Lake Hopatcong

Fisheries Management Plan

Borough of Mt. Arlington, Borough of Hopatcong
Jefferson Township, Roxbury Township
Sussex County and Morris County

Watershed Management Area: One, Upper Delaware
Musconetcong River Drainage
Watershed Area: 29.7 mi^2 (7,692 hectares)
2686 Acres
Average depth: 18 ft

Prepared By:

Christopher Smith
Principal Fisheries Biologist

January 2015

Grant F-48-R

This project was paid for by fishing license sales and
matching Dingell-Johnson/Wallop-Breaux funds available through the Federal Sportfish Restoration Act.

INTRODUCTION

Lake Hopatcong is situated on the border of Sussex and Morris Counties, and the Boroughs of Mount Arlington, Hopatcong, Jefferson, Roxbury Township and Byram Township surround the lake (Figure 1). Lake Hopatcong was formed by damming two ponds, Great Pond and Little Pond and the Musconetcong River. The outflow of Lake Hopatcong now forms the Musconetcong River. The lake has a surface area of 2686 acres (1087 hectares), with a maximum depth of about 58 feet and an average depth of 18 feet (Figure 2).

The shoreline of Lake Hopatcong is highly developed consisting of residential homes, marinas, swimming beaches and restaurants. Lake Hopatcong was once a summer vacation destination for New Yorkers and celebrities. The exclusive hotels and amusement park are long gone; now Lake Hopatcong serves as a year round residence for thousands of New Jersey residents.

Lake Hopatcong is New Jersey's largest lake and has one the most diverse fisheries in the state. The Division of Fish and Wildlife and the Knee Deep Club have contributed to the species richness by annually stocking warmwater, coolwater and coldwater fish species (Appendix A). Lake Hopatcong was last intensively sampled in 1995 – 1996, and a fisheries survey report was completed in 1997. Lake Hopatcong is not only the largest lake; it is one of the most popular lakes in the state attracting thousands of anglers, boaters and swimmers each year. Summer warm weather activities prevail at Lake Hopatcong; however the lake is utilized year round. Ice fishing on Lake Hopatcong has remained extremely popular since the 1950's and 60's and appears to have a resurgence of popularity in recent years. Large "Trophy" fish such as muskellunge, walleye and hybrid striped bass are frequently caught through the ice and attract hundreds of anglers each winter.

Lake Hopatcong is one of only a few lakes in New Jersey that unlimited horsepower gasoline motors are permitted. A 30 mph speed limit is imposed during the peak of the boating season from May 15th to September 15th, on weekends and holidays. This allows anglers greater mobility while traversing the lake between the many coves, weed beds, docks and rocky islands in search of a Lake Hopatcong trophy. The use of unlimited horsepower motors also makes the lake one of the most popular in the state for recreational boating. An armada of large pleasure boats, pontoon boats, water skiers, jet skis and wave runners descend upon Lake Hopatcong every weekend of the boating season. Night fishing is rather popular on Lake Hopatcong during the warmer months of the year. A10 mph speed limit is imposed and gives anglers some reprieve from the barrage of recreational boaters.

Lake Hopatcong offers boaters a number of ramps and access points at the many private marinas around the lake. The two primary public boats ramps are located at Lake Hopatcong State Park and Lee's County Park.

Tournament bass fishing is extremely popular at Lake Hopatcong. Tournaments are held on both weekdays and weekends, with peak tournament season from June 16th till the end of September. Weekend events draw the most participants as evident from the number of bass boat trailers at Lee's Marina on Saturday and Sundays. A few prominent tournament trails have held regional qualify events at the lake in recent years.

Active fisheries management and stocking is imperative to maintaining the quality fisheries of Lake Hopatcong. Stocking programs and species emphasis have evolved over the years and will continue to change as the lake itself changes. A balanced management strategy is necessary to ensure that all user groups are satisfied. Managing a multiuse resource is inherently challenging and managing the fisheries in that type of resource is equally as challenging.

Changing water quality and the introduction of invasive plant species including Eurasian milfoil and water chestnuts have altered management strategies. Extensive water quality monitoring as well as active water level monitoring and management are integral parts to managing the largest freshwater lake in New Jersey.

MATERIALS AND METHODS

A total of 12 Bureau of Freshwater Fisheries staff (consisting of eight seasonal employees, one technician and three biologists) spent 21 days in the field collecting fisheries information from Lake Hopatcong from August 2013 through June 2104. Sampling locations are shown for all sampling methods in (Figure 3).

Water quality parameters were measured at various locations in the lake (Figure 4). Dissolved oxygen, conductivity, pH, and temperature were measured in the field using hand held Yellow Springs Instrument (YSI) meter (Professional Plus model). Alkalinity was determined in the lab from water samples collected in August 2013, using a titration method.

A 13.2 Smith-Root electrofishing boat was used during the six electrofishing-sampling surveys completed at Lake Hopatcong during the 2013 – 2014 sampling period. There were five surveys conducted at night and one during the day. Two surveys were completed in 2013 and four surveys were completed in 2014. In 2013, one survey conducted at night on October 9th and one during the day on October 18th. In 2014 all electrofishing surveys were completed at night, on May 14th, May 20th, June 4th and June 9th.

The October 9th, 2013 electrofishing survey was completed to obtain a catch per unit effort (CPUE) for all species; all individuals encountered were collected. The four electrofishing surveys completed in 2014 focused primarily on game species including: largemouth bass, smallmouth bass, walleye, muskellunge, hybrid striped bass, chain pickerel and channel catfish. In addition to game species, sunfish, black crappies, and bullheads were collected during the June 9th, 2014 survey to obtain a CPUE for the 2014 spring sampling period.

The New York State DEC Fish Sampling Manual suggests that night electrofishing is the most cost efficient method for monitoring walleye abundance and age composition. Spring and fall are the preferred sampling times, however sampling should be conducted at the same time of year if annual comparisons are to be made. The preferred sampling time is mid-September through October; however sampling from mid-May to mid-June is acceptable (Green 1985).

The one daytime electrofishing survey was completed on October 18th, 2013 during the day after the lake was lowered approximately two to three feet. The survey was completed during the day, to improve navigation around exposed submerged aquatic vegetation and targeted primarily game species including largemouth bass and chain pickerel.

There were 19 locations sampled via South Dakota style trap net during the period of April 16th to May 8th, 2014. The trap netting was conducted concurrently as part of the coolwater fisheries assessment project, which was initiated in 2013 to evaluate the State's muskellunge and walleye stocking programs. Locations were selected based on water depth and habitat, and represented all major habitat types in Lake Hopatcong. Four experimental gillnets were set in October 2013 at locations previously sampled in during the 1995-1996 survey.

Length and weight measurements were taken on all game and panfish species collected. Proportional stock densities (PSD), relative stock densities (RSD), and relative weights (W_r) were calculated for largemouth bass, smallmouth bass, chain pickerel, muskellunge, hybrid striped bass, bluegill, pumpkinseed, yellow perch and black crappie. Scales were removed from a sub-sample of all gamefish species, and later mounted between two microscope slides, viewed using a microfiche projector, and aged. Back-calculation was used to obtain information on the growth history of year classes of largemouth bass, smallmouth bass, bluegill, pumpkinseed, yellow perch, black crappie, chain pickerel, muskellunge, hybrid striped bass and walleye (using the Fraser-Lee Method and standard a values, as suggested by Carlander).

RESULTS

Water Quality

The three dissolved oxygen temperature profiles conducted on August 19, 2013 indicate significant thermal stratification with temperatures ranging from 10.7 to 23.8 C and dissolved oxygen ranging from 0 to 8.1 mg/l (Figure 4). Anoxic conditions were present below 23 feet. Water temperature and oxygen levels do not appear to be conducive to supporting a fish community below 23-25 feet during the summer based on these anoxic conditions and indicate the lake should be managed as a warmwater fishery. The average surface temperature during the sampling period was 19.7^{o} C. Surface dissolved oxygen levels average 7.27 (n=7) and ranged from 5.16 - 8.4 mg/L. The specific conductance averaged 310.2 *u*S/cm and ranged from 253 - 352.4 *u*S/cm (Table 1). The pH averaged 8.22 and ranged from 7.38 - 8.74. The alkalinity averaged (n=2) 36.5 mg/L as $CaCO_3$.

Aquatic Vegetation

Aquatic vegetation is extremely abundant in Lake Hopatcong and in portions of the lake recreational activities such as fishing, boating, water skiing and swimming are significantly impacted during the summer months. Eurasian milfoil is the most abundant and problematic of the aquatic plants found in Lake Hopatcong based on current distribution and ability to flourish in depths up to 12-15 feet. In shallow areas less than 10 feet it can reach the surface and form dense mats. Eurasian milfoil reproduces and spreads through fragmentation, which makes mechanical removal problematic. Milfoil is difficult to completely remove from a waterbody once established. Though Eurasian milfoil is an invasive species it provides excellent habitat for warmwater fish species such as largemouth bass and bluegill.

Water chestnuts have been found in a couple locations within Lake Hopatcong however through early detection and removal, the invasive has not yet become a nuisance. Water chestnuts were first observed in Massachusetts in 1859. Water chestnuts can form dense floating mats which limits light penetration and native species growth. Infestations can reduce oxygen levels and potentially impact fish populations. Recreational activities can be impacted in areas of dense water chestnut infestation. Water chestnuts can be controlled manually, mechanically and chemically however complete removal of the plant, prior to seed production in July, is necessary to effectively control this aggressive invasive.

Aquatic vegetation has been problematic in Lake Hopatcong for many years. From 1959 through 1989 the Division of Fish and Wildlife received state funding for aquatic vegetation control. Under the program portions of the lake were treated annually with herbicides. The treatments were generally localized with less than 200 acres of vegetation treated annually. Since 1990, the use of mechanical weed harvesters has been the primary method of vegetation removal.

Aquatic vegetation abundance plays an important part in the life cycle of most freshwater warmwater and coolwater species. Species richness has been directly related to abundance of aquatic macrophytes. In recent studies at Saratoga Lake, in New York, the overall CPUE for bluegill was reduced following the application of chemical herbicide (Cornwell and Poole 2009). Another study at Saratoga Lake indicated that 2 to 8% of the standing crop of juvenile fish was removed in harvested areas (Mikol 1985). Another study in reported that mechanical harvesting removed 21,000 – 31,000 fish per year, which represented 25% of the total fry (Engel 1990). Most recently Booms (1999) indicates that 46% of fish removed at a Wisconsin lake by mechanical harvesters were bluegill 40-100 mm and 24% were largemouth bass 20-60 mm. Though it is unclear at Lake Hopatcong the exact impact that vegetation control has on the fish population, it is generally accepted that that control and removal of aquatic vegetation can have an impact.

Water Level Manipulation

The New Jersey Division of Parks and Forestry owns and maintains the dam at Lake Hopatcong. The water level is managed in accordance with the Lake Hopatcong Water Level Management Plan, established in 2011. The current plan established a minimum flow of 12.0 CFS must be maintained in the Musconetcong River immediately downstream of the dam at Lake Hopatcong at all times. In times of drought a 6.8 CFS can be ordered by the Department of Environmental Protection to insure appropriate aquatic habitat for fish populations.

The lake's water level is annually dropped a maximum of 26" in the fall, prior to November 1st, to protect docks and bulkheads from winter ice damage. The lake is allowed to refill after ice out, which is generally in March. Every five years a major 60 inch lowering is scheduled, commencing after Labor Day, to allow for major repairs to lakeshore structures. Beginning the second week of December the lake is allowed to partially refill (to the 26 inch level) and allowed to completely refill beginning around ice-out.

Fisheries

A total of 9,647 fish, represented by twenty-eight species, ten families and seven orders were collected during the 2013-2014 sampling at Lake Hopatcong (Table 2). The most abundant species collected during trap netting and all sampling combined was bluegill (Table 3).

Trap nets utilized during the spring to specifically target walleye and muskellunge, provided a good assessment of the overall fish population. A total of 22 species and 6,118 individual fish were collected by trap net during the sampling period of April 16th to May 8th (Table 3). A total of 29 individual net sets were completed at 19 locations. Eighty-one percent all fish collected were panfish, consisting of bluegill, black crappie, yellow perch and pumpkinseed.

A total of 18 species and 898 individual fish were collected during six electrofishing surveys. Yellow perch were the most abundant species collected during electrofishing (Table 4).

Thirteen species of fish (n=212) were collected utilizing gillnets in October 2013. White perch (n=64) were the most abundant by that sampling method (Table 5).

Eighteen species of fish and (n=2419) were collected by shoreline seining in August 2013. Bluegill were the most abundant young of the year fish collected (Table 6).

Largemouth bass

The largemouth bass population appears to be well distributed, relatively balanced and in good condition despite being found in very low abundance. A total of 119 largemouth bass were collected during 9.83 hours of electrofishing in 2013-2014, which yields a catch rate of 12 bass/hour. A total of 88 largemouth bass were collected during three hours of electrofishing in the 1995-1996 Lake Hopatcong Fisheries Survey and the catch rate was 29 bass/hour (Hamilton, 1997). The largest bass collected in 2013-2014 was 2.18 kg (4.80 lbs.) and measured 527 mm (20.75"), captured on May 14th, 2014.

Largemouth bass were not well represented during fall gill netting or spring trap netting with only one collected by gill net and four collected by trap net. Largemouth bass are generally believed to be "net shy" in regard to trap nets, however sampling in 2014 at Farrington Lake (Middlesex County), utilizing the same methodology resulted in a total 27 largemouth bass collected and a average of 1.69 bass/net.

Catch per unit effort (CPUE) can vary greatly depending on the time of year and time of day due to seasonal migrations and diel fish movements. Electrofishing CPUE for day versus night and spring versus fall was compared during the 2013-2014 sampling period. All surveys produced similar results indicating the population was of low abundance.

The CPUE, number/hour, for largemouth bass (n=20) during fall 2013 night electrofishing was 13 per hour on October 9th (Table 7). The CPUE for largemouth bass $\geq$ 254 mm was 11 per hour. Using the State of New York's equation for first order estimates of abundance renders of population density of 3.88 for largemouth bass $\geq$ 254 mm (Green 1989). For largemouth bass < 254 the first order estimate of abundance gives a value of 1.15. Both estimates indicate the population is low density. Similarly, the CPUE for largemouth bass (n=87) during spring 2014 night electrofishing was 13 bass per hour (Table 8). The CPUE for largemouth bass $\geq$ 254 mm (n=69) was 10 per hour, which correlates to a first order estimate of abundance of 6.61 indicating a moderate density. Values less than 5.5 indicate a population of low density whereas values of 5.5 to 13.0 suggest a moderate density by the New York State Sampling Manual.

The largemouth bass population appears to be relatively balanced based on the proportional stock density (PSD) and relative stock density (RSD) values from all electrofishing-sampling periods. PSD and RSD_{15} values were similar during spring and fall electrofishing. PSD and RSD_{15} values were 73 and 43 during fall 2013 electrofishing and 77 and 39 during spring 2014 electrofishing. PSD and RSD_{15} values are within the recommended 40 -70 and 10 - 40 values indicating a balanced population (Table 9). The length distribution graph from 2014 indicates the population is well distributed and balanced (Figure 5). The fall 2013 sample size (n=32) was smaller than 2014 (n=87), and despite the smaller sample size, the graph still suggests a well distributed balanced population (Figure 6).

Relative weights for largemouth bass were within the recommended 95 – 105 mean during spring and fall electrofishing and indicate the population is in good condition. The overall mean W_r for largemouth bass collected during fall electrofishing was 97 ± 4.32 and ranged from 75 - 129 (Table 10). The overall mean W_r for largemouth bass collected during spring 2014 electrofishing was 95 ± 2.40 and ranged from 69 – 127. Relative weights decreased as individual size increased during spring sampling indicative of spawning stress. Individuals >380 mm collected during the spring had the lowest W_r at 91 ± 3.00.

Growth rates for largemouth bass collected in 2014 (n=81) are generally average compared to statewide averages as indicated by the length at age graph (Figure 7). Age II – Age IV individuals showed slightly below average growth whereas Age I, V and VII had slightly above average growth (Table 11). The age frequency graph shows a balanced population with Age III largemouth bass the most abundant in 2014 (Figure 8). This 2011-year class was also prevalent in the 2013 electrofishing age frequency graph (Figure 9).

Largemouth bass reproduction appears to be relatively poor based on only 22 young of the year collected. Largemouth bass represented 1% of all young of the year collected. A total of 77 locations were sampled via shoreline seining to assess reproduction. Largemouth bass were found at 21% of sites sampled (Table 6).

Anglers reported the largemouth bass population of Lake Hopatcong, to be in decline since the mid-2000s. Though angler reports are often subjective and speculative, a comparison of electrofishing CPUE from the 1995-1996 fisheries survey to the 2013-2014 survey clearly indicates the population has declined. A 58% reduction in CPUE suggests the population has been negatively affected by one or more variables.

In 2007 the Division conducted a statewide testing of waters for largemouth bass virus (LMBV). Lake Hopatcong tested positive for LMBV, as did many other popular waterbodies including Greenwood Lake, Assunpink Lake and Union Lake, all of which were reported, by anglers, to have noticeable declines in largemouth bass catch rates. One study in Arkansas suggests that though LMBV caused extensive mortality of large adult bass, the mass mortality had little impact on the overall population abundance (Neal, Eggleton, Goodwin 2009). It is generally believed that LMBV has no long-term affect on bass populations and angler reports and presence of LMBV may be merely coincidental. Each of the lakes previously mentioned had additional negative habitat and predator relationships that may have affected the largemouth bass populations in addition to LMBV.

Changes to fish populations generally do not occur overnight and may take a number of years before they are observed, by not only anglers but fisheries managers. Consistent and regular monitoring of populations is necessary to track changes in abundance, distribution and condition. The Division regularly monitors bass population through electrofishing and by tournament catch reports at our Wildlife Management Areas. The Division of Fish and Wildlife maintains a permitting system for tournaments held on Wildlife Management Area waterbodies. Applicants are required to submit catch results following the event. Unfortunately, extensive tournament result data is not available for Lake Hopatcong due to a lack of a centralized reporting process. This annual data received from anglers has given the Division the ability to monitor current bass populations through catch data and focus sampling efforts when changes are detected.

Natural predation from other species, mortality from aquatic vegetation harvest or angler-induced mortality may have the greatest impact to the bass population.

Walleye

The walleye population appears to be unbalanced despite being well distributed and in good condition. Individuals are large and exceed the recommended RSD and PSD values. The largest walleye collected measured 720 mm (28.35") and weight 8.04 lbs. A heavier walleye was collected (8.32 lbs.) but measured 26.69 inches.

Walleye had a CPUE of 10 fish/hour based on four nights (6.83 hours) of electrofishing in mid-May to mid-June (Table 8). This rate is considered a marginal to moderate abundance based on abundance estimates established by the New York DEC Bureau of Freshwater Fisheries, which considers a catch rate of $\leq$ 8 fish/hour marginal and $\geq$20 fish/hour high. The highest CPUE for walleye was 17 per hour on May 20th.

Walleye were collected in 65% of all trap net sets in 2014 (Table 10). A total of (n=70) walleye represents an average of 2 walleye per net (Table 3). Trap nets are set in the spring to intercept walleye migrating to spawning grounds. The walleye encountered were determined to be in all stages of spawning. Walleye were found throughout Lake Hopatcong, present at 79% of all locations sampled however a major spawning run was not encountered. It is presumable that the major spawning migration had already occurred. Trap netting provides a good indication of condition and abundance of adults but few younger fish limits the ability to predict future stock abundance (Green 1985). Supplemental sampling via electrofishing and gill nets was utilized to assess younger age classes.

The walleye population is well distributed based on the 2014 length frequency graph which shows individuals collected by both electrofishing and trap nets (Figure 10). A slightly different distribution was observed during fall gillnetting but also indicates the population is well distributed (Figure 11).

Gill nets were set on October 22nd and retrieved on October 23rd, 2013. There were a total of (n=39) walleye collected from the four nets. Walleye represented 18% by number of all fish collected and were present at all locations (Table 5). An average of 9 walleye per net indicates a population of high abundance, as suggested in the New York DNR Sampling Manual. Walleye catch rates ranged from 2 to 16 per net.

Walleye are in the good condition based on relative weights, W_r values calculated during all sampling periods. The highest overall W_r of 95 was observed during the spring 2014 electrofishing (Table 10) and lowest was 90 during spring trap netting (Table 11). Fall gill netting resulted in an overall W_r value of 92 (Table 12). The relative weights were the lowest during spring trap netting due to recently completed spawning activities. Individuals greater than 630 mm had the lowest W_r value of 85 during spring trap netting. The W_r values decreased as size of walleye increased. A similar trend was observed in those collected during spring electrofishing however a larger number of smaller individuals were collected which resulted in a higher overall W_r.

The PSD and RSD_{20} values of 90 and 35 (Table 9), as calculated from 2014 electrofishing indicate a population that is unbalanced. A PSD of 30-60 is recommended for a balanced population (Anderson and Weithman, 1978). Results were similar during all sampling periods with spring trap netting have the highest PSD and RSD_{20} values of 100 and 86 and gill netting the lowest at 87 and 21. Additionally, the RSD_m (RSD_{25}) values of 23 from trap netting and 3 from spring electrofishing indicate large individuals dominate the population.

Walleye growth rates are highly variable from male to female, especially among older individuals. During the sampling period walleye were not differentiated by sex and were analyzed collectively. Growth rates are consistent with statewide averages (Figure 12) and were consistent with those reported in the 1995-1996 Lake Hopatcong Fisheries Survey (Hamilton, 1997). Growth rates (Table 13) appear to be slower than those observed at Monksville Reservoir during the 2002 Inventory (Papson, 2003). The walleye population is not balanced based on the age frequency graphs for 2013 (Figure 13). However, the combined 2014 walleye age frequency suggests the population is balanced (Figure 14).

Only one juvenile walleye was collected during shoreline seining (Table 6), which is consistent with previous work by the Bureau of Freshwater Fisheries at Monksville Reservoir in 2002, when only two young of the year were collected. Seining is considered an effective method for collecting walleye however literature indicates that young of the year walleye move to deeper water during the summer, which limits the efficacy of seining. There is no definitive evidence that suggests that walleye are successfully reproducing in Lake Hopatcong. However a strong year class was documented from the 2012, which is surprising considering the lake received a significantly reduced stocking rate based on poor success rate at the Hackettstown Hatchery during that year.

Stocking rates for pond fingerlings (1 -2") fish and advanced fingerlings (2-4") have been modified since 2009 (Figure 15). Overall stocking rates have been reduced since 2008 and different combinations of fry, pond fingerlings and advanced fingerlings have been stocked depending on availability and success rate at Hackettstown hatchery. The total stocking rate for pond and advanced fingerlings was 31/acre in 2010, 27/acre in 2011, 3.7/acre in 2012, 5.6/acre in 2013 and 23/acre in 2014. Though overall stockings rates have varied since 2010, the stocking of advanced fingerlings has been rather consistent ranging from 6729 – 10,000 per year or (2.5 – 2.3 per acre). Though some states have developed successful walleye fisheries utilizing just fry or pond fingerling stockings, Lake Hopatcong appears to respond best to advanced fingerling stockings.

Stocked walleye appear to have good survival rates based on a consistent year classes and a well-distributed population. There were no major gaps in year classes despite changes in stocking rates since 2003. Walleye appear to have become the dominant predator species based on a situation of opportunity.

Chain pickerel

There were 142 chain pickerel collected during the 2013-2014 sampling period by electrofishing and trap netting indicating an abundant population. There were 72 chain pickerel collected during spring trap netting in Lake Hopatcong. Thirty-five chain pickerel were collected during both fall and spring electrofishing surveys. The CPUE of 21 per hour during fall night electrofishing was much higher than the spring CPUE of 5 per hour (Table 8). Chain pickerel consisted of 9% of all fish caught during fall electrofishing (Table 7). Only one chain pickerel was collected by fall gill netting, which is considered an effective method for collecting chain pickerel. The largest chain pickerel collected measured 681 mm (26.81") and weighed 2.23 kg (4.92 lbs.). The fish was collected on April 22, 2014 via trap netting.

The length frequency graph from trap netting and fall electrofishing were rather different, however both indicate that the population is not balanced. The fall electrofishing graph (Figure 16) indicates an unbalanced population with few small individuals in the 200 – 350 mm range collected. Chain pickerel had a wide PSD range during the sampling period, indicating the population is not balanced. The lowest PSD observed was 65 during fall electrofishing and the highest was 96 during spring trap netting. RSD_{20} values were also variable ranging from 27 during fall electrofishing to 60 during trap netting (Table 9).

The overall W_r for chain pickerel was rather similar during all sampling periods. The highest of which was during fall electrofishing at 88 ± 3.57, however chain pickerel $\geq$ 510 mm had the lowest mean W_r at 77 ± 3.11 (Table 10). Relative weights were generally below acceptable ranges and indicate the population is below optimal condition.

The length frequency graph from 2014 indicates the population is well distributed but unbalanced (Figure 17). There does appear to be a good year class from 2012 that is evident in both age frequency graphs from 2013 (Figure 18) and 2014 sampling (Figure 19). There appears to be a weak 2011 year class of chain pickerel based on the 2014 age frequency graph (Figure 19). Chain pickerel had above average growth rates for all age classes (Figure 20). There were three young of the year chain pickerel collected during shoreline seining (Table 6).

Smallmouth bass

There were 36 smallmouth bass collected during the sampling period indicating the population is not very abundant. The overall CPUE for electrofishing was 2.4 bass/hour. Spring night electrofishing had the highest success rate for capturing smallmouth bass (n = 22) with a CPUE of 3 per hour during four nights of spring electrofishing (Table 8). However, 21 of the 22 smallmouth collected were captured on June 9th. The CPUE for this night alone was 9 per hour, which is significantly higher than past catch rates. The overall CPUE of 2.4 fish/hour was slightly higher than the 1.7 fish per hour observed during the 1995 survey (Hamilton, 1997)

The length frequency from spring electrofishing suggests the population is balanced, however the sample size was rather small (Figure 21). An additional six smallmouth bass ranging from 196 – 291 mm were collected with gill nets and six smallmouth bass ranging from 286 - 433 were collected with trap nets (Table 3). Both sample sizes were too small to draw any conclusions. However, in comparison only one largemouth was collected by gillnet and four by trap net.

The overall mean W_r of 85 ± 4.35 from spring electrofishing indicates condition is less than optimum, but could be related to post spawn condition, since W_r progressively decreased with size (Table 10). Individuals greater than 350 mm had the lowest mean relative weight at 75 ± 8.75 and ranged from 69 – 92 mm.

The PSD of 50 and RSD_{15} of 25 suggest that the population is relatively balanced (Table 9). Growth rates for smallmouth bass were above average for Age I and II individuals, below average for Age III and IV individuals and above average for Age V (Figure 22). Though the sample size was rather small there appears to be a strong 2012-year class (Figure 23).

