected with the fyke net. Tiger musky lengths ranged from 7.5 (recently stocked) to 35.3 in (192 to 897 mm; Figure 26). Tiger musky were in good condition with a mean Wr of 95 (SD = 17). Mean length at age of the tigers captured was highly variable and no legal length (≥36 in) tiger musky were caught during the survey (Figure 27). Unfortunately, the small sample size and high variability in growth of those sampled makes it difficult to infer anything meaningful about the growth rate of tiger musky in Otisco Lake at this time.

Tiger musky are an important part of the lake fishery, and currently the angler diary program targeted catch rates are the best measure of the fishery. Different sampling gears or methods should be used in the future to better obtain tiger musky data and to better monitor the fishery.

Brown Trout

Only one brown trout was caught during the survey, a 16 in (410 mm) fish that was age-2, and is most likely from the 2014 stocking. This trout was collected in August by gill net, resulting in a gill net CPUE of 0.1/net night (SD = 0.3). The 2014 SI netting CPUE of 0.0001/ft^2 was equal to the 2008 FLSG CPUE of 0.0001/ft^2 (Table 6). The late-August water chemistry survey (Figure 3) indicated there was only a very narrow band of water where temperatures were less than 65^o F and DO levels were at or above 4 ppm, considered the maximum temp and minimum DO for brown trout survival; 2014 was most likely another difficult year for brown trout survival at Otisco Lake.

Alewives

Alewives were apparently introduced in the mid-1960's to Otisco Lake and were abundant by 1968 (Chiotti 1980). An abundant alewife population can often make fishing harder as gamefish tend to be well fed, and full fish are generally harder to catch. High alewife populations in the mid-1960's and 70's prompted both the stocking of brown trout in 1969 and the introduction of tiger musky in 1977 (Chiotti 1980).

Only 93 alewives were collected during the 2014 survey, with alewives in the 5-inch (129 to 150 mm) range being most frequent (Figure 28). The 2014 SI netting CPUE of 0.0016/ft^2 was much less than the 2008 FLSG CPUE of 0.0047/ft^2 (Table 6). Whether this low gill net catch in 2014 is due to the difference in gears, as the FLSG netting has an additional 50 ft (15.2 m) of 1.0 and 1.5 in (2.5 and 3.8 cm) mesh, or is abundance related, is unknown at this time. It's most likely a combination of both factors, as 77% of the alewives collected in FLSG nettings from 1977 to 2008 were collected in the 1.0 in mesh and just 19% were from the 1.5 in mesh (Table 8). However, the catch of alewife in 2008 was very low relative to earlier surveys so the low catch in 2014, compared to 2008, suggests that alewife abundance was down.

There was some winter mortality of alewives in 2014, most likely due to the long cold winter of 2013-2014. Dead alewives were seen in Ninemile Creek in early April 2014 and were assumed to have washed down from the lake. Excessive cold water temperatures can cause alewife mortality through cold thermal stress; mortality begins to occur at 37^{o}F (Colby 1975). Chiotti (1980) mentions three massive winter alewife die-offs occurring in Otisco Lake between 1968 and 1978. Based on the available data it is unclear whether the alewife population was truly down and, if so, what is responsible for the decline.

Alewife populations in Otisco and other waterbodies have a history of fluctuating greatly in terms of abundance. Multiple factors contribute to these fluctuations including winter kill during exceptionally cold winters, multiple years of failed reproduction, and predatory pressure. High densities of alewives can negatively influence growth and recruitment of panfish populations through competition for available food items. In theory, an abundant, but not overly abundant alewife population can provide sufficient forage to support healthy populations of top predators like bass, walleye, and tiger musky yet still allow "room" for popular panfish species like yellow perch and sunfish to thrive. Evidence from Otsego Lake, in particular, and to a lesser extent Owasco Lake, would indicate that sizable walleye populations are capable of exerting sufficient predatory pressure to reduce alewife abundance. Maintenance of an abundant walleye population through stocking is currently the only tool available to the Department which provides any ability to reduce the peak population levels of Otisco Lake alewife.

Other Fishes

Channel catfish (*Ictalurus punctatus*), like white crappie, are relatively new to the fishery with the first DEC collection taking place in a 1995 survey. Eight channel catfish

were caught with a mean length of 18.3 in (465 mm; SD = 2 mm); catfish were caught in both basins. Channel catfish were in fair condition with a mean Wr of 89 (SD = 17). Ten brown bullhead (*Ictalurus nebulosus)* and ten yellow bullhead were collected with a mean length of 11.9 in (304 mm; SD = 1 mm) and 11.1 (283 mm; SD = 2 mm), respectively. As mentioned previously, yellow bullhead had never been collected prior to 2014.

Five members of the minnow family were collected, which included common carp, golden shiner (*Notemigonus crysoleucas*), bluntnose minnow (*Pimephales notatus*), emerald shiner (*Notropis atherinoides*), and spottail shiner (*Notropis hudsonius*). The five common carp from which data were recorded, had a mean length of 25.1 in (639 mm; SD = 5 mm). Other species collected were white sucker (*Catastomus commersoni*), banded killifish (*Fundulus diaphanus*) and tessellated darter (*Etheostoma nigrum*).

Recommendations

Management recommendations based on the results of this survey are:

- Continue with current special regulations for tiger musky (36-inch), walleye (18-inch, 3/day) and brown trout (12-inch).
- Implement a reduced creel limit (25/day) for “sunfish” which includes bluegill and pumpkinseeds.
- Implement a reduced creel (25/day) for yellow perch.
- Maintain a robust walleye population, through stocking, to reduce likelihood of alewife becoming overly abundant.
- Continue with current annual stocking of 11,000 tiger musky, 2,400 brown trout; and a biennial stocking of 44,000 50-day fingerling walleye.
- Continue with the Otisco Lake angler diary program and recruit new cooperators.
- Conduct a Standard Inland Gill netting in 2018.
- Conduct fall walleye assessments, in all years that walleye stocking occurs, to assess relative survival of each stocking. Also, whenever feasible, conduct fall surveys in non-stocking years to look for presence of wild YOY walleye.
- Entertain alternate sampling methods/gears to assess the status of the tiger musky (staff angling, data collection at tiger musky ice fishing tournaments, etc.).
- Continue to pursue the development of a DEC trailered boat launch on the lake.
- Conduct a spring “Centrarchid Sampling Plan” electrofishing survey to monitor the black bass and sunfish populations in 2018.

Acknowledgements

I would like to thank Scott Prindle (Aquatic Biologist), Ian Blackburn (Fish and Wildlife Technician II), Heather Bull (Fish and Wildlife Technician), Greg Cocquyt (Fish and Wildlife Technician), Katherine England (Student Intern) and Eric Stanzyck (Carpenter's Brook Fish Hatchery Superintendent) for their hard work during fish sampling efforts on Otisco Lake in 2014. I would also like to thank David Lemon (Region 7 Fisheries Manager), Jeff Loukmas (Warmwater Unit leader), and Lisa Holst (Rare and Endangered Fish Unit Leader) for their careful review and comments on early drafts of this report.

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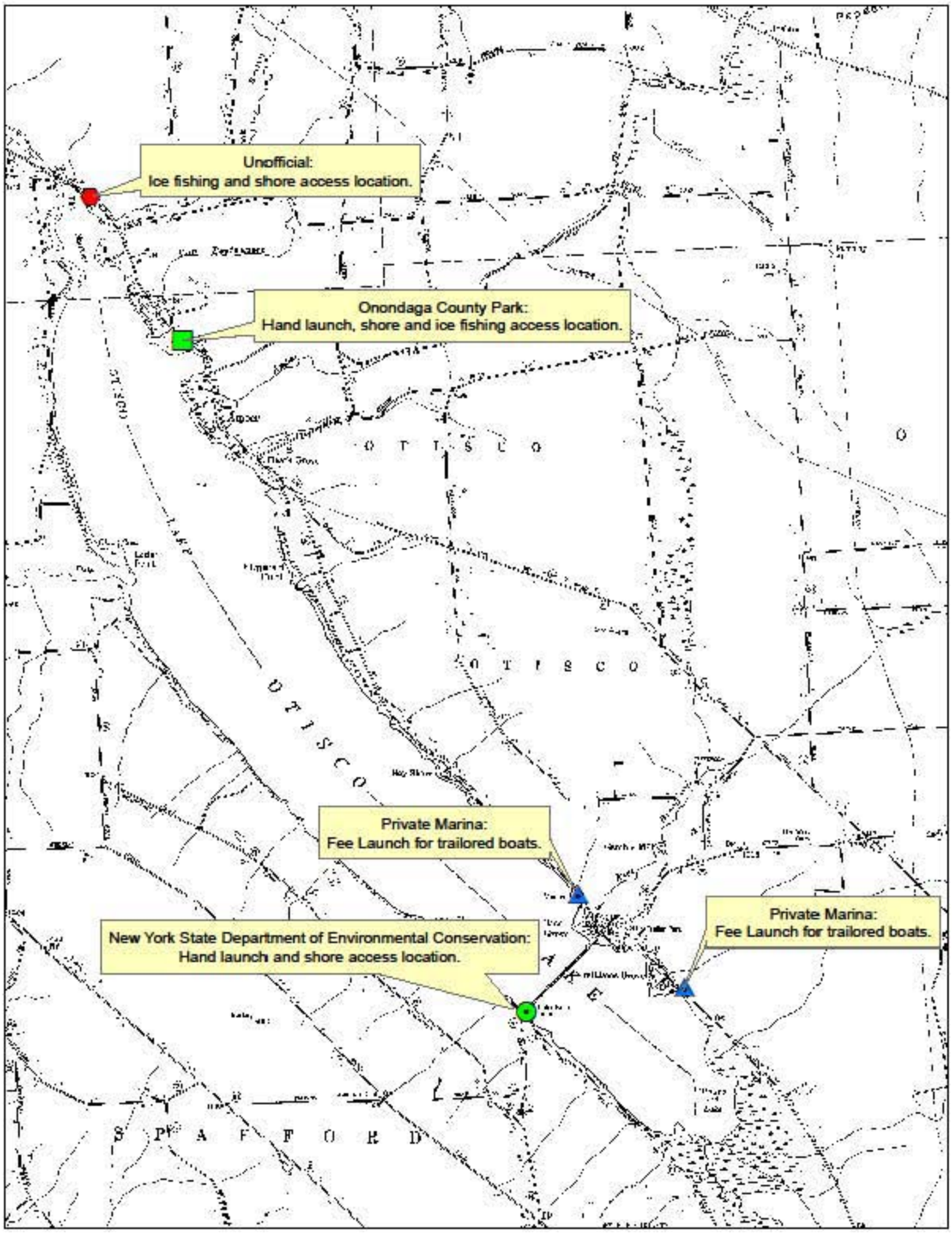

Figure 1. Fishing access points for Otisco Lake.

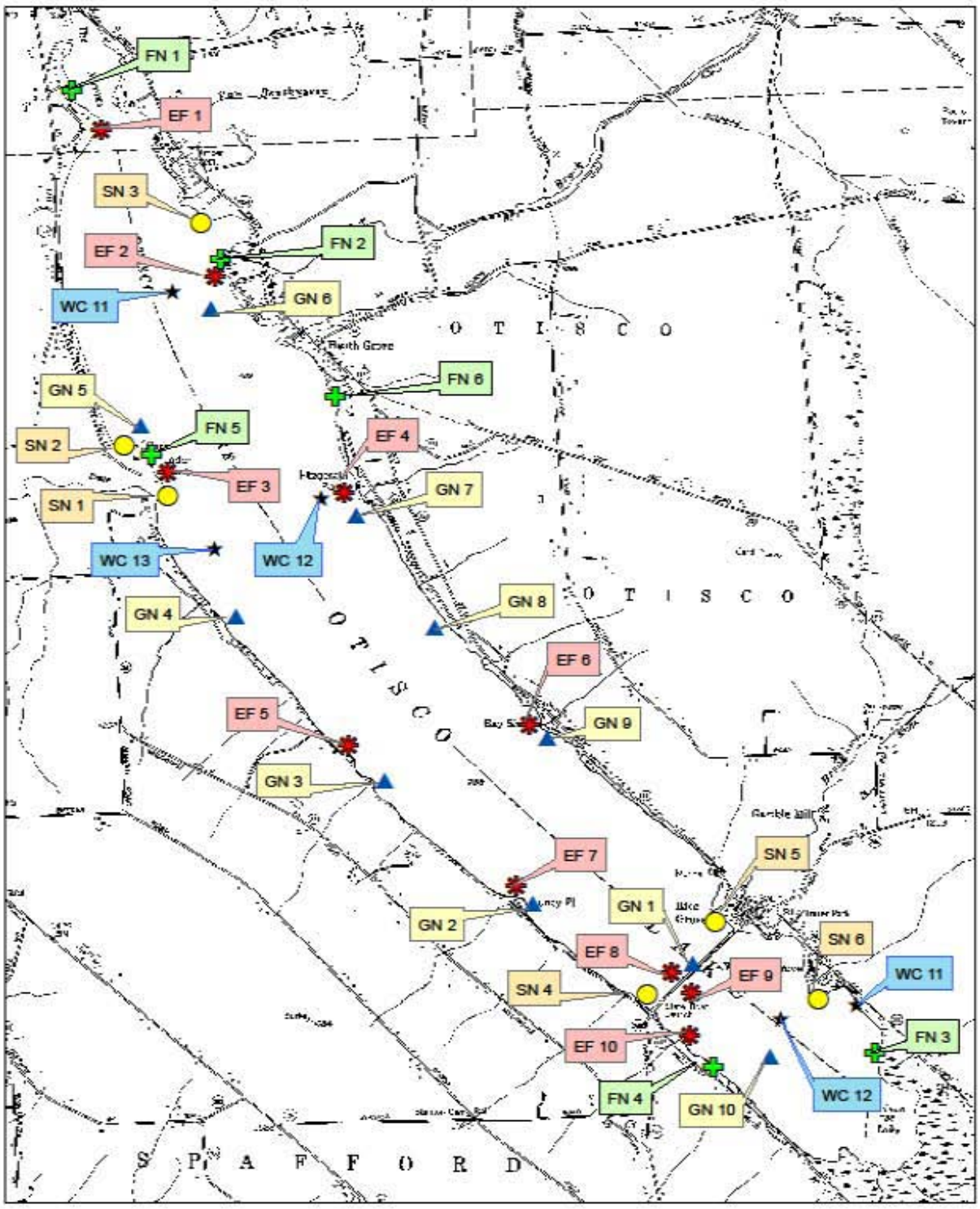

Figure 2. Site locations for fyke net (FN), gill net (GN), seine (SN), water chemistry (WC), and the starting point for electrofishing (EF) sites for Otisco Lake full lake assessment survey 2014.

