# Glenn Flint Lake

Putnam County

2005 to 2017 Summary
Fish Management Report

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2017

## EXECUTIVE SUMMARY


- Glenn Flint Lake is a 330 acre impoundment located 6 miles northwest of Greencastle, Indiana in Putnam County.

- Surveys for Largemouth Bass, Bluegill, and Gizzard Shad were conducted each spring from 2005 to 2008. A general survey was conducted June 5 to 13th, 2013. Aquatic vegetation was sampled from 2005 to 2008, and in August of 2013. A survey of the lakes tributary streams was conducted in August 2017.

- From 2005 to 2008 the number of sites with aquatic vegetation declined from 40 to 0 of 70 sites. In 2013 aquatic vegetation rebounded slightly and was present at 8 sites.

- Trends in abundance of fish species over time indicate declines in most game species since the year 2000 with the exception of Bluegill.

- Bluegill growth and size structure improved slightly between 2005 and 2013.

- The Glenn Flint Lake fish community is currently dominated by Bluegill and Yellow Bass less than 7 inches. Gizzard Shad and benthic, non-game, species also comprise a significant portion of the fish community.

- Brown Bullheads were sampled in the lake for the first time in 2013.

- The 2017 survey of the lakes tributaries found 22 species of native fish. Noxious species were absent from the majority of the tributaries with the exception of Gizzard Shad found in the lower portion of Owl Creek.

- Another fishery renovation project is not recommended due to a repeated pattern of species introductions and the short lived benefits of the previous renovation attempt.

- A program of predator stocking is considered the best option to improve the lake's fishing opportunities. Saugeye is recommended as the most appropriate predator for stocking due to limited habitat for other species currently cultured by DFW.

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# INTRODUCTION

Glenn Flint Lake is a 330-acre impoundment located about 6 miles northwest of Greencastle, IN. The lake is owned by the Little Walnut Creek Conservancy District and the Indiana Department of Natural Resources, Division of Fish and Wildlife (DFW) manages the fishery. Glenn Flint is an impoundment of Owl Creek and was dammed in 1975. The lake was initially stocked by DFW with four species of fish including Largemouth Bass, Bluegill, Redear Sunfish, and Channel Catfish. A number of additional species colonized the lake shortly after impoundment from a diverse fish community native to the inflowing Owl Creek (Table 1). For a period roughly of 5 years after impoundment, the lake provided quality angling for Channel Catfish, Bluegill and Redear Sunfish. Unfortunately, species with negative effects on the fishery were introduced to Glenn Flint including Common Carp in 1980 and Gizzard Shad in 1983. The delayed colonization of these species after impoundment suggests that they were not residents native to Owl Creek but rather were likely introduced into the lake by other means (unintentional transport, illegal intentional stocking, or movement of fish from ponds in the watershed). Gizzard Shad and Common Carp abundance increased after 1983 leading to declines in water clarity, Largemouth Bass recruitment and sunfish growth and size structure. Several attempts were made to control the expanding Gizzard Shad and Common Carp populations including winter drawdowns and stocking of predators. Unfortunately these efforts were unsuccessful in reversing the decline of the fishery. Adding to the lake's problems, Yellow Bass (another potential problem species) were detected in the lake in 1991. Fishing quality continued to decline after 1991 resulting in reduced angler use of the lake. The decline in angler use prompted a decision by DFW to renovate the fishery through application of rotenone (Keller 1994).

Prior to the renovation of Glenn Flint Lake and its watershed, a study was conducted by the DFW aquatic non-game biologist to evaluate the presence of any threatened or unique fish communities residing in the lakes tributaries including Owl Creek. A secondary goal of this study was to document the presence and distribution of any noxious species inhabiting the creek that could serve as a source of contamination to Glenn Flint Lake. No state or federally threatened fish were detected in these surveys, however, a diverse community of 26 native fish species as well as Common Carp and Mosquitofish were found to inhabit the streams (Gammon 1996). In an effort to preserve the biodiversity of the Owl Creek fish community while still removing unwanted species from Glenn Flint Lake, a decision was made to renovate only the lower portions of the east and west branches of the tributaries and allow them to be recolonized from the untreated upper portions. Glenn Flint Lake, the adjacent Van Bibber Lake, ponds within the watershed, and the lower segments of both forks of Owl Creek were renovated in the fall of 1995 through rotenone application. Later that fall, Glenn Flint Lake was restocked by DFW with Bluegill, Redear Sunfish, Largemouth Bass, and Channel Catfish. Black Crappie were also subsequently stocked by DFW in the fall of 1996.

The renovation conducted in 1995 was effective in removing Gizzard Shad and Common Carp as indicated by a lack of these species collected in a follow up survey conducted in 1996. Several fish species, including Yellow Bass, were not completely eliminated by the rotenone treatment as evidenced by their presence in the 1996 follow up survey (Table 1). Despite the continued persistence of Yellow Bass in the lake, the removal of Gizzard Shad and Common Carp resulted in a dramatic increase in water clarity and vegetation cover. By 1998, a quality sport fishery was developing that was similar to that observed immediately following impoundment. Unfortunately, Gizzard Shad were once again found in the lake in 1998, and both Gizzard Shad and Common Carp were sampled in the DFW lake survey in 2000 (Table 1). Gizzard Shad and Common Carp were believed to have been reintroduced into the lake due to the absence of these species for several years after the renovation (Keller 1999). Initially, there was hope that the growing Largemouth Bass population would be able to stave off the negative impacts of the noxious species for a period of time, however, this did not happen. By 2000, Gizzard Shad was the dominant species by both number and weight. The impact of the abundant Gizzard Shad were felt almost immediately. As a result, Largemouth Bass recruitment fell sharply, Bluegill size structure began to decline once again and Bluegill growth slowed.

Several efforts to reduce the number of shad and promote and maintain a quality sport fishery were made by DFW between 2000 and 2006. In 2000, an attempt was made to keep the lake level down 15ft over the winter. However, the drastically reduced volume needed to help provide a significant winter kill on Gizzard Shad could not be maintained because of issues with the drain structure. In 2004, the first of what was planned to be a series of Gizzard Shad selective rotenone treatments was conducted. This was followed by Muskellunge stocking in 2005. The selective rotenone application was successful at drastically reducing the Gizzard Shad population. Additional selective Gizzard Shad treatments were planned but were not conducted due to a malfunction of the drain structure that lead to an inability to adequately lower the lake level. The inability to manipulate water levels prevented the implementation of further fisheries management strategies and all fish stocking was halted in 2006. An effort was made to monitor trends in populations of Largemouth Bass, Bluegill, and Gizzard Shad through targeted sampling conducted from 2005 to 2008. A general survey was conducted in 2013 to examine the state of the fishery after the cessation of Gizzard Shad control measures and fish stocking. Lastly, a survey of the lakes tributary streams was conducted in the fall of 2017 to evaluate the current status of the native stream fish communities and to again investigate the distribution of noxious species that may serve as a source for colonizing the lake. The purpose of this report is to summarize trends in the Glenn Flint Lake fishery based on sampling conducted since 2005, to characterize the current state of the lake and stream fish communities, and compare the current status of the fishery and fish communities to historical trends.