Smallmouth bass are generally less abundant than largemouth bass in Lake Hopatcong. The smallmouth population does appear to have slightly increased since Lake Hopatcong was last sampled. The smallmouth population is rather small, considering that largemouth bass had a CPUE of 12 bass/hour and are in low abundance. Smallmouth bass population appears to be limited due to competition with other predators and limited available habitat. The species relies less on aquatic vegetation than the largemouth bass but prefers the same spawning habitat, with a mix of sand, gravel and rock substrate. Thermal stratification and anoxic conditions in the hypolimnion limits the smallmouth bass population’s growth potential.

Hybrid striped bass

Hybrid striped bass (n=22) were not well represented during the sampling period. Gill nets set during the fall 2013 had the greatest success rate for capturing this open-water schooling predator (Table 5). A total of 15 hybrid striped bass were collected with gill nets and at three out four sampling locations. The schooling nature of the species was evident with ten individuals collected in one net.

Fall length frequencies indicate the population is not balanced (Figure 24). The spring electrofishing sample also indicates the population is not balanced based on the age frequency graph (Figure 25).

Age and growth information was rather limited due to the small sample size. Individuals collected via gill nets were either Age I or II (Figure 26). Hybrid striped bass collected during spring electrofishing (n=6) were somewhat larger, represented by Age II and IV individuals. Age I and II hybrid striped bass collected during the fall gillnetting had below average growth rates (Table 13). Age IV individuals collected in the spring had above average growth rates (Table 11).

Hybrid striped bass were not well represented during the sampling period. The limited data collected indicates population was not balance and growth rates were below average. This species is one of the most desirable species at Lake Hopatcong. The population should be regularly monitored to ascertain whether stocking walleye has affected the hybrid striped bass population. The current stocking rates should be maintained to continue to provide exciting fishing opportunities.

Muskellunge

Seasonal Technician Ryan Preston with a Trophy Muskellunge collected during spring trap netting.

The Division of Fish and Wildlife has stocked muskellunge in Lake Hopatcong since 1997 (Appendix A), as a result of a recommendation made in the 1995 – 1996 Fisheries Survey. In addition, tiger musky have been stocked 14 of the years since 1997. Both muskellunge and tiger musky are managed under the statewide 36 inch size limit and one fish creel limit however most anglers practice catch and release for this trophy species. A total of 10 muskellunge were collected during trap netting in 2014. Muskellunge were not encountered during any of the other sampling periods. The sample size was rather small however the Age VIII year class was the most abundant (Figure 27). Fifty-percent of the muskellunge collected were between 1000-1049 mm (Figure 28). Relative weights were good for muskellunge with the overall mean W_r at 103 ± 1.34 (Table 11). Limited information is available for age and growth in New Jersey, however growth rates were better than those reported at Monksville Reservoir in 2002. The largest muskellunge collected measured 1210 mm (47.64") and weighed 16 kg (35.28 lbs.).

<u>Bluegill</u>

Bluegill were the most abundant fish representing 32% of the total catch during spring trap netting (Table 3). Bluegill had the highest CPUE during spring electrofishing, at 122 per hour (Table 8) and were the most abundant during shoreline seining.

The bluegill population appears to be balanced when considering all sampling methods and bias associated with them. The fall electrofishing length frequency graph indicates the population is balanced and well distributed (Figure 29). However, the length frequency derived from bluegill collected during spring trap netting and spring electrofishing indicates an unbalanced population dominated by larger individuals (Figure 30).

Similarly, the size structure appears to be balanced based on fall electrofishing, with a PSD of 41 and a RSD_8 of 2 (Table 9). Spring electrofishing and trap netting suggest that the population is not balanced based on a PSD of 78 and RSD_8 of 10 for spring electrofishing and a PSD of 81 and RSD_8 of 1 for trap netting. Recommended PSD and RSDp values by (Novinger and Legler, 1978) are 20-60 and 5-20 for a balanced population. The fall electrofishing survey probably gives the best indicator of the distribution and balance of the bluegill population. Individuals collected during spring electrofishing were larger adults in close proximity to spawning beds. Trap nets in general have a tendency to favor larger individuals, especially when sampling in the spring.

The mean W_r for all bluegill collected during spring electrofishing was 104 ± 3.51 and ranged from 69 - 141 (Table 10), which indicates fish are in good condition. Bluegill collected during spring trap netting had an overall lower mean W_r of 89 ± 2.41. All size ranges collected during trap netting exhibited the same poor condition. Recommended values are 95 – 105 for a population in good condition. The individuals collected via spring electrofishing were in excellent condition. Bluegill collected during fall electrofishing were also below average condition as indicated by an overall mean W_r of 87 ± 3.52.

Growth rates for bluegill were equal with the statewide averages for all age classes (Figure 31). Age III bluegill were the most abundant age class, but Age I and II had similar abundance (Figure 32). A total of 682 young of the year bluegill were collected during shoreline seining (Table 6). In addition there were 450 unknown *Lepomis sp.* young of the year collected, which were too small to be identified in the field. Young of the year bluegill accounted for 46% of all young of the year collected shoreline seining. When including the unknown Lepomis sp, sunfish represented 76% of all young of the year. Bluegill were also the most abundant in the intermediate range. Bluegill were collected at 61% of all seining locations (n= 77).

The sunfish population is abundant, well distributed and in good condition. Bluegill were more abundant than pumpkinseed and spawning success is good. Despite occupying the same niche, bluegill and pumpkinseed have significantly different growth rates. The abundant sunfish population is attributed to the extensive weed growth.

A fish kill consisting of primarily of bluegill occurred during the end of May to beginning of June 2014. Fish samples were collected and delivered to the state fish pathologist. Though results were not conclusive a bacteria that was not able to be isolated was the cause of the kill.

Pumpkinseed

The pumpkinseed population was found in similar abundance to bluegill during fall night electrofishing at 13% of all fish collected (Table 4). Pumpkinseed were rather abundant during trap netting and comprised 10% of all fish collected (Table 3). Pumpkinseeds were not as abundant as bluegill as indicated by the CPUE of 33 per hour during fall electrofishing (Table 7).

The population appears to be well distributed based on the fall length frequency graph (Figure 33) though most individuals were small. The overall size structure of pumpkinseeds appears to be unbalanced based on a PSD of 39 and RSD_8 of 0 from those collected during fall electrofishing (Table 9). Spring electrofishing and trap netting were rather different with a PSD of 94 and RSD_8 of 3 from spring trap netting. The length frequency from trap net shows the population (n=72) is not balance and most individuals were in a rather narrow (160 – 169 mm) range (Figure 34).

Relative weights were within the recommended range of 95 – 105, for those collected during fall electrofishing with a mean W_r of 97 ± 6.70 and spring trap netting with a mean W_r of 98 ± 2.65. The overall mean W_r of 116 ± 5.82 from spring electrofishing suggests that the population is of above average condition (Table 10). Pumpkinseed W_r was similar to that of the bluegill with larger individuals having lower W_r. Growth rates were above average for all age classes (Figure 35).

The age frequency graph indicates that the age structure has a normal distribution and slightly unbalanced with few Age I and II individuals represented (Figure 36). Pumpkinseeds were well represented during shoreline seining at 5% of young of the year fish and 25% of intermediates (Table 6).

Yellow perch

Yellow perch were abundant (n=154) with a CPUE of 103 fish per hour during fall electrofishing (Table 7). Yellow perch made up 41% of all fish collected during fall 2013 electrofishing (Table 7) and 16% of all fish collected during trap netting (Table 3).

The yellow perch population is poorly distributed as evident from the 2013 length frequency graph with most individuals in the 200 – 224 mm range (Figure 37). The PSD values ranged from 72 – 86 during the sampling period. Fall electrofishing in 2013 had the lowest PSD and spring trap netting had the highest PSD (Table 9). RSD_{10} values ranged from 10 to 14 with the lowest observed during spring electrofishing and the highest of 14 during trap netting. All values are above of the recommended 30-60 value for a balanced population.

The overall mean W_r was 79 ± 1.37 from spring trap netting and ranged from 48 – 102. This suggests that the population is below average condition however yellow perch were observed to have just completed spawning activities. Yellow perch had a higher overall mean W_r during spring electrofishing at 93 ± 2.44. Individuals in the 130 – 199 mm range had the highest W_r at 99 ± 5.44. Yellow perch collected during fall electrofishing in 2013 had below average relative weights at 79 ± 1.34 (Table 10).

The age frequency graph supports the poor distribution with most individuals Age II – IV and Age III the most abundant (Figure 38). Growth rates were below average for all age classes of yellow perch (Figure 39). A total of 26 young of the year were collected during shoreline seining and were encountered at 18% of all sites. Yellow perch represented 2% of the total young of the year collected (Table 6).

Yellow perch population was poorly distributed but growth rates were good. Spawning success was excellent in 2010 and should help to maintain the population. The yellow perch population has been affected by predation most likely from walleye abundance, however all predators including largemouth bass, smallmouth bass and muskellunge consume yellow perch regularly.

<u>Black crappie</u>

The black crappie population was abundant (n=1379) during spring trap netting and represent 32% of the total collected (Table 3). The largest black crappie collect by trap net measured 14.65” and weighed 2.00 lbs. Black crappie were not well represented during spring and fall electrofishing surveys as evident by a CPUE of 9 fish/hour during the fall and spring surveys (Table 7). Black crappie were well represented during fall gill netting in 2013 (n=19) at 9% of the total (Table 5).

The length frequency from fall electrofishing (Figure 40) and PSD values indicate the population is out of balance. Recommended values are 30-60 for PSD and >10 for RSD-p. PSD and RSD_{10} values of 79 and 18 from spring trap netting indicate population consists primarily of larger individuals (Table 9). Fall electrofishing showed a similar trend with a PSD of 67 and a RSD_{10} of 46 and a RSD_{12} of 21 (Table).

The age frequency from the fall 2013 sampling period shows an unbalanced population (Figure 41). The length frequency (Figure 42) and age frequency (Figure 43) from spring trap indicates the population is not balance and most individuals are larger.

The mean W_r of 95 ± 1.34 from trap netting indicates black crappies are of good condition. Black crappies 100-149 had a W_r 102 ±13.93 and those150-199 mm had a W_r of 103 ± 6.91 (Table 11). Black crappies had generally near average growth rates based on the length at age graph from 2014 sampling (Figure 44). Age II and IV individuals had above average growth while age III had below average. There were no black crappies collected during shoreline seining (Table 6).

Black crappies were encountered in good abundance and were in good condition. Growth rates were good and the current distribution should provide good fishing opportunities with many larger individuals collected.

Channel catfish and bullhead

Four members of the catfish family are present in Lake Hopatcong; channel catfish, white catfish, brown bullhead and yellow bullhead, with brown bullhead the most abundant (n=191) as determined by spring trap netting (Table). Brown bullhead were also most frequently encountered during spring (n=11) and fall (n=25) electrofishing. Despite the abundance of brown bullheads anglers most often target the channel catfish because of the larger size they obtain. Channel catfish were not well represented during the sampling period (n = 10). Nine of which were collected by spring electrofishing. There were no channel catfish collected with gill nets in the fall. The largest individual collected was 585 mm and 3.60 kg. Those collected ranged from 248 - 585 mm. The Division stocks Lake Hopatcong every other year with channel catfish to maintain the population, as they do not reproduce in the lake.

Channel catfish were not well represented during the sampling period however those collected were in good condition. The current stocking rates should continue to provide outstanding recreation opportunities for this species.

Alewife and Golden Shiner

Alewives were frequently observed while electrofishing however collection was not attempted. Harvest reports are received each year from the commercial fishery that exists on Lake Hopatcong and provide sufficient information that the population is stable. Alewives serve as an essentially forage component for most predator species including walleye, hybrid striped bass, largemouth and smallmouth bass and white perch.

Golden shiner were found to be rather abundant (n=105) during trap netting and daytime fall electrofishing after the lake level had been lowered two feet for shoreline cleaning and dock repair. Several large common carp were captured, but did not appear to be very abundant. Similarly, creek chubsucker were not abundant and only a few individuals were collected.

White perch

White perch were encountered frequently during the sampling period. White perch are an open water member of the temperate bass family, closely related to the striped bass and hybrid striped bass. They too are a schooling fish and found in high abundance when encountered. White perch (n=64) made up 30% of the total catch from gill nets but were rarely encountered electrofishing. White perch were encountered frequently during trap netting (n=350) which represented 6% of the total catch. They were collected at 76% of all net sets. Growth rates were near the statewide averages and were generally in good condition, W_r at 94 ± 3.44. The length distribution graph indicates the population is not balanced and poorly distributed (Figure 45).

Native Fishes

Many of the species found in the Lake Hopatcong are introduced species, however a few species were encountered that were previously not collected during the 1995/1996 survey and are native species. Bridle shiner, bluespotted sunfish and satinfin shiner were found while shoreline seining (Table 6). These native species are generally small, less than 2.5” and rarely encountered by the public. Their sensitivity to habitat change and predation by non-natives has garnered threatened and endangered status in some states. Seven of the game species collected in Lake Hopatcong were natives including chain pickerel, pumpkinseed, redbreast sunfish, yellow perch, white perch, white catfish, brown bullhead and yellow bullhead.

DISCUSSION

Lake Hopatcong is New Jersey’s largest lake and has one the highest species diversities in the state with 28 species represented during the survey. Many of the species have been introduced for recreational purpose however a few of New Jersey’s rare native species still inhabit these nutrient rich waters. Lake Hopatcong’s recreational use is as diverse as the fish population. Recreational boaters, water skiers, wave runners, anglers, swimmers and lake residents all play an integral part in the management of the lake. A balanced management strategy is necessary to achieve and maintain all management goals.

Stocking is one of the primary tools, in addition to regulation changes and habitat alterations that fisheries managers utilize to manipulate fish populations. Stocking is a common tool utilized each year by the Division to maintain and enhance fish populations throughout the state. Lake Hopatcong has a long history of fish stocking by the Division and The Knee Deep Club. Habitat, water quality and weighing angler interests have the biggest influences on making management decisions.

The 1950’s fisheries survey conducted by the Division suggested that Lake Hopatcong should be managed for largemouth bass, smallmouth bass and chain pickerel. The report suggested that walleye would survive if stocked occasionally, and would be a valuable addition provided it did not compete with bass and pickerel. Since the 1950’s there has been considerable research on interspatial, dietary and predatory interactions of different species. Notable is the close relationship between largemouth bass and walleye. Literature suggests an inverse relationship between largemouth bass and walleye abundance (Fayram, Hansen and Ehlinger, 2005). Largemouth bass are known to prey heavily on stocked walleye (Santuchi and Wahl, 1993), however walleye are less likely to consume largemouth bass. In addition, the diets of juvenile and adult walleye overlap the diets of largemouth bass (Eayram, Hansen and Ehlinger, 2005). It appears that the close relationship between these two species may have contributed to the unbalanced walleye population.

There appears to be a strong correlation between the reduction in the numbers of walleye being stocked and an increase in other species. In 2009 walleye stocking rates were reduced from 50/acre of pond fingerlings (1-2") to 30/acre, due to growing concerns that walleyes were being overstocked. The change in stocking rates was based on research conducted by Wisconsin that showed that the lower stocking rate maximized the survival of walleye to age one. At that time, both Pennsylvania and New York were utilizing a stocking rate of 20/acre. In 2014 stocking rates were again reduced and a maximum of 20/acre was recommended for both pond and advanced fingerlings. An 80% pond fingerling and 20% advanced fingerling stocking rate has been utilized in the past and should be maintained until the coolwater assessment is complete. The walleye-stocking rate for total pond and advanced fingerlings was reduced 47% between 2009 and 2014. A 30% reduction of stocked walleye in 2009 appears to have been the catalyst to help to improve growth and recruitment of a few species.

Yellow perch appear to have a very strong 2010-year class. Smallmouth bass as previously mentioned were not well documented but appear to have a good 2012-year class as did chain pickerel. Black crappies, as with yellow perch, had a good 2010-year class. Largemouth bass were generally not as abundant as in other lakes in the state, but the 2010 – 2012 year classes are the strongest and with continued active management, the population looks to be promising for the future.

Most likely stressors from competition, angler harvest and natural mortality from disease have all had an impact on the largemouth bass population. In recent years tournament weigh in procedures and fish care have been major priorities of tournament organizers. However, despite significant improvements made to tournament procedures, mortality is still inevitable and may, in combination with other factors, contribute to a low abundance bass population.

Supplemental stocking of largemouth bass has been utilized to enhance existing populations and re-establish populations throughout the country. Stocking has been completed with varying results depending on stocking rate, size at stocking, habitat and natural predators. Supplemental stocking of young of the year largemouth bass has been shown to contribute to increase catch rates in some situations. Union Lake (Cumberland County) has been stocked on a regular basis since 2008, with young of the year largemouth bass. Stocked fish were encountered frequently one year after stocking during electrofishing surveys. Tournament results from Union Lake have shown a steady improvement in catch rates in recent years. Enhancing the largemouth bass population in Lake Hopatcong would have significant positive social and economic implications.

Management Objectives

1. Lake Hopatcong should be managed as a warmwater and coolwater fishery.

2. Enhance the abundance of the quality largemouth bass fishery that presently exists in Lake Hopatcong.

3. Maintain the quality chain pickerel fishery that presently exists in Lake Hopatcong.

4. Maintain the quality walleye fishery that exists in Lake Hopatcong.

5. Maintain a diverse population by continuing to stock channel catfish and hybrid striped bass.

6. Maintain the seasonal trout stocking program.

The management objectives for Lake Hopatcong have been established to maintain, develop and enhance the recreational fishing opportunities for anglers. Management objectives are most often achieved through regulatory changes, stocking and habitat manipulation. Lake Hopatcong should continue to be managed under the current statewide fishing regulations.

Recommendations

1. The largemouth bass population should be enhanced with an intensive stocking program. Lake Hopatcong should be stocked with advanced fingerling largemouth bass 3 – 4" at a rate of 25/acre for a period of 4 years. The lake will be resampled after three and four years (2017 and 2018) to evaluate change and determine if further stocking is necessary.

2. The walleye population should continue to be evaluated on a five-year basis through spring night electrofishing and determine if stocking rates are appropriate.

3. Walleye stocking rates should be maintained at the current statewide stocking rate. Current stocking rates are a total maximum of 20/acre, consisting of a combination of pond fingerlings (1-2") and advanced fingerling (2-4") at a ratio of 80% and 20%.

4. Further sampling is required to better assess the muskellunge population, and will be completed under the Coolwater Fisheries Assessment in 2015 – 2016.

5. Maintain an aquatic vegetation control program utilizing a combination of mechanical, chemical and physical removal methods. Establish no harvest areas as a refuge for fish to ensure adequate fish habitat is maintained. Utilize chemical herbicides if needed.

LITERATURE CITED

Barbour, C. D. and J. H. Brown. 1974. Fish species diversity in lakes. The American Naturalist 108: 473-489.

Bettoli, P.W., M.J. Maceina, R.K. Betsill, and R.L. Noble. 1992 Piscivory in largemouth bass as a function of aquatic vegetation abundance. N. American Journal of Fisheries Management. 12: 509-516.

Bugbee, G. and White, J. 2001. Control of Cabomba and Eurasian Milfoil in Lake Quonnipaug with Fluridone and 2, 4-D. The Connecticut Agricultural Experiment Station, New Haven.

Cohen, Yosef and Jigyin Li, D. Schupp, I.R Adelman. 1996. Effects of Walleye Stocking on Population Abundance and Fish Size. North American Journal of Fisheries Management 16:830-839.

Colle, D. E., and J. V. Shireman. 1980. Coefficients of condition for largemouth bass, bluegill, and redear sunfish in hydrilla-infested lakes. Trans. Am. Fish. Soc. 109: 521-531.

Cornwell, Mark D. and K. Poole. 2009. Fisheries Survey of Saratoga Lake. State University of New York. College of Agriculture and Technology. Cobleskill, NY.

Diana, Matthew J. and David Wahl. 2008. Long-Term Stocking Success of Largemouth Bass and the Relationship to Natural Populations. American Fisheries Society Sumposium 62:000-000.

Graham, J. H. 1993. Species diversity of fishes in naturally acidic lakes in New Jersey. Transactions of the American Fisheries Society 122: 1043-1057.

Green, D. M. 1989. N.Y.S. Bureau of Fisheries Centrarchid Sampling Manual. Warmwater Fisheries Unit, Cornell Biological Field Station, Bridgeport. N.Y.

Murphy, B. R. & D.W. Willis, editors. 1996. Fisheries techniques, 2nd edition. American Fisheries Society, Bethesda, Maryland.

Neal, J. Wesley, M. Eggleton, and A. Goodwin. 2009. The Effects of Largemouth Bass Virus on a Quality Largemouth Bass Population in Arkansas. Journal of Widlife Diseases. 45(3), pp.766-771.

New Jersey Department of Environmental Protection, 2008. Surface Water Quality Standards. N. J. A. C. 7:9B.

Novinger, Gary D. & Legler, Robert E. 1978. "Bluegill Population Structure and Dynamics", North Central Division, American Fisheries Society, Special Publication No. 5.

Poff, N.L and J. D Allan. 1995. Functional organization of stream fish assemblages in relation to hydrological variability. Ecology 76:606-627.

Savino, J. F. and R. A. Stein. 1989. Behavioral interactions between fish predators and their prey: effects of plant density. Anim. Behav. 37: 311- 321.

Staff, Bureau of Freshwater Fisheries. 1998. "Warmwater Fisheries Management Plan." New Jersey Division of Fish and Wildlife. Bureau of Freshwater Fisheries.

Wege, Gary J. and Anderson, Richard O. 1978. "Relative Weight: A Index of Condition for Largemouth Bass", North Central Division, American Fisheries Society, Special Publication No. 5.

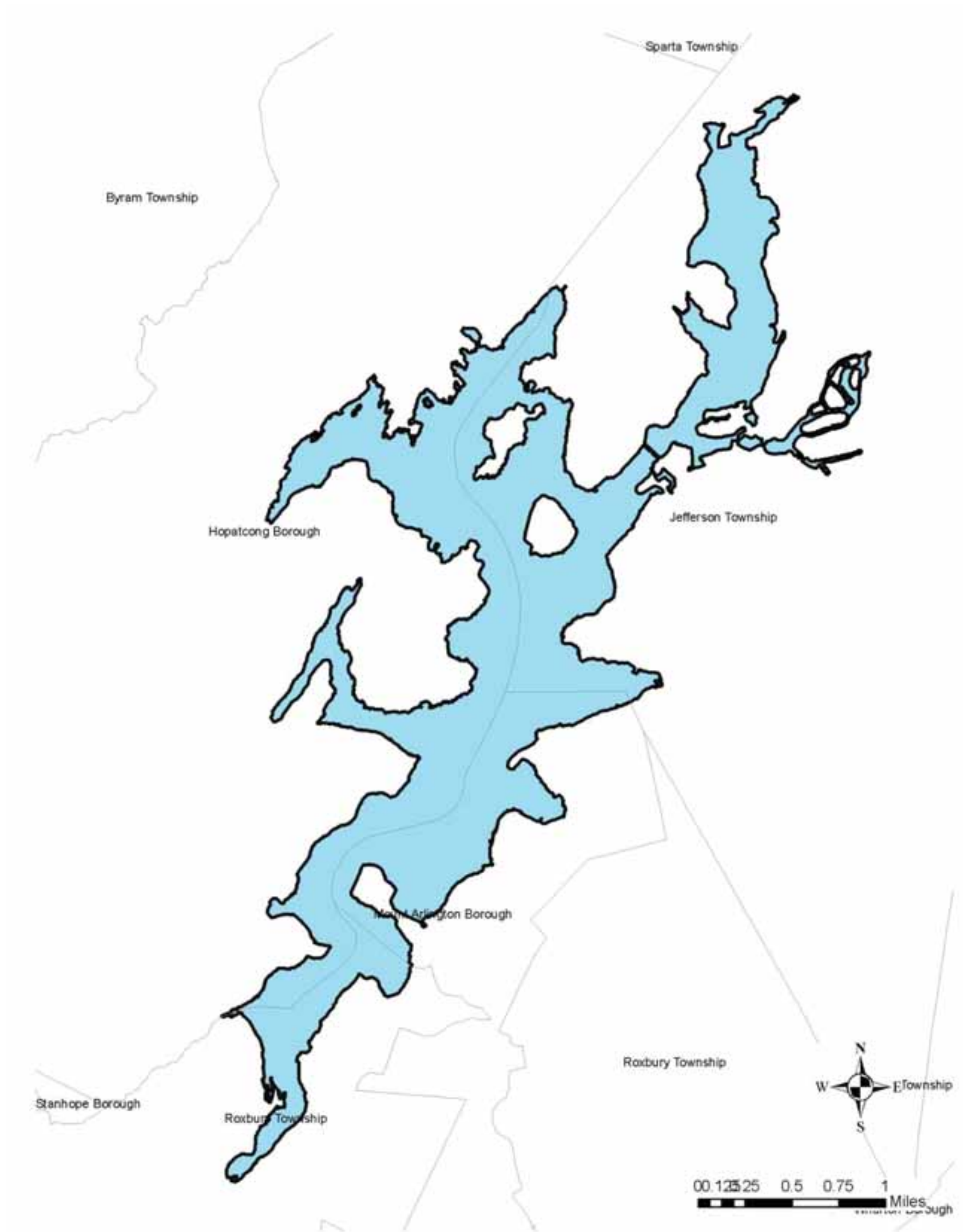

Figure 1. Map of Lake Hopatcong showing townships and boroughs surrounding the lake