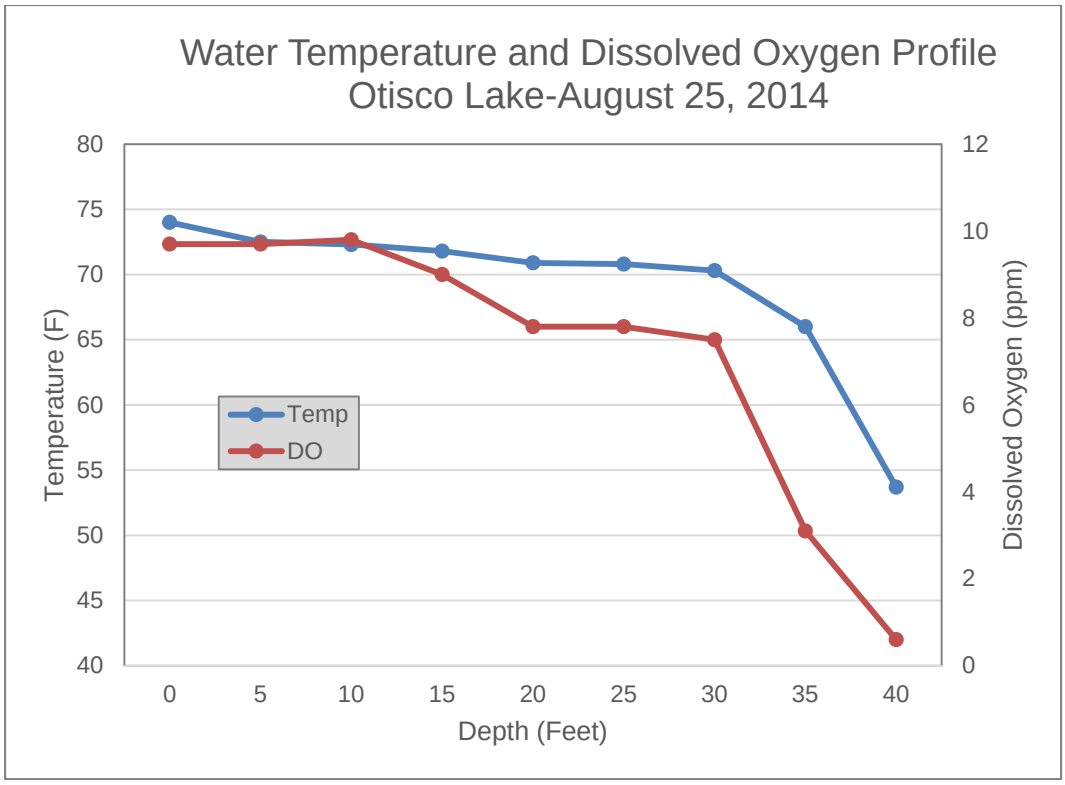

Figure 3. Temperature and Dissolved Oxygen Profile for Otisco Lake, August 25, 2014.

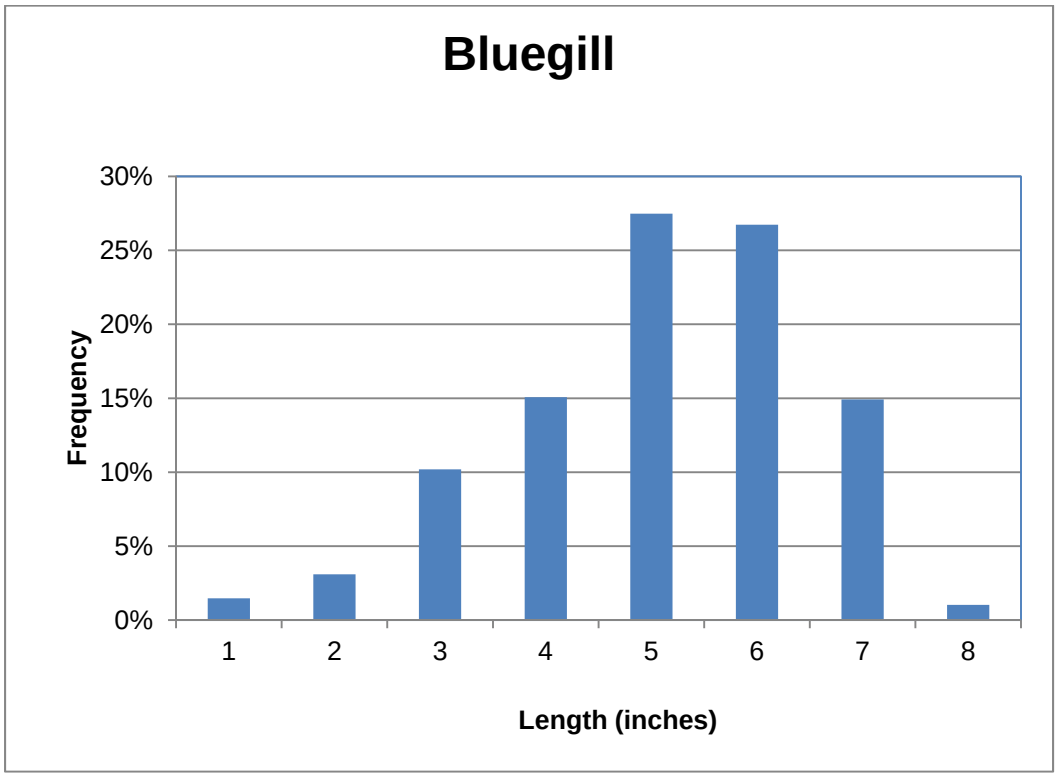

Figure 4. Length frequency distributions of bluegill sampled in Otisco Lake 2014.

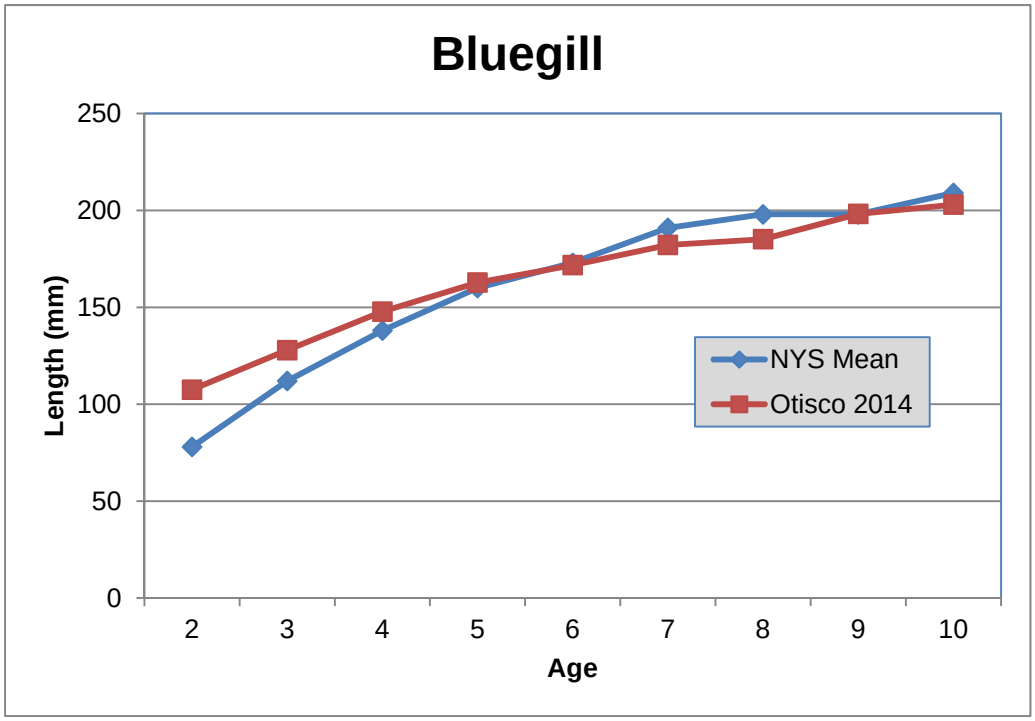

Figure 5. Otisco Lake bluegill mean lengths (mm) at age and the New York State mean growth rate (Green 1989).

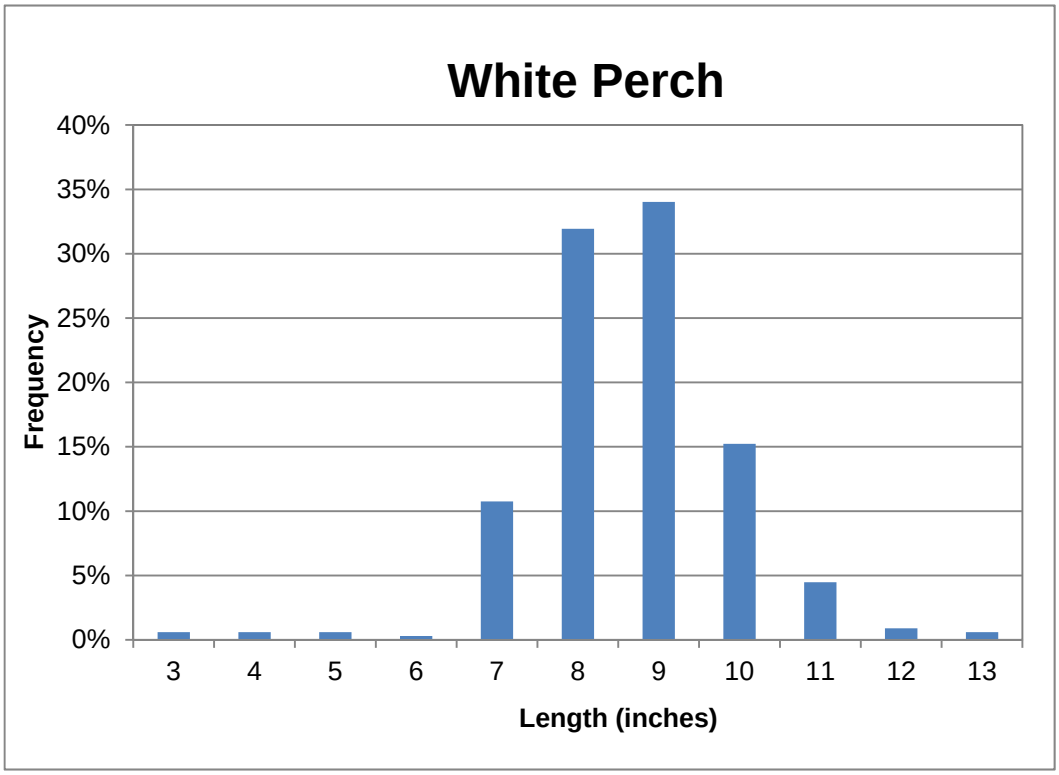

Figure 6. Length frequency distributions of white perch sampled in Otisco Lake 2014.