## METHODS

Surveys focused on Largemouth Bass, Bluegill and Gizzard Shad were conducted June 15 to 29, 2005; June 06, 2006; June 11, 2007; and June 17, 2008. A standard fishery survey was conducted June 5 to 13, 2013. Water quality parameters including temperature and dissolved oxygen profiles and Secchi disk depth were collected on June 5, 2013. Submersed aquatic vegetation was sampled on July 26, 2005; August 16, 2006; August 6, 2007; July 24, 2008; and August 15, 2013 using the standard DFW protocol (Indiana Department of Natural Resources 2007). Sampling of the lakes tributary streams was conducted on August 21, 2017.

In all lake fishery surveys, fish were collected by pulsed DC electrofishing the shoreline at night with two dippers. Targeted surveys conducted from 2005 to 2008 consisted of 3 hours of nighttime electrofishing whereas 1.25 hours of sampling were conducted during the standard survey in 2013. Also during the standard survey in 2013, two trap nets and four gill nets were fished for two nights. All fish collected were enumerated and measured to the nearest 0.1 in TL. Scale samples were collected from all Largemouth Bass and Bluegill for age structure and growth rate determination. Samples were used to estimate catch per effort, growth rate (length at age), and size structure of Largemouth Bass and Bluegill. Size structure indices included standard proportional stock density (PSD) as well as PSD of larger fish (7 in and above for Bluegill and 14 and 15 in for Largemouth Bass). Samples of other fish species collected in 2013 were used to calculate catch per effort and fish community composition (percent by number and percent by weight). Growth and size structure metrics were not calculated for Black Crappie and Redear Sunfish because of repeatedly low numbers of fish sampled and inconsistent catches over time.

Sampling of the lakes two tributaries including Owl Creek (the eastern tributary) and the unnamed western tributary was completed using a backpack electrofisher, a 4 ft. kick seine, and both 15 and 25 ft. straight seines. Sampled sites were selected to match a subset of those visited in the previous stream fish survey conducted by Gammon (1996). The selected sampling sites included the lower portions of each tributary as well as the middle segment of Owl Creek (sites 4, 5, and 6 from Gammon 1996). Five to eight seine hauls with each seine type (straight and kick) were conducted at each site whereas electrofishing was only conducted on the lower portion of Owl Creek. Electrofishing was not conducted on the other sites because the habitat in these sections was effectively sampled by seining. The upper sections of the western tributary and the uppermost reach of Owl Creek were not sampled due to dry conditions resulting in a lack of water in the stream bed. All collected fish were identified to species in the field with the aid of the DFW aquatic nongame biologist.

To place the results of these surveys in the context of previous trends in the fishery at Glenn Flint Lake, water quality parameters, species presence/absence, catch rates of major fish species, and size structure of Largemouth Bass and Bluegill were summarized along with historical values from previous surveys. Historical data for lake fish sampling incorporated information back to 1989 when the current standardized sampling protocols were established. Fish species presence/absence information was summarized back to the initial DFW sampling in 1979 for lake communities and 1995 for the tributary streams. Catch rate calculations were restricted to the gear types that best sampled each species including electrofishing for Largemouth Bass, Bluegill, and Gizzard Shad and gill net catches to estimate catch rates of Common Carp, Yellow Bass, Channel Catfish, and White Crappie. Catches in trap nets were consistently low for all species and therefore this information was not used for catch rate determination. Fish sampled in trap nets were, however, pooled with information from the other gears for estimates of growth and size structure. Water quality information was summarized as Secchi disk depth and the depth of the oxycline (depth where dissolved oxygen was <3ppm). Information from vegetation surveys was summarized as the average number of plant species collected per site, and the number of sites where submerged aquatic vegetation was present.

# RESULTS

*Trends in Water Quality, Vegetation, and Fish Populations: 2005 to 2013 versus Historical*

Since the last sample in 2000, Secchi disk depth in Glenn Flint declined from 3.6 to 3.0 ft. The 2013 value is the second lowest water clarity recorded in the lake since 1979. This value is similar to the measurement taken in 1993 prior to the renovation and is consistent with a general decline in water clarity since 1996 (Figure 1A). The depth of the oxycline also declined slightly between 2000 and 2013 from 15 to 12 ft. This value is also the second lowest recorded and also falls in line with a trend of decrease since 1996 (Figure 1A). From 2005 to 2008 the number of sites where submerged aquatic vegetation was present and the average number of species per site declined (Figure 1B-C). Out of 70 sampled locations, the number of sites with vegetation declined from 40 to 0 (Figure 1B) and the number of species per site declined from 1.2 to 0 (Figure 1C) over this period. In 2013, there was a slight rebound in submerged aquatic vegetation cover with vegetation present at 8 sites and the number of species per site increasing to 0.2.

The range of Bluegill electrofishing catch rates since 2005 has been within the typical range for the lake and the overall trend has been stable. The average Bluegill catch rates of 207/h over this period remains above those observed prior to the 1995 renovation (Figure 2A). In contrast to trends in Bluegill catch rates, the catch rate of Largemouth Bass has shown a pattern of decline from 2005 to 2013 that began in the year 2000. Largemouth Bass catch rates declined from100/h in the year 2000 to an average of 51 from 2005 to 2013. These values are much lower than the post renovation highs and are similar to the pre-renovation range of values (Figure 2B). The electrofishing catch rates of Gizzard Shad also showed a consistent trend of decline over the period from 2000 to 2013 (Figure 2C). The Gizzard Shad selective rotenone application conducted in 2004 caused a decline in abundance in 2005, however, the population rebounded quickly and the general trend has remained unchanged. From 2005 to 2013 the Gizzard Shad catch rate has averaged 126/h. This value is much lower than prior to the renovation and is also lower than the catch rates immediately following reinvasion of this species from 2000 to 2004 (Figure 2C).

Gill net catch rates of Common Carp and Channel Catfish declined slightly between 2000 and the most recent sample in 2013 (Figure 3A-C). Catch rates of White Crappie increased slightly from 0.7 in 2000 to 1.6 per net lift in 2013. White Crappie catch rates have remained relatively low and consistent since 1996. Prior to the renovation in 1995, White Crappie catch rates were much greater, averaging 34 per lift (Figure 3B). A notable exception to the general trend of decrease in the abundance of most fish species has been a consistently high catch rate of Yellow Bass (Figure 3D). Yellow Bass catch rates were relatively consistent prior to the renovation averaging less than 10 per net lift. After 1996, Yellow Bass catch rates increased sharply and have been consistently over 30 per lift from 2000 to 2013 (Figure 3D).

Examination of Bluegill growth rates from 2005 to 2013 indicated a decrease in average length of age-2 fish and an increase in average length at age of adult fish at age 4 (Figure 4A). Length at age of age-5 fish showed no pattern but comparisons were limited by low sample size. Average length of age-2 Blugill decreased from 4.7 inches from 2005 to 2007 to 4.3 inches from 2008 to 2013. Over these same time periods, average length of age-4 fish increased from 6.1 to 6.5 inches. These growth rates are both above District 4 averages of 3.5 inches for age 2 and 6.4 inches for age-4 Bluegill. Length at age of Largemouth Bass decreased for age-3 and 4 fish from 2005 to 2013 (Figure 4B). Average length of age-3 fish decreased from 11.6 in (2005 to 2007) to 10.5 inches (2008 to 2013) whereas average length of age-4 fish decreased from 14 to 13.3 inches. Similar to Bluegill, length at age of age 5 fish was relatively unchanged but was limited by low sample size. The most recent averages are now below the district average of 11 inches for age 3 fish and similar to the average of 13 inches for age-4 fish.