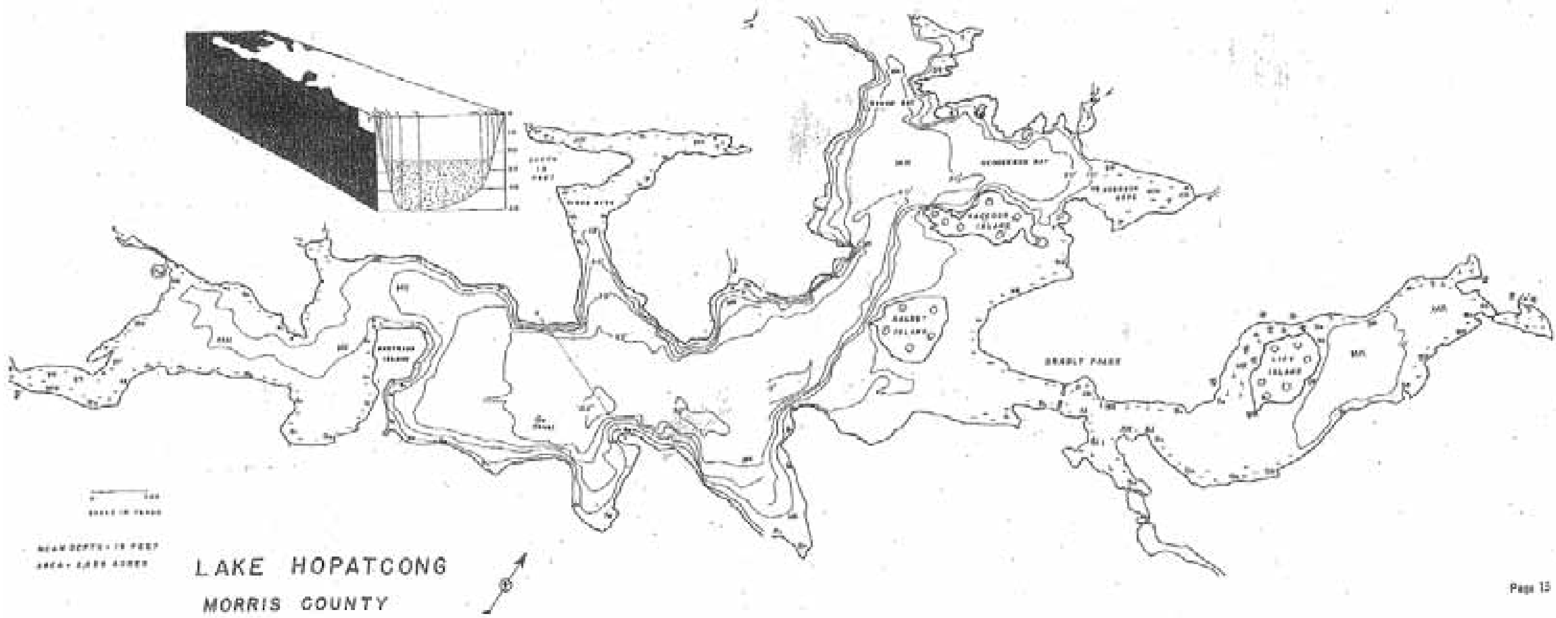

Figure 2. Bathymetric map of Lake Hopatcong

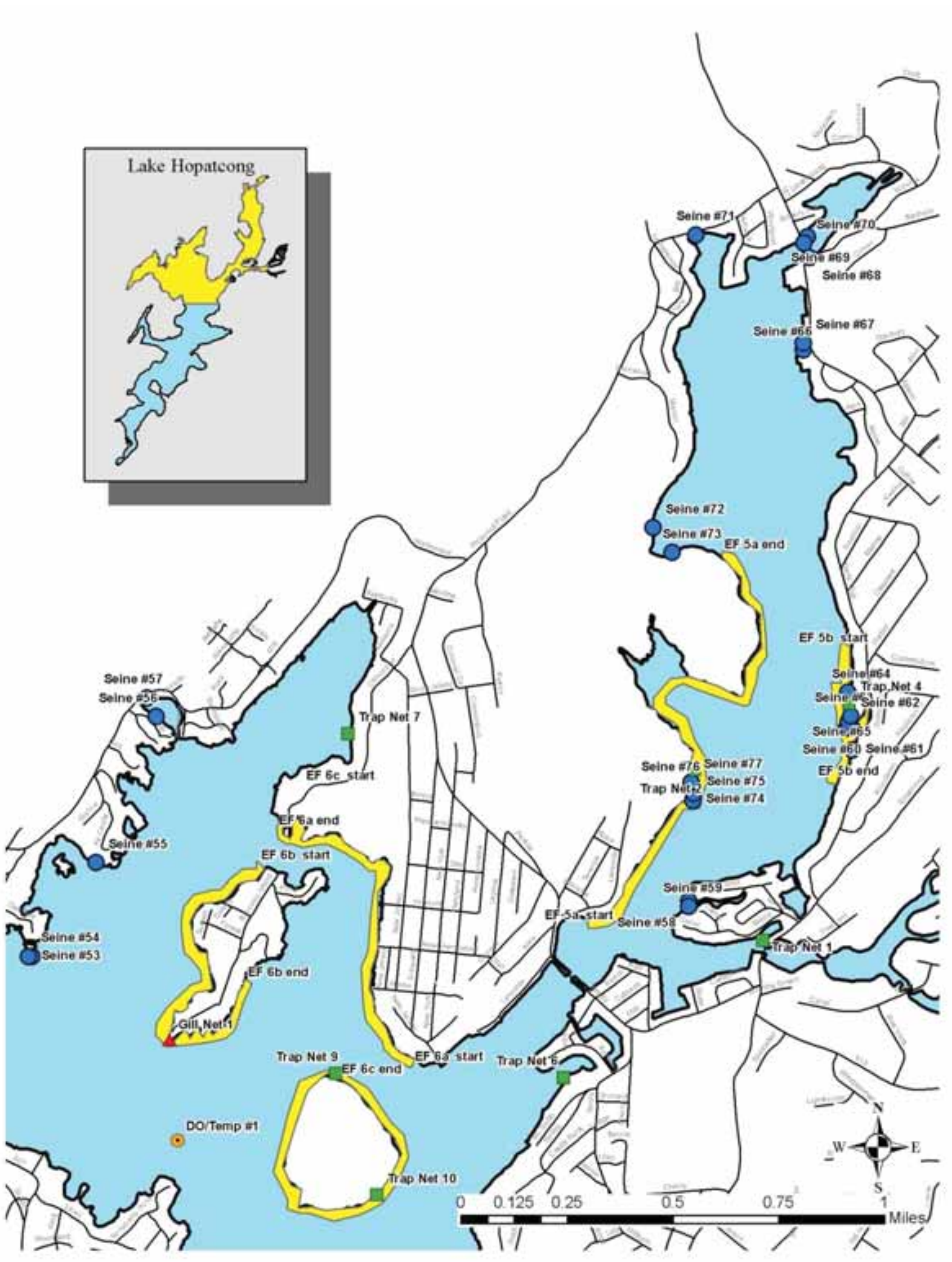

Figure 3a. Lake Hopatcong Upper Section, sampling locations.

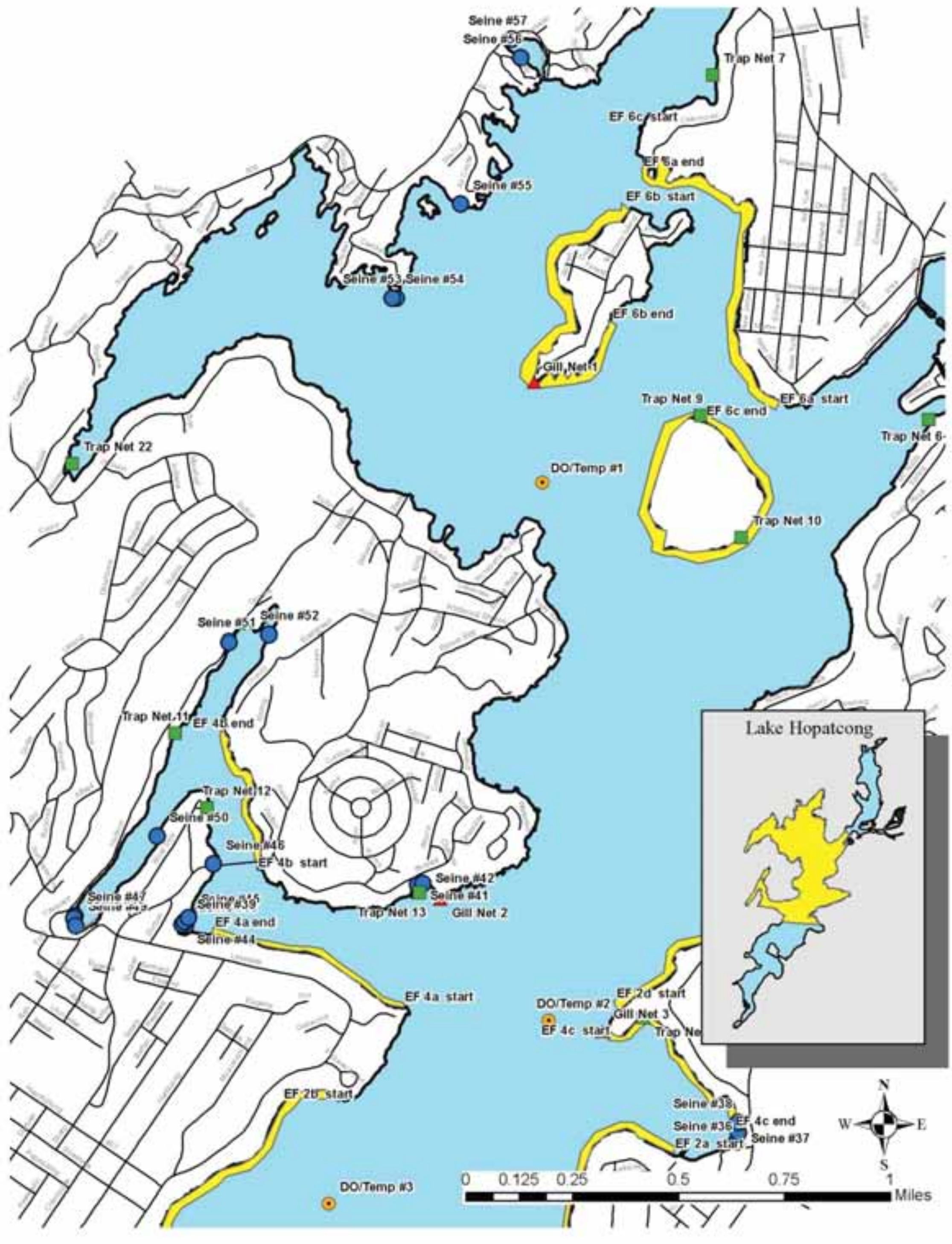

Figure 3b. Lake Hopatcong Middle Section, sampling locations.

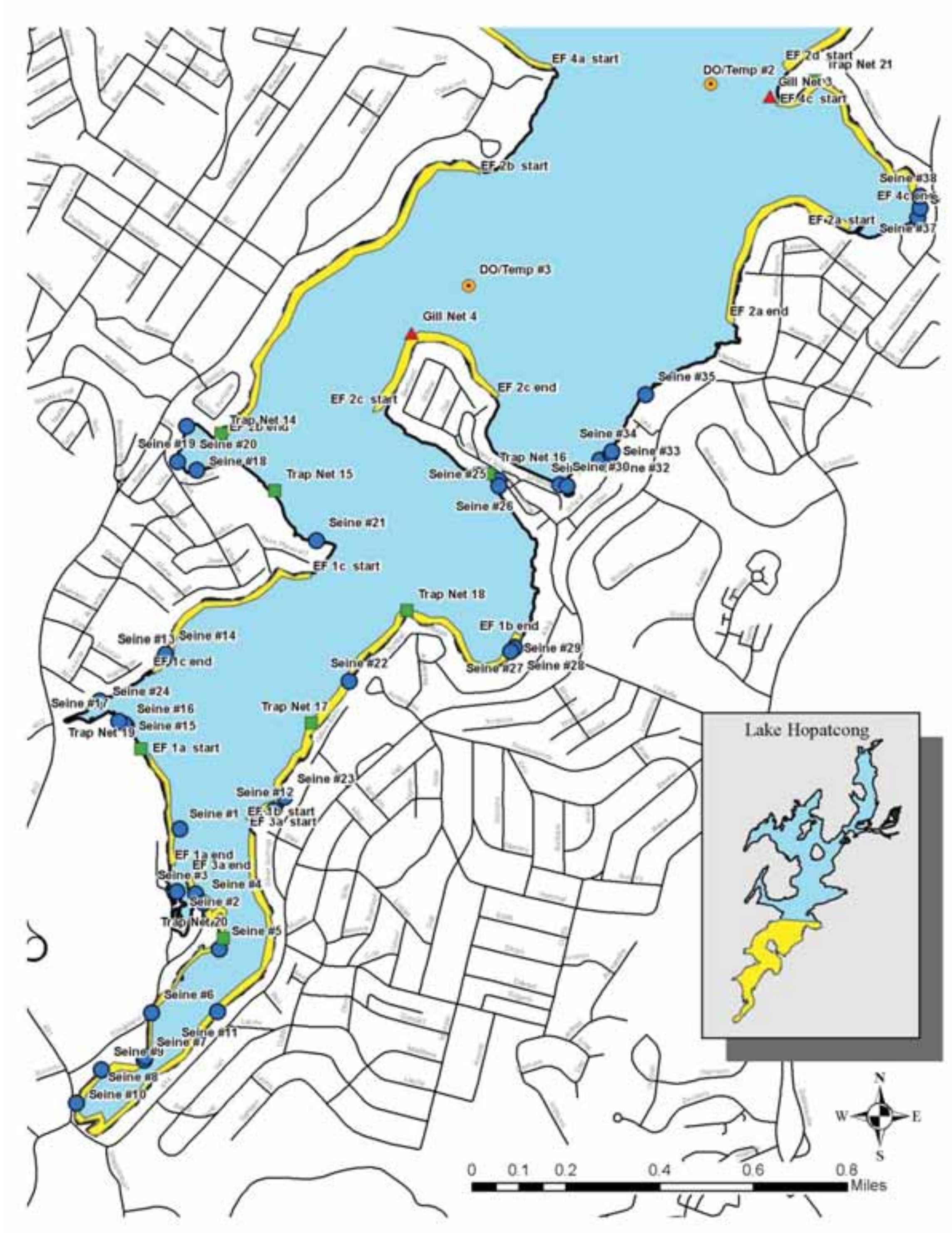

Figure 3c. Lake Hopatcong Lower Section, sampling locations.

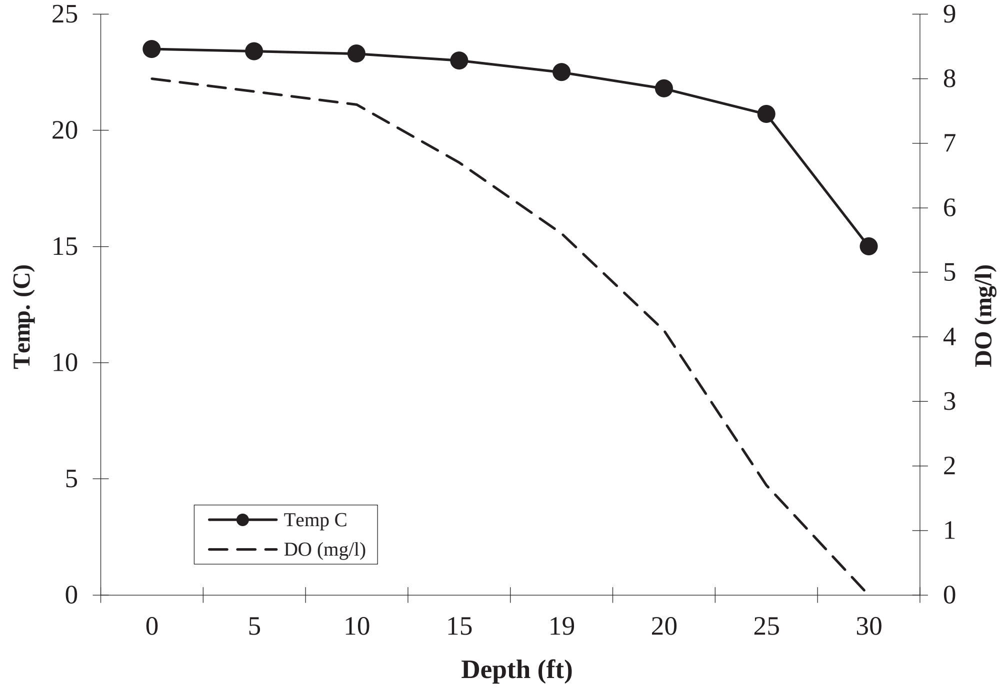

Figure 4a. Dissolved oxygen temperature profile created on August 19, 2013 at Lake Hopatcong, near Yacht Club.

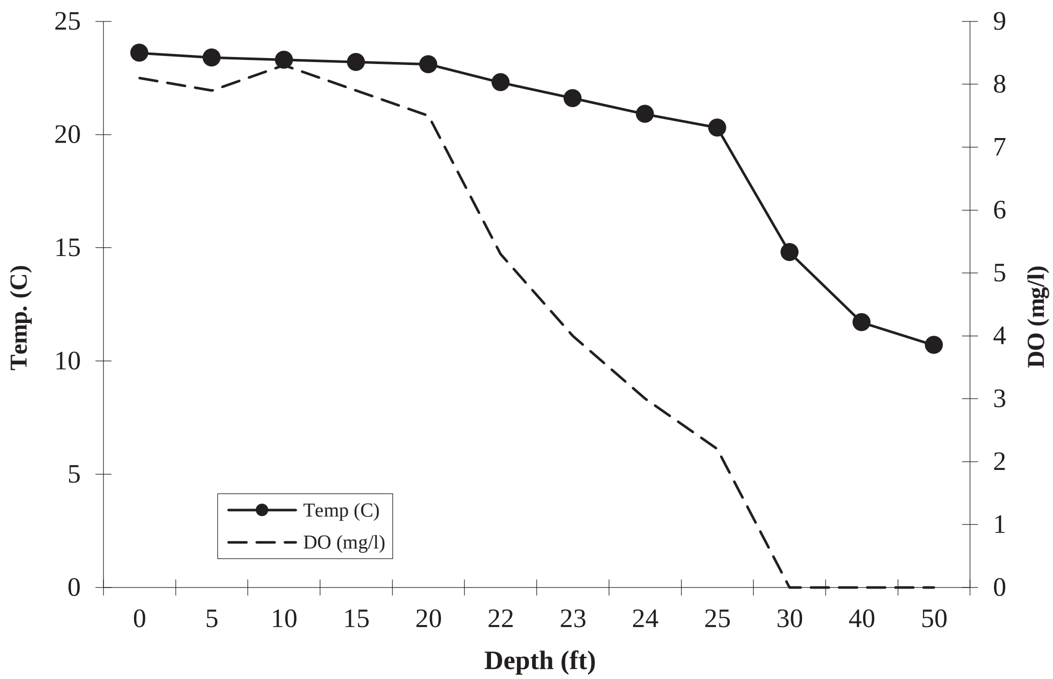

Figure 4b. Dissolved oxygen temperature profile created on August 19, 2014 at Lake Hopatcong, near Chestnut Point.

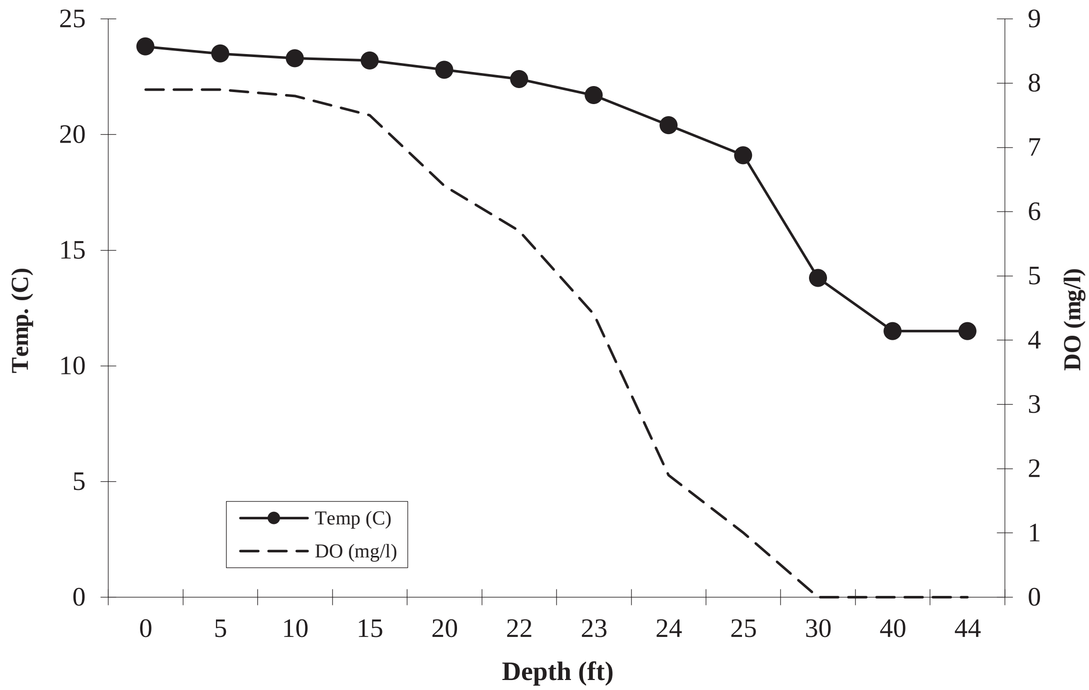

Figure 4c. Dissolved oxygen temperature profile created on August 19, 2014 at Lake Hopatcong, near Raccoon Island.

Table 1. Physical-chemical characteristics collected at Lake Hopatcong in 2013 – 2014.

Parameters	Mean Values (n)	Range	Dates
Water Temperature (C)	19.7 (10)	10.8 – 24.8	8/19/13 – 6/4/14
Air Temperature (C)	22.0 (2)	16.0 – 28.0	8/19/13 – 6/4/14
Specific Conductance (*u*S/cm)	310.2 (7)	253 – 352.4	8/19/13 – 6/4/14
Conductivity (*u*S/cm)	287.6 (8)	240.5 – 312.3	8/19/13 – 6/4/14
Dissolved Oxygen (mg/l)	7.27 (7)	5.16 – 8.4	8/19/13 – 6/4/14
Alkalinity (mg/l)	36.5 (2)	34 - 39	8/19/13 – 6/4/14
pH	8.22 (8)	7.38 – 8.74	8/19/13 – 6/4/14

Table 2. Fish species collected from Lake Hopatcong during 2013 - 2014.

I. Order: Clupeiformes
- A. Family: Clupeidae – Herrings and Shads
  1) *Alosa pseudoharengus* – alewife

II. Order: Cypriniformes
- A. Family: Catostomidae – Suckers and minnows
  1) *Erimyzon oblongus* – creek chubsucker
- B. Family: Cyprinidae – Carps and minnows
  1) Cyprinella analostana – satinfin shiner
  2) *Cyprinus carpio* – common carp
  3) *Notemigonus crysoleucas* – golden shiner
  4) *Notropis bifrenatus* – bridle shiner

III. Order: Cyprinodontiformes
- A. Family: Fundulidae – Topminnows and Killifish
  1) *Fundulus diaphanus* – banded killifish

IV. Order: Esociformes
- A. Family: Esocidae – Pikes
  1) *Esox americanus* – redfin pickerel
  2) *Esox masquinongy* - muskellunge
  3) *Esox niger* – chain pickerel

V. Order: Perciformes
- A. Family: Centrarchidae – Sunfishes
  1) *Ambloplites rupestris* – rock bass
  2) *Enneacantus gloriosus* – bluespotted sunfish
  3) *Lepomis auritus* – redbreast sunfish
  4) *Lepomis gibbosus* – pumpkinseed
  5) *Lepomis macrochirus* – bluegill
  6) *Micropterus dolomieu*– smallmouth bass
  7) *Micropterus salmoides* – largemouth bass
  8) *Pomoxis nigromaculatus* – black crappie
- B. Family: Percidae – Perches
  1) *Etheostoma olmstedi* – tessellated darter
  2) *Perca flavescens* – yellow perch
  3) *Stizostedion vitreum* - walleye
- C. Family: Moronidae – Temperate Basses
  1) *Morone americana* – white perch
  2) *Morone saxatilis x Morone chrysops* – hybrid striped bass

VI. Order: Salmoniformes
- A. Family: Salmonidae – Trout and Salmon
  1) *Oncorhynchus mykiss* – Rainbow trout

VII. Order: Siluriformes
- A. Family: Ictaluridae - Bullhead catfishes
  2) *Ameiurs catus* – white catfish
  3) *Ameiurus natalis* – yellow bullhead
  4) *Ameiurus nebulosus* – brown bullhead
  5) *Ictalurus punctatus* – channel catfish

Table 3. Species composition determined by trap netting in Lake Hopatcong in 2014.

Species Name	Number	Percent Composition	No/Net
Alewife	203	3%	7
Black crappie	1379	23%	48
Bluegill	1988	32%	69
Brown bullhead	191	3%	7
Chain pickerel	72	1%	2
Channel catfish	1	<1%	<1
Common carp	4	<1%	<1
Creek chubsucker	1	<1%	<1
Golden shiner	105	2%	4
Hybrid striped bass	1	<1%	<1
Largemouth bass	6	<1%	<1
Muskellunge	10	<1%	<1
Pumpkinseed	606	10%	21
Rainbow trout	1	<1%	<1
Redbreast sunfish	5	<1%	<1
Redfin pickerel	1	<1%	<1
Rockbass	87	1%	3
Smallmouth bass	6	<1%	<1
Walleye	72	1%	2
White perch	350	6%	12
Yellow bullhead	45	1%	2
Yellow perch	984	16%	34
Total	**6118**	**100%**	**211**

Table 3b. Trap Net sampling locations, coordinates and description of location in 2014.

Location ID#	Description of Location	Latitude Coordinate	Long Coordinate
1	Espanong Rd. Bridge	40.962501	-74.61283
2	Point south of Lify Island	40.96835	-74.615898
4	Woodport swim beach	40.970626	-74.608935
6	Small cove with swim beach	40.957778	-74.621799
7	Henderson cove	40.969552	-74.631565
9	Halsey Island sand bar	40.957918	-74.632078
10	Halsey Island south side	40.953753	-74.630232
11	River Styx	40.947052	-74.655737
12	River Styx	40.944503	-74.654294
13	River Styx near swim beach	40.941602	-74.644703
14	West of Betrand Island, small cove	40.92638	-74.658854
15	Bed bug	40.92974	-74.65681
16	Betrand Island	40.925148	-74.647932
17	Landing sand bar	40.917431	-74.655153
18	Kings cove south rock point	40.920909	-74.651258
19	State Park swim beach	40.91662	-74.662105
20	Landing, small rock island	40.910758	-74.658715
21	Lees Cove	40.937351	-74.634628
22	Byram Cove	40.956241	-74.660394

Table 4. Total number collected by electrofishing in 2013 and 2014 at Lake Hopatcong.

Species	2013	2014
Alewife	21	1
Black crappie	27	9
Brown bullhead	25	11
Bluegill	76	61
Chain pickerel	38	35
Channel catfish	0	9
Common carp	1	0
Golden shiner	29	10
Hybrid striped bass	0	6
Largemouth bass	32	87
Rock bass	8	18
Smallmouth bass	2	22
Pumpkinseed	49	16
Walleye	5	70
Yellow perch	154	65
White perch	0	4
White catfish	1	0
Yellow bullhead	5	1
Total	**473**	**425**

Table 5. Gill net totals and species composition from October 23, 2013.

Species Name	Total	Percent Composition
Alewife	**3**	1%
Black crappie	**19**	9%
Bluegill	**19**	9%
Brown bullhead	**2**	1%
Chain pickerel	**1**	0%
Golden shiner	**1**	0%
Hybrid striped bass	**15**	7%
Largemouth bass	**1**	0%
Pumpkinseed	**16**	8%
Smallmouth bass	**6**	3%
Walleye	**39**	18%
White perch	**64**	30%
Yellow perch	**26**	12%
Total	**212**	**100%**

Table 5b. Gill net sampling locations and coordinates in 2013.