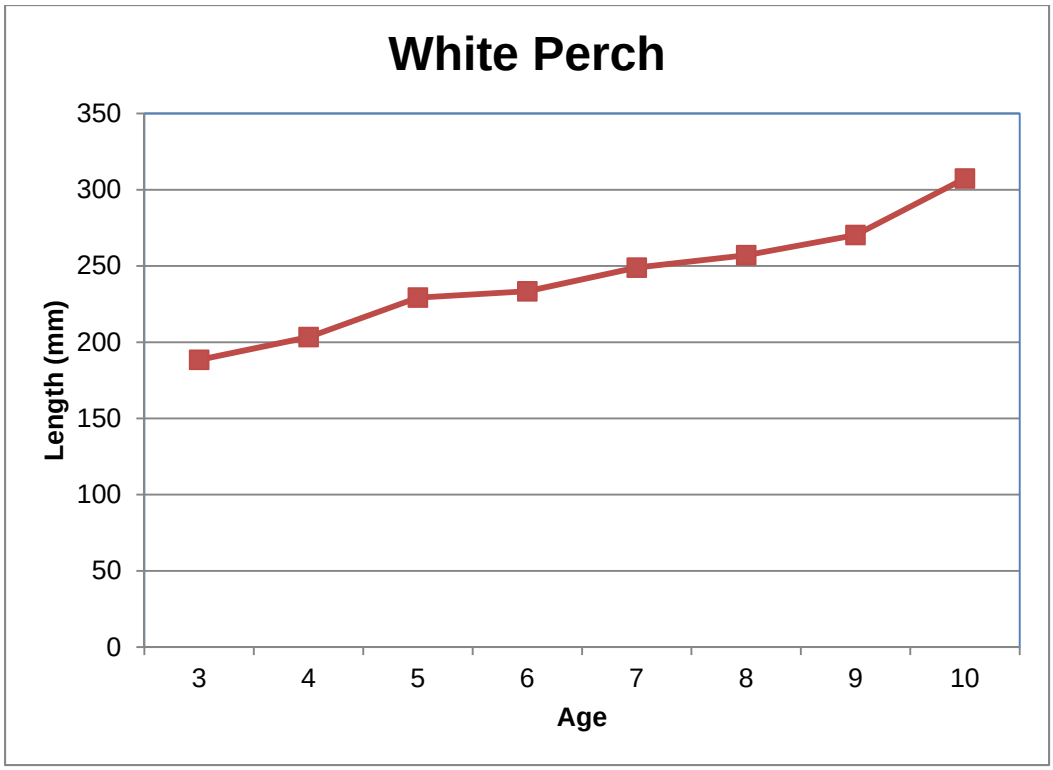

Figure 7. Otisco Lake white perch mean lengths (mm) at age sampled in Otisco Lake 2014.

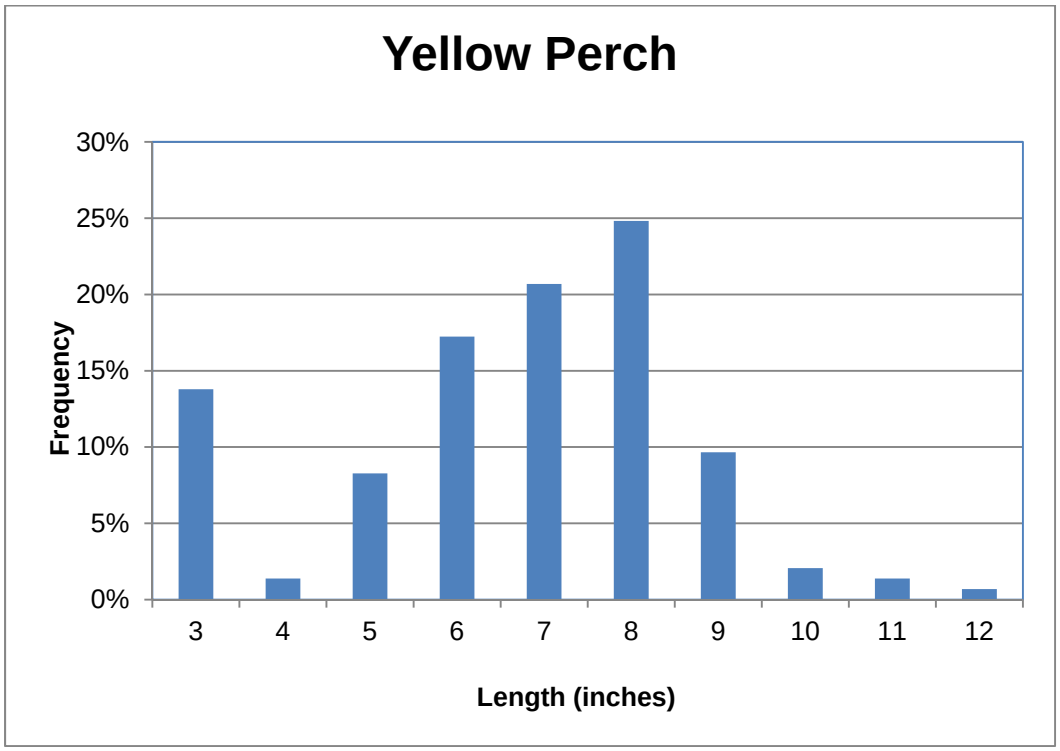

Figure 8. Length frequency distributions of yellow perch sampled in Otisco Lake 2014.

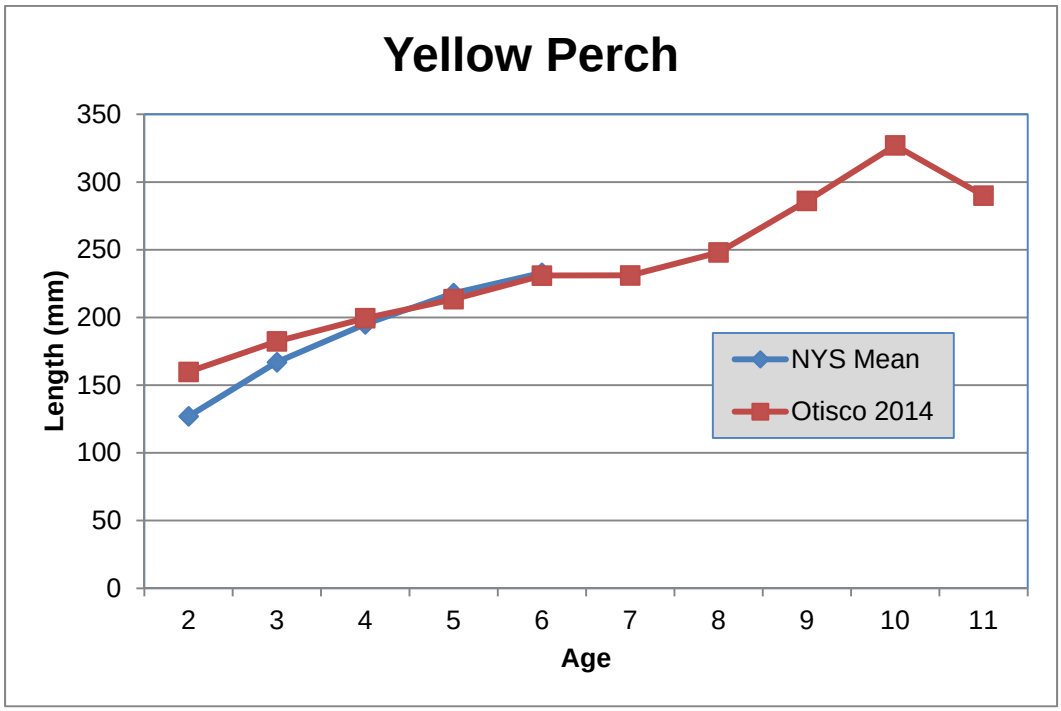

Figure 9. Otisco Lake yellow perch mean lengths (mm) at age and the New York State mean growth rate (Green et al.1993).

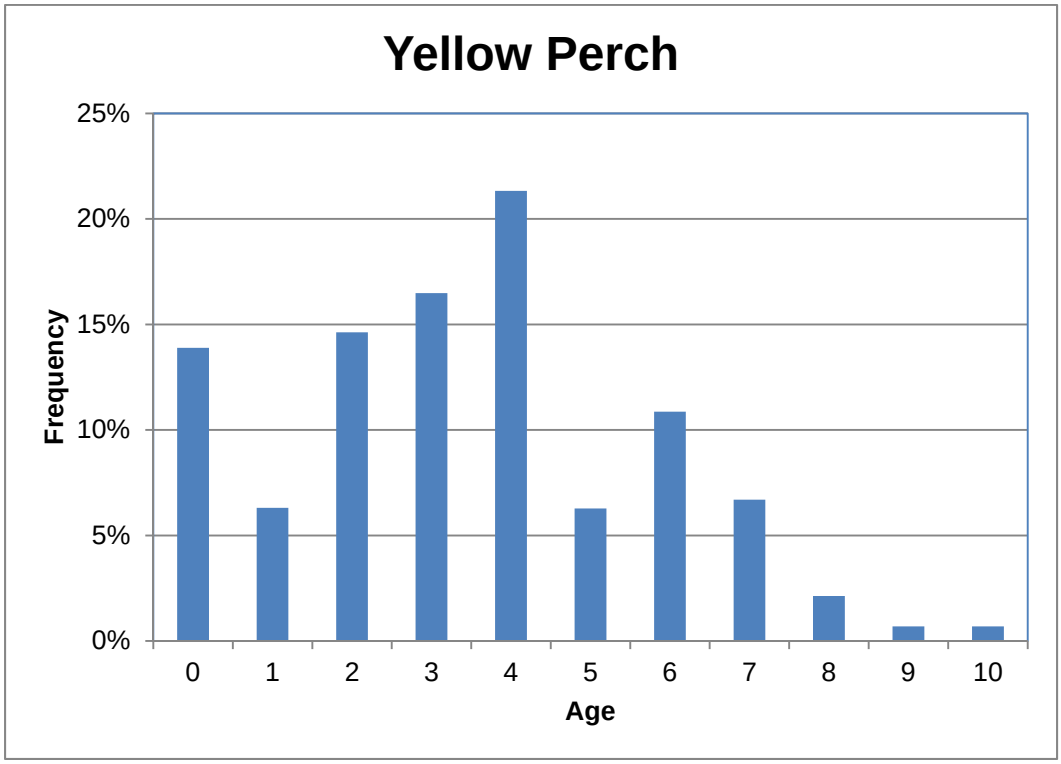

Figure 10. Age frequency distributions of yellow perch sampled in Otisco Lake 2014

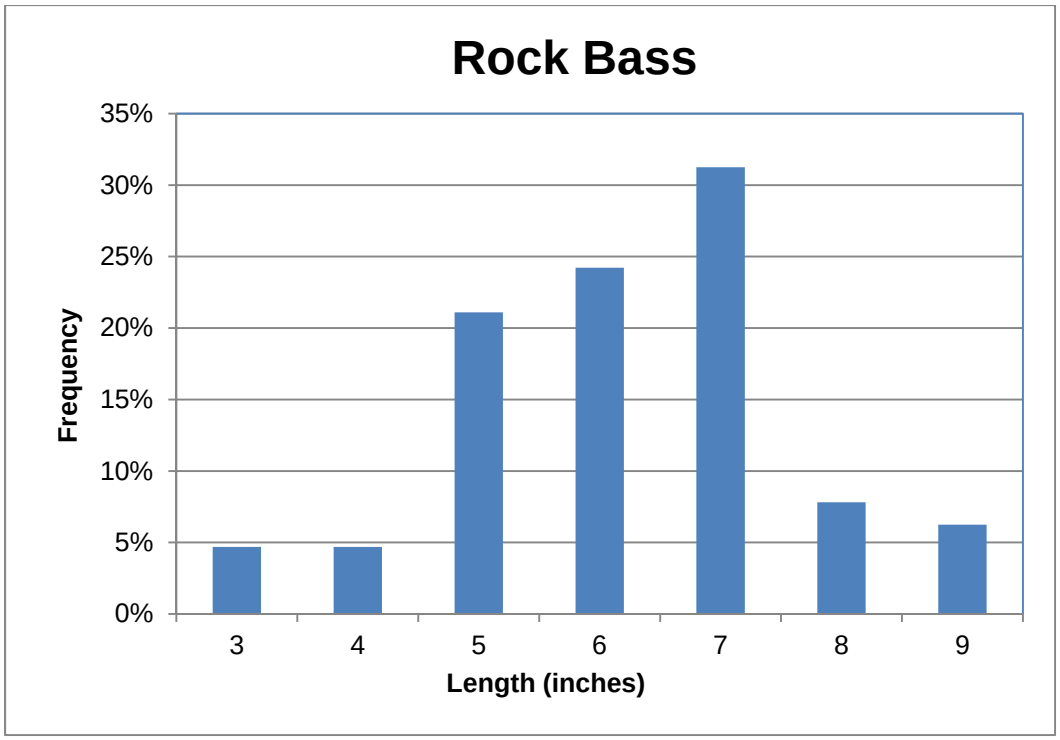

Figure 11. Length frequency distributions of rock bass sampled in Otisco Lake 2014.