Bluegill size structure was relatively constant from 2002 to 2008 but increased in 2013 (Figure 5A). The increase in size structure was most pronounced for PSD. Bluegill PSD increased from an average of 21 (2002 to 2008) to 45 in 2013. The proportion of Bluegill greater than 3 inches that were also over 7 inches (PSD7) was relatively unchanged over this same time period (Figure 5B). Largemouth Bass PSD14 increased steadily from 2000 to 2005 with a slight decline from 2005 to 2013 (Figure 6A-B). Largemouth Bass PSD14 averaged 69 from 2005 to 2007 and declined to an average of 47 from 2008 to 2013. The proportion of Largemouth Bass greater than 8 inches that were also over 15 inches (PSD15) increased from 2 in 2000 to a high of 41 in 2005. The most recent estimate of 40 indicated little change since 2005 (Figure 6A-B).

*Fish Community Composition in 2013 Standard Lake Survey and 2017 Stream Survey*

The fish community of Glenn Flint Lake in the 2013 survey was dominated by small

Bluegill and Yellow Bass (Appendix 1). These two species made up more than 50% of the fish collected across all gear types. White Sucker was the most abundant fish caught by weight at 18% and Common Carp and Gizzard Shad at both over 14% also made up a significant portion of the biomass. White Sucker and Common Carp were much less abundant in the last standard survey where they both made up less than 8% of the biomass. In the previous standard sample in 2000, Gizzard Shad were the most abundant fish sampled accounting for 57% of the fish collected and 54 % of the biomass. In the most recent sample Gizzard Shad made up less than 15% by number and weight. There was also a decrease in the proportion of the fish community made up of Largemouth Bass that declined from 5% by number in 2000 to 1% and an increase in the proportion of White Crappie that increased from 0.2 to over 6% (Appendix 1).

Fish species presence in standard fisheries surveys of Glenn Flint Lake indicates a gradual increase in species diversity since the 1995 renovation. Several species survived the renovation including Yellow Bass, Green Sunfish, Yellow Bullhead, Black Bullhead, and White Crappie. Several other fish species, however, have not reappeared since 1995 including Brook Silverside, Yellow Perch, Quillback, and White Bass. Fish species that appeared to be eliminated from the lake by the renovation and have subsequently been reintroduced or recolonized the lake include Gizzard Shad, Common Carp, White Sucker, Warmouth, and Longear Sunfish. In 2013 Brown Bullhead were sampled for the first time in Glenn Flint Lake. Brown Bullhead were fairly abundant in this most recent sample, representing the fourth most collected fish by number and fifth most by biomass (Appendix 1).

The 2017 survey of fish communities in the Glenn Flint Lake tributaries indicated the continued presence of a diverse native fish community in these headwater streams. Similar to surveys conducted in 1995 prior to treatment with rotenone, the greatest diversity of both native and lake migrant species were found in the lower portion of Owl Creek. Collectively, a total of 22 species were collected in the survey including representatives of the Cyprinidae, Catostomidae, Ictaluridae, Poeciliidae, Centrarchidae, Percidae, and Cottidae families (Table 2). In the previous survey of the tributary streams, Gammon (1996) reported that a number of species were possibly eliminated from the stream by rotenone treatment. These species included, Common Carp, Hornyhead Chubb, Sand Shiner, Rock Bass, Fantail Darter, and Mottled Sculpin. Of these species, Mottled Sculpin were collected in the 2017 survey. Common carp were not collected in the 2017 stream survey but are currently present in the lake. The previous survey in

1996 also noted that some of the species formerly present in the lower stream portions had not recolonized these areas after these sectioned were renovated. These species included Orangethroat Darter, Rainbow Darter, and Longear Sunfish. Results of the 2017 survey indicate that all of these species have now recolonized these areas. The only collection of noxious species in the 2017 survey included Gizzard Shad found in a single seine haul on the lower portion of Owl Creek. This portion of stream was the nearest point sampled to the lake and was more lentic than other stretches due its downstream proximity to an upstream beaver dam.

## DISCUSSION

The time series of water clarity and the depth of the oxycline indicate a decline in water quality in Glenn Flint Lake between 2004 and 2013. This decline in water clarity is likely responsible for the decrease in submerged aquatic vegetation abundance over this same period. Causes for the decline in water quality and submerged vegetation are likely multifaceted and include nutrient loading from watershed sources, increased biomass of benthic feeding fish, declines in predatory fish abundance and the continued presence of Gizzard Shad. The abundant benthic feeding fish including White Sucker, Common Carp, Brown Bullhead, and juvenile Yellow Bass likely contribute to poor water quality through disturbance of sediments, and recycling of nutrients from the lake bottom. Similarly Gizzard Shad are also known to negatively affect water clarity through predation on zooplankton as well as translocation of nutrients from sediments to the water column (Schaus and Vanni 2000). The continued decrease in Largemouth Bass abundance contributes to these problems through reduced predation on benthic fishes and Gizzard Shad. The slight rebound in submerged aquatic vegetation in 2013 may be related to the continued decline in Gizzard Shad abundance since 2000.

Trends in catch rates between 2004 and 2013 reflect continued negative effects of water quality and competitor species on recruitment of most sport fish including Largemouth Bass, Crappie species and Channel Catfish in Glenn Flint Lake. Declines in Largemouth Bass catch rates are likely due to competition between Gizzard Shad and juvenile bass for zooplankton as well as the decline in submerged aquatic vegetation (an important nursery habitat for age-0 Largemouth Bass; Boyle 1979; Durocher et al. 1984). In the case of Channel Catfish, competition with other benthic fishes and the cessation of stocking in 2004 most likely explains the continued low abundance of this species. The low abundance of Black Crappie may be related to this species being sensitive to water quality. The low abundance of White Crappie observed since 1995, however, is unexpected since this species is usually tolerant of poor water quality (Egertson and Downing 2004). A plausible explanation for the observed low abundance of Crappie species since the 1995 renovation is competition with the dense Yellow Bass population that has developed over this time period. The dense Yellow Bass population in Glenn Flint Lake may limit the recruitment of game species like crappie and Largemouth Bass by both competition and predation on early life stages. One of the few studies examining the trophic ecology of Yellow Bass found that this species consumes a diet similar to Black and White Crappie and also noted that Yellow Bass consumed considerable amounts of fish eggs (Driscoll and Miranda 1999). Fisheries biologists in other states have also noted declines in sport fish populations after Yellow Bass invasions (Globe Gazette 2004).

An exception to the general trend of declines in sportfish abundance in Glenn Flint Lake has been the relatively stable Bluegill population. Bluegill catch rates decreased immediately following the reinvasion of Gizzard Shad in 1998 but began to recover coincident with the onset of declines in Gizzard Shad abundance in 2000. Reduced competition with Gizzard Shad may explain the recovery of Bluegill, although reduced predation from the declining Largemouth Bass population may also be a contributing factor. Gizzard Shad are strong competitors with Bluegill due to their consumption of zooplankton that is a critical food source for adult Bluegill growth (Mittelbach and Osenberg 1993; Oplinger and Wahl 2013).

Declines in overall Gizzard Shad abundance may explain why adult Bluegill growth has increased since 2005. This increase in growth may explain the improved size structure. Decreases in Largemouth Bass growth rates from 2005 to 2013 are also best explained by the decline in Gizzard Shad abundance. In lakes where Gizzard Shad are present, they commonly comprise 50 percent or more of Largemouth Bass diets (Michaletz 1997). Therefore, decreases in Gizzard Shad availability would be expected to negatively affect Largemouth Bass growth. The trend of increasing Largemouth Bass size structure despite decreases in growth is most likely the result of poor recruitment stemming from the effects of Gizzard Shad, Yellow Bass, and declines in submerged aquatic vegetation.