Location ID #	Description of Location	Latitude Coordinate	Longitude Coordinate
1	Raccoon Island	40.959061	-74.639588
2	River Styx, Point near swim area	40.941392	-74.643772
3	Lees Cove, Point	40.936866	-74.636476
4	Betrand Island	40.929506	-74.651089

Table 6. Species composition determined by seining in Lake Hopatcong in 2013.

	YOY				Intermediate				Adult			
	Total No.	No. Sites Found	% Sites Found	% of Total	Total No.	No. Sites Found	% Sites Found	% of Total	Total No.	No. Sites Found	% Sites Found	% of Total
Alewife	0	0	0%	0%	0	0	0%	0%	3	1	1%	1%
Banded killifish	56	18	23%	4%	161	20	26%	32%	302	15	19%	71%
Black crappie	0	0	0%	0%	7	4	5%	1%	1	1	1%	0%
Blue spotted sunfish	29	13	17%	2%	7	5	6%	1%	3	1	1%	1%
Bluegill	682	47	61%	46%	117	29	38%	23%	28	14	18%	7%
Bridle shiner	7	3	4%	0%	18	6	8%	4%	4	2	3%	1%
Chain pickerel	3	3	4%	0%	0	0	0%	0%	0	0	0%	0%
Golden shiner	0	0	0%	0%	1	1	1%	0%	0	0	0%	0%
Hybrid Striped Bass	1	1	1%	0%	0	0	0%	0%	0	0	0%	0%
Largemouth bass	22	16	21%	1%	2	2	3%	0%	2	2	3%	0%
Pumpkinseed	70	14	18%	5%	124	33	43%	25%	57	21	27%	13%
Redbreast sunfish	2	1	1%	0%	7	5	6%	1%	3	3	4%	1%
Rock bass	2	2	3%	0%	0	0	0%	0%	3	3	4%	1%
Satinfin shiner	130	12	16%	9%	25	4	5%	5%	8	2	3%	2%
Smallmouth bass	2	2	3%	0%	0	0	0%	0%	0	0	0%	0%
Tesselated darter	4	3	4%	0%	30	11	14%	6%	6	5	6%	1%
Unknown Esox spp.	2	2	3%	0%	2	1	1%	0%	0	0	0%	0%
Unknown sunfish sp.	450	26	34%	30%	0	0	0%	0%	0	0	0%	0%
Walleye	0	0	0%	0%	0	0	0%	0%	1	1	1%	0%
Yellow perch	26	14	18%	2%	4	4	5%	1%	5	5	6%	1%
Total	**1488**				**505**				**426**			

Table 7. CPUE (fish/hour) of all species collected night electrofishing on 10/9/13.

Species	Number	Time (hours)	(Catch Per Hour)	% of Total
Alewife	5	1.5	3	1%
Black crappie	13	1.5	9	3%
Bluegill	55	1.5	37	15%
Brown bullhead	24	1.5	16	6%
Chain pickerel	32	1.5	21	9%
Channel catfish	0	1.5	0	0%
Common carp	1	1.5	1	0%
Golden shiner	4	1.5	3	1%
Largemouth bass	20	1.5	13	5%
Pumpkinseed	49	1.5	33	13%
Rock bass	5	1.5	3	1%
Smallmouth bass	1	1.5	1	0%
Walleye	5	1.5	3	1%
White catfish	1	1.5	1	0%
White perch	0	1.5	0	0%
Yellow bullhead	4	1.5	3	1%
Yellow perch	154	1.5	103	41%
Total	**373**			**100%**

Table 8. CPUE (fish/hour) of all species collected night electrofishing in 2014.

Species	Number	Time (hours)	CPH (Catch Per Hour)
Alewife*	-	-	-
Black crappie	9	1.00	9
Bluegill	61	0.50	122
Brown bullhead	11	1.00	11
Chain pickerel	35	6.83	5
Channel catfish	9	6.83	1
Common carp*	-	-	-
Golden shiner	10	1.00	10
Largemouth bass	87	6.83	13
Pumpkinseed	16	0.50	32
Rock bass	18	4.00	5
Smallmouth bass	22	6.83	3
Walleye	70	6.83	10
White catfish	0	6.83	0
White perch	4	1.00	4
Yellow bullhead	0	1.00	0
Yellow perch	65	1.00	65
Total	**417**		

Table 9. Proportional Stock Density (PSD), Relative Stock Density (RSD_p and RSD_m) of gamefish collected at Lake Hopatcong during 2013 - 2014.

Species	Size (mm)	Number	PSD	RSD_p	RSD_m
Largemouth bass (Fall 2013 – Electrofishing)	≥ 200	30			
	≥ 300	22			
	≥ 380	13	**PSD = 73**	**$RSD_{15} = 43$**	**$RSD_{20} = 0$**
Largemouth bass (Spring 2014 - Electrofishing)	≥ 200	79			
	≥ 300	61			
	≥ 380	31			
	> 510	1	**PSD = 77**	**$RSD_{15} = 39$**	**$RSD_{20} = 1$**
Chain pickerel (Fall 2013 - Electrofishing)	≥ 250	26			
	≥ 380	17			
	≥ 510	7			
	≥ 630	0	**PSD = 65**	**$RSD_{20} = 27$**	**$RSD_{25} = 0$**
Chain pickerel (Spring 2014 - Electrofishing)	≥ 250	30			
	≥ 380	21			
	≥ 510	11			
	≥ 630	1	**PSD = 70**	**$RSD_{20} = 37$**	**$RSD_{25} = 3$**
Chain pickerel (Spring 2014 – Trap Net)	≥ 250	47			
	≥ 380	45			
	≥ 510	28			
	≥ 630	1	**PSD = 96**	**$RSD_{20} = 60$**	**$RSD_{25} = 2$**
Muskellunge (Spring 2014 – Trap Net)	≥ 510	10			
	≥ 760	10			
	≥ 970	10			
	≥ 1070	4	**PSD = 100**	**$RSD_{20} = 100$**	**$RSD_{25} = 40$**
Bluegill (2013 – Electrofishing)	≥ 80	54			
	≥ 150	22			
	≥ 200	1	**PSD = 41**	**$RSD_8 = 2$**	**$RSD_m = 0$**
Bluegill (2014 – Electrofishing)	≥ 80	60			
	≥ 150	47			
	≥ 200	6	**PSD = 78**	**$RSD_8 = 10$**	**$RSD_m = 0$**
Bluegill (2014 – Trap Net)	≥ 80	117			
	≥ 150	95			
	≥ 200	1	**PSD = 81**	**$RSD_8 = 1$**	**$RSD_m = 0$**
Pumpkinseed (2013 – Electrofishing)	≥ 80	49			
	≥ 150	19			
	≥ 200	0	**PSD = 39**	**$RSD_8 = 0$**	**$RSD_m = 0$**
Pumpkinseed (2014 –Electrofishing)	≥ 80	16			
	≥ 150	15			
	≥ 200	0	**PSD = 94**	**$RSD_8 = 0$**	**$RSD_m = 0$**
Pumpkinseed (2014 – Trap Net)	≥ 80	72			
	≥ 150	65			
	≥ 200	2	**PSD = 90**	**$RSD_8 = 3$**	**$RSD_m = 0$**
Yellow perch (2013 – Electrofishing)	≥ 130	150			
	≥ 200	108			
	≥ 250	17			
	≥ 300	1	**PSD = 72**	**$RSD_{10} = 11$**	**$RSD_{12} = 1$**

Yellow perch	≥ 130	63			
(2014 – Electrofishing)	≥ 200	50			
	≥ 250	6			
	≥ 300	0	**PSD = 79**	**RSD_{10} = 10**	**RSD_{12} = 0**
Yellow perch	≥ 130	145			
(2014 – Trap Net)	≥ 200	125			
	≥ 250	21			
	≥ 300	0	**PSD = 86**	**RSD_{10} = 14**	**RSD_{12} = 0**
Hybrid Striped Bass	≥ 200	15			
(2013 – Fall Gill Net)	≥ 300	14			
	≥ 380	13			
	≥ 510	0	**PSD = 93**	**RSD_{10} = 87**	**RSD_{12} = 0**
Black crappie	≥ 130	24			
(2013 – Electrofishing)	≥ 200	16			
	≥ 250	11			
	≥ 300	5	**PSD = 67**	**RSD_{10} = 46**	**RSD_{12} = 21**
Black crappie	≥ 130	165			
(2014 – Trap Net)	≥ 200	130			
	≥ 250	30			
	≥ 300	8	**PSD = 79**	**RSD_{10} = 18**	**RSD_{12} = 5**
Walleye	≥ 250	39			
(2013 – Fall Gill Nets)	≥ 380	34			
	≥ 510	8			
	≥ 630	8	**PSD = 87**	**RSD_{20} = 21**	**RSD_{25} = 0**
Walleye	≥ 250	70			
(Spring 2014, Trap Net)	≥ 380	70			
	≥ 510	60			
	≥ 630	16	**PSD = 100**	**RSD_{20} = 86**	**RSD_{25} = 23**
Walleye	≥ 250	68			
(Spring 2014, Electrofishing)	≥ 380	61			
	≥ 510	24			
	≥ 630	2	**PSD = 90**	**RSD_{20}= 35**	**RSD_{25} = 3**
Smallmouth bass	≥ 180	20			
(Spring 2014 Electrofishing)	≥ 280	10			
	≥ 350	5			
	≥ 430	3	**PSD = 50**	**RSD_{15} = 25**	**RSD_{20} = 15**
White perch	≥ 130	64			
(2013 – Gill Net)	≥ 200	54			
	≥ 250	24			
	≥ 300	0	**PSD = 84**	**RSD_{10} = 38**	**RSD_{12} = 0**

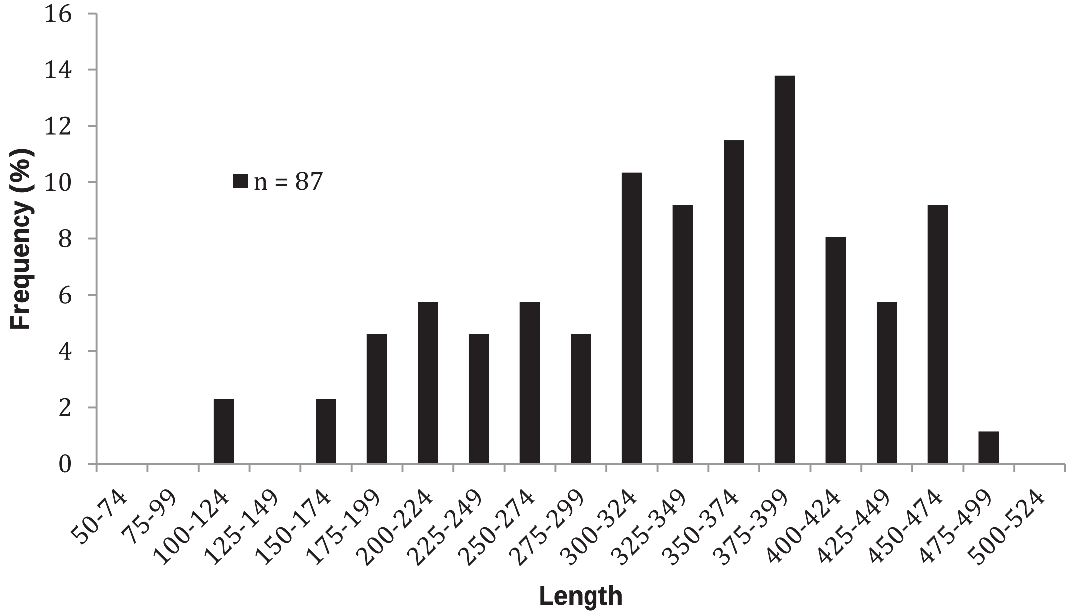

Figure 5. Length frequency of largemouth bass collected at Lake Hopatcong during Spring 2014 electrofishing.

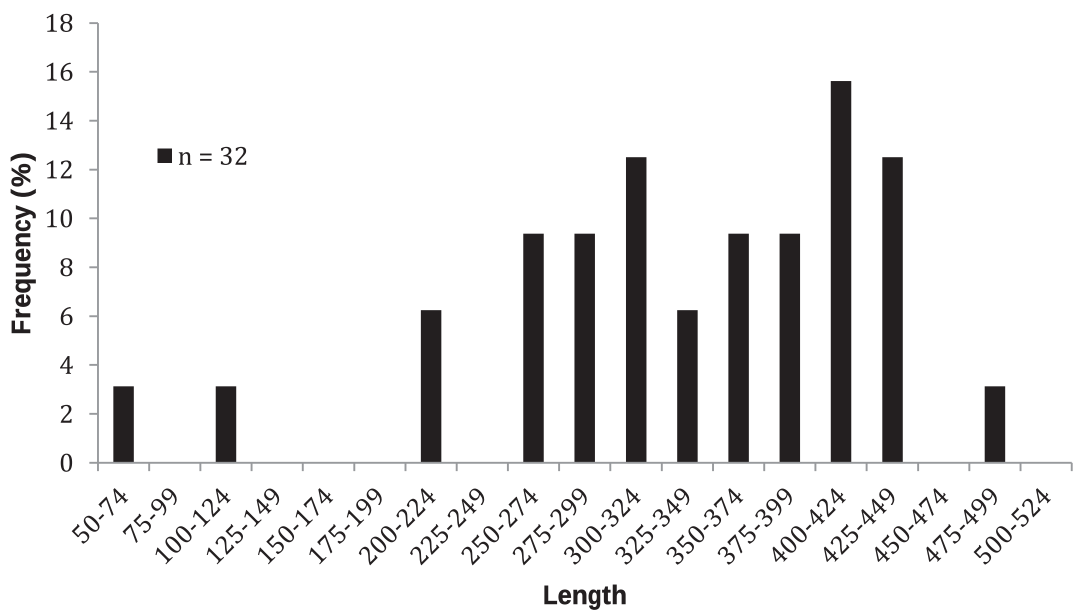

Figure 6. Length frequency of largemouth bass collected at Lake Hopatcong during Fall 2013 electrofishing.

Table 10. Number and average W_r (mean ± 95% CI.), grouped by length, of selected species collected via electrofishing at Lake Hopatcong in 2013 and 2014.

Species	Length (mm)	Number	Average W_r	SE	Range W_r
Largemouth bass (Fall 2013)	150-199	-	-	-	-
	200-299	8	101 ± 3.20	.46	96 - 109
	300-379	9	95 ± 10.08	1.58	81 - 129
	≥380	13	96 ± 7.04	1.32	75 - 117
	ALL	30	97 ± 4.32	1.23	75 - 129
Largemouth bass (Spring 2014)	150-199	6	108 ± 13.00	1.56	85 - 127
	200-299	18	100 ± 5.25	1.14	74 - 121
	300-379	30	93 ± 3.60	1.04	71 - 110
	≥380	31	91 ± 3.00	.89	69 - 109
	ALL	85	95 ± 2.40	1.16	69 - 127
Smallmouth bass (Spring 2014)	180-279	10	91 ± 4.78	.81	83 - 103
	280-349	5	82 ± 3.57	.45	78 - 87
	≥350	5	75 ± 8.75	1.15	68 - 92
	ALL	20	85± 4.35	1.08	68 - 103
Chain pickerel (Fall 2013)	150-249	9	93 ± 9.40	1.49	68 - 108
	250-379	9	95 ± 3.58	.56	85 - 103
	380-510	10	84 ± 4.14	.73	75 - 97
	≥510	7	77 ± 3.11	.48	71 - 84
	ALL	35	88 ± 3.57	1.15	68 - 108
Chain pickerel (Spring 2014)	150-249	5	99 ± 13.63	1.57	81 - 119
	250-379	9	92 ± 6.76	1.08	70 - 107
	380-510	10	80 ± 6.71	1.21	64 - 96
	≥510	11	80 ± 5.06	.96	69 - 96
	ALL	35	86 ± 4.17	1.36	64 - 119
Bluegill (Fall 2013)	80 – 149	40	92 ± 5.36	1.80	49 -157
	150 – 199	33	81 ± 3.50	1.14	46 - 99
	>200	1	78	-	-
	All	74	87 ± 3.52	1.65	46 - 157
Bluegill (Spring 2014)	80 – 149	13	109 ± 9.26	1.63	69 - 141
	150 – 199	39	104 ± 3.94	1.23	81 - 126
	>200	6	96 ± 7.13	.91	87 - 108
	All	58	104 ± 3.51	1.34	69 - 141
Pumpkinseed (Fall 2013)	80-149	30	104 ± 10.08	2.76	71 - 176
	150-199	19	86 ± 2.45	.59	75 - 94
	>200	-	-	-	-
	All	49	97 ± 6.70	2.43	71 - 176
Pumpkinseed (Spring 2014)	80-149	1	143	-	-
	150-199	15	114 ± 4.94	.91	97 - 128
	>200	-	-	-	-
	All	16	116 ± 5.82	1.10	97 - 143

Yellow perch (Fall 2013)	100 - 129	3	71 ± 7.34	.77	64 - 77
	130 - 199	42	80 ± 2.15	.79	57 - 92
	200-249	91	79 ± 1.76	.96	44 - 126
	>250	17	74 ± 4.43	1.08	43 - 86
	All	153	79 ± 1.34	.95	43 - 126
Yellow perch (Spring 2014)	100 - 129	2	91 ± 40.42	3.06	70 -111
	130 - 199	13	99 ± 5.44	1.00	86 - 125
	200-249	44	93 ± 2.12	.74	72 - 106
	>250	6	79 ± 8.32	1.17	62 - 87
	All	65	93 ± 2.44	1.04	62 - 125
Black crappie (Fall 2013)	130-199	8	95 ± 7.31	1.08	82 - 110
	200-249	5	89 ± 5.48	.66	81 - 96
	250-299	6	79 ± 9.94	1.40	57 - 91
	>300	6	93± 8.90	1.05	78 - 104
	All	24	89 ± 4.63	1.22	57 - 110
Walleye (Spring 2014)	250 - 379	7	101 ± 4.41	.59	90 - 107
	380 -509	36	95 ± 2.24	.70	78 - 107
	510 - 629	22	91 ± 2.35	.59	81 – 101
	>630	2	96 ± 20.13	1.48	86 - 106
	ALL	70	95 ± 1.93	.85	78 - 124

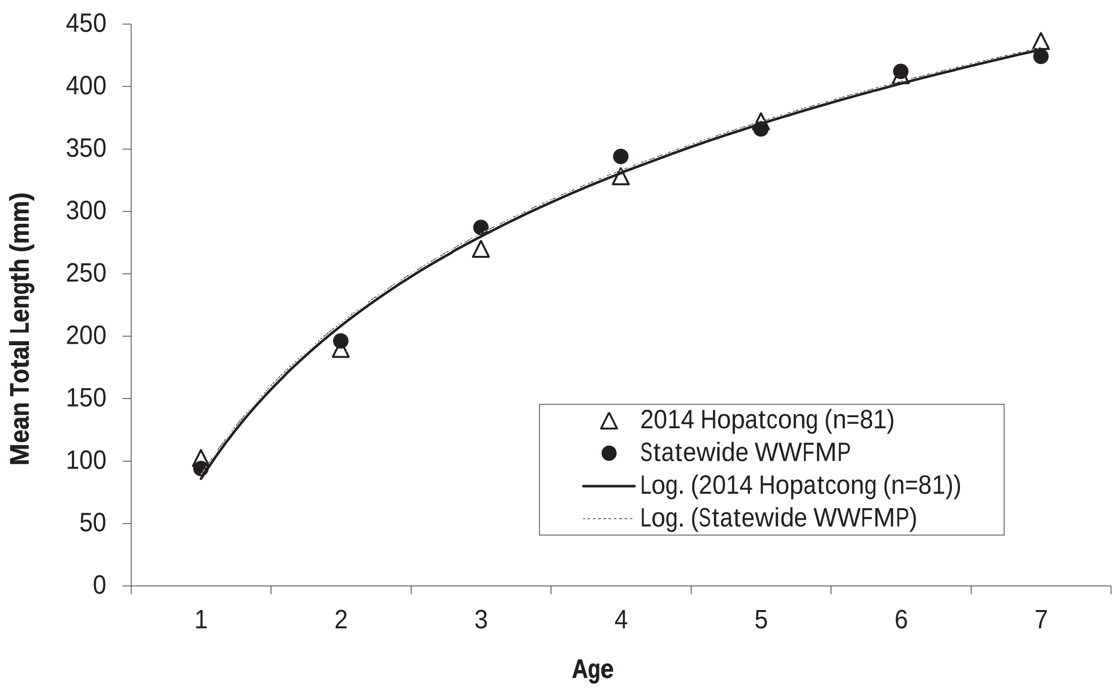

Figure 7. Length at age of largemouth bass collected at Lake Hopatcong in 2014.

Table 11. Back calculated length at age (mean ± 95% CI) of selected species collected from Lake Hopatcong in 2014.

Species	Age	Number at age	Number of scales/age	Average total length (mm)	Length range (mm)
Largemouth bass	1	5	81	102 ± 3.03	81 - 148
	2	15	76	190 ± 4.71	133 – 255
	3	18	61	270 ± 6.29	222 – 328
	4	15	43	328 ± 5.50	285 – 364
	5	11	28	372 ± 5.28	336 – 395
	6	5	17	409 ± 5.77	386 - 437
	7	6	12	436 ± 6.53	416 - 455
	8	5	6	457 ± 7.76	440 - 468
	9	1	1	480	-
Chain pickerel	1	6	44	163 ± 5.31	132 – 210
	2	10	38	278 ± 10.12	221 – 373
	3	3	28	385 ± 10.24	346 – 467
	4	7	25	464 ± 12.07	401 – 518
	5	11	18	519 ± 16.72	438 – 566
	6	6	7	591 ± 13.88	566 - 614
	7	1	1	649	1
Black Crappie	1	0	82	89 ± 2.74	72 – 132
	2	11	82	138 ± 3.34	113 – 182
	3	13	71	185 ± 3.28	155 – 241
	4	33	59	218 ± 3.21	194 – 269
	5	16	25	250 ± 6.31	224 – 308
	6	3	9	285 ± 10.46	271 – 325
	7	2	6	303 ± 13.75	288 – 337
	8	2	4	323 ± 22.15	307 – 356
	9	2	2	348 ± 35.50	330 - 366
Hybrid striped bass	1	0	7	263 ± 20.99	206 – 286
	2	3	7	398 ± 9.32	379 - 411
	3	0	4	483 ± 15.23	464 - 502
	4	4	4	537 ± 5.53	529 - 541
Smallmouth bass	1	3	23	113 ± 7.69	92 – 176
	2	8	20	198 ± 11.00	158 - 258
	3	3	12	283 ± 9.70	252 – 310
	4	4	9	348 ± 20.14	299 - 387
	5	4	5	415 ± 11.88	395 - 429
	6	1	1	439	-
Walleye	1	2	141	229 ± 4.57	156 – 294
	2	21	139	348 ± 4.68	282 – 441
	3	12	118	426 ± 4.37	379 – 498
	4	19	106	485 ± 5.27	431 – 586
	5	36	87	527 ± 6.26	469 – 609
	6	21	51	567 ± 8.27	516 - 643
	7	14	30	610 ± 10.54	556 – 676
	8	11	16	637 ± 15.59	588 – 710
	9	4	5	649 ± 19.41	612 - 671
	10	1	1	688	-

Muskellunge	1	0	9	250 ± 27.91	170 – 305
	2	0	9	509 ± 62.74	320 – 618
	3	0	9	702 ± 49.36	537 – 794
	4	0	9	842 ± 50.03	687 – 918
	5	1	9	932 ± 42.39	787 – 1008
	6	1	8	990 ± 41.58	887 – 1087
	7	2	7	1031 ± 42.55	953 – 1127
	8	4	5	1085 ± 58.85	987 – 1170
	9	1	1	1192	-

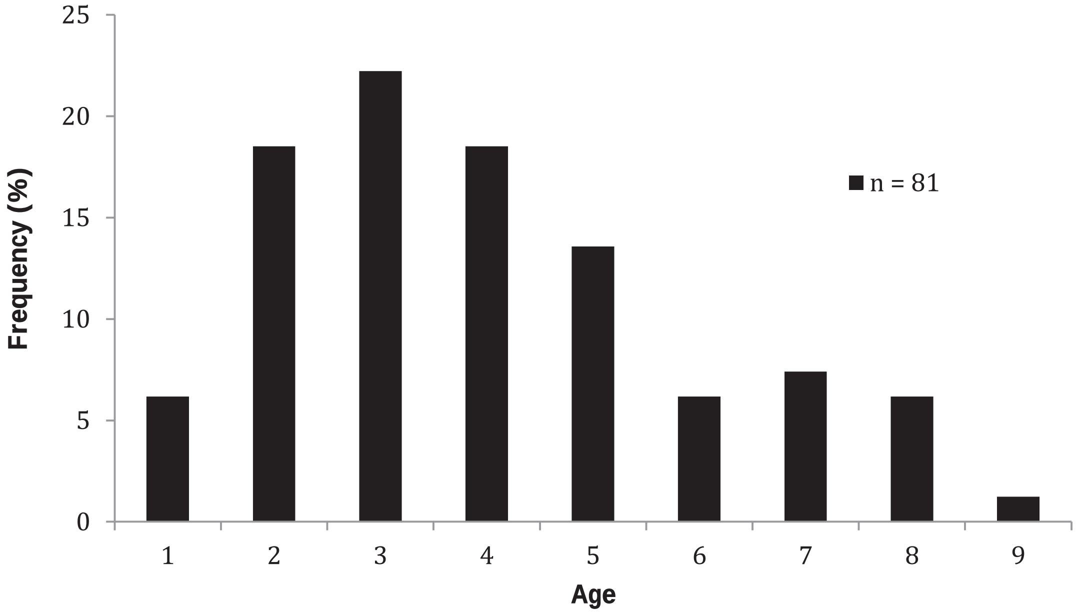

Figure 8. Age frequency of largemouth bass collected at Lake Hopatcong in 2014.