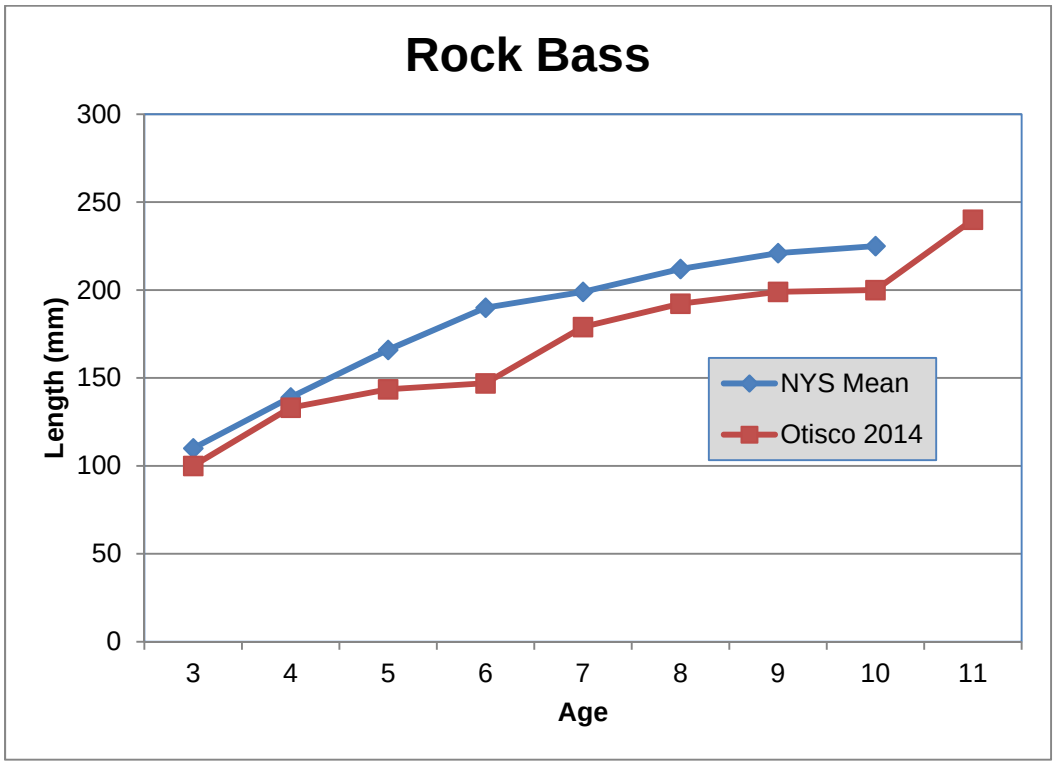

Figure 12. Otisco Lake rock bass mean lengths (mm) at age and the New York State mean growth rate (Green 1989).

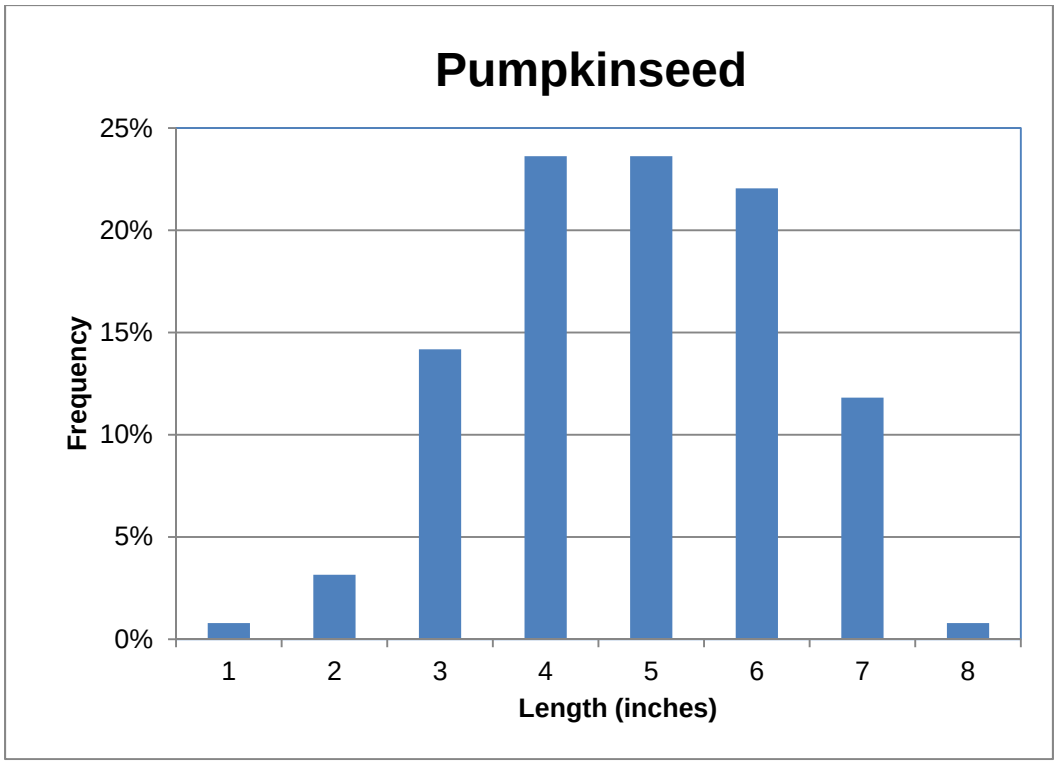

Figure 13. Length frequency distributions of pumpkinseeds sampled in Otisco Lake 2014.

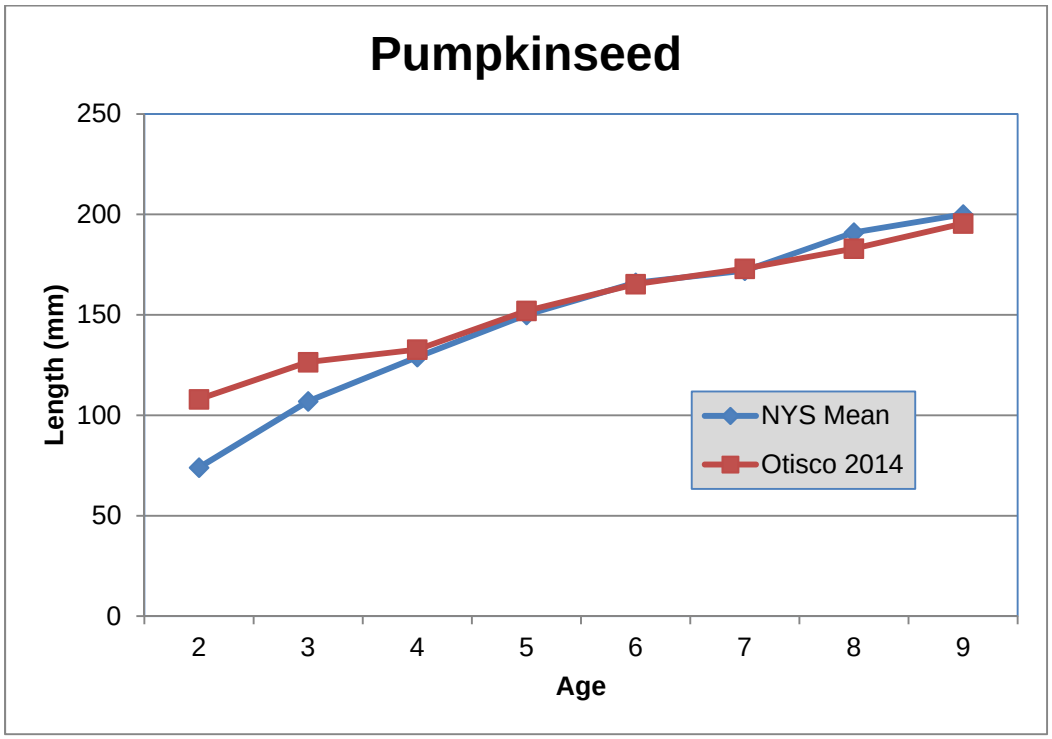

Figure 14. Otisco Lake pumpkinseed mean lengths (mm) at age and the New York State mean growth rate (Green 1989).

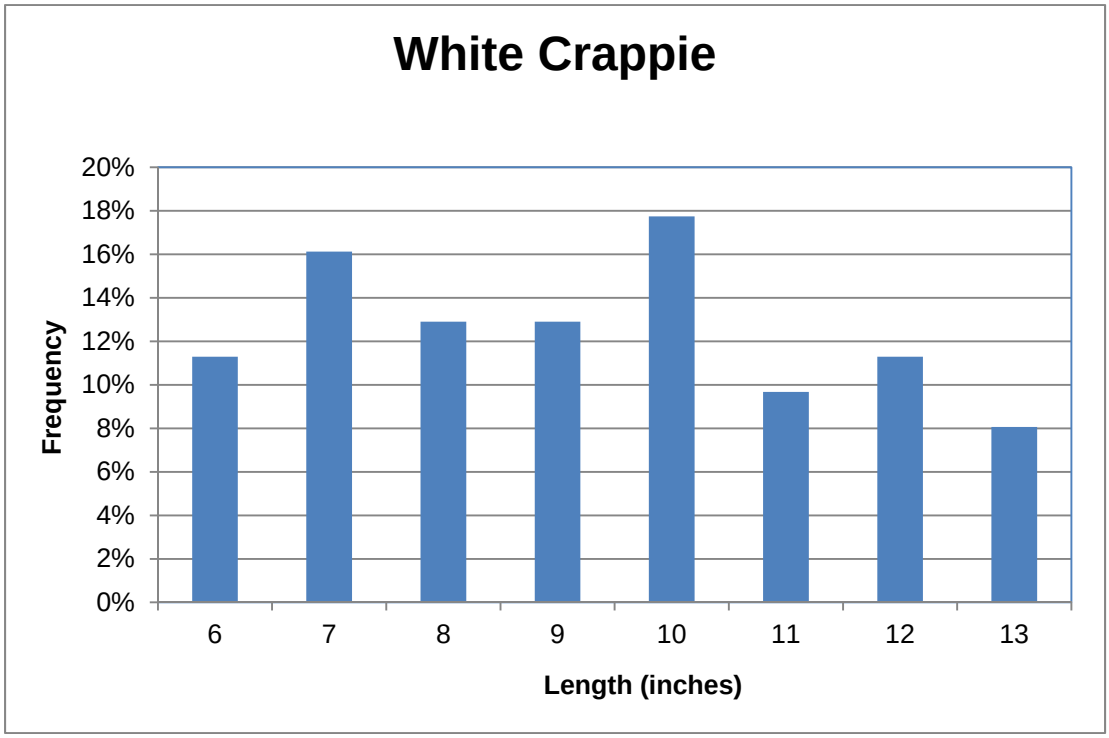

Figure 15. Length frequency distributions of white crappie sampled in Otisco Lake 2014.

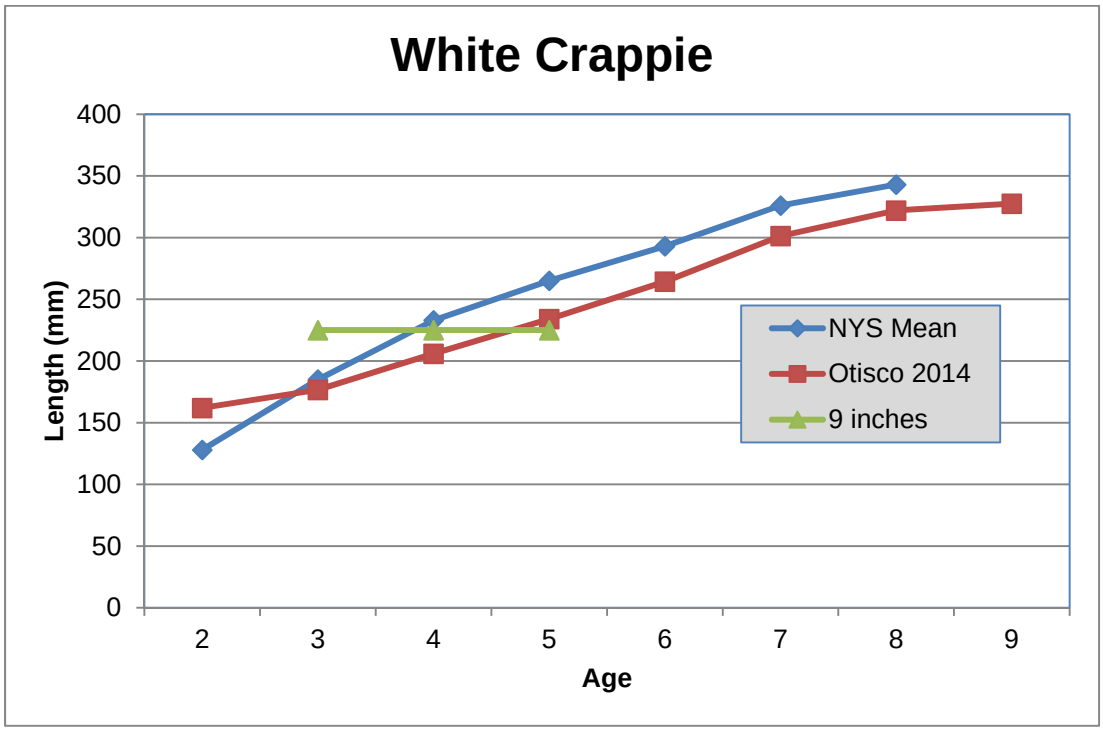

Figure 16. Otisco Lake white crappie mean lengths (mm) at age, legal length (9 inches) and the New York State me

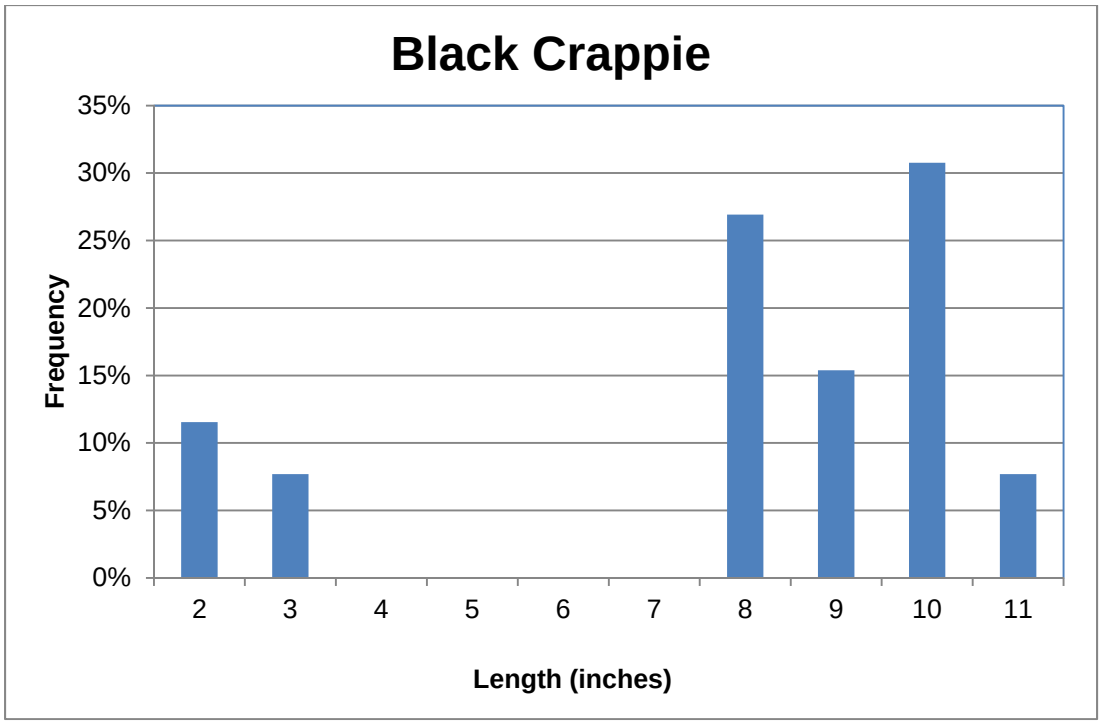

Figure 17. Length frequency distribution of black crappie sampled in Otisco Lake in 2014.