Examination of fish community composition within Glenn Flint Lake since the 1995 renovation suggests that the rotenone application may have failed to eradicate Yellow Bass within the lake whereas other harmful species such as Common Carp and Gizzard Shad were reintroduced. To date, Common Carp and Gizzard Shad have been collected from only a single site in the lower portion of Owl Creek nearest the lake. The continued absence of noxious species in other portions of the tributaries, and the fact that the lower portion of Owl Creek was treated with rotenone in the last renovation, indicates that the continual reintroduction of noxious species into Glenn Flint Lake is not a result of fish migration from the tributary streams. The evidence indicates Yellow Bass and Gizzard Shad originated from outside the watershed. Gizzard Shad and Common Carp have been introduced to the lake on multiple occasions. The trend of unsanctioned fish introductions has continued with the discovery of Brown Bullhead in the most recent survey.

In its current state, the fish community in Glenn Flint Lake offers limited angling opportunities for Bluegill and Yellow Bass between 6-7 inches and benthic non-game fish such as White Sucker, Common Carp, and Bullhead species. Current abundances of other sportfish are similar to those observed prior to the last lake renovation. Angling opportunities for Bluegill, Black and White Crappie, and Yellow Bass are hindered by poor size structure of these species whereas fishing for Channel Catfish is limited by low abundance. Large Largemouth Bass are present in the lake offering an opportunity to catch quality fish, however, the abundance of these fish has declined slightly in recent surveys. With no intervention, the state of the fishery at Glenn Flint Lake is unlikely to improve substantially under the continued influences of Gizzard Shad, benthic fish, and Yellow Bass. Options to address these fisheries issues at Glenn Flint Lake are limited due to the strong foothold unwanted species have acquired in the lake but include predator stocking, or a renovation of the fish community.

Renovation of the Glenn Flint Lake fishery through rotenone application is the approach most likely to substantially improve sport fishing opportunities in Glenn Flint Lake in the short term; however, the history of repeated introduction of noxious species in the lake suggests that this approach would be unlikely to succeed as a long term strategy. The benefits of the last lake renovation in 1995 indicated sharp increases sport fish abundance, and angler use (Keller 1997), but these improvements were extremely short lived. The available information demonstrates that the fishery returned to a state similar to pre-renovation in less than five years and offered quality angling for only around 3 years. Based on DFW estimates, the short lived increase in fishing quality from the 1995 renovation was achieved at an inflation adjusted cost to the DFW of $108,747 ($68,282 in 1995 dollars; Keller 1997; Bureau of Labor Statistics 2017). In order to make a renovation project cost effective, the renovated lake must remain free of noxious species for a considerably longer time period (typically 10 years or more) to allow for the development of quality game fish populations, re-establishment of aquatic habitat, and increases in angler use. Historically, periods where Glenn Flint Lake has been free of unwanted species and provided quality angling have been brief (3 to 5 years). There is no reasonable expectation that this pattern will change in the future, therefore, further renovation projects would be unlikely to be cost effective in the long term.

In addition to financial considerations, the DFW must also concern itself with a tradeoff between the Glenn Flint Lake Fishery and the protection of the native fish species in the lake's major tributary Owl Creek. Prior to the last renovation it was deemed that elimination of the native fish community of Owl Creek was at odds with the DFW's mission to professionally manage Indiana's fish and wildlife for present and future generations, balancing ecological, recreational, and economic benefits. As a result, only the lower portions of the lake's tributaries were treated with rotenone. Despite the attempt to protect the native fish species in Owl Creek, the 2017 survey of the lakes tributaries found that four fish species including Hornyhead Chubb, Spotted Bass, Rock Bass, Fantail Darter, and Sand Shiner were likely eliminated from the stream by the rotenone treatment. A future renovation of Glenn Flint Lake would once again require rotenone application to part of the lake's tributary streams due to the presence of Gizzard Shad in the lower portions of Owl Creek. The history of the Glenn Flint Lake fishery indicates that the potential loss of additional fish species from Owl Creek is unlikely to be compensated for by long term improvements in angling quality within the lake.

Given the low probability of long term benefits of further renovations, and the need for action to improve the fishery in Glenn Flint Lake, the strategy that has the greatest potential cost to benefit ratio is a program of predatory fish stocking. Establishing additional predatory fish within the lake would have the benefit of increasing sport fishing opportunities, and potentially improving the growth of existing game fish populations through predation on competing non-game species. Current water quality conditions in Glenn Flint Lake are likely a limiting factor for establishment of cool water predators such as Walleye and Muskellunge. It is recommended, therefore, that predator introductions consider species more tolerant of these conditions. Fish species currently cultured by DFW, that may tolerate the water quality conditions in Glenn Flint Lake include Saugeye (Hybrid Walleye), Largemouth Bass, and Hybrid Striped Bass.

Of the predatory fish available for stocking by DFW, Saugeye would be the top candidate for establishment in Glenn Flint Lake due to the tolerance of this hybrid for poor water quality and warm water temperatures (Zwiefel et al. 2010). Saugeye also display high growth rates, and a tendency to prey upon a variety of non-game species (Johnson et al. 1988; Denlinger et al. 2006). As a result of these traits, predation by introduced Saugeye has been demonstrated to improve growth of game fish such as White and Black Crappie (Boxrucker 2002; Galinat 2002). Stocked Largemouth Bass and Hybrid Striped Bass may survive in Glenn Flint Lake; however, there are significant drawbacks to each of these other candidate species. Recent studies have indicated that stocking of Largemouth Bass in lakes with existing natural populations is often ineffective at increasing overall predator density (Diana and Wahl 2008; Diana and Wahl 2009). Hybrid Striped Bass may survive in the lake but would be heavily reliant on the declining gizzard shad forage base and may not prey on other non-game species (Olsen et al. 2007). Furthermore, Hybrid Striped Bass are not currently produced by DFW and would have to be purchased from an outside source, whereas Saugeye are currently cultured on an annual basis.

Currently, the DFW has developed Saugeye fisheries in two Indiana lakes with habitat conditions similar to Glenn Flint Lake including Sullivan Lake (Sullivan County), and Huntingburg Lake (Dubois County; Roberts 2013; King 2015). A 2013 creel survey from Sullivan Lake found that 84 anglers targeted Saugeye accounting for an estimated 2,100 angling trips in the calendar year (Kittaka 2015). Economic data provided to DFW by the Little Walnut Creek Conservancy District lists a proportion of 82% daily and 18% annual launch fees collected by the district. Based on these proportions and current access fees, the development of a Saugeye fishery generating angling effort comparable to Sullivan Lake would account for estimated added annual revenue of roughly $12,600 to the conservancy district. In comparison, gross revenue information from 1992-2014 provided to DFW by the conservancy district indicates an average increase in revenue of around $7,000 (1992-1995 average $36,104 versus 1998-2004 average $43,288) in the years following the 1995 renovation. Therefore, in addition to improved angling opportunities for Indiana residents, the development of a successful Saugeye fishery at Glenn Flint Lake may be expected to have greater long term economic benefits to the conservancy district than another renovation with results similar to those observed previously.