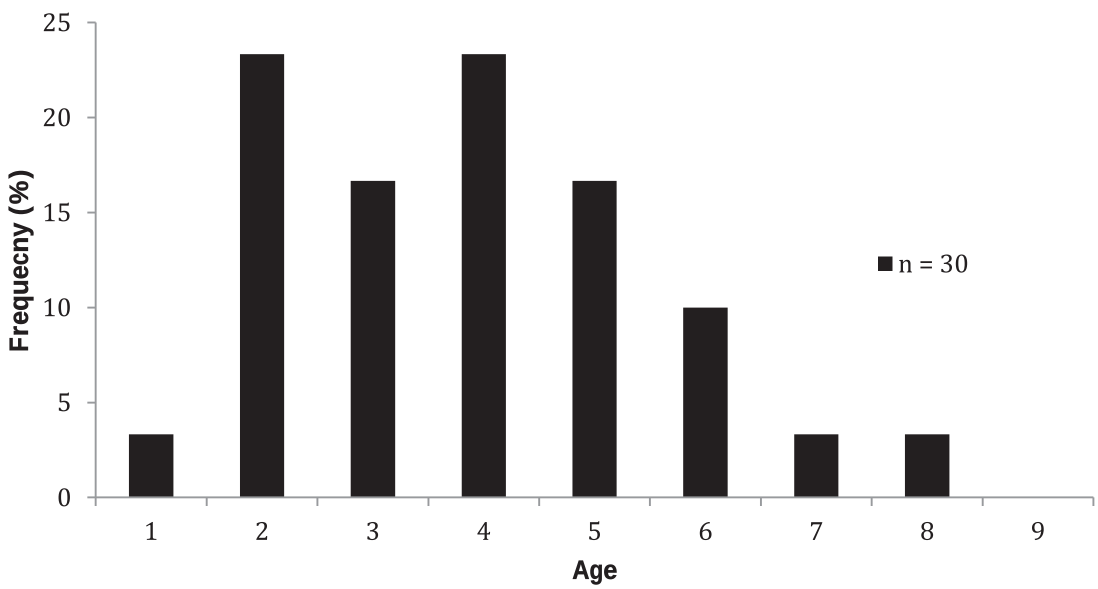

Figure 9. Age frequency of largemouth bass collected at Lake Hopatcong during fall 2013 electrofishing.

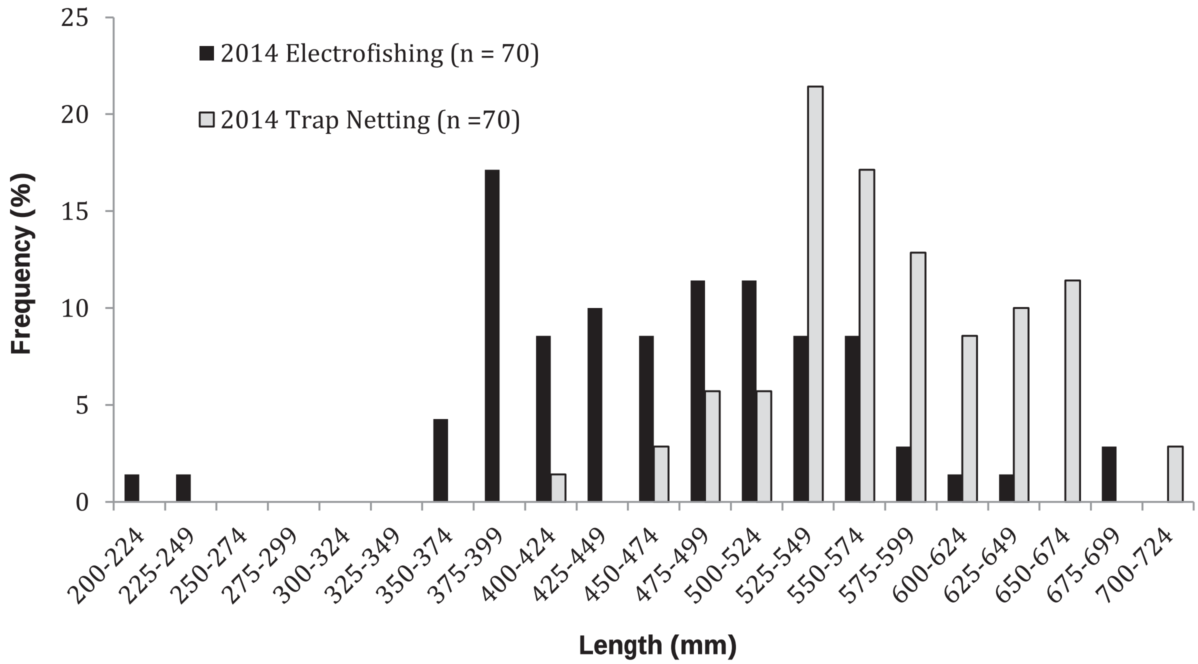

Figure 10. Length frequency of walleye collected at Lake Hopatcong during Spring 2014 trap netting and electrofishing.

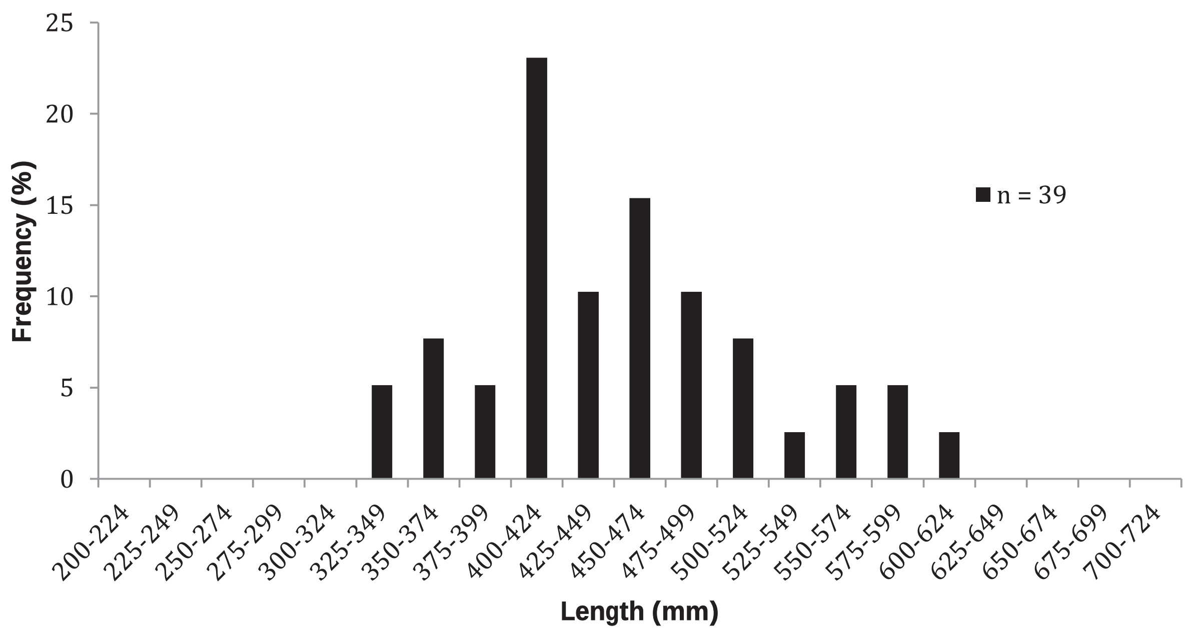

Figure 11. Length frequency of walleye collected at Lake Hopatcong during fall 2013 gill netting.

Table 12. Number and average W_r (mean ± 95% CI.), grouped by length, of selected species collected via trap net in Lake Hopatcong in Spring 2014.

Species	Length (mm)	Number	Average W_r	SE	Range W_r
Chain pickerel	150-249	-	-	-	-
	250-379	2	92 ± 8.59	.65	88 - 97
	380-510	17	87 ± 2.48	.56	76 - 97
	≥510	28	85 ± 5.22	1.53	69 - 139
	ALL	47	86 ± 3.25	1.23	69 - 139
Bluegill	80 – 149	20	89 ± 9.20	2.22	55 - 139
	150 – 199	94	89 ± 2.24	1.17	49 - 115
	>200	1	89	-	-
	All	115	89 ± 2.41	1.40	49 - 139
Pumpkinseed	80-149	7	108 ± 16.42	2.13	76 - 144
	150-199	63	96 ± 2.31	.95	61 - 116
	>200	1	100	-	-
	All	72	98 ± 2.65	1.16	61 - 144
Yellow perch	130 - 199	20	83 ± 4.48	1.12	61 - 102
	200-249	104	79 ± 1.40	.82	58 - 95
	>250	21	73 ± 3.96	1.08	48 - 89
	All	145	79 ± 1.37	.95	48 - 102
Black crappie	130-199	35	97 ± 3.17	.97	80 - 119
	200-249	99	95 ± 1.80	.94	77 - 143
	250-299	22	93 ± 2.48	.62	81 - 105
	>300	8	95 ± 3.86	.57	84 - 101
	All	164	95 ± 1.34	.90	77 - 143
Muskellunge	760 - 969	1	84	-	-
	970 - 1069	5	104 ± 9.59	1.07	92 - 119
	>1070	4	106 ± 3.86	1.89	79 - 120
	All	10	103 ± 1.34	1.48	79 - 120
Walleye	380 -509	10	90 ± 3.74	.64	81 -100
	510 - 629	44	92 ± 2.77	.98	72 - 133
	>630	16	85 ± 3.36	.74	76 - 100
	ALL	70	90 ± 2.05	.92	72 - 133
White Perch	80 - 149	-	-	-	-
	150 - 199	-	-	-	-
	>200	13	94 ± 3.44	.65	79 - 107
	All	13	94 ± 3.44	.65	79 - 107

Table 13. Number and average W_r (mean ± 95% CI), grouped by length, of selected species collected via Gill Net in Lake Hopatcong in fall 2013.

Species	Length (mm)	Number	Average W_r	SE	Range W_r
Hybrid striped bass	200-299	1	93	-	-
	300-379	1	87	-	-
	380-509	12	80 ± 2.73	.54	73 - 88
	≥510	-	-	-	-
	ALL	14	82 ± 3.01	.64	73 - 93
Walleye	250 - 379	5	90 ± 4.04	.48	84 - 95
	380 -509	26	93 ± 2.42	.65	83 - 109
	510 - 629	8	90 ± 4.07	.62	84 - 101
	>630	-	-	-	-
	ALL	39	92 ± 1.87	.62	83 - 109
White Perch	130 - 199	9	80 ± 6.56	1.12	75 - 106
	200 - 249	29	92 ± 1.51	.43	91 - 111
	>250	24	91 ± 1.88	.49	88 - 108
	All	62	90 ± 1.69	.71	66 - 101

Table 13. Back calculated length at age (mean ± 95% CI) of selected species collected from Lake Hopatcong in 2013.

Species	Age	Number at age	Number of scales/age	Average total length (mm)	Length range (mm)
Largemouth bass	1	1	30	101 ± 3.63	81 – 117
	2	7	29	190 ± 6.34	147 – 223
	3	5	22	273 ± 7.08	244 – 299
	4	7	17	336 ± 7.27	306 – 367
	5	5	10	376 ± 5.84	360 – 393
	6	3	5	409 ± 6.11	398 – 417
	7	1	2	429 ± 1.43	428 - 430
	8	1	1	456	-
Chain pickerel	1	0	27	169 ± 7.90	127 – 202
	2	10	27	279 ± 10.86	218 – 323
	3	2	17	382 ± 18.89	326 – 438
	4	6	15	456 ± 15.97	413 – 499
	5	6	9	515 ± 11.42	485 – 534
	6	3	3	563 ± 11.94	551 - 570
Bluegill	1	11	55	57 ± 2.00	43 - 77
	2	12	44	92 ± 2.49	74 – 109
	3	14	31	120 ± 3.31	99 – 139
	4	9	17	146 ± 3.61	136 – 158
	5	9	9	172 ± 3.98	164 - 182
Pumpkinseed	1	5	52	55 ± 2.13	42 - 75
	2	4	47	85 ± 2.80	68 – 105
	3	15	43	115 ± 2.76	96 – 135
	4	12	26	139 ± 3.51	118 – 158
	5	7	16	158 ± 4.22	142 – 171
	6	8	9	176 ± 3.20	169 - 183
Yellow perch	1	2	152	91 ± 1.23	72 – 110
	2	29	150	145 ± 1.86	120 – 181
	3	66	121	184 ± 2.29	149 – 225
	4	35	55	216 ± 3.51	188 – 250
	5	12	20	244 ± 4.87	223 - 268
	6	6	7	272 ± 3.13	267 – 278
	7	1	2	287 ± 5.30	284 - 290
	8	0	1	306	-
	9	0	1	321	-
	10	1	1	337	-
Black Crappie	1	8	45	84 ± 2.52	70 – 102
	2	3	37	138 ± 3.18	116 – 159
	3	7	34	183 ± 4.00	154 – 217
	4	10	27	215± 4.87	192 – 253
	5	7	17	251 ± 6.34	233 – 277
	6	4	10	276± 5.90	262 – 300
	7	2	6	298 ± 8.63	284 – 317
	8	2	4	312 ± 1.84	310 – 314
	9	1	2	322 ± 2.01	321 – 323
	10	0	1	338	-
	10	1	1	337	-

Hybrid striped bass	1	9	13	289 ± 16.11	237 - 349
	2	4	4	392 ± 30.06	359 - 433
Smallmouth bass	1	4	9	137 ± 13.33	105 – 155
	2	3	5	208 ± 22.50	168 – 228
	3	0	2	271 ± 9.85	266 – 276
	4	0	2	332 ± 12.40	326 – 339
	5	1	2	406 ± 6.93	403 – 410
	6	0	1	453	-
	7	1	1	476	-
Walleye	1	5	44	231 ± 7.78	168 – 285
	2	13	39	349 ± 8.87	286 – 399
	3	5	26	415 ± 11.31	374 – 476
	4	13	21	467 ± 14.47	418 – 536
	5	5	7	530 ± 28.77	477 – 571
	6	2	3	539± 51.41	508 - 591
	7	1	1	549	-
White perch	1	8	63	82 ± 2.40	56 – 97
	2	2	54	153 ± 3.61	129 – 189
	3	16	53	199 ± 3.39	176 – 221
	4	8	37	225 ± 3.05	207 – 244
	5	21	29	244 ± 2.90	229 – 263
	6	7	8	259 ± 6.81	245 - 274
	7	1	1	283	283

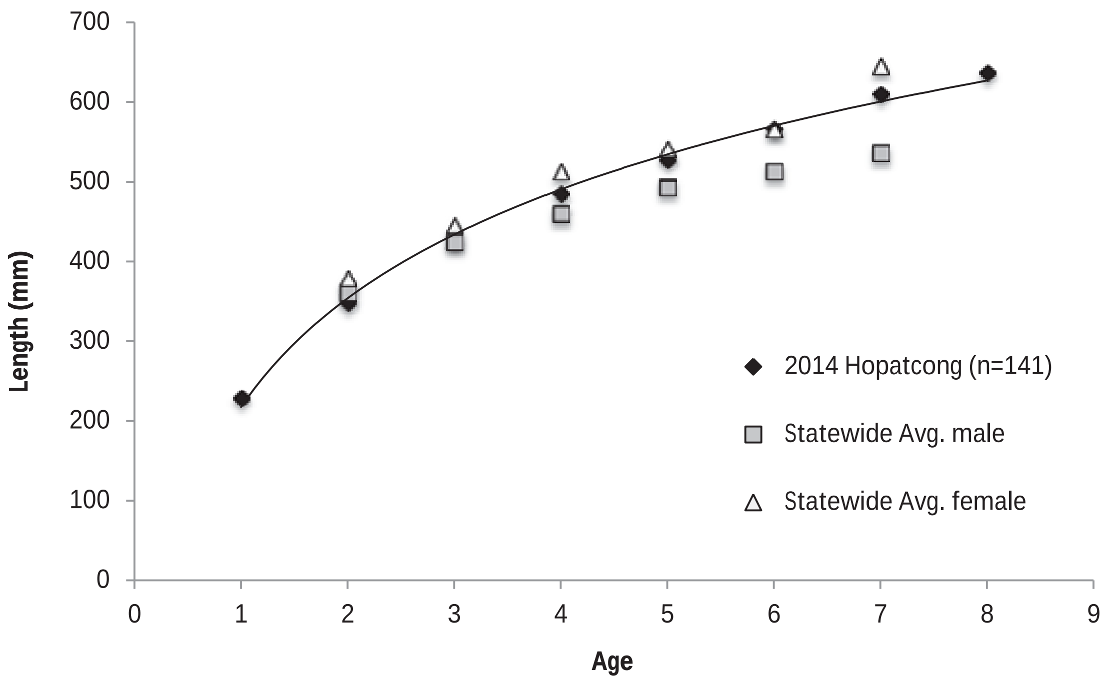

Figure 12. Length at age of walleye collected at Lake Hopatcong in 2014.

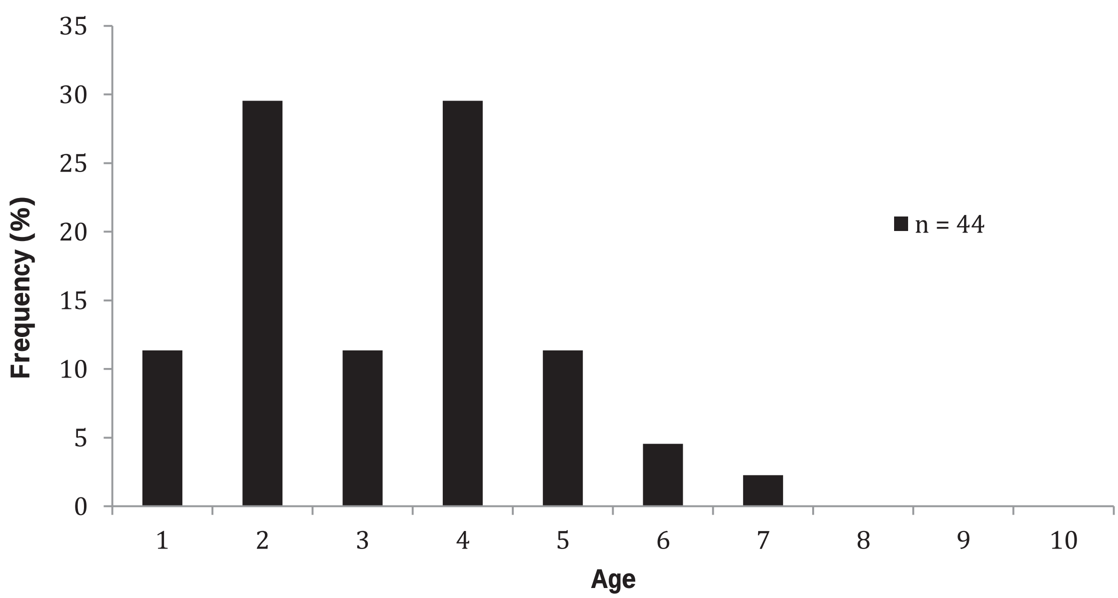

Figure 13. Age frequency of walleye collected at Lake Hopatcong in 2013.

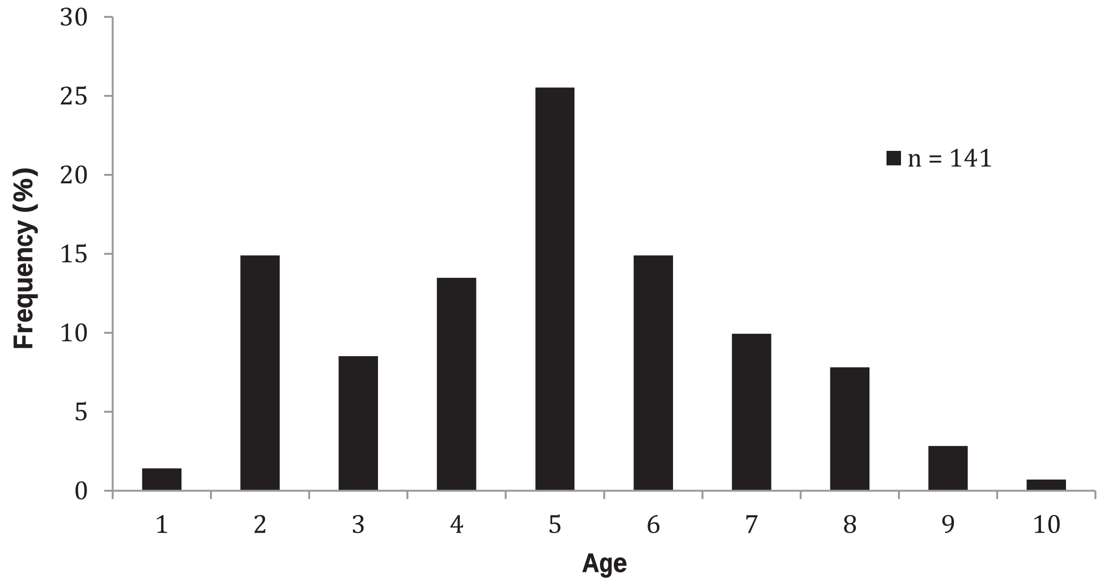

Figure 14. Age frequency of walleye collected at Lake Hopatcong in 2014.

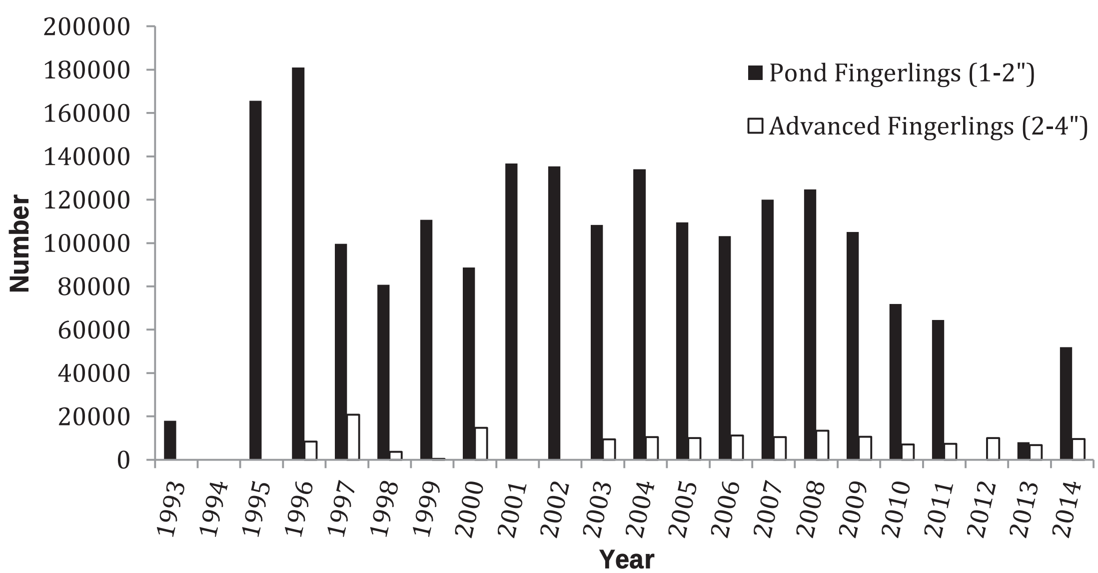

Figure 15. Walleye stocking history from 1993 – 2014, of two size ranges produced at Hackettstown Hatchery.

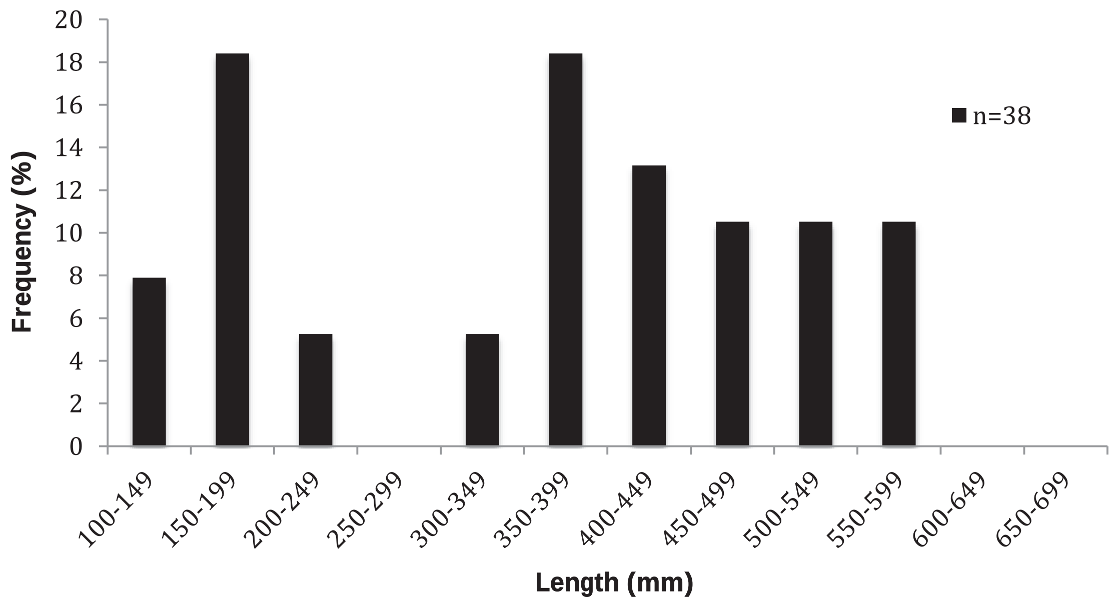

Figure 16. Length frequency of chain pickerel collected at Lake Hopatcong during fall electrofishing in 2013.

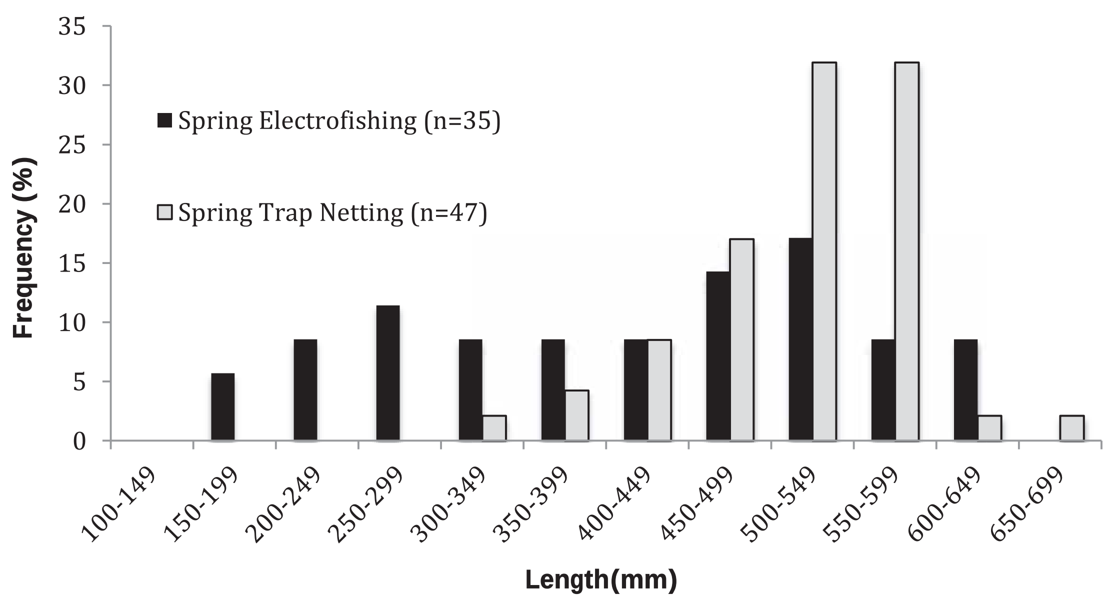

Figure 17. Length frequency of chain pickerel collected at Lake Hopatcong during spring trap netting and electrofishing.