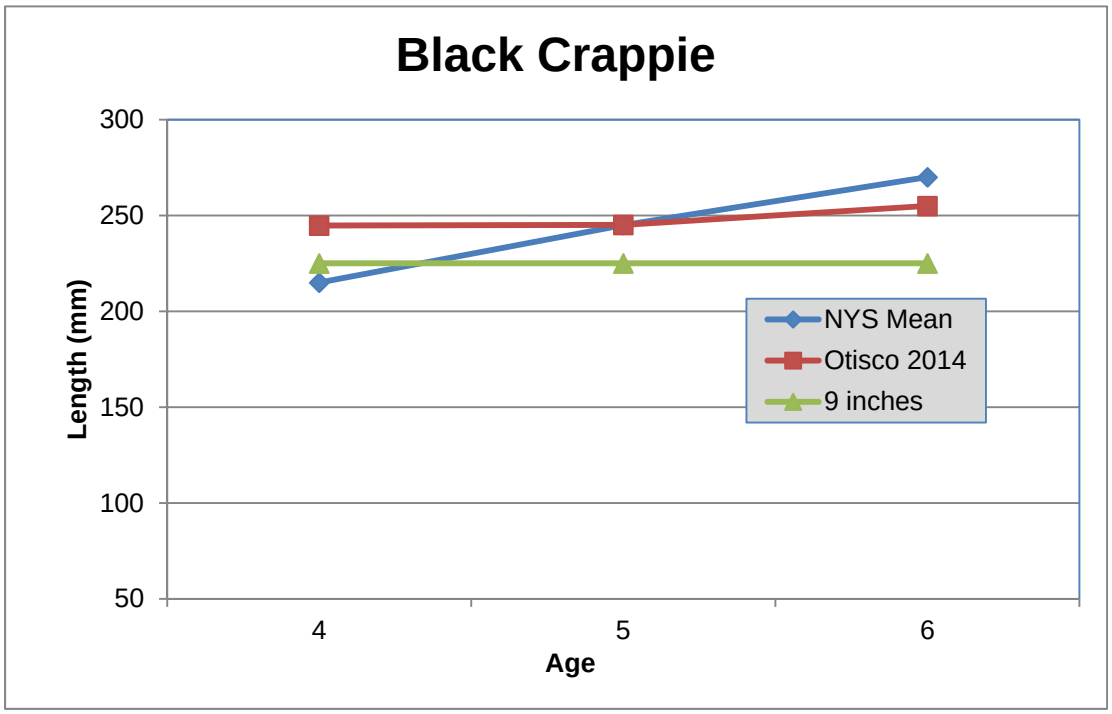

Figure 18. Otisco Lake black crappie mean lengths (mm) at age, legal length (9 inches) and the New York State mean growth rate (Green 1989).

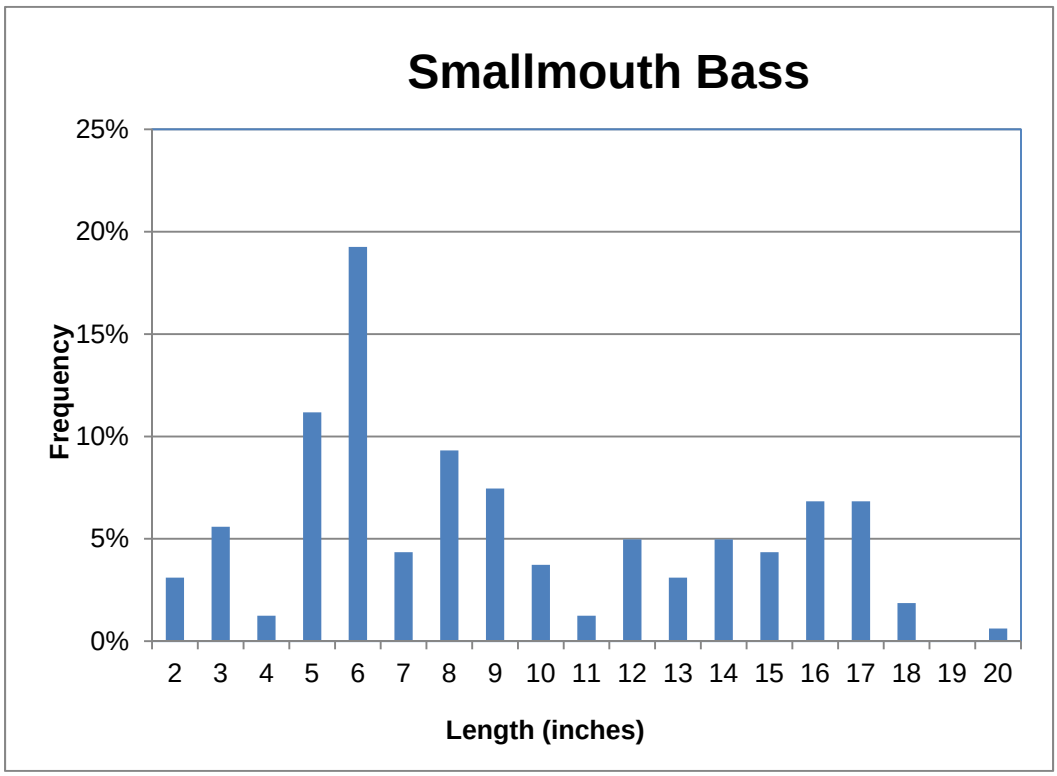

Figure 19. Length frequency distributions of smallmouth bass sampled in Otisco Lake 2014.

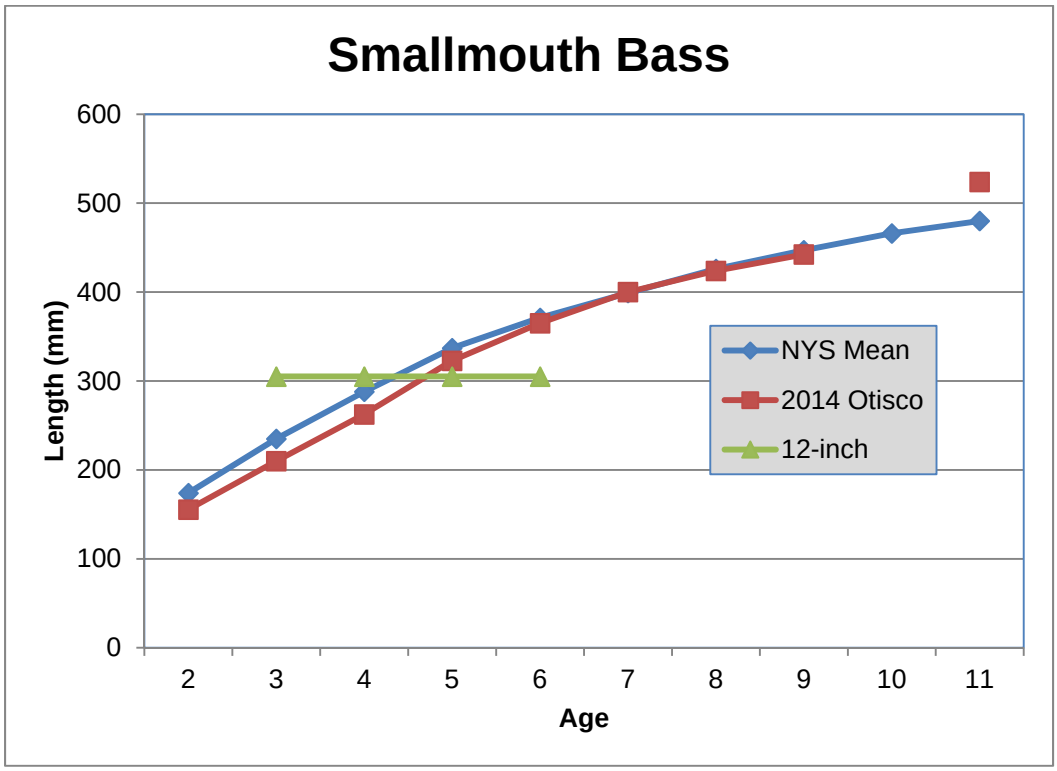

Figure 20. Otisco Lake smallmouth bass mean lengths (mm) at age, 12 inch legal length and the New York State mean growth rate (Green 1989).

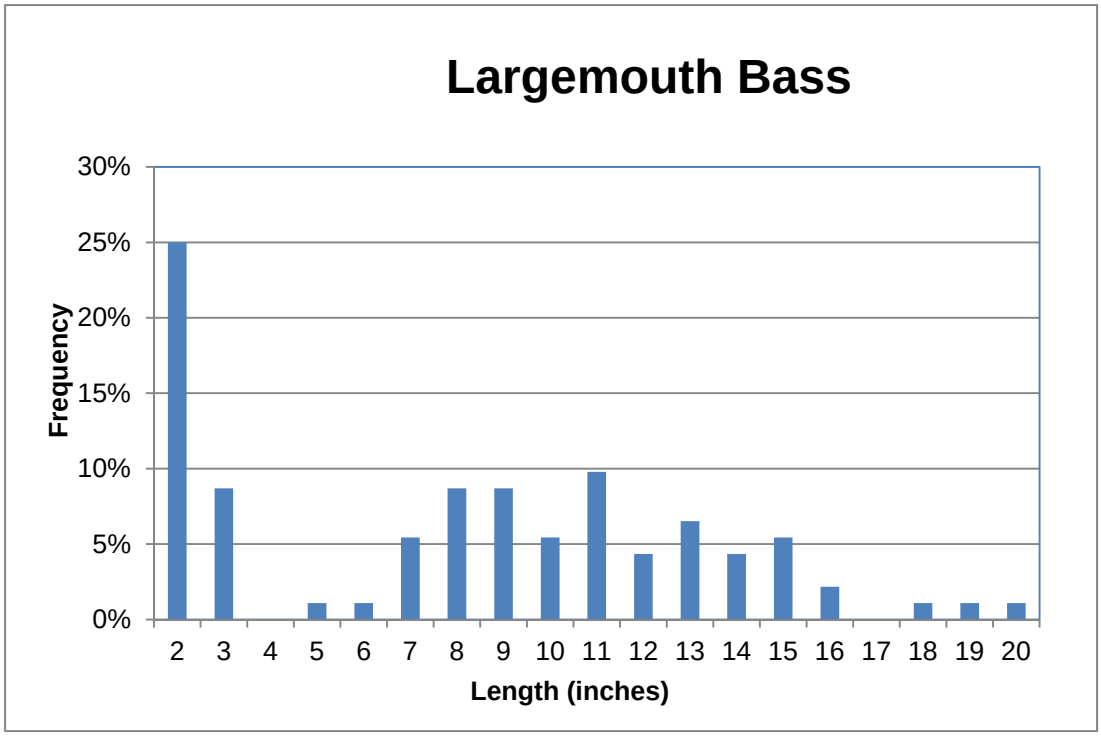

Figure 21. Length frequency distributions of largemouth bass sampled in Otisco Lake 2014.