## RECOMMENDATIONS

- The DFW should begin stocking Glenn Flint Lake with Saugeye at a rate of 50/acre in 2018 for a total of 16,500 fingerlings.
- The DFW will conduct an evaluation of the initial Saugeye stocking during fall 2018.
- The DFW will conduct a status and trend fish survey in 2018 to assess the current status of the Glenn Flint Lake Fishery.
- A meeting should be held in winter 2017 or spring 2018 with the Little Walnut Creek Conservancy District to discuss fisheries management at Glenn Flint Lake.

## LITERATURE CITED


Boyle, T.P. 1979. Responses of experimental lentic aquatic ecosystems to suppression of rooted macrophytes. *in* J.E. Breck, R.T. Prentki and O.L. Loucks (Editors), Aquatic Plants, Lake Management and Ecosystem Co: 269-283.

Boxrucker, J. 2002. Improved growth of a white crappie population following stocking of saugeyes (sauger x walleye): A top down, density dependent growth response. North American Journal of Fisheries Management 22:1425-1437.

Bureau of Labor Statistics. CPI Inflation Calculator. Bureau of Labor Statistics Division of Labor and Marketing Services. Washington, D.C. Accessed online September 13th 2017. URL: https://www.bls.gov/data/inflation_calculator.htm.

Denlinger, J. C. S., Hale, R. S., and R. A. Stein. 2006. Seasonal consumptive demand and prey use by stocked saugeyes in Ohio reservoirs. Transactions of the American Fisheries Society 135:12-27.

Diana, M. J. and D. H. Wahl. 2009. Growth and survival of four sizes of stocked largemouth bass. North American Journal of Fisheries Management 29:1653-1663.

Diana, M. J. and D. H. Wahl. 2008. Long term stocking success of largemouth bass and the relationship to natural populations. American Fisheries Society Symposium 62:413-426.

Driscoll, M.P, and Miranda, L.E. 1999. Diet ecology of yellow bass, Morone mississississippiensis, in an oxbow of the Mississippi River. Journal of Freshwater Ecology 14:477- 486.

Durocher, P.P., Provine, W.C., and Kraai, J.E. 1984. Relationship between abundance of largemouth bass and submerged vegetation in Texas reservoirs. North American Journal of Fisheries Management 4:84-88.

Egertson, C.J., and Downing, J.A. 2004. Relationship of fish catch and composition to water quality in a suite of agriculturally eutrophic lakes. Canadian Journal of Fisheries and Aquatic Sciences 61:1784-1796.

Galinat, G. F., Willis, D. W., Blackwell, B. G., and Hubers, M. J. 2002. Influence of a saugeye introduction program on the black crappie population in Richmond Lake, South Dakota. North American Journal of Fisheries Management 22:1416-1424.

Gammon, J.R. 1996. Assessment of fish communities in the Owl Creek tributaries of Glenn Flint Lake before and after partial treatment with rotenone. Depauw University. 26pp.

Globe Gazette. 2004. "DNR Battling yellow bass problem in southern Iowa lakes." The Globe Gazette. Mason City, Iowa. February 25th, 2004. Accessed online May 21st, 2017. URL: http://globegazette.com/dnr-battling-yellow-bass-problem-in-southern-iowa-lakes/article_95a9343f-9c78-5637-b357-92fa4eae2a81.html

Indiana Department of Natural Resources. 2007. Tier II vegetation survey protocol. Indiana Division of Fish and Wildlife. 26pp.

Johnson, B. L, Smith, D. L, and R. F. Carline. 1988. Habitat preferences, survival, growth, foods, and harvests of walleyes and walleye X sauger hybrids. North American Journal of Fisheries Management 8:292-304.

Keller, D. C. 1994. Glenn Flint Lake, 1993 fish management report. Indiana Division of Fish and Wildlife. Indianapolis, Indiana. 25pp.

Keller, D. C. 1997*b*. Fisheries renovation of Glenn Flint Lake. Final project evaluation. Indiana Division of Fish and Wildlife. Indianapolis, Indiana. 3pp.

Keller, D. C. 1997*a*. Glenn Flint Lake, 1996 fish management report. Indiana Division of Fish and Wildlife, Indianapolis, Indiana. 13pp.

Keller, D. C. 1999. Glenn Flint Lake, 1998 fish management report. Indiana Division of Fish and Wildlife. Indianapolis, Indiana. 25pp.

King, D. A. 2015. Sullivan Lake, 2013 fish management report. Indiana Division of Fish and Wildlife, Indianapolis, Indiana. 30pp.

Kittaka, D. S. 2015. Fishing pressure and harvest at Sullivan Lake. 2013 fish management report. Indiana Division of Fish and Wildlife, Indianapolis, Indiana. 12pp.

Michaletz, P.H. 1997. Influence of abundance and size of age-0 gizzard shad on predator diets, diet overlap, and growth. Transactions of the American Fisheries Society 126:101-111.

Mittelbach, G.G., Osenber, C.W. 1993. Stage-structured interactions in bluegill: consequences of adult resource variation 74:2381-2394.

Olson, N. W., Guy, C. S., and K. D. Koupal. 2007. Interactions among three top-level predators in a polymictic great plains reservoir. North American Journal of Fisheries Management 27:268-278.

Oplinger, R. and Wahl. D.H. 2013. Population social structure and gizzard shad density influence the size-specific growth of bluegill. Canadian Journal of Fisheries and Aquatic Sciences 70:1278-1288.

Roberts, C. M. 2013. Huntingburg Lake, 2012 fish management report. Indiana Division of Fish and Wildlife, Indianapolis, Indiana. 21pp.

Schaus, M. and Vanni M. 2000. Effects of gizzard shad on phytoplankton and nutrient dynamics: role of sediment feeding and fish size. Ecology 81:1701-1719.

Zwiefel, R. D., Landis, A.M. G., Hale, R. S., and R. A. Stein. 2010. Development and evaluation of a bioenergetics model for saugeye. Transactions of the American Fisheries Society 139:855-867.

Submitted by: Corey S. DeBoom, Fisheries Biologist
Date: September 18th, 2017

Approved by: Daniel P. Carnahan
Daniel P. Carnahan, Fisheries Supervisor
Date: September 21st, 2017

Table 1. Fish species sampled in general DFW surveys of Glenn Flint Lake from initial sampling in 1979 to 2013. Underlined species indicate those introduced through DFW approved stocking. Species in bold represent harmful fish species not introduced by DFW. Species presence in a sample is indicated by an x. The vertical line indicates the timing of the last lake renovation conducted in the fall of 1995.

| Species / Year | 1979 | 1980 | 1983 | 1987 | 1989 | 1993 | 1996 | 1998 | 2000 | 2013 |
|---|---|---|---|---|---|---|---|---|---|---|
| Bluegill | x | x | x | x | x | x | x | x | x | x |
| Largemouth Bass | x | x | x | x | x | x | x | x | x | x |
| Channel Catfish | x | x | x | x | x | x | x | x | x | x |
| Redear Sunfish | x | x | x | x | | x | x | x | x | x |
| Longear Sunfish | x | x | x | x | x | x | | x | x | x |
| Yellow Bullhead | x | | x | x | x | x | x | x | | x |
| White Sucker | x | x | x | x | x | x | | x | x | x |
| Brook Silverside | x | x | x | x | | x | | | | |
| Green Sunfish | x | x | x | x | x | | x | x | x | x |
| Hybrid Sunfish | x | x | x | x | | | | | x | x |
| Yellow Perch | x | x | x | x | x | x | | | | |
| White Crappie | x | x | x | x | x | x | x | | x | x |
| **Common Carp** | | x | x | x | x | x | | | x | x |
| Goldfish | | x | | | | | | | | |
| Quillback | | x | x | x | x | x | | | | |
| Warmouth | | | x | x | x | x | | x | | x |
| Black Bullhead | | | x | x | x | x | x | x | x | |
| *Black Crappie | | | x | | | x | x | x | x | x |
| **Gizzard Shad** | | | x | x | x | x | | x | x | x |
| Brown Bullhead | | | | | | | | | | x |
| Flathead Catfish | | | | | x | | | | | |
| White Bass | | | | | x | x | | | | |
| Northern Pike | | | | | | x | | | | |
| **Yellow Bass** | | | | | | x | x | x | x | x |

* Black Crappie were first stocked by DFW in 1996.