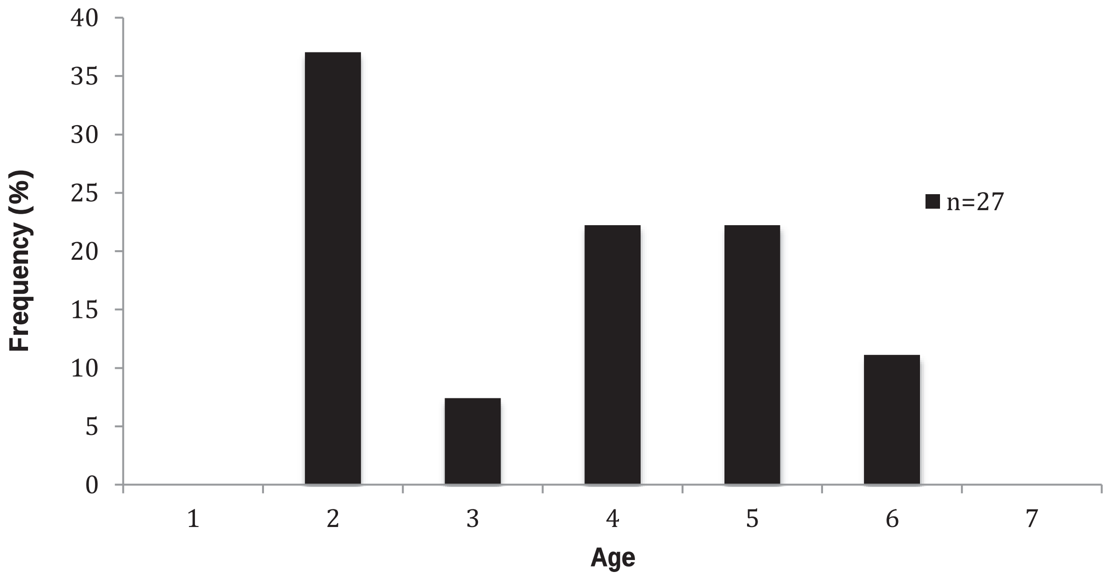

Figure 18. Age frequency of chain pickerel collected at Lake Hopatcong in 2013.

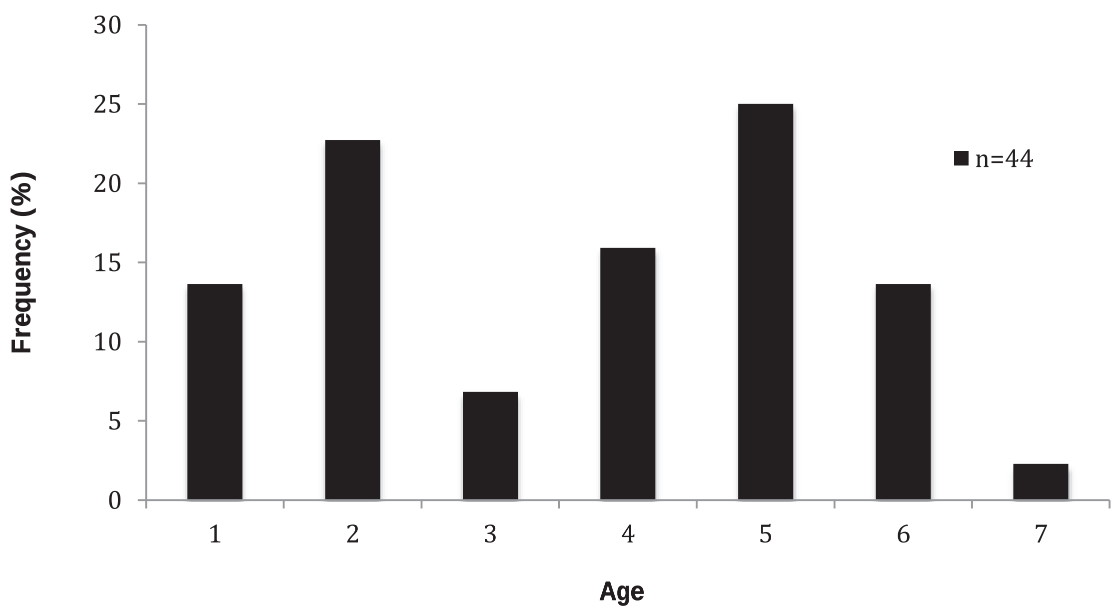

Figure 19. Age frequency of chain pickerel collected at Lake Hopatcong in 2014.

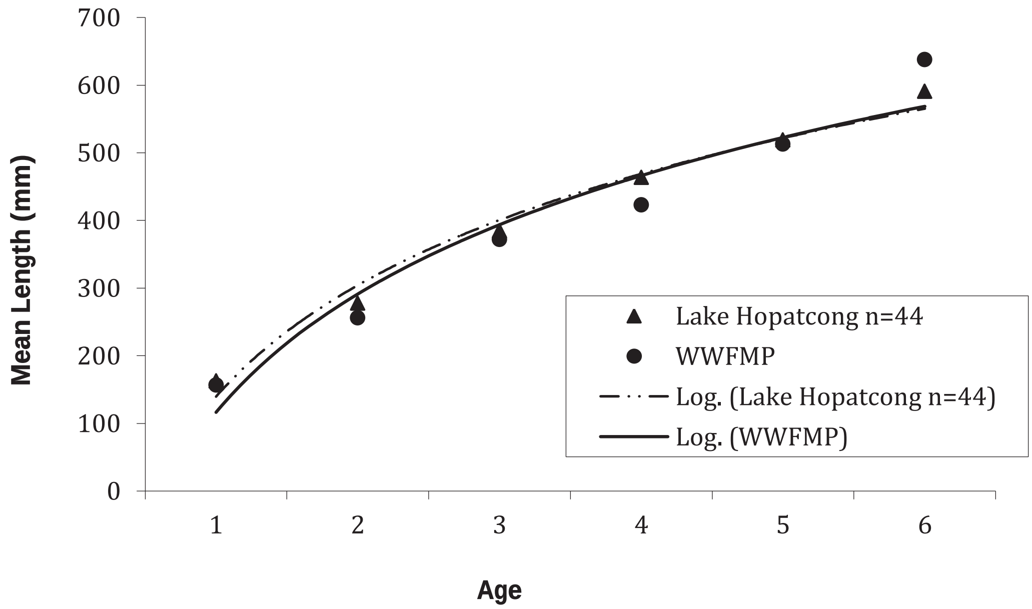

Figure 20. Length at age of chain pickerel collected at Lake Hopatcong in 2014.

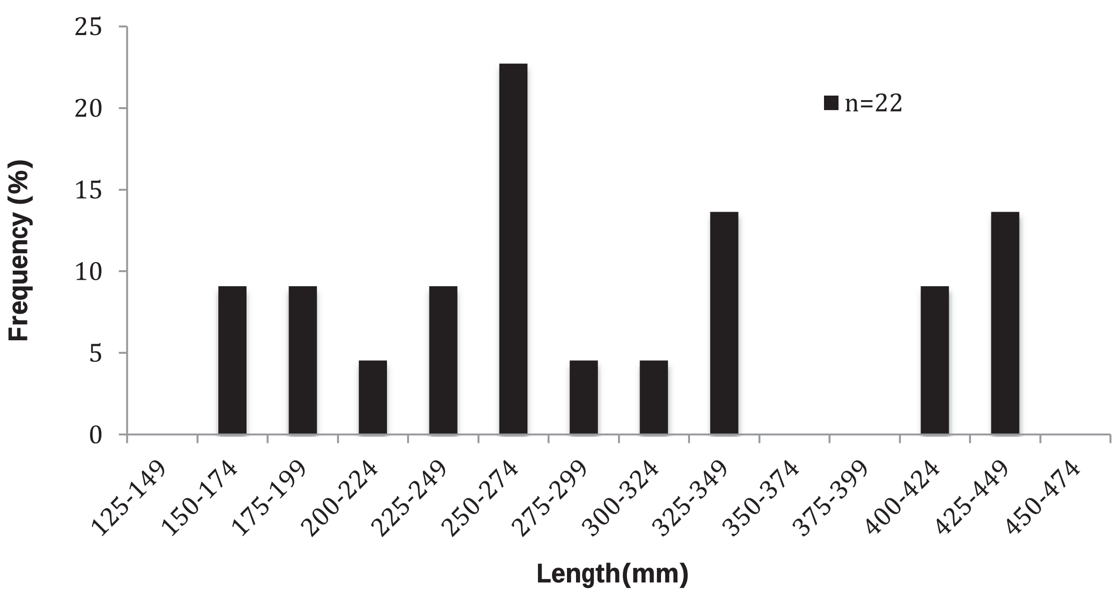

Figure 21. Length frequency of smallmouth bass collected at Lake Hopatcong during spring electrofishing in 2014.

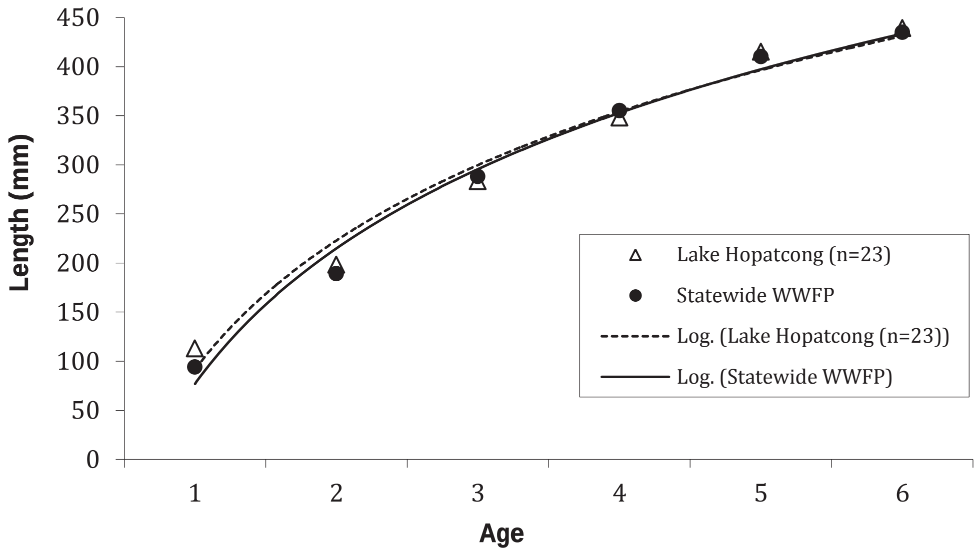

Figure 22. Length at age of smallmouth bass collected at Lake Hopatcong in 2014.

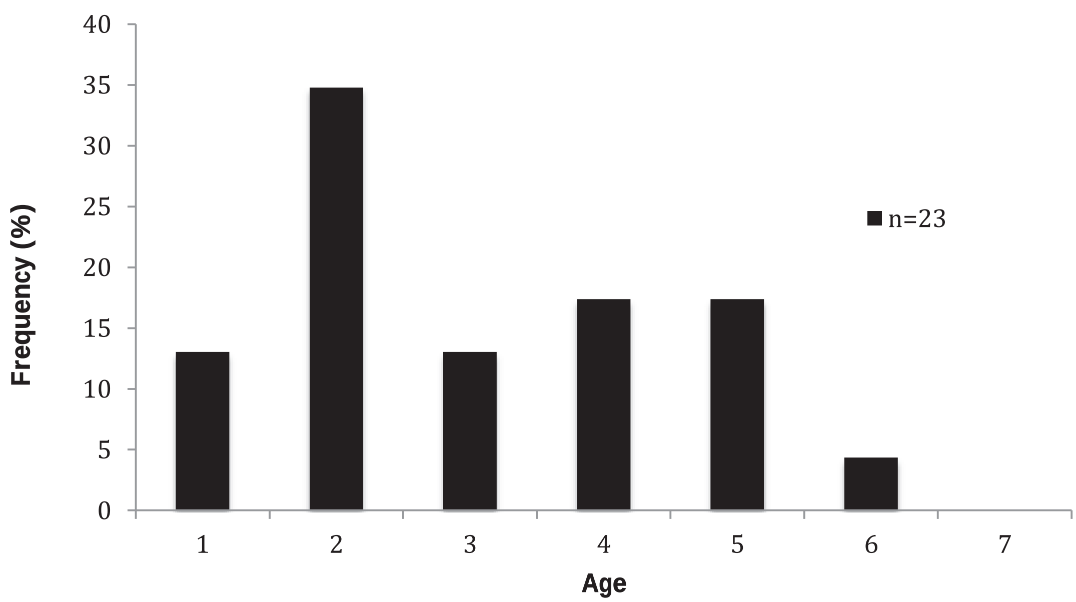

Figure 23. Age frequency of smallmouth bass collected at Lake Hopatcong in 2014.

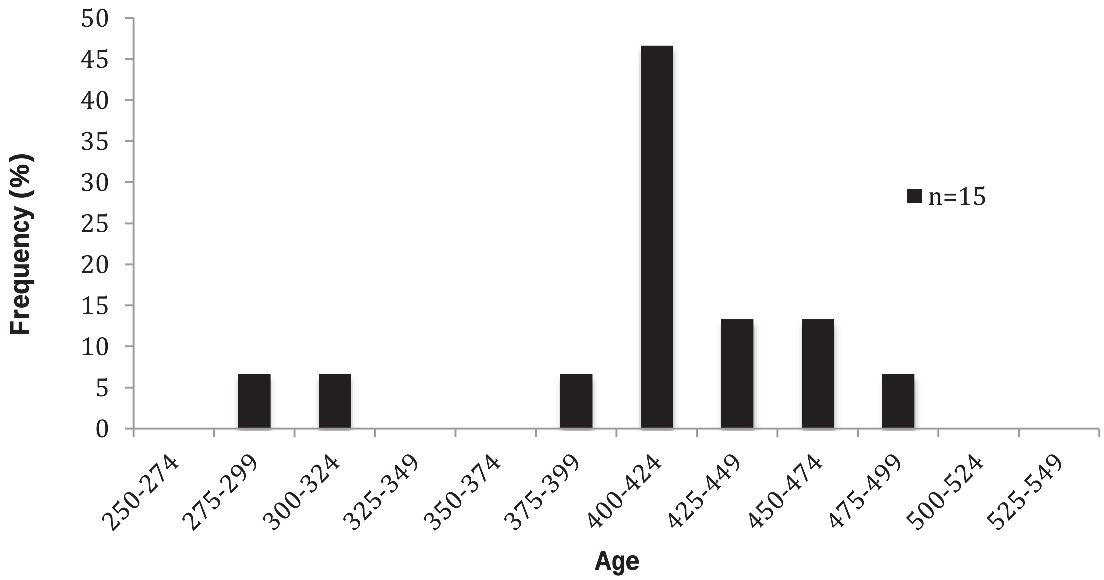

Figure 24. Length frequency of hybrid striped bass collected at Lake Hopatcong in fall 2013 during gillnetting.

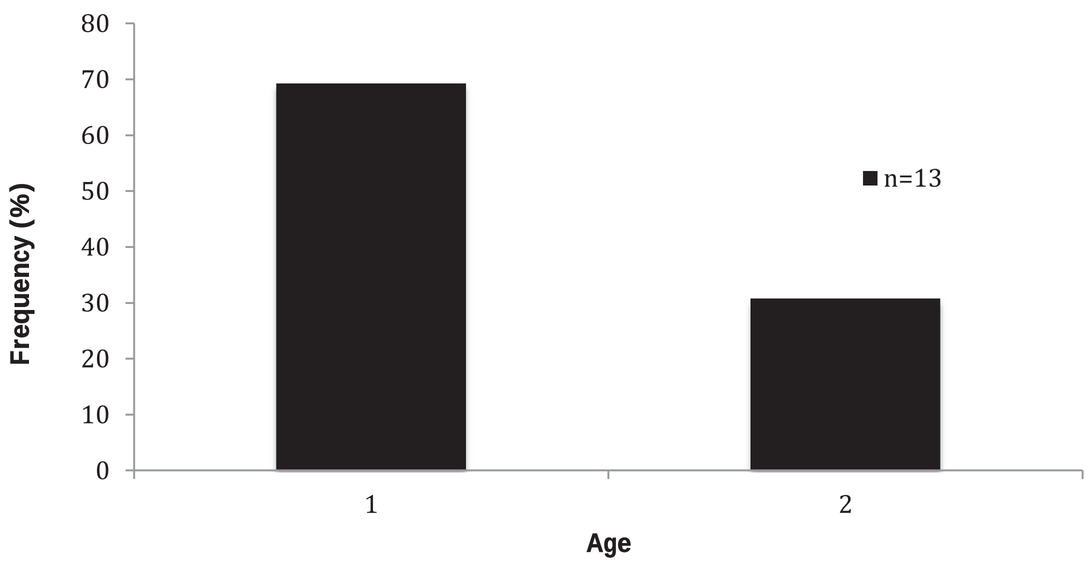

Figure 25. Age frequency of hybrid striped bass collected at Lake Hopatcong in fall 2013.

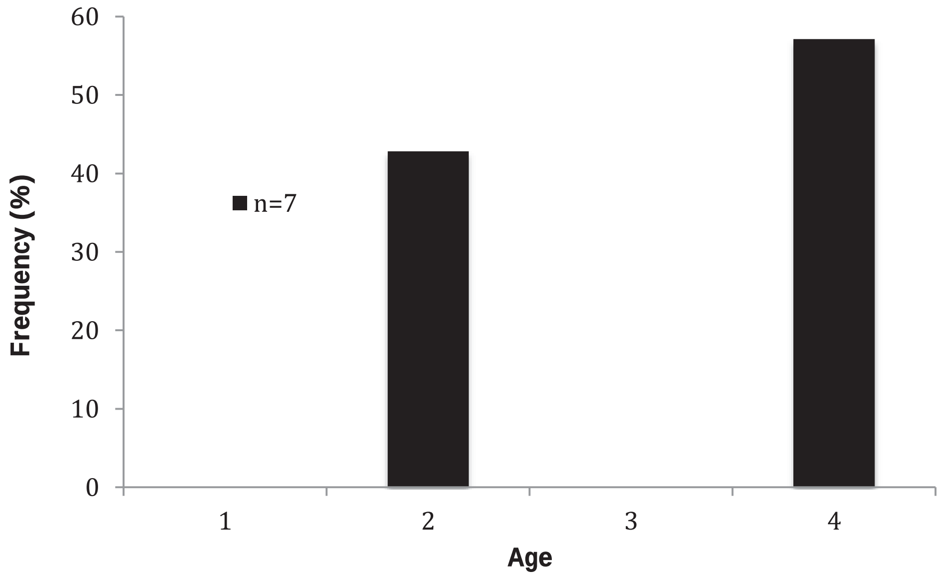

Figure 26. Age frequency of hybrid striped bass collected at Lake Hopatcong in 2014.

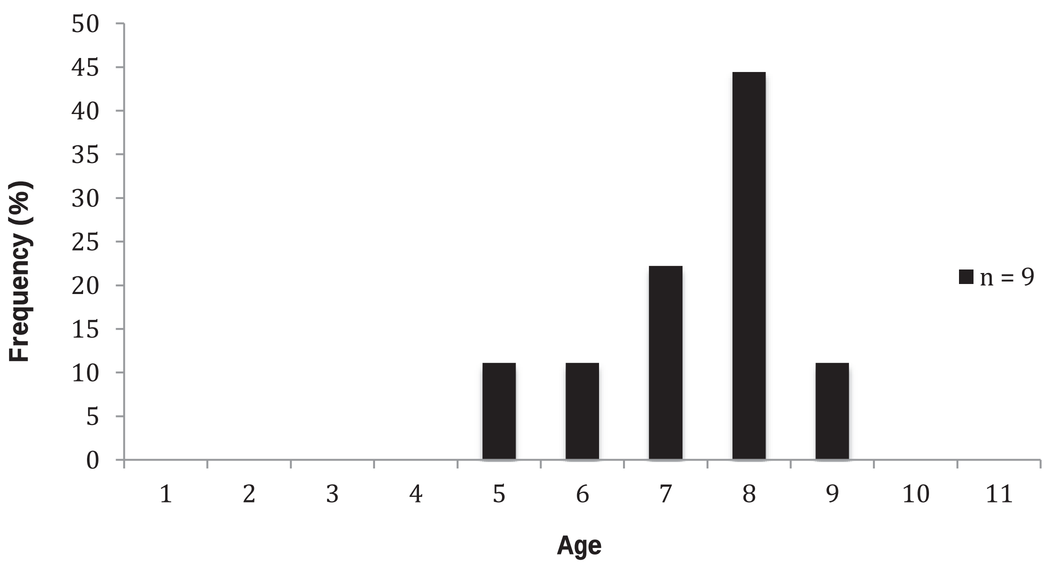

Figure 27. Age frequency of muskellunge collected at Lake Hopatcong in 2014.

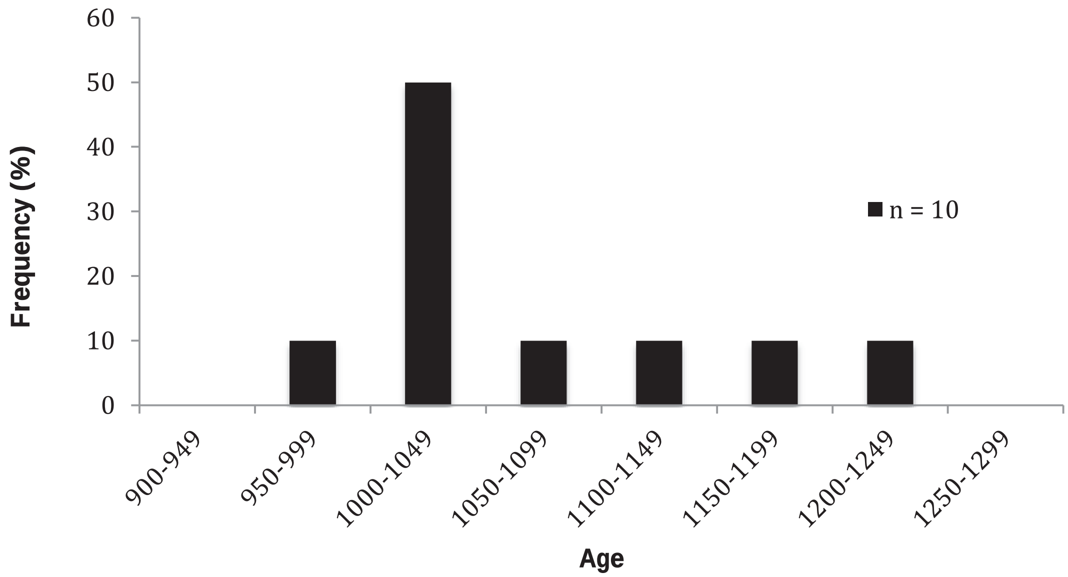

Figure 28. Length frequency of muskellunge collected at Lake Hopatcong in spring 2014 during trap netting.

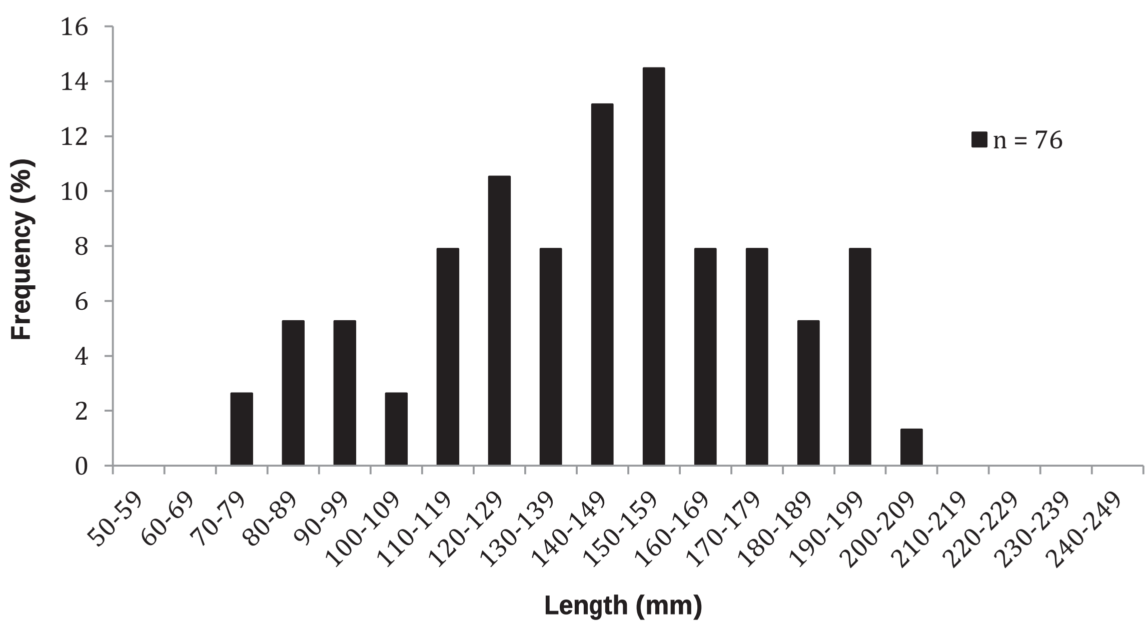

Figure 29. Length frequency of bluegill collected at Lake Hopatcong during fall electrofishing in 2013.

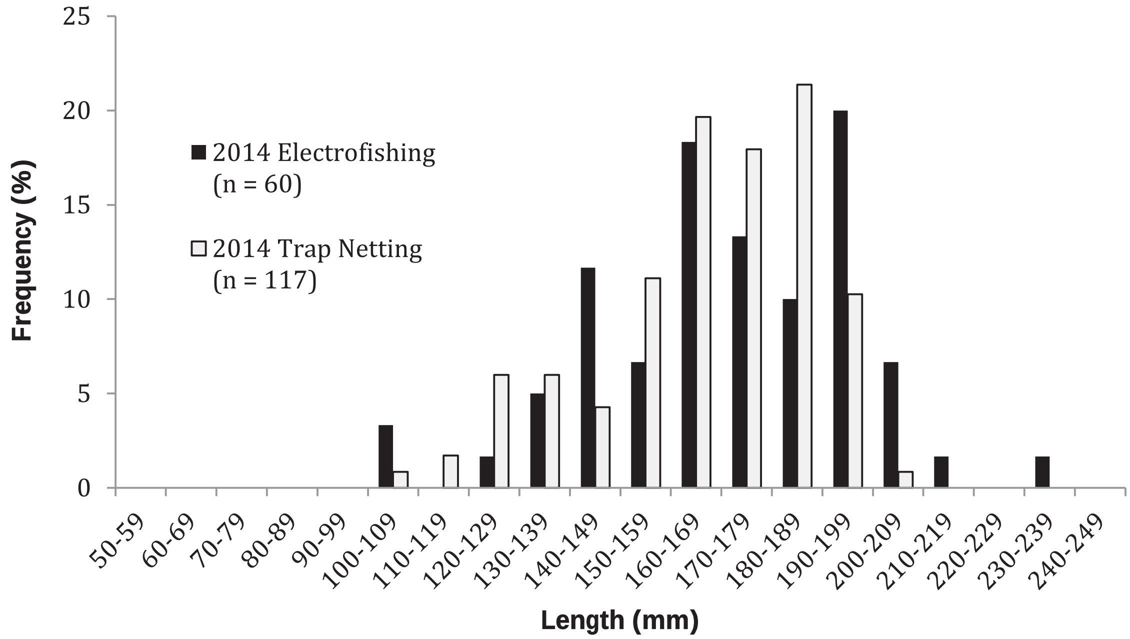

Figure 30. Length frequency of bluegill collected at Lake Hopatcong during spring trap netting in 2014.