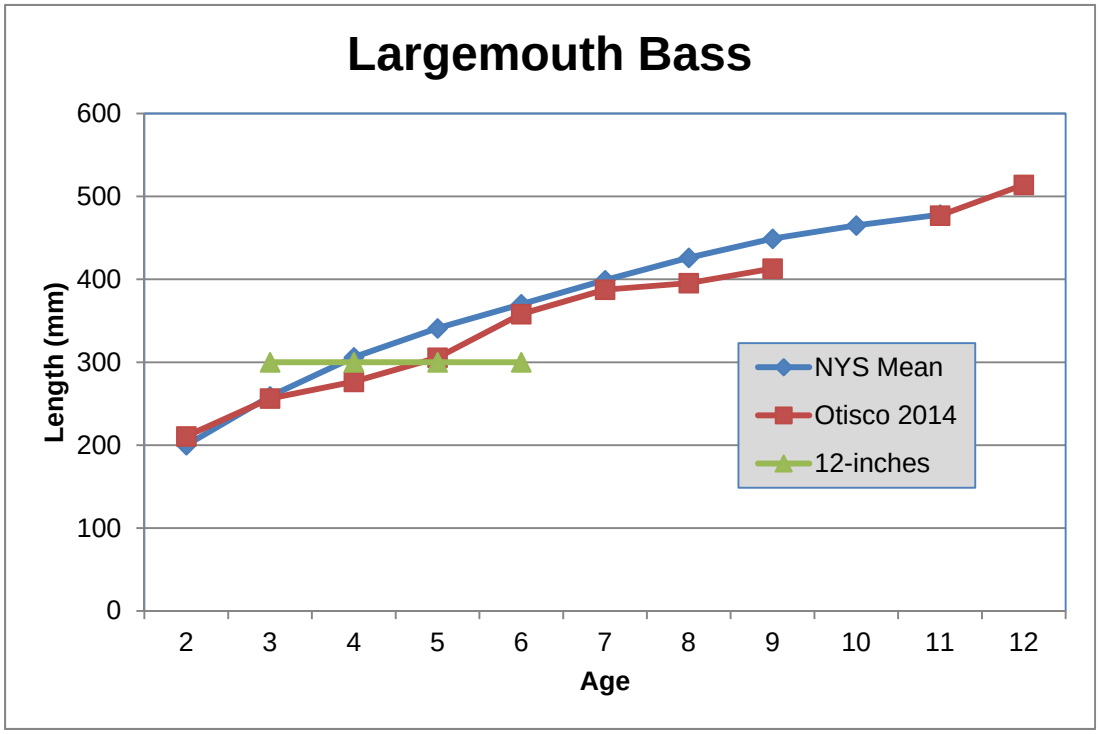

Figure 22. Otisco Lake largemouth bass mean lengths (mm) at age, legal length (12 inches) and the New York State mean growth rate (Green 1989).

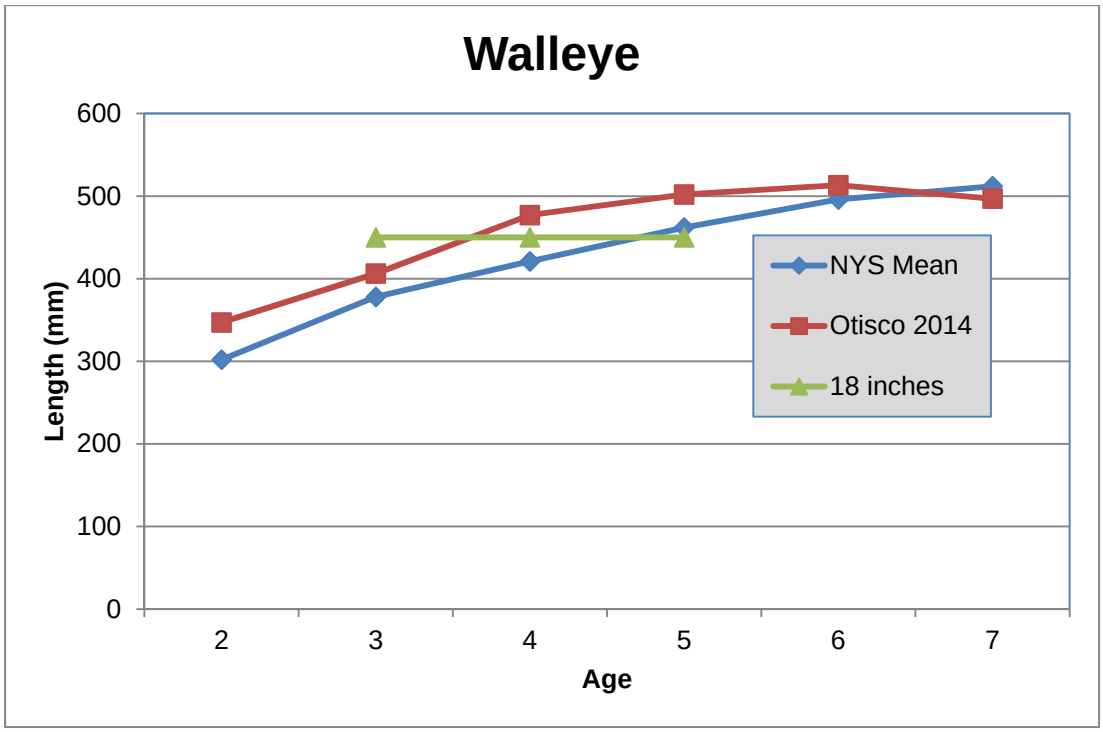

Figure 23. Otisco Lake walleye mean lengths (mm) at age based on otolith aging, legal length (18 inches) and the New York State mean growth rate (Green et al.1993).

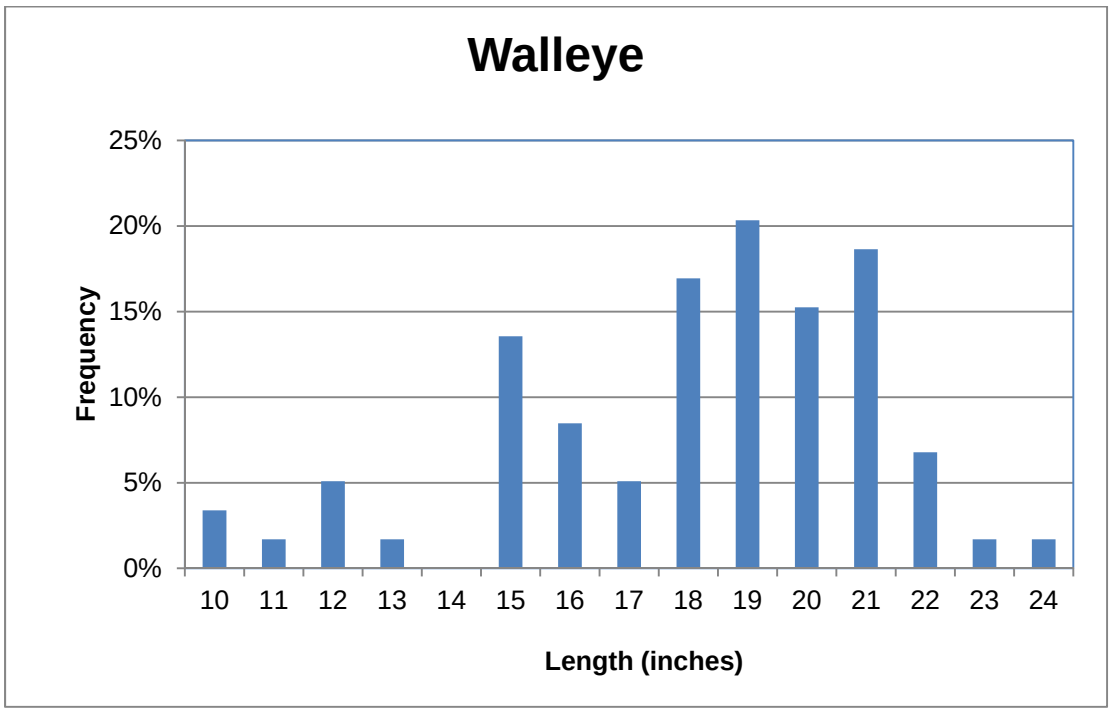

Figure 24. Length frequency distributions of walleye sampled in Otisco Lake 2014.

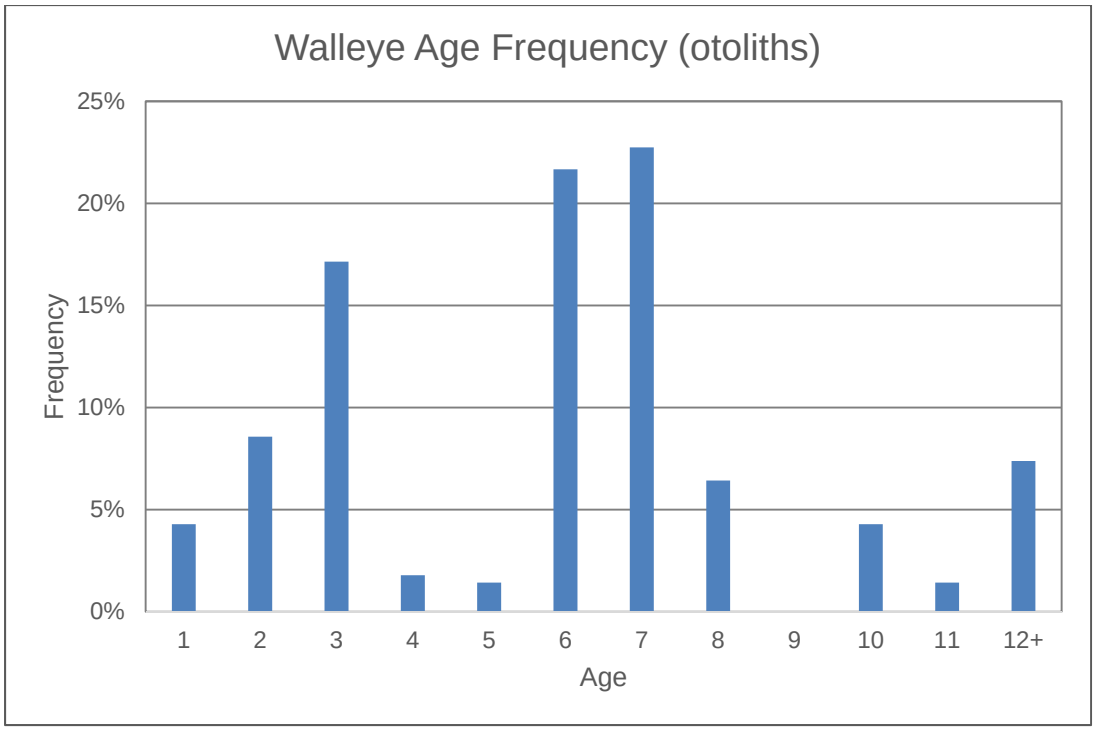

Figure 25. Age frequency distributions of walleye sampled in Otisco Lake 2014 based on otolith ages.

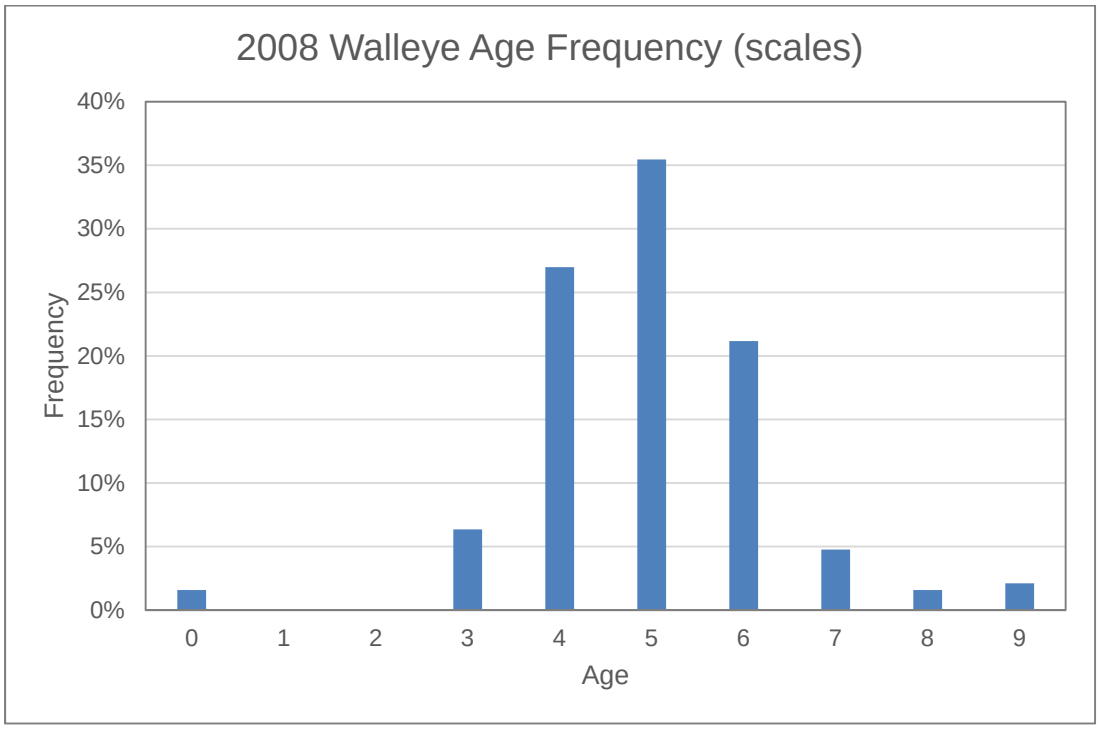

Figure 26. Age frequency distribution of walleye sampled in Otisco Lake in 2008 based on scale ages.