Table 2. Fish species collected from the Glenn Flint Lake tributary streams during stream surveys conducted in 1995, 1996, and 2017. Underlined species indicate those that were thought eliminated by rotenone treatment in 1995 but were again collected in 2017. Species in bold indicate those that have not been collected since prior to the 1995 rotenone treatment. Species presence in a sample is indicated by an x. Vertical lines indicate year of rotenone treatment.

| Common Name / Site | Scientific Name | Site 6* (CR 400W) Lower Portion of Owl Creek | | | Site 5* (CR 550N) Unnamed West Tributary | | | Site 4* (CR 500N) Owl Creek (Midsection) | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 1995 | 1996 | 2017 | 1995 | 1996 | 2017 | 1995 | 1996 | 2017 |
| Bluntnose Minnow | *Pimephales notatus* | x | x | x | x | x | x | x | x | x |
| Central Stoneroller | *Campostoma anomalum* | x | x | x | x | x | x | x | x | x |
| Creek Chub | *Semotilus atromaculatus* | x | x | x | x | x | x | x | x | x |
| Eastern Blacknose Dace | *Rhinichthys atratulus* | x | x | x | x | x | x | x | x | x |
| Southern Redbelly Dace | *Chrosomus erythrogaster* | | | x | x | | x | x | x | x |
| Silverjaw Minnow | *Notropis buccatus* | x | x | x | x | x | x | x | x | x |
| Striped Shiner | *Luxilus chrysocephalus* | x | x | x | | | x | x | | x |
| Green Sunfish | *Lepomis cyanellus* | x | x | x | | x | x | x | | x |
| **Fantail Darter** | *Etheostoma flabellare* | | | | | | | x | | |
| Johnny Darter | *Etheostoma nigrum* | x | x | x | | x | x | x | x | x |
| <u>Orangethroat Darter</u> | *Etheostoma spectabile* | | | x | | | | x | | x |
| <u>Mottled Sculpin</u> | *Cottus bairdii* | x | | x | | | | x | | x |
| Yellow Bullhead | *Ameiurus natalis* | x | | x | x | x | | | | |
| <u>Western Moquitofish</u> | *Gambusia affinis* | x | | x | x | | x | | | x |
| White Sucker | *Catostomus commersonii* | x | | x | x | x | x | | | x |
| Bluegill | *Lepomis macrochirus* | x | x | x | x | x | x | | | |
| **Spotted Bass** | *Micropterus punctulatus* | | | | x | | | | | |
| Rainbow Darter | *Etheostoma caeruleum* | x | | x | x | x | x | | | |
| Black Bullhead | *Ameirus melas* | x | x | x | | x | | | | |
| Common Carp | *Cyprinus carpio* | x | | | | | | | | |
| **Hornyhead Chub** | *Nocomis biguttatus* | x | | | | | | | | |
| **Sand Shiner** | *Notropis stramineus* | x | | | | | | | | |
| **Rock Bass** | *Ambloplites rupestris* | x | | | | | | | | |
| <u>Longear Sunfish</u> | *Lepomis megalotis* | x | | x | | | x | | | |
| Largemouth Bass | *Micropterus salmoides* | x | x | x | | x | | | | x |
| Channel Catfish | *Ictalurus punctatus* | | x | | | x | | | | |
| Fathead Minnow | *Pimephales promelas* | | x | x | | | x | | | |
| White Crappie | *Pomoxis annularis* | | x | | | | | | | |
| Gizzard Shad | *Dorosoma cepedianum* | | | x | | | | | | |
| Spotfin Shiner | *Cyprinella spiloptera* | | | x | | | | | | |
| Total Species | | 21 | 14 | 22 | 12 | 13 | 15 | 12 | 7 | 14 |

*Site numbers correspond to those from Gammon (1996).