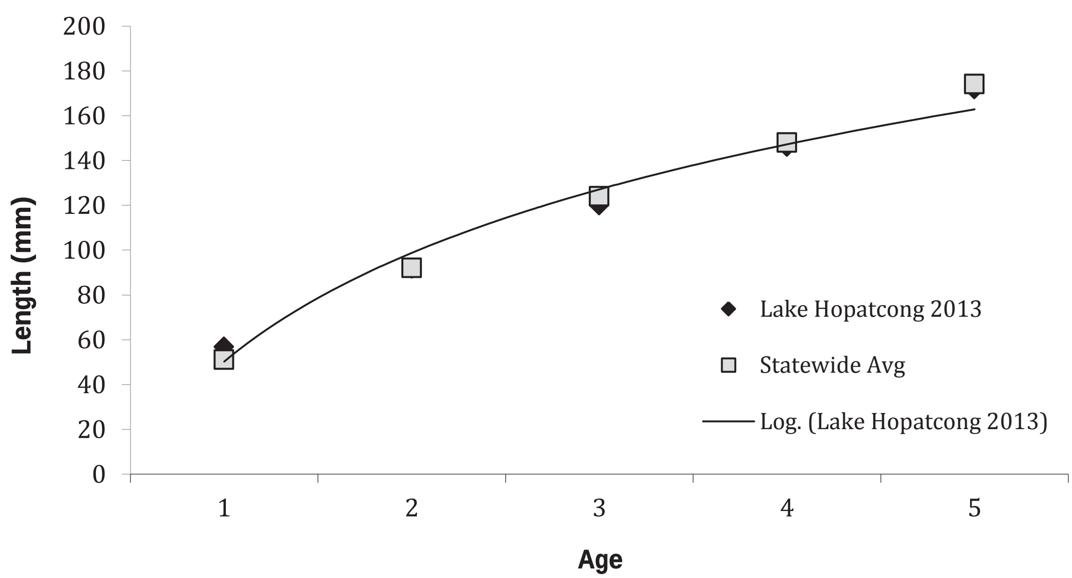

Figure 31. Length at age of bluegill collected at Lake Hopatcong in 2013.

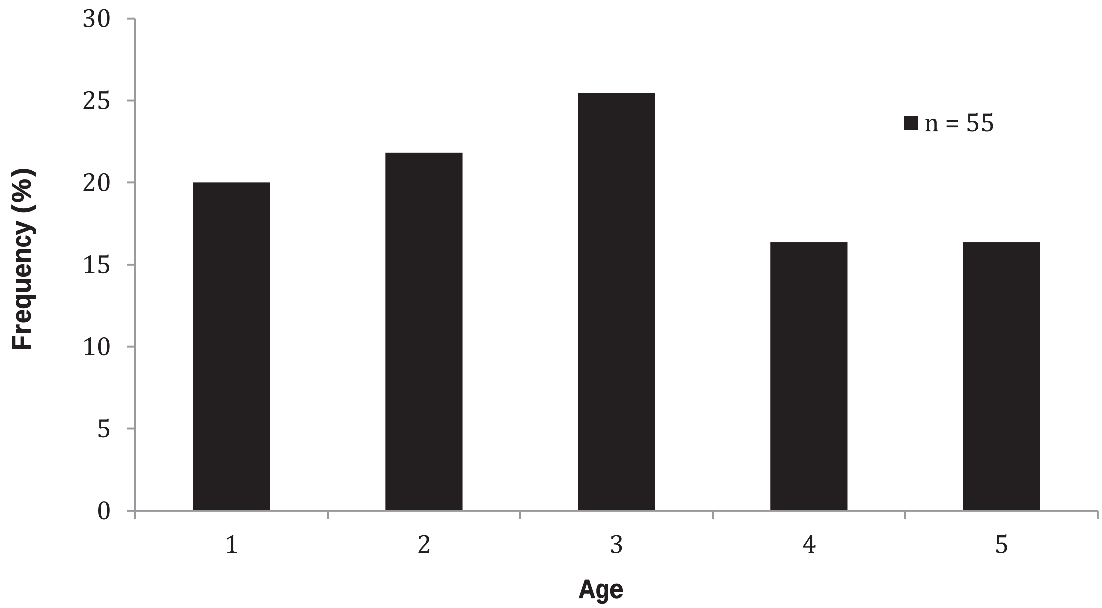

Figure 32. Age frequency of bluegill collected at Lake Hopatcong in 2013.

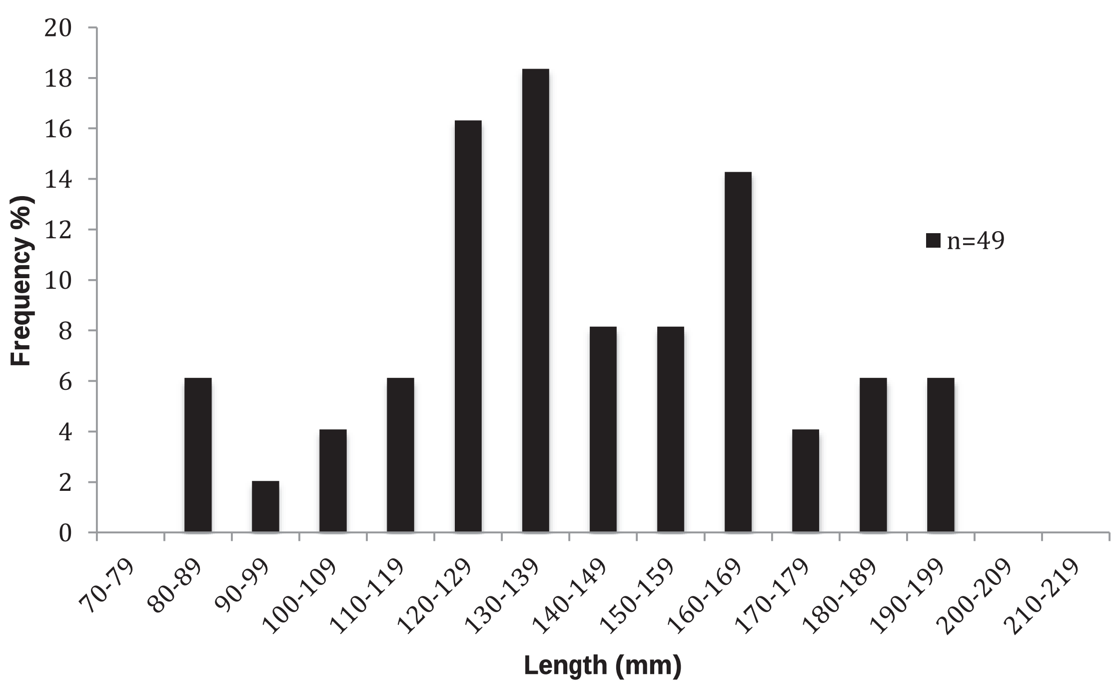

Figure 33. Length frequency of pumpkinseed collected at Lake Hopatcong in fall 2013 during electrofishing trap netting.

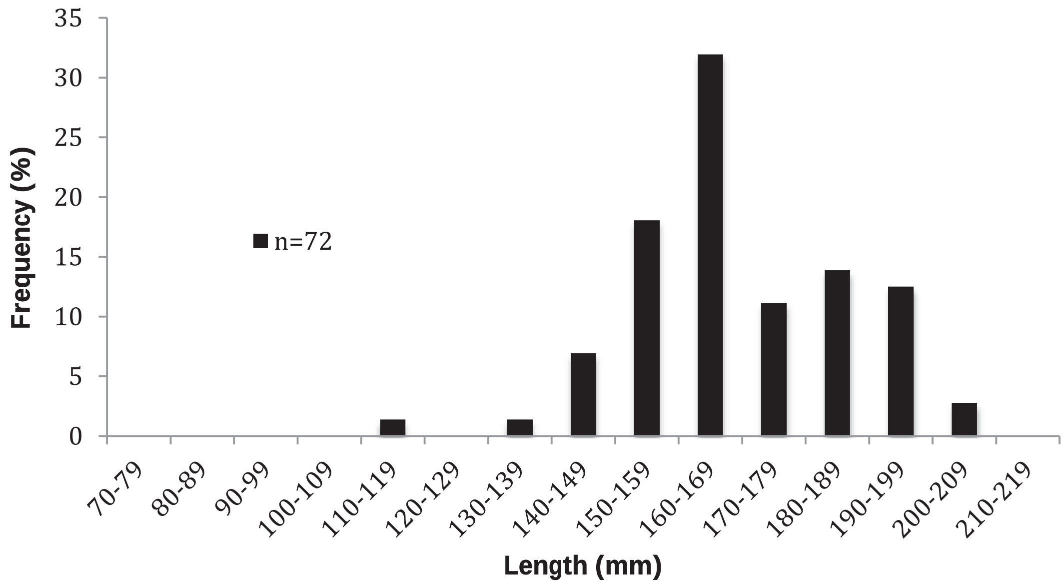

Figure 34. Length frequency of pumpkinseed collected at Lake Hopatcong in spring 2014 during trap netting.

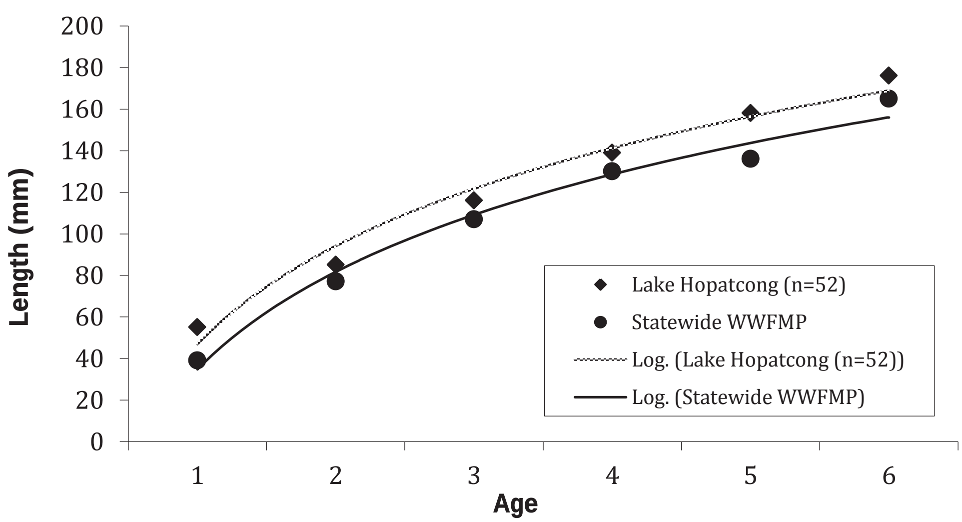

Figure 35. Length at age of pumpkinseed collected at Lake Hopatcong in 2013.

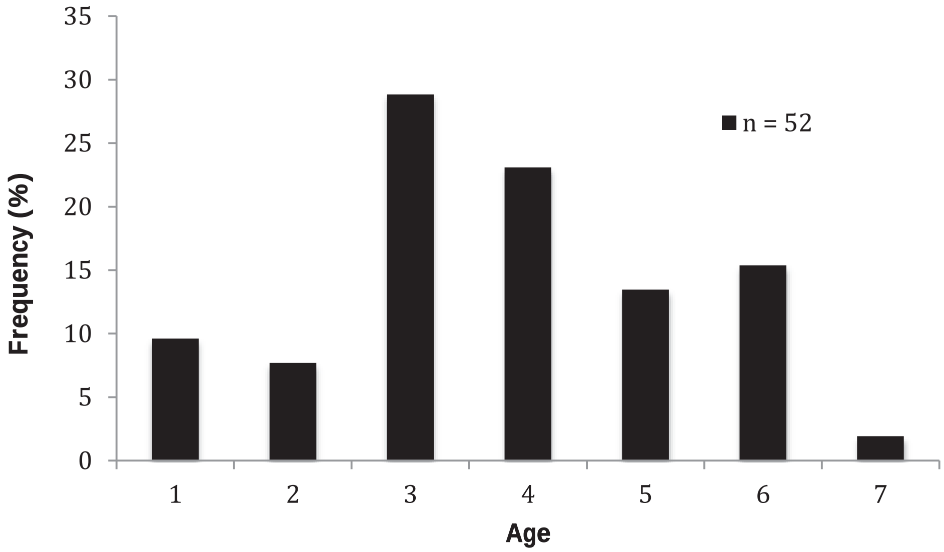

Figure 36. Age frequency of pumpkinseed collected at Lake Hopatcong in 2013.

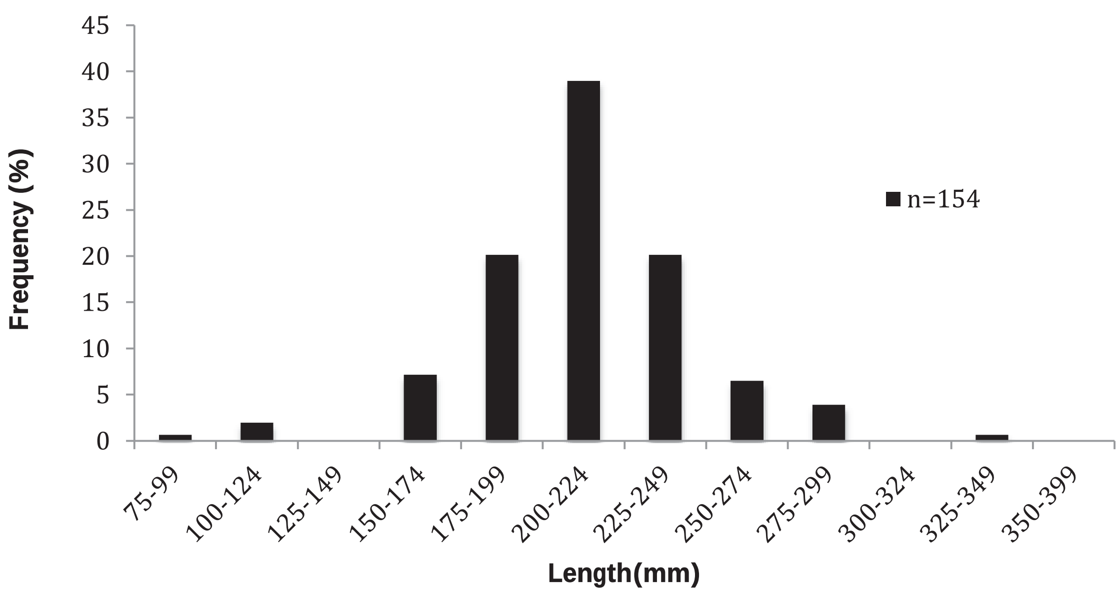

Figure 37. Length frequency of yellow perch collected at Lake Hopatcong during fall 2013 electrofishing.

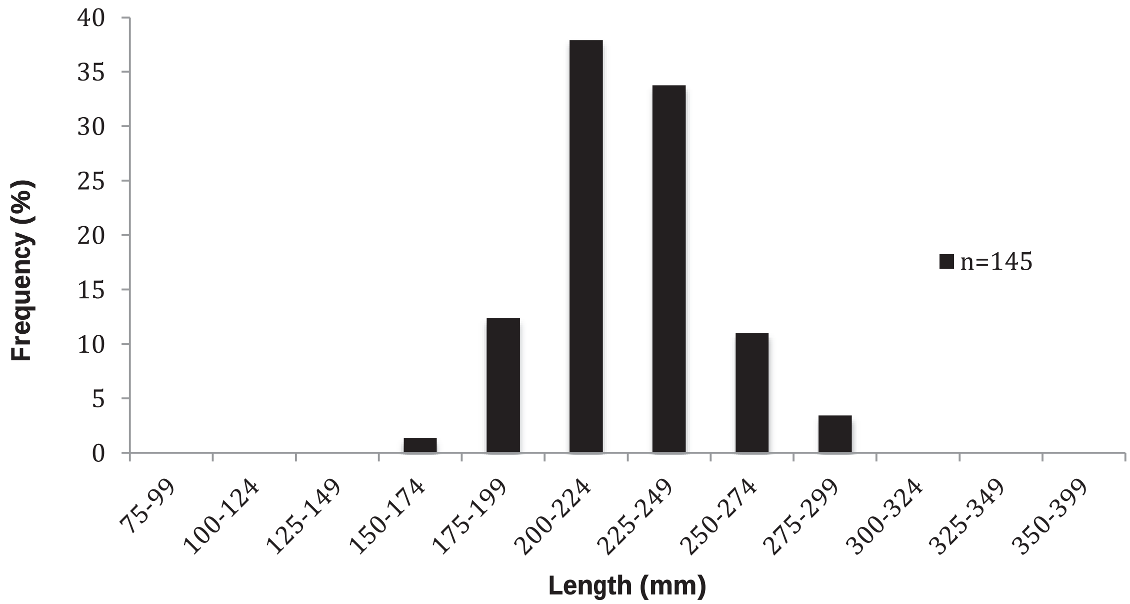

Figure 37b. Length frequency of yellow perch collected at Lake Hopatcong during spring 2014 trap netting.

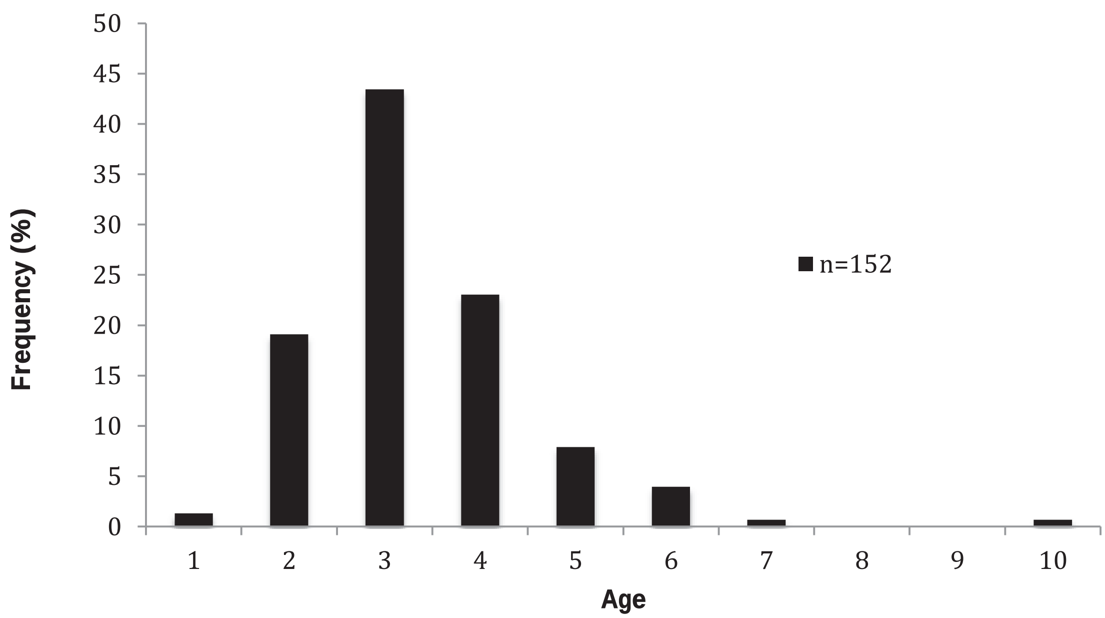

Figure 38. Age frequency of yellow perch collected in Lake Hopatcong in 2013.

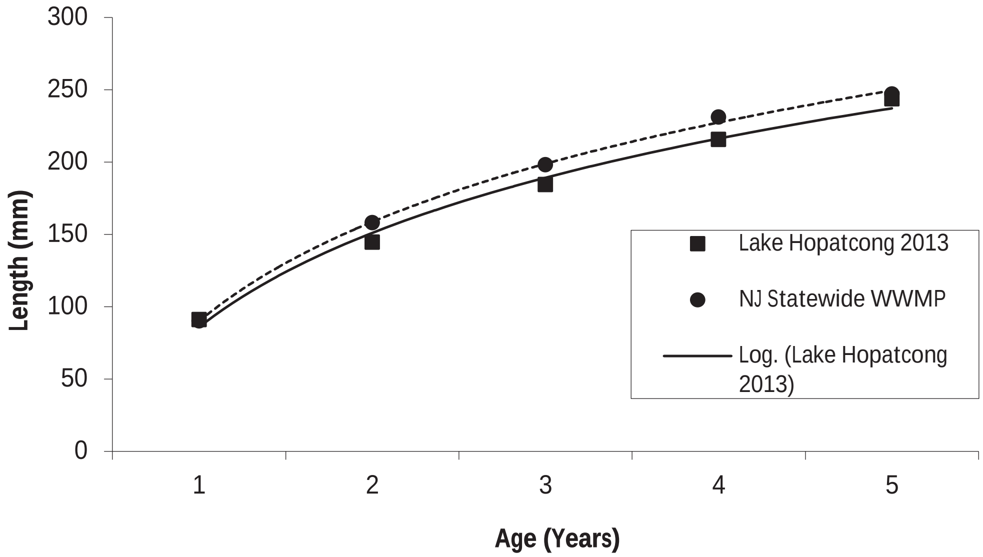

Figure 39. Length at age of yellow perch collected at Lake Hopatcong in 2013.

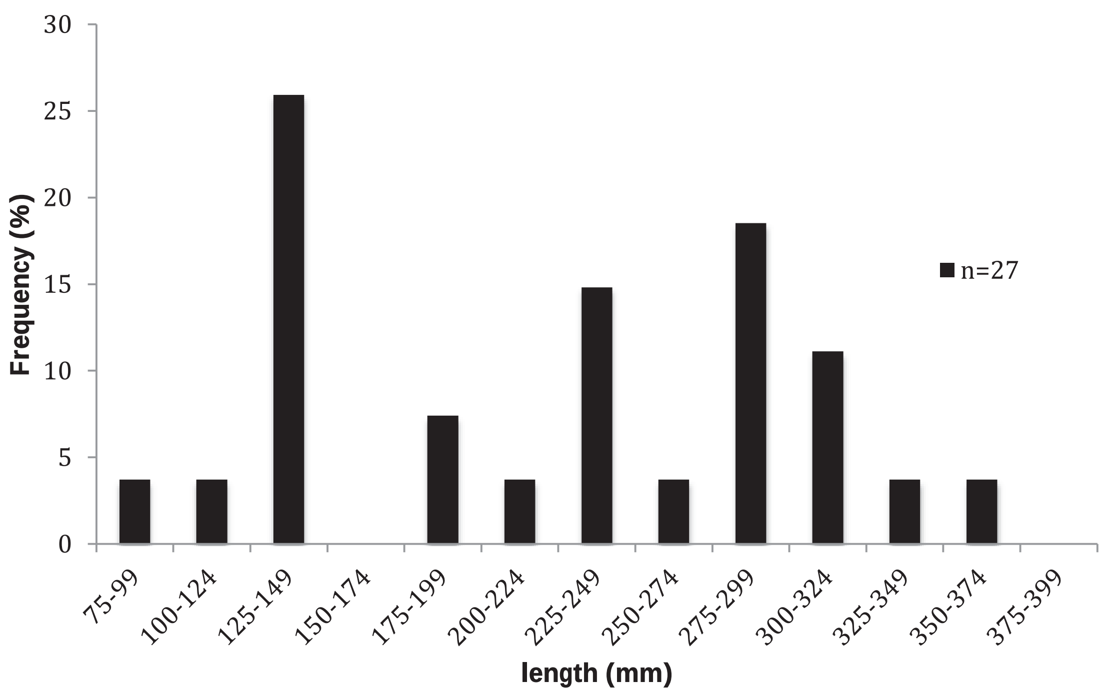

Figure 40. Length frequency of black crappie collected at Lake Hopatcong in fall 2013 during electrofishing.

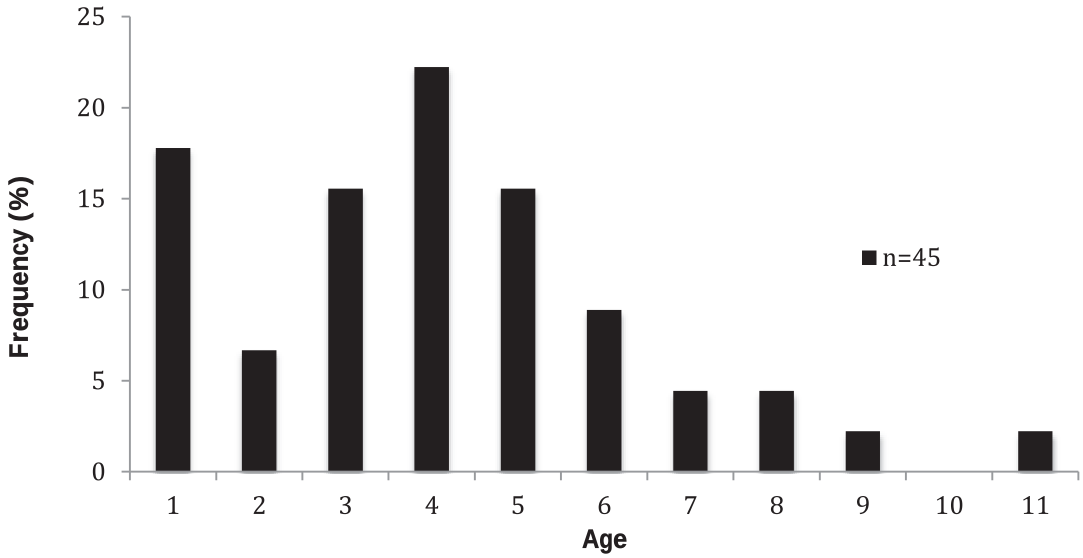

Figure 41. Age frequency of black crappie collected in Lake Hopatcong in 2013.