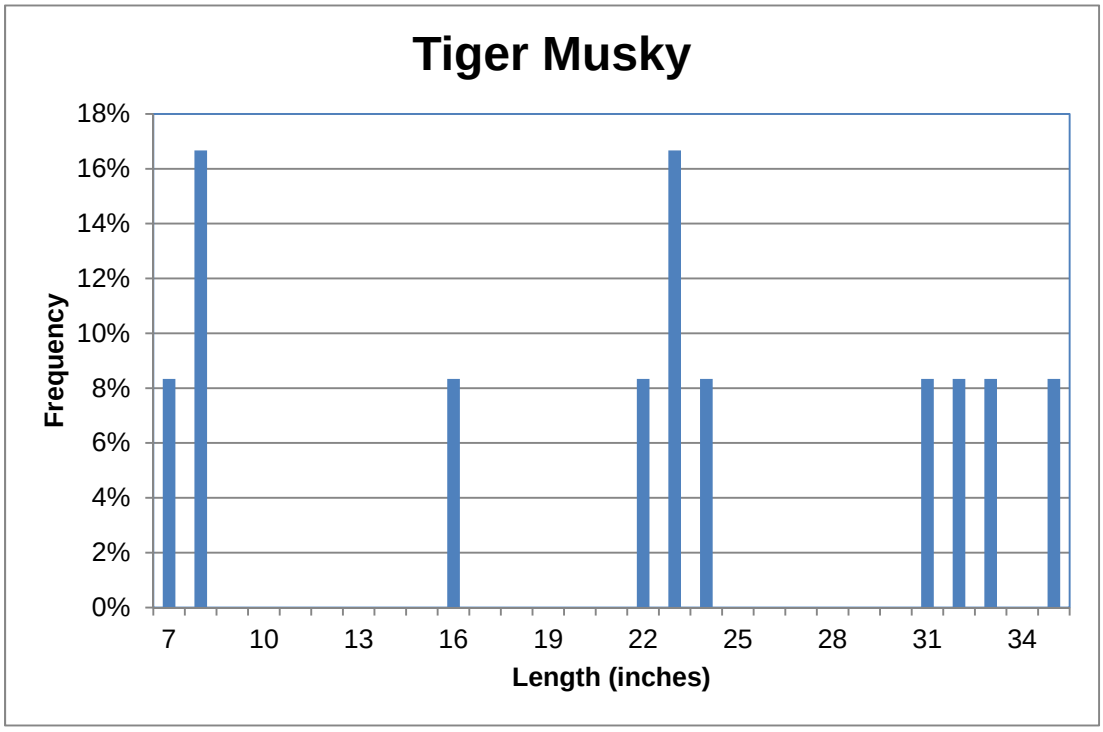

Figure 27. Length frequency distributions of tiger musky sampled in Otisco Lake 2014.

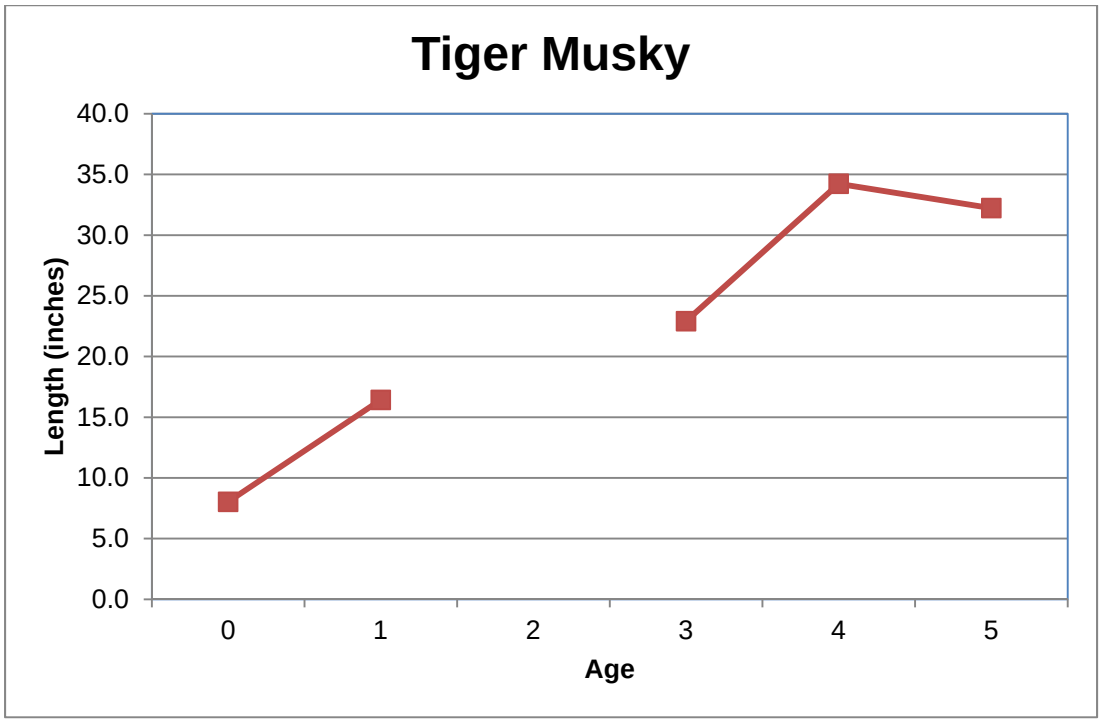

Figure 28. Otisco Lake tiger musky mean lengths (inches) at age for fish collected in 2014.

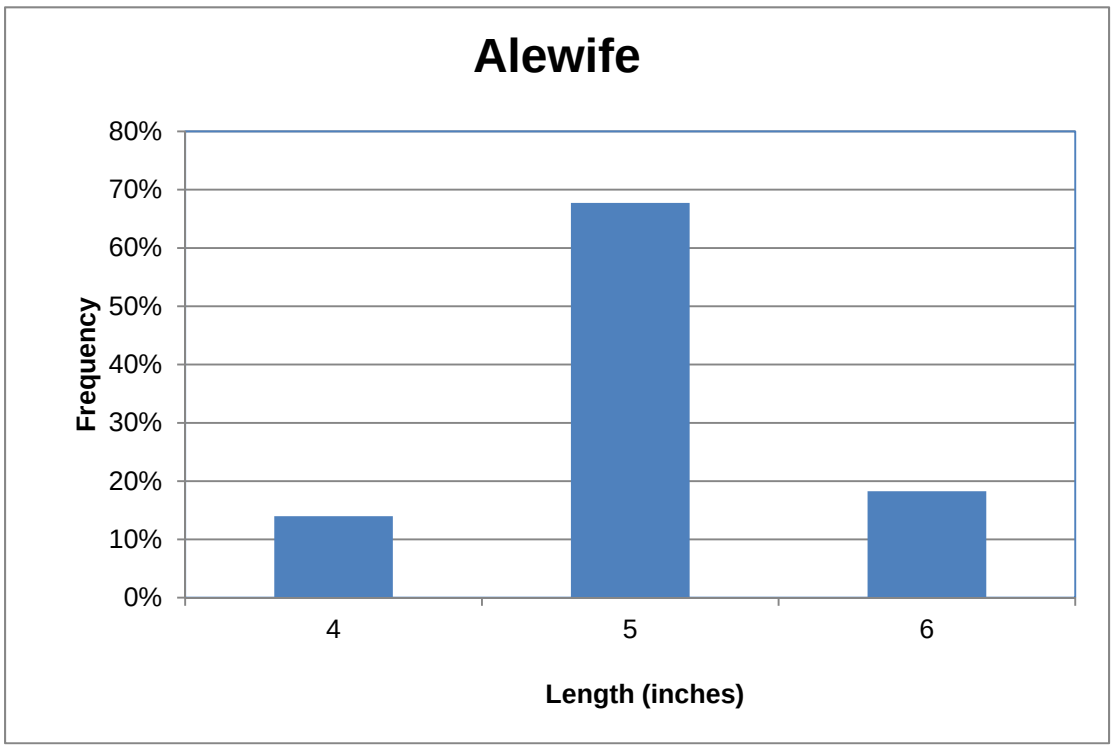

Figure 29. Length frequency distributions of alewives sampled in Otisco Lake 2014.

Table 1. NYSDEC stocking history for Otisco Lake from 1910-2014.

Species	Year Stocked
Brook Trout	1933, 2005
Brown Trout	1969-72, 1974, 1979-1996, 1999, 2001-2014
Rainbow Trout	1968-70, 1974, 1976-77, 1980
Cisco or Lake Herring	1929
Muskellunge	1925, 1927
Tiger Musky	1977-78, 1980-82, 1985-2014
Brown Bullhead	1920, 1929, 1936-42, 1948
Black Bass	1910-17, 1932-38
Largemouth Bass	1930, 1936-39, 1948
Smallmouth Bass	1918-19, 1922-23, 1925, 1927-39, 1948
Black Crappie	1932-1938
Yellow Perch	1911,1915, 1919, 1922-24, 1927-42
Walleye	1915-19, 1921-24, 1927-56, 1958-59, 1961-69, 1988, 1990-1998, 2002-2006, 2008-2013

Table 2. 2014 water chemistry for Otisco Lake.

Date	Depth (ft)	Water Temp. (F)	DO (ppm)	pH	Conductivity (umho/cm3)	Secchi depth (ft)	Location
6/11/2014	0	70.7	9.2	8.5	771		Northern Basin
6/12/2014	0	69.2	8.6	8.6	770		Southern Basin
6/16/2014	0	69.5	9.1	8.7	773		Northern Basin
8/25/2014	0	78.3					
	2	76.1					
	4	74					
	6	72.8					
	8	72.8					
	10	72.7					
	12	72.6					
	14	72.6					
8/25/2014	0	77.4					Northern Basin
	2	76.1					
	4	74.7					
	6	73.3					
	8	72.7					
	10	72.5					
	12	72.2					
	14	72					
	16	71.8					
	18	71.6					
	20	71.2					
	22	71					
	24	70.8					
	26	69.7					
	28	69.2					
	30	63.4					
	32	60.4					
	34	59					
	36	54					
	38	54					
	40	53					
	42	52					
	44	51					
	46	50					
	48	49					
8/26/2014	0	74	9.7	8.6	463	8	Northern Basin

Date	Depth (ft)	Water Temp. (F)	DO (ppm)	pH	Conductivity (umho/cm3)	Secchi depth (ft)	Location
6/11/2014	0	70.7	9.2	8.5	771		Northern Basin
	5	72.5	9.7				
	10	72.3	9.8				
	15	71.8	9				
	20	70.9	7.8				
	25	70.8	7.8				
	30	70.3	7.5				
	35	66	3.1				
	40	53.7	0.6				
9/23/2014	0	65	10.1		353		Northern Basin
9/24/2014	0	64.8	10	7.9	360		Southern Basin

Table 3. Fish species caught or observed during 2014 Fisheries surveys in Otisco Lake. Fyke net (FN), gill net (GN), seine (SN), and electrofishing (EF).

Species	Scientific Name	FN	GN	SN	EF	Total	Percent
Alewives	*Alosa pseudoharengus*	78	14	3	1	96	4%
Brown Trout	*Salmo trutta*	0	1	0	0	1	0%
Tiger Musky	*Esox lucius x masquinongy*	0	4	0	8	12	1%
Common Carp	*Cyprinus carpio*	2	2	0	48	52	2%
Golden Shiner	*Notemigonus crysoleucas*	0	11	3	28	42	2%
Spottail Shiner	*Notropis hudsonius*	1	0	5	30	36	2%
Cyprinid Family	*Cyprinidae*	0	0	2	0	2	0%
Emerald shiner	*Notropis atherinoides*	0	0	50	0	50	2%
White Sucker	*Catastomus commersoni*	2	5	0	0	7	0%
Bluntnose Minnow	*Pimephales notatus*	0	0	0	13	13	1%
Yellow Bullhead	*Ictalurus natalis*	9	0	0	1	10	0%
Brown Bullhead	*Ictalurus nebulosus*	4	1	0	5	10	0%
Channel Catfish	*Ictalurus punctatus*	2	6	0	0	8	0%
White Perch	*Morone americana*	128	186	0	21	335	14%
Banded Killifish	*Fundulus diaphanus*	0	0	13	0	13	1%
Rock Bass	*Ambloplotes rupestris*	8	13	0	107	128	5%
Sunfish family	*Centrarchidae*	0	0	192	0	192	8%
Pumpkinseed	*Lepomis gibbosus*	62	9	5	51	127	5%
Bluegill	*Lepomis macrochirus*	358	34	0	285	677	29%
Smallmouth Bass	*Micrpterus dolomieui*	1	64	5	91	161	7%
Largemouth Bass	*Micrpterus salmoides*	2	5	21	64	92	4%
White Crappie	*Pomoxis annularis*	53	1	0	8	62	3%
Black Crappie	*Pomoxis nigromaculatus*	5	11	0	10	26	1%
Tessellated Darter	*Etheostoma nigrum*	0	0	9	5	14	1%
Yellow perch	*Perca flavescens*	14	68	0	63	145	6%
Walleye	*Strizostedion vitreus*	0	59	0	12	71	3%
	Total	**729**	**494**	**308**	**822**	**2,382**	

Table 4. Number of fish collected of stock, quality, preferred, memorable and trophy lengths in 2014 Fisheries surveys in Otisco Lake.