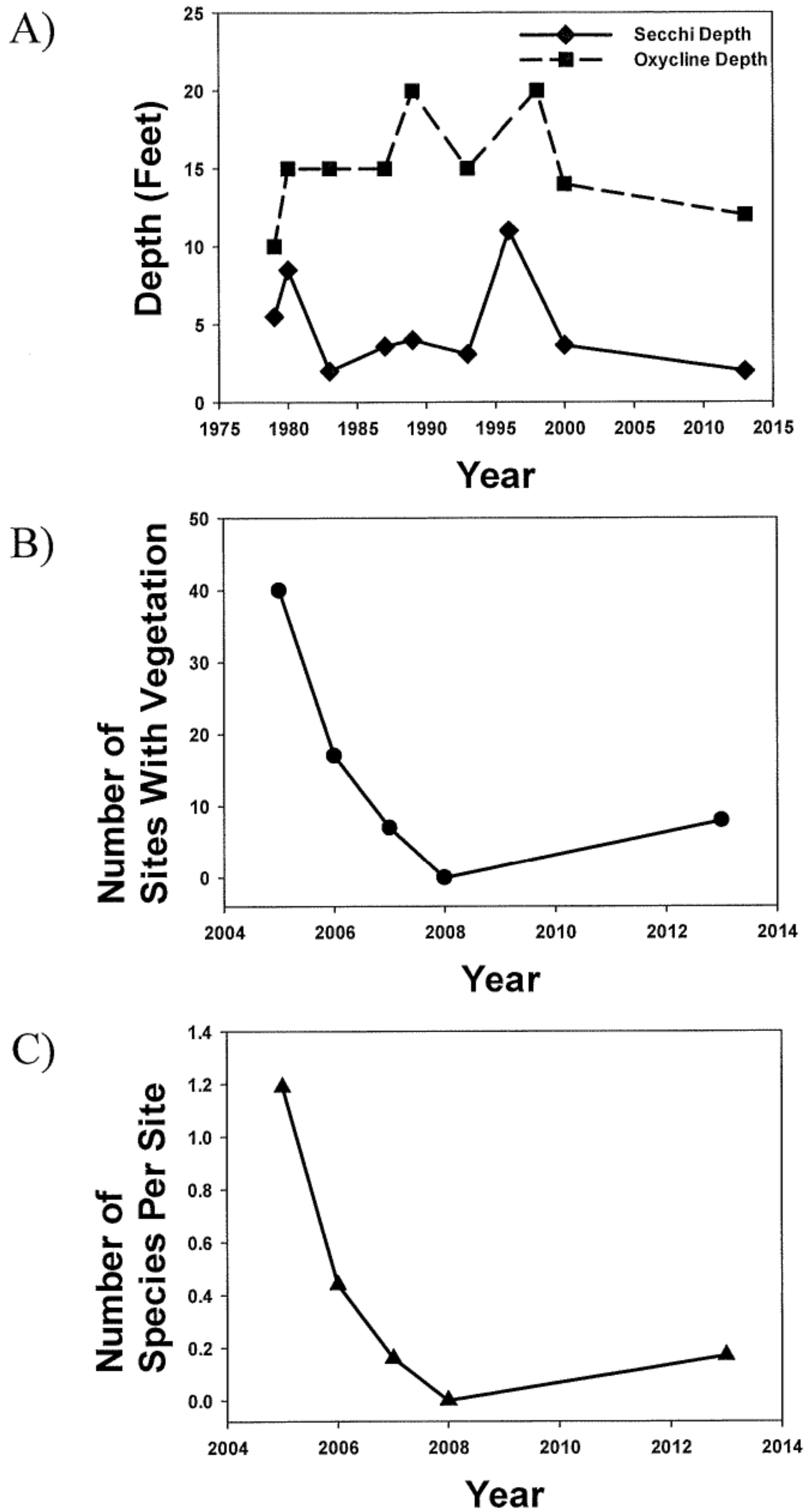



Figure 1. Temporal trends in water quality parameters (A), submersed aquatic vegetation presence (B), and submerged aquatic vegetation diversity (C) in Glenn Flint Lake. Water quality trends are depicted from 1979 to 2013 whereas submerged vegetation information covers 2005 to 2013.

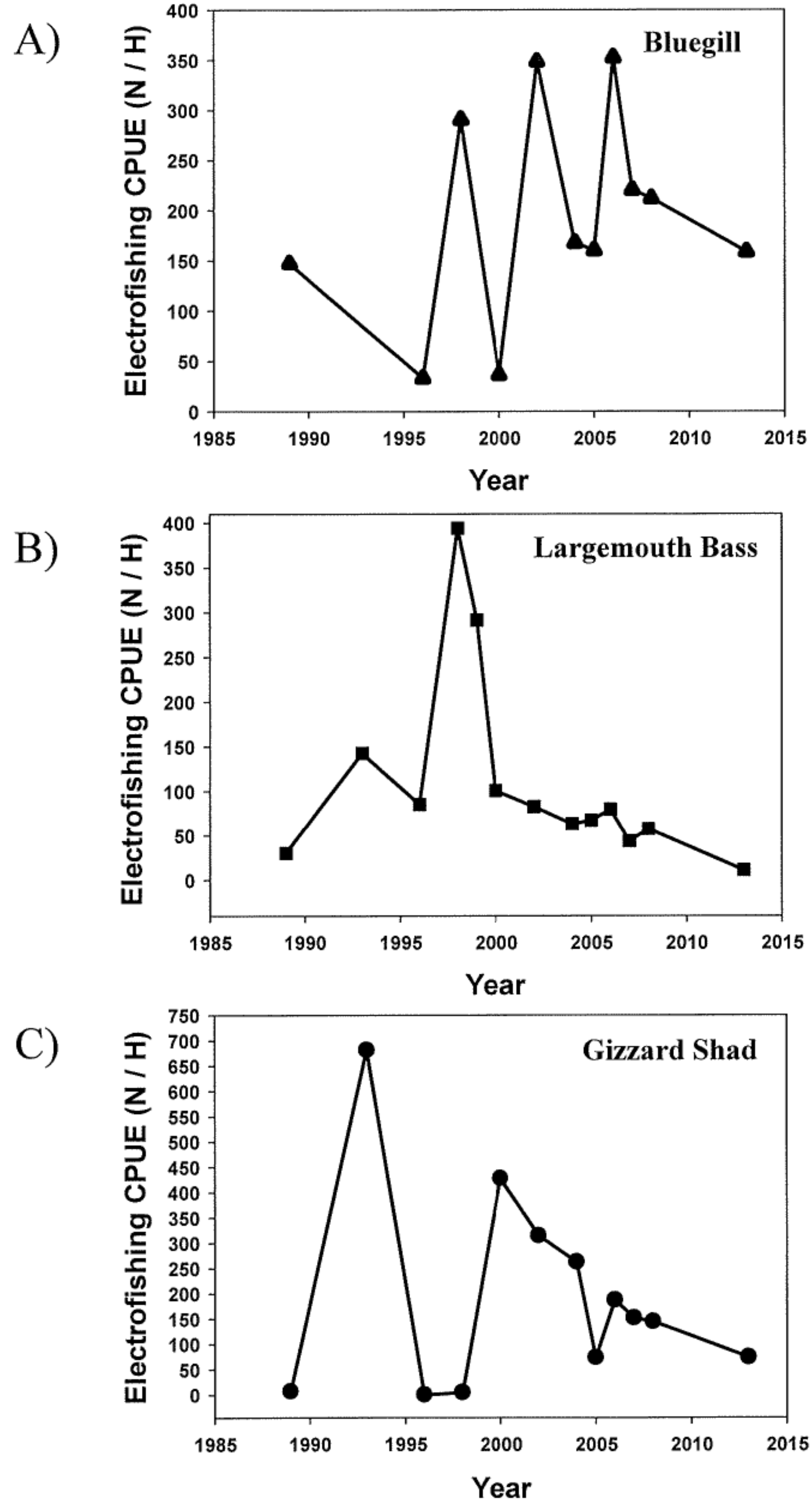



Figure 2. Time series of electrofishing catch per unit effort for Bluegill (A), Largemouth Bass (B), and Gizzard Shad (C) in Glenn Flint Lake from standard DFW surveys conducted from 1989 to 2013.

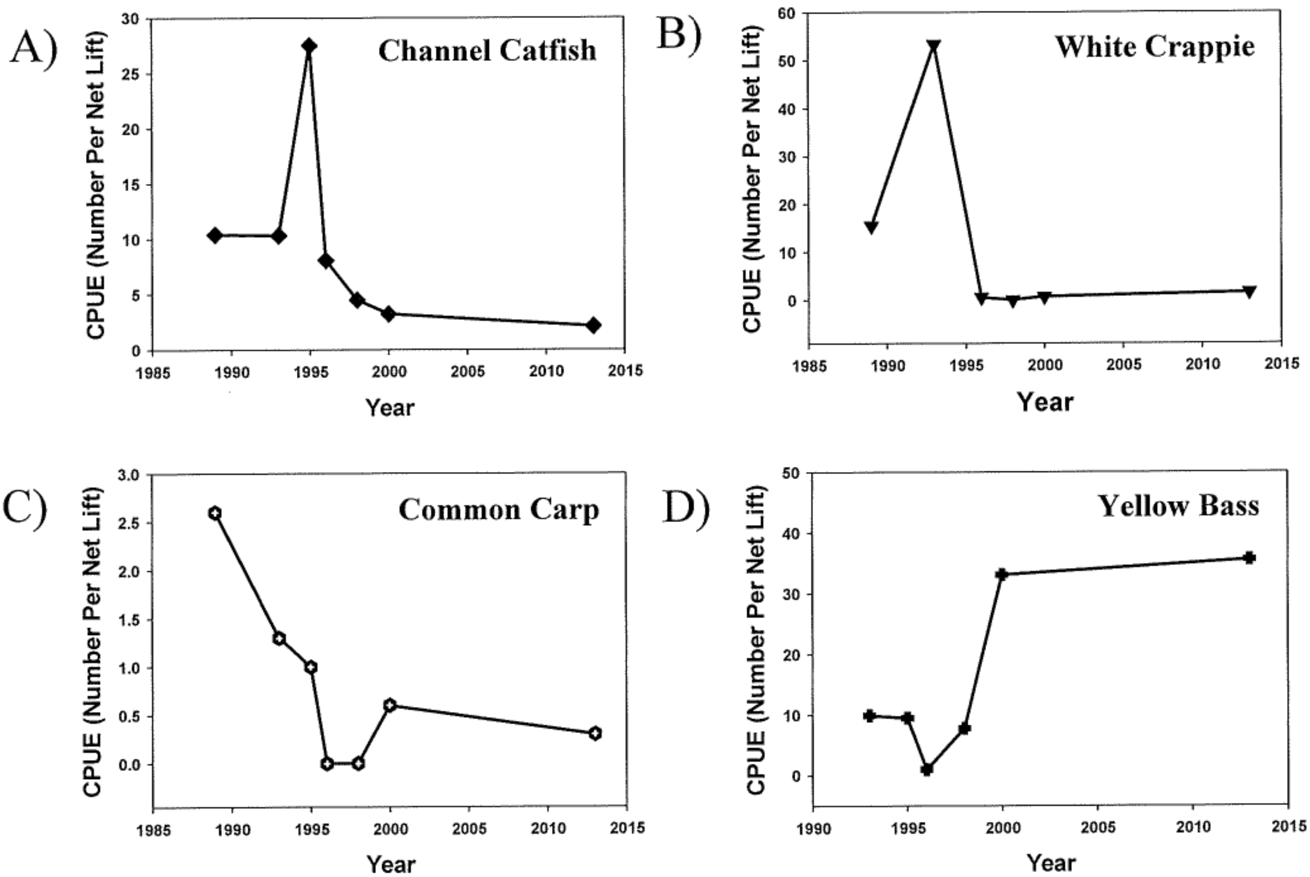
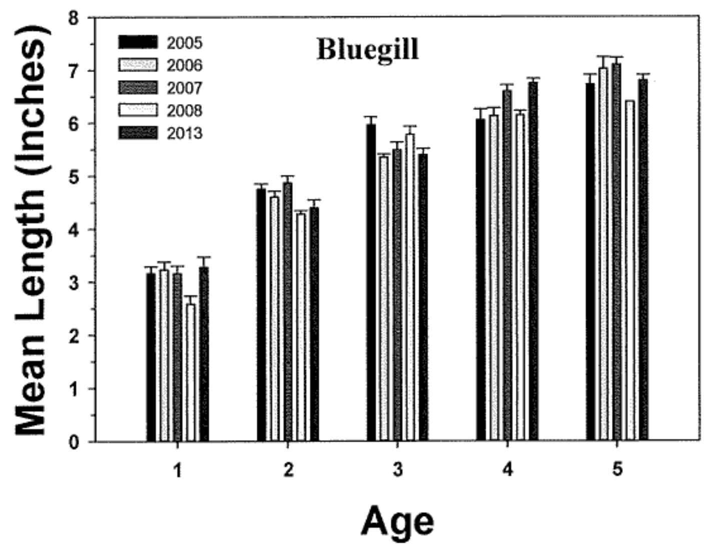



Figure 3. Time series of gill net catch (number of fish per lift) of Channel Catfish (A), White Crappie (B), Common Carp (C), and Yellow Bass (D) in Glenn Flint Lake from standard DFW surveys conducted 1989 to 2013.

A)




B)

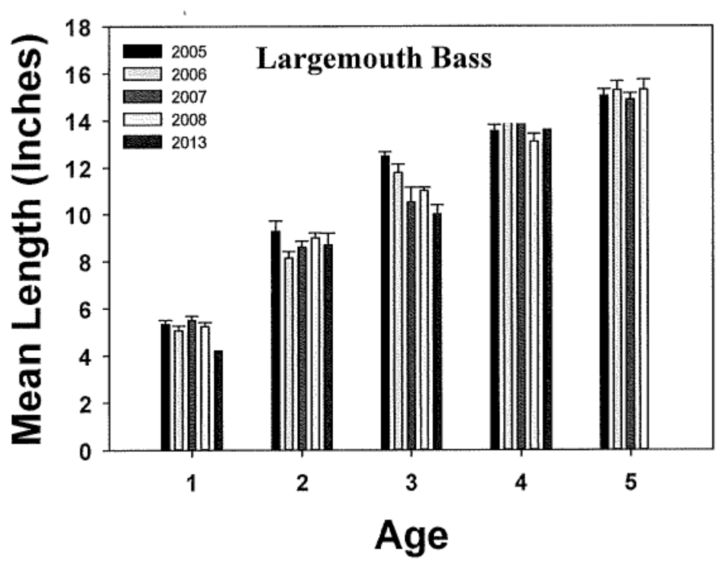
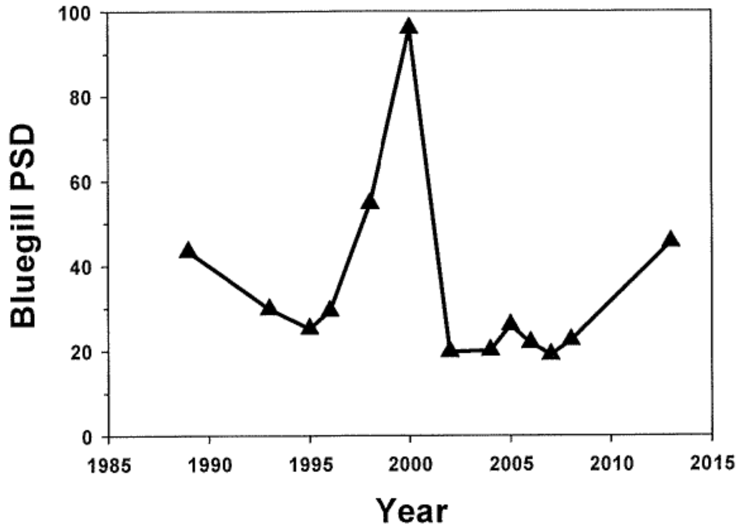



Figure 4. Average length at age of Bluegill (A) and Largemouth Bass (B) collected in standard DFW surveys in Glenn Flint Lake from 2005 to 2013. Error bars represent standard errors of the mean for each year class.

A)




B)

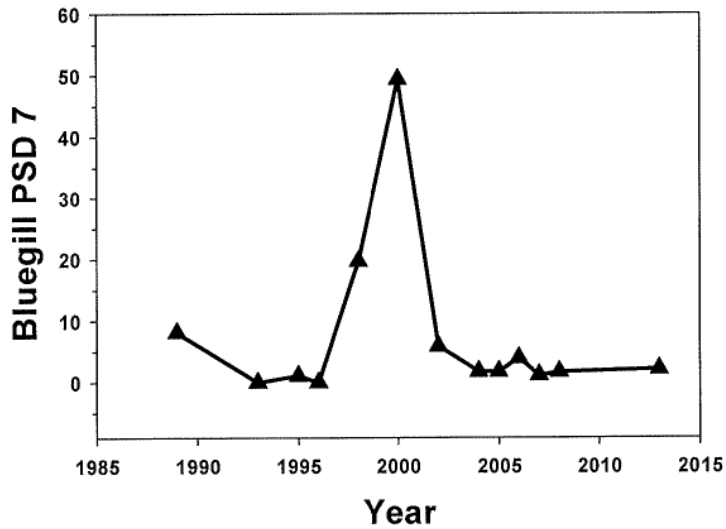