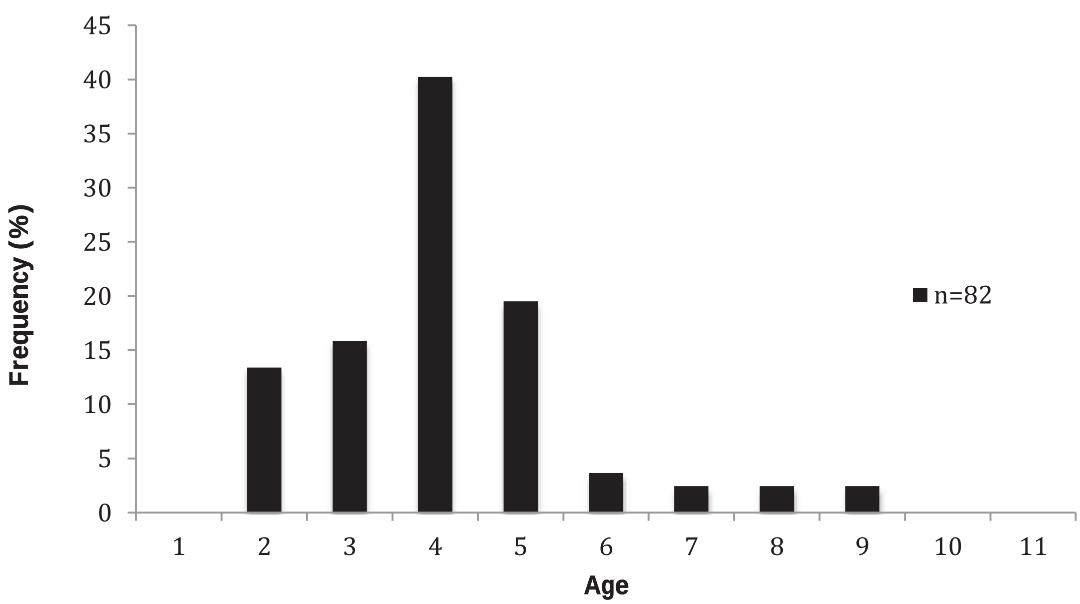

Figure 42. Age frequency of black crappie collected in Lake Hopatcong in 2014.

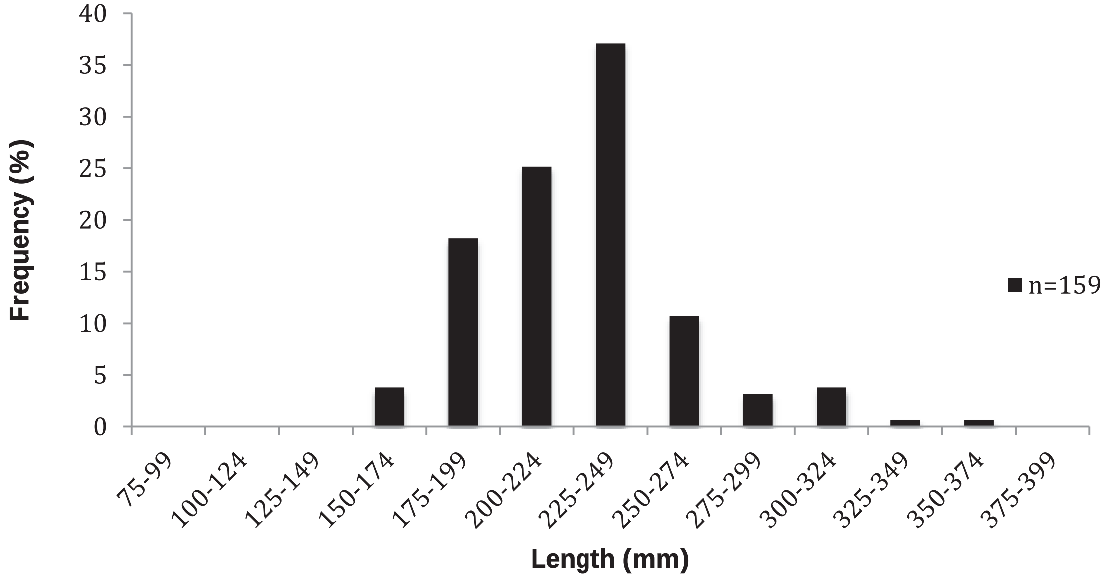

Figure 43. Length frequency of black crappie collected at Lake Hopatcong in spring 2014 during trap netting

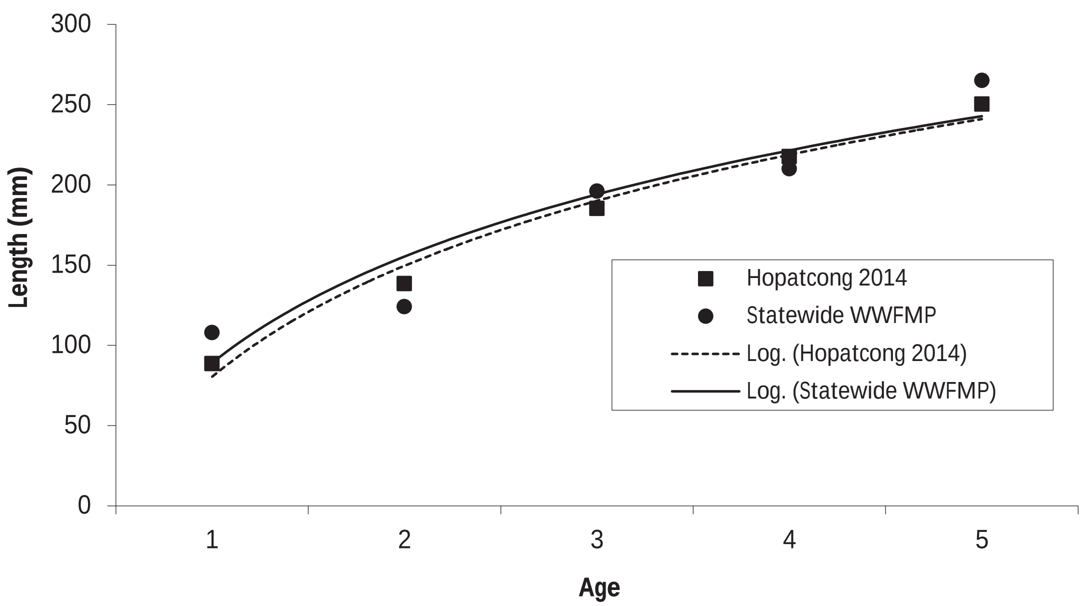

Figure 44. Length at age of black crappie collected in Lake Hopatcong in 2014.

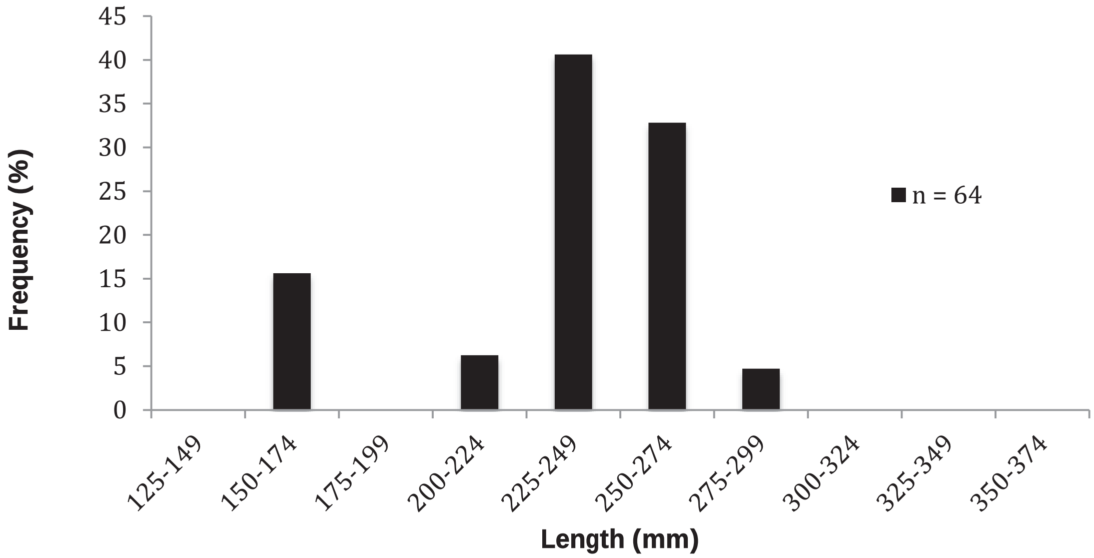

Figure 45. Length frequency of white perch collected at Lake Hopatcong in fall 2013 during gillnetting.

APPENDIX A

New Jersey Division of Fish and Wildlife
Bureau of Freshwater Fisheries
Stocking History – Lake Hopatcong 2014 - 2014

Species Name	Number	Total Weight (lb)	Mean Length (in)	Mean Weight (lb)	Length Range	Fish/lb	Date	Hatchery Name
Bass, hybrid striped	159	43	8			3.7	10/10/14	Hackettstown Fish Hatchery
Bass, hybrid striped	19307	826.6	4.5			23.4	7/24/14	Hackettstown Fish Hatchery
Bass, hybrid striped	1475	61	4.3			24.3	7/22/14	Hackettstown Fish Hatchery
Bass, hybrid striped	5887	127	3.5			46.5	7/7/14	Hackettstown Fish Hatchery
Bass, hybrid striped	7734	264	4.1		3.8-4.3	29.3	8/1/13	Hackettstown Fish Hatchery
Bass, hybrid striped	19544	656	4.1		3.8-4.3	29.8	7/26/13	Hackettstown Fish Hatchery
Bass, hybrid striped	16325	531	4			30.7	8/3/12	Hackettstown Fish Hatchery
Bass, hybrid striped	8668	244	3.8			35.6	7/26/12	Hackettstown Fish Hatchery
Bass, hybrid striped	2905	98	4			29.6	8/11/11	Hackettstown Fish Hatchery
Bass, hybrid striped	3793	161	4.1			23.6	8/8/11	Hackettstown Fish Hatchery
Bass, hybrid striped	6269	227	4			28	8/3/11	Hackettstown Fish Hatchery
Bass, hybrid striped	10124	327	4			31	7/29/11	Hackettstown Fish Hatchery
Bass, hybrid striped	18832	560	4			33.6	8/31/10	Hackettstown Fish Hatchery
Bass, hybrid striped	8196	207	3.8			39.7	7/15/10	Hackettstown Fish Hatchery
Bass, hybrid striped	15866	406	3.7		3.4-4.2	39.1	8/21/09	Hackettstown Fish Hatchery
Bass, hybrid striped	4925	128	3.7		3.4-4.3	38.6	8/18/09	Hackettstown Fish Hatchery
Bass, hybrid striped	8088	309	4.3		3.8-4.6	26.2	8/3/09	Hackettstown Fish Hatchery
Bass, hybrid striped	11923	433	4.2		3.7-4.8	27.5	7/29/08	Hackettstown Fish Hatchery
Bass, hybrid striped	5073	137	3.8		3.3-3.4	37	7/23/08	Hackettstown Fish Hatchery
Bass, hybrid striped	12556	362	4		3.6-4.4	34.6	7/23/08	Hackettstown Fish Hatchery
Bass, hybrid striped	15325	364	3.6		3.2-3.9	42.1	8/30/07	Hackettstown Fish Hatchery
Bass, hybrid striped	3979	96.1	3.6		3.2-3.9	41.4	8/27/07	Hackettstown Fish Hatchery
Bass, hybrid striped	437	11.8	3.8		3.6-4.4	37.2	8/7/07	Hackettstown Fish Hatchery
Bass, hybrid striped	5639	161	3.9		3.6-4.4	35	7/16/07	Hackettstown Fish Hatchery
Bass, hybrid striped	27481	919.1	4.4		3.7-4.5	29.9	7/21/06	Hackettstown Fish Hatchery
Bass, hybrid striped	10341	374.7	4		3.7-4.4	27.6	8/3/05	Hackettstown Fish Hatchery
Bass, hybrid striped	2226	16.5	2.5		2.2-2.9	135.1	8/3/05	Hackettstown Fish Hatchery
Bass, hybrid striped	14377	496.3	4.1		3.8-4.5	28.9	7/29/05	Hackettstown Fish Hatchery
Bass, hybrid striped	11449	526	4.5		4.1-4.8	21.8	8/9/04	Hackettstown Fish Hatchery
Bass, hybrid striped	13811	566	4.3		3.9-4.6	24.4	8/3/04	Hackettstown Fish Hatchery
Bass, largemouth	785	196	6			4	10/31/14	Hackettstown Fish Hatchery
Catfish, channel	220	220	14.4		12.8-16.1	1	10/17/14	Hackettstown Fish Hatchery
Catfish, channel	1794	117.2	6.2			15.3	9/29/14	Hackettstown Fish Hatchery
Catfish, channel	3319	173.7	5.8			19.1	9/15/14	Hackettstown Fish Hatchery
Catfish, channel	9746	9.8	0.7			999	7/22/14	Hackettstown Fish Hatchery
Catfish, channel	2000	56	4.7			35.7	9/4/12	Hackettstown Fish Hatchery
Catfish, channel	28974	7	1			4150	7/11/12	Hackettstown Fish Hatchery
Catfish, channel	150	83	11.9		10.8-14.2	1.8	10/18/11	Hackettstown Fish Hatchery

APPENDIX A

New Jersey Division of Fish and Wildlife
Bureau of Freshwater Fisheries
Stocking History – Lake Hopatcong 2014 - 2014

Species Name	Number	Total Weight (lb)	Mean Length (in)	Mean Weight (lb)	Length Range	Fish/lb	Date	Hatchery Name
Catfish, channel	1820	100	5.8			18.5	9/7/11	Hackettstown Fish Hatchery
Catfish, channel	3566	170	5.6			21	8/30/11	Hackettstown Fish Hatchery
Catfish, channel	9865	45	2.6		2-3	221	7/22/11	Hackettstown Fish Hatchery
Catfish, channel	250	125	11		7-13.2	2	10/22/10	Hackettstown Fish Hatchery
Catfish, channel	2872	47				61.1	8/4/10	Hackettstown Fish Hatchery
Catfish, channel	2050	10	3			133	7/21/10	Hackettstown Fish Hatchery
Catfish, channel	3350	160	5.6		5.1-6.4	21	10/6/09	Hackettstown Fish Hatchery
Catfish, channel	2275	98	5.4		5-6.1	23.2	9/25/09	Hackettstown Fish Hatchery
Catfish, channel	3148	12.5	5.3		4.8-5.9	25.1	9/18/08	Hackettstown Fish Hatchery
Catfish, channel	13	32.5	18		15.7-21	0.4	8/23/08	Hackettstown Fish Hatchery
Catfish, channel	5377	201.5	5.2		4.4-5.9	26.7	10/23/07	Hackettstown Fish Hatchery
Catfish, channel	100	66.7	13.5		12.8-14.9	1.5	7/16/07	Hackettstown Fish Hatchery
Catfish, channel	5030	455.8	7		6.5-7.5	11	10/13/05	Hackettstown Fish Hatchery
Muskellunge	232	29.5	9.1			7.9	9/29/14	Hackettstown Fish Hatchery
Muskellunge	1551	141	8.5			11	9/15/14	Hackettstown Fish Hatchery
Muskellunge	817	71.7	10.6			11.4	9/10/14	Hackettstown Fish Hatchery
Muskellunge	2040	269	9.4			7.4	10/22/13	Hackettstown Fish Hatchery
Muskellunge	245	34.5	9.4			7.1	10/21/13	Hackettstown Fish Hatchery
Muskellunge	116	35.7	12.4			3.25	10/15/13	Hackettstown Fish Hatchery
Muskellunge	200	23.5	9			8.5	10/15/13	Hackettstown Fish Hatchery
Muskellunge	40000		0.5				5/14/13	Hackettstown Fish Hatchery
Muskellunge	600	85	9.4			7.1	10/26/12	Hackettstown Fish Hatchery
Muskellunge	830	106	8.7		7.5-10.4	7.8	10/15/12	Hackettstown Fish Hatchery
Muskellunge	1210	186	9.4		7.8-11	6.5	10/5/12	Hackettstown Fish Hatchery
Muskellunge	1280	133	8.5			9.6	9/16/10	Hackettstown Fish Hatchery
Muskellunge	1320	61.4	6.5			21.5	8/4/10	Hackettstown Fish Hatchery
Muskellunge	910	125	9.3		8.5-10.3	7.3	9/26/09	Hackettstown Fish Hatchery
Muskellunge	825	80	8.3		7.8-9.2	10.3	9/26/09	Hackettstown Fish Hatchery
Muskellunge	340	30	8		7.7-9.1	12	9/25/09	Hackettstown Fish Hatchery
Muskellunge	444	96.5	10.8		9.2-12.4	4.6	9/18/08	Hackettstown Fish Hatchery
Muskellunge	400	45	8.7		7.8-10	8.9	9/11/08	Hackettstown Fish Hatchery
Muskellunge	2092	95	6.4		5.8-7.8	22	8/18/08	Hackettstown Fish Hatchery
Muskellunge	7	7.4	17.4		16-19.1	0.95	8/11/08	Hackettstown Fish Hatchery
Muskellunge	1153	77.9	7.4		6.8-7.9	14.8	9/18/07	Hackettstown Fish Hatchery
Muskellunge	1497	124.8	7.9		7.4-9.2	12	9/18/07	Hackettstown Fish Hatchery
Muskellunge	500	45	8.1		7.5-9.1	11.1	10/31/06	Hackettstown Fish Hatchery
Muskellunge	441	38.4	8		7.2-8.7	11.5	9/22/06	Hackettstown Fish Hatchery
Muskellunge	1300	100	7.7		7.2-8.8	12.9	9/14/05	Hackettstown Fish Hatchery

APPENDIX A

New Jersey Division of Fish and Wildlife
Bureau of Freshwater Fisheries
Stocking History – Lake Hopatcong 2014 - 2014

Species Name	Number	Total Weight (lb)	Mean Length (in)	Mean Weight (lb)	Length Range	Fish/lb	Date	Hatchery Name
Muskellunge	1180	151.2	9.1		8.3-10.1	7.8	9/22/04	Hackettstown Fish Hatchery
Muskellunge	195	34.8	10.3		9.2-10.9	5.6	9/14/04	Hackettstown Fish Hatchery
Muskellunge, Tiger	212	50.5	10.6		8.6-16.6	4.2	9/10/14	Hackettstown Fish Hatchery
Muskellunge, Tiger	2900	11.6	2.5		2-3	250	5/16/13	Hackettstown Fish Hatchery
Muskellunge, Tiger	1326	61	6.2		5.8-6.4	21.6	7/2/12	Hackettstown Fish Hatchery
Muskellunge, Tiger	1000	250	11		9.5-11.8	4	10/3/11	Hackettstown Fish Hatchery
Muskellunge, Tiger	225						11/15/10	Hackettstown Fish Hatchery
Muskellunge, Tiger	300	25				12	8/4/10	Hackettstown Fish Hatchery
Muskellunge, Tiger	325	47.9	9.2		7.7-11.1	6.8	9/22/06	Hackettstown Fish Hatchery
Muskellunge, Tiger	1317	131.7	8.1		7.4-8.6	10	8/28/06	Hackettstown Fish Hatchery
Muskellunge, Tiger	50	35.7	14.7		13.3-16.2	1.4	10/13/05	Hackettstown Fish Hatchery
Muskellunge, Tiger	1300	178.1	9		8.2-9.8	7.3	8/17/05	Hackettstown Fish Hatchery
Muskellunge, Tiger	100	47.6	13.6		12.5-15	2.1	9/22/04	Hackettstown Fish Hatchery
Muskellunge, Tiger	1320	231.5	9.8		8.1-11	5.6	8/25/04	Hackettstown Fish Hatchery
Walleye	122	61	8			2	10/31/14	Hackettstown Fish Hatchery
Walleye	3630	36.3	3.5		2.8-4.2	100	7/29/14	Hackettstown Fish Hatchery
Walleye	5847	63.4	3.62		2.7-5.4	92.2	7/24/14	Hackettstown Fish Hatchery
Walleye	51989	49	1.5		1.3 - 1.7	1061	6/4/14	Hackettstown Fish Hatchery
Walleye	504775	5.2					4/26/14	Hackettstown Fish Hatchery
Walleye	25		14		12-16		10/25/13	Hackettstown Fish Hatchery
Walleye	100				8-9		8/15/13	Hackettstown Fish Hatchery
Walleye	1751	28	4		3.4-4.9	63	7/26/13	Hackettstown Fish Hatchery
Walleye	4978	62	3.7		3.2-4.4	80.3	7/18/13	Hackettstown Fish Hatchery
Walleye	8000	9	2		1.5-2.3	900	6/14/13	Hackettstown Fish Hatchery
Walleye	19	36	16.2		10-20	0.53	11/21/12	Hackettstown Fish Hatchery
Walleye	134	253	16.2		10-20	0.53	10/24/12	Hackettstown Fish Hatchery
Walleye	10000	120	3.7		3.4-4.4	83	7/11/12	Hackettstown Fish Hatchery
Walleye	834	9.5				87	8/11/11	Hackettstown Fish Hatchery
Walleye	468	36				13	8/10/11	Hackettstown Fish Hatchery
Walleye	6510	84.5				77	8/10/11	Hackettstown Fish Hatchery
Walleye	64500	125	2			516	6/16/11	Hackettstown Fish Hatchery
Walleye	295625	3	0.5				4/19/11	Hackettstown Fish Hatchery
Walleye	129	20	8			6.6	10/22/10	Hackettstown Fish Hatchery
Walleye	16	6.4	12			2.5	9/16/10	Hackettstown Fish Hatchery
Walleye	936	16	3.9			58.5	8/11/10	Hackettstown Fish Hatchery
Walleye	6160	132	4			46.6	8/4/10	Hackettstown Fish Hatchery
Walleye	1900	63.3	5			29.7	7/21/10	Hackettstown Fish Hatchery
Walleye	71928	72	1.8			999	5/25/10	Hackettstown Fish Hatchery

APPENDIX A
New Jersey Division of Fish and Wildlife
Bureau of Freshwater Fisheries
Stocking History – Lake Hopatcong 2014 - 2014

Species Name	Number	Total Weight (lb)	Mean Length (in)	Mean Weight (lb)	Length Range	Fish/lb	Date	Hatchery Name
Walleye	55	7	8		7.7-8.7	8	8/21/09	Hackettstown Fish Hatchery
Walleye	10586	141.3	3.8		3.4-4.9	75	7/22/09	Hackettstown Fish Hatchery
Walleye	38000	40	1.8		1.3-2.5	953	6/12/09	Hackettstown Fish Hatchery
Walleye	67150	74	1.8		1.3-2.5	908	6/3/09	Hackettstown Fish Hatchery
Walleye	38	9.5				0.25	9/11/08	Hackettstown Fish Hatchery
Walleye	17	22.6	15.8		13.4-18	0.75	8/22/08	Hackettstown Fish Hatchery
Walleye	62	83.1	15.8		13.4-18	0.75	8/11/08	Hackettstown Fish Hatchery
Walleye	3919	31.4	3.5		3.2-4.1	125	7/28/08	Hackettstown Fish Hatchery
Walleye	5488	56	3.6		3-4.1	98	7/23/08	Hackettstown Fish Hatchery
Walleye	4054	82.1	4		3.4-4.6	49.4	7/1/08	Hackettstown Fish Hatchery
Walleye	40400	40	1.8		3.2-4.6	1010	6/6/08	Hackettstown Fish Hatchery
Walleye	84386	47.7	1.5		2.9-5.7	1769	6/4/08	Hackettstown Fish Hatchery
Walleye	8225	109	3.7		3.2-4.6	75.5	8/7/07	Hackettstown Fish Hatchery
Walleye	2268	42	4		3.5-4.7	54	8/1/07	Hackettstown Fish Hatchery
Walleye	1286	50.1	5		1.5-2	25.7	7/16/07	Hackettstown Fish Hatchery
Walleye	120000	120.5	1.8		1.5-2.3	996	6/14/07	Hackettstown Fish Hatchery
Walleye	11173	218.6	4		3.3-5.1	51.1	7/21/06	Hackettstown Fish Hatchery
Walleye	103200	129	1.7		1.5-2	800	6/6/06	Hackettstown Fish Hatchery
Walleye	1480	21	3.8		3.4-4.3	70.7	8/4/05	Hackettstown Fish Hatchery
Walleye	8552	171	4		3.5-4.7	50	7/29/05	Hackettstown Fish Hatchery
Walleye	710	16.2	4.3		3.8-5.1	43.8	7/8/05	Hackettstown Fish Hatchery
Walleye	109600	133.7	1.7		1.5-2.0	820	6/23/05	Hackettstown Fish Hatchery
Walleye	10500	140	3.8		3.4-5	75	7/14/04	Hackettstown Fish Hatchery
Walleye	134000	100	1.4		1.1-1.8	1340	5/28/04	Hackettstown Fish Hatchery
Walleye	318200	3.3	0.3				4/16/04	Hackettstown Fish Hatchery

APPENDIX B

New Jersey statewide average growth of selected fish species.
1990 - 1995 (NJDFW - 1997)

Species	Total length (mm) at annuli						
	I	II	III	IV	V	VI	VII
Black crappie	108	124	196	210	265	---	---
Bluegill	51	92	124	148	174	201	---
Chain pickerel	157	256	372	423	513	638	---
Hybrid striped bass	299	422	418	525	570	---	---
Largemouth bass	94	196	287	344	366	412	424
Northern pike (male)	410	520	570	612	669	690	---
Northern pike (female)	431	567	658	740	841	882	914
Pumpkinseed	39	77	107	130	136	165	---
Redbreast sunfish	60	91	106	127	142	---	---
Rock bass	---	99	119	165	216	---	---
Smallmouth bass	94	189	288	355	410	435	---
Tiger muskellunge	---	---	483	767	914	1067	---
Walleye (male)	---	361	424	460	493	513	536
Walleye (female)	---	379	445	513	541	566	645
White perch	71	146	201	226	240	259	275
Yellow perch	90	158	198	231	247	279	---

APPENDIX C

New Jersey Division of Fish and Wildlife Standardized Criteria for Harvestable Size

	Total Length	
Species	mm	inches
Trout (brook, brown, rainbow)	≥228	9
Tiger muskies – muskellunge	≥ 1016	40
Northern pike	≥ 610	24
Pickerel (chain, redfin)	≥ 380	15
Black Bass (Trophy Bass Regulations)	≥ 380	15
Largemouth bass	≥ 305	12
Smallmouth bass	≥ 305	12
Perch (yellow and white)	≥ 178	7
Catfish (all species except channel catfish)	≥ 178	7
Channel catfish	≥ 305	12
Rock bass	≥ 127	5
Sunfish (all species)	≥ 127	5
Crappie (black and white)	≥ 203	8
Striped bass	≥ 710	28
Hybrid striped bass (striped bass x white hybrid)	≥ 406	16
Walleye	≥ 457	18