Species	Stock		Quality		Preferred		Memorable		Trophy	
Channel Catfish	8	(11)	7	(16)	0	(24)	0	(28)	0	(36)
White Perch	331	(5)	292	(8)	71	(10)	3	(12)	0	(15)
Rock Bass	122	(4)	58	(7)	8	(9)	0	(11)	0	(13)
Pumpkinseed	122	(3)	43	(6)	1	(8)	0	(10)	0	(12)
Bluegill	289	(3)	7	(6)	0	(8)	0	(10)	0	(12)
Smallmouth Bass	96	(7)	56	(11)	41	(14)	15	(17)	1	(20)
Largemouth Bass	54	(8)	24	(12)	10	(15)	1	(20)	0	(25)
White Crappie	62	(5)	43	(8)	27	(10)	11	(12)	0	(15)
Black Crappie	21	(5)	21	(8)	10	(10)	0	(12)	0	(15)
Yellow Perch	123	(5)	56	(8)	6	(10)	1	(12)	0	(15)
Walleye	71	(10)	64	(15)	26	(20)	0	(25)	0	(30)

*Number in ( ) is length in inches for stock, quality, preferred, memorable and trophy for species.

Table 5. Comparison of Proportional Stock Densities (PSD), Relative Stock Densities (RSDp) and Relative Weights (Wr) for Otisco Lake 2008 Finger Lakes Standard Gang and 2014 Standard Inland gill netting surveys.

	PSD		RSDp		Wr	
Species	2008	2014	2008	2014	2008	2014
White Perch	67	90	9	18	97	86
Rock Bass	27	77	0	31	98	93
Pumpkinseed	96	89	6	0	104	92
Bluegill	97	62	10	3	95	87
Smallmouth Bass	76	87	56	66	109	97
Largemouth Bass		60		20		90
White Crappie		100		100		80
Black Crappie	100	100		46		97
Yellow Perch	67	54	25	7	91	79
Walleye	94	98	29	38	106	107

Table 6. Comparison of 2008 Finger Lakes Standard Gang gill netting survey to the 2014 Standard Inland gill netting survey. Catch per unit effort is in square foot of net.

	Total		fish/ft^2 of net		fish/ft^2 of net *1000	
Species	**2008**	**2014**	**2008**	**2014**	**2008**	**2014**
Alewives	66	14	0.0047	0.0016	4.714	1.556
Brown Trout	1	1	0.0001	0.0001	0.071	0.111
Tiger Musky	0	4	0.0000	0.0004	0.000	0.444
Carp	7	2	0.0005	0.0002	0.500	0.222
Golden Shiner	0	11	0.0000	0.0012	0.000	1.222
White Sucker	22	6	0.0016	0.0007	1.571	0.667
Brown Bullhead	4	1	0.0003	0.0001	0.286	0.111
Channel Catfish	2	6	0.0001	0.0007	0.143	0.667
Rock Bass	11	13	0.0008	0.0014	0.786	1.444
Pumpkinseed	53	9	0.0038	0.0010	3.786	1.000
Bluegill	92	34	0.0066	0.0038	6.571	3.778
Smallmouth Bass	91	64	0.0065	0.0071	6.500	7.111
Largemouth Bass	0	5	0.0000	0.0006	0.000	0.556
White Crappie	0	1	0.0000	0.0001	0.000	0.111
Black Crappie	1	11	0.0001	0.0012	0.071	1.222
Yellow Perch	13	68	0.0009	0.0076	0.929	7.556
Walleye	63	58	0.0045	0.0064	4.500	6.444
White Perch	304	186	0.0217	0.0207	21.714	20.667
Total	**730**	**494**	**0.052**	**0.055**	**52.1**	**54.9**

Table 7. Walleye age comparison between scale and otolith aging methods for Otisco Lake Standard Inland gill netting 2014.

Length	Age (years)		
(mm)	Scale	Otolith	Difference
308	1	2	1
386	2	2	0
393	2	3	1
395	3	3	0
397	3	3	0
402	3	3	0
402	3	3	0
412	3	3	0
437	3	3	0
412	4	3	1
477	5	4	1
502	6	5	1
460	5	6	1
472	6	6	0
476	6	6	0
484	6	6	0
505	6	6	0
515	6	6	0
528	6	6	0
535	6	6	0
535	6	6	0
566	6	6	0
582	7	6	1
501	8	6	2
505	5	7	2
507	5	7	2
544	5	7	2
460	6	7	1
466	6	7	1
474	6	7	1
498	6	7	1
504	6	7	1
507	6	7	1
512	6	7	1
437	7	7	0
494	7	7	0

Length	Age (years)		
(mm)	Scale	Otolith	Difference
308	1	2	1
515	7	7	0
533	7	7	0
460	6	8	2
587	6	8	2
509	7	8	1
554	7	8	1
490	6	10	4
550	7	10	3
555	7	10	3
505	7	11	4
421	6	12	6
528	7	12	5
545	8	12	4
542	8	13	5
610	8	22	14

Table 8. Alewives caught by mesh size, and number caught by net night for Otisco Lake Finger Lakes Standard Gang gill netting surveys from 1977 to 2008.

	Mesh Size (inches)								Fish/net
Year	**1**	**1.5**	**2**	**2.5**	**3**	**4**	**5**	**Sum**	**night**
1977	131	189	79	23	14	4	3	443	89
1981	1119	23	2	5	1	1	0	1151	128
1984	1052	48	2	3	5	0	0	1110	111
1987	224	155	12	8	1	2	0	402	40
1990	659	148	2	7	0	0	3	819	91
1993	522	290	3	10	6	1	0	832	92
2008	15	45	5	1	0	0	0	66	13
Total	**3722**	**898**	**105**	**57**	**27**	**8**	**6**	**4823**	

Appendix 1. Species summary table for NYSDEC Fisheries surveys on Otisco Lake. Survey purpose, target species and sampling gear varies by survey. An **X** indicates that species was collected and/or observed.

	1977	1978	1981	1984	1987	1990	1992	1993	1993	1993	1994	1994
Otisco Lake Species	777153	778157	781153	784153	787153	790016	792027	793014	793026	793028	794100	794018
Minnow & Carp Family												
Sunfish Family												
Alewife	X	X	X	X	X	X	X	X			X	
Cisco or Lake Herring	X	X	X	X								
Rainbow Trout	X		X	X								
Atlantic Salmon			X									
Brown Trout	X	X	X	X	X	X		X	X			X
Tiger Musky		X		X	X	X	X		X			X
Common Carp		X	X	X	X	X		X				X
Cutlip Minnow		X										
Golden Shiner	X	X		X								X
Satinfin Shiner												
Emerald Shiner												
Common Shiner		X										
Spottail Shiner		X	X	X	X	X		X		X	X	X
Spotfin Shiner												
Bluntnose Minnow												
Creek Chub												
Fallfish		X										
White Sucker	X	X	X	X	X	X		X				X
Creek Chubsucker		X										
Yellow Bullhead												
Brown Bullhead						X		X				
Channel Catfish												
Margined Madtom												
Banded Killifish												
White Perch	X	X	X	X	X	X		X				X
Rock Bass	X	X		X	X	X		X				X
Green Sunfish												
Pumpkinseed	X	X						X				X
Bluegill		X			X	X		X				
Smallmouth Bass	X	X	X	X	X	X	X	X				X
Largemouth Bass		X	X				X		X			X
White Crappie												
Black Crappie	X	X	X									
Johnny Darter		X										
Tessellated Darter										X		
Yellow Perch	X	X	X	X	X	X		X	X			X
Walleye	X	X	X	X	X	X	X	X	X	X		X

Appendix 1 continued. Species summary table for NYSDEC Fisheries surveys on Otisco Lake. Survey purpose, target species and sampling gear varies by survey. An **X** indicates that species was collected and/or observed.

Otisco Lake Species	1995 795016	1995 795030	1995 795035	1995 795009	1996 796020	1996 796004	1997 797028	1997 797024	1999 799002	1999 799014	2001 701028	2003 703015
Minnow & Carp Family						X						
Sunfish Family												
Alewife	X		X	X		X	X	X				
Cisco or Lake Herring												
Rainbow Trout												
Atlantic Salmon												
Brown Trout								X				
Tiger Musky	X	X			X			X			X	X
Common Carp	X		X				X	X				X
Cutlip Minnow												
Golden Shiner	X					X		X				X
Satinfin Shiner	X					X						
Emerald Shiner	X											
Common Shiner												
Spottail Shiner	X			X		X	X					
Spotfin Shiner	X											
Bluntnose Minnow	X					X						
Creek Chub						X						
Fallfish												
White Sucker						X		X				X
Creek Chubsucker												
Yellow Bullhead												
Brown Bullhead	X						X					
Channel Catfish	X						X					
Margined Madtom	X					X						
Banded Killifish						X						
White Perch			X	X			X	X			X	
Rock Bass	X											X
Green Sunfish	X											
Pumpkinseed	X					X		X				
Bluegill	X					X		X				
Smallmouth Bass	X					X		X			X	X
Largemouth Bass	X					X		X			X	X
White Crappie												
Black Crappie								X			X	
Johnny Darter	X					X						
Tessellated Darter	X			X		X					X	
Yellow Perch	X			X		X	X	X			X	X
Walleye	X	X		X	X		X	X	X	X	X	

Appendix 1 continued. Species summary table for NYSDEC Fisheries surveys on Otisco Lake. Survey purpose, target species and sampling gear varies by survey. An **X** indicates that species was collected and/or observed.

	2004	2005	2006	2008	2008	2009	2009	2010	2011	2011	2012	2013
Otisco Lake Species	704028	705050	706005	708038	708004	709013	709006	710008	711916	711012	712018	713028
Minnow & Carp Family												
Sunfish Family										X		
Alewife					X			X		X		
Cisco or Lake Herring												
Rainbow Trout												
Atlantic Salmon												
Brown Trout	X				X							X
Tiger Musky	X	X	X	X			X	X	X	X	X	X
Common Carp			X		X			X				
Cutlip Minnow												
Golden Shiner		X						X				
Satinfin Shiner												
Emerald Shiner												
Common Shiner												
Spottail Shiner		X			X			X				
Spotfin Shiner												
Bluntnose Minnow									X			
Creek Chub												
Fallfish												
White Sucker			X		X			X				
Creek Chubsucker												
Yellow Bullhead												
Brown Bullhead			X		X			X				
Channel Catfish					X			X				
Margined Madtom												
Banded Killifish												
White Perch			X		X			X		X		
Rock Bass	X				X			X	X			
Green Sunfish												
Pumpkinseed			X		X			X	X			
Bluegill	X		X		X			X	X			
Smallmouth Bass	X	X	X	X	X	X		X	X	X	X	X
Largemouth Bass	X	X	X	X				X	X	X	X	X
White Crappie			X			X		X		X		
Black Crappie	X	X			X							
Johnny Darter												
Tessellated Darter								X	X			
Yellow Perch	X	X	X		X			X	X	X		
Walleye	X	X	X	X	X	X		X		X	X	X

Appendix 1 continued. Species summary table for NYSDEC Fisheries surveys on Otisco Lake. Survey purpose, target species and sampling gear varies by survey. An **X** indicates that species was collected and/or observed.

Otisco Lake Species	2014 714006	2014 714009	2014 714014	2014 714015
Minnow & Carp Family			X	
Sunfish Family			X	
Alewife	X	X	X	X
Cisco or Lake Herring				
Rainbow Trout				
Atlantic Salmon				
Brown Trout		X		
Tiger Musky		X		X
Common Carp	X	X		X
Cutlip Minnow				
Golden Shiner		X	X	X
Satinfin Shiner				
Emerald Shiner			X	X
Common Shiner				
Spottail Shiner	X		X	X
Spotfin Shiner				
Bluntnose Minnow				X
Creek Chub				
Fallfish				
White Sucker	X	X		X
Creek Chubsucker				
Yellow Bullhead	X			X
Brown Bullhead	X	X		X
Channel Catfish	X	X		
Margined Madtom				
Banded Killifish			X	
White Perch	X	X		X
Rock Bass	X	X		X
Green Sunfish				
Pumpkinseed	X	X	X	X
Bluegill	X	X		X
Smallmouth Bass	X	X	X	X
Largemouth Bass	X	X	X	X
White Crappie	X	X		X
Black Crappie	X	X		X
Johnny Darter				
Tessellated Darter			X	X
Yellow Perch	X	X		X
Walleye		X		X

Appendix 2. Species summary table for the 1927 State of New York Conservation Department Biological survey of the Oswego River system (Greely 1928) and the 2014 NYSDEC Fish Community Survey. X-Recorded from actual specimen, R-recorded on reliable authority, St-stocked but apparently not established.

Species	1927	2014
Alewives		X
Cisco or Lake Herring	X	
Brown Trout	R	X
Chain Pickerel	X	
Tiger Musky		X
Muskellunge	St	
Common Carp	X	X
Golden Shiner	X	X
Creek Chub	X	
Spottail Shiner		X
Silvery minnow	X	
Emerald shiner		X
White Sucker	X	X
Creek Chubsucker	X	
Bluntnose Minnow	X	X
Yellow Bullhead		X
Brown Bullhead	X	X
Channel Catfish		X
White Perch		X
Banded Killifish	X	X
Rock Bass	X	X
Pumpkinseed	X	X
Bluegill		X
Smallmouth Bass	X	X
Largemouth Bass	X	X
White Crappie		X
Black Crappie		X
Tessellated Darter		X
Yellow Perch	X	X
Walleye		X
Number of Species	**18**	**24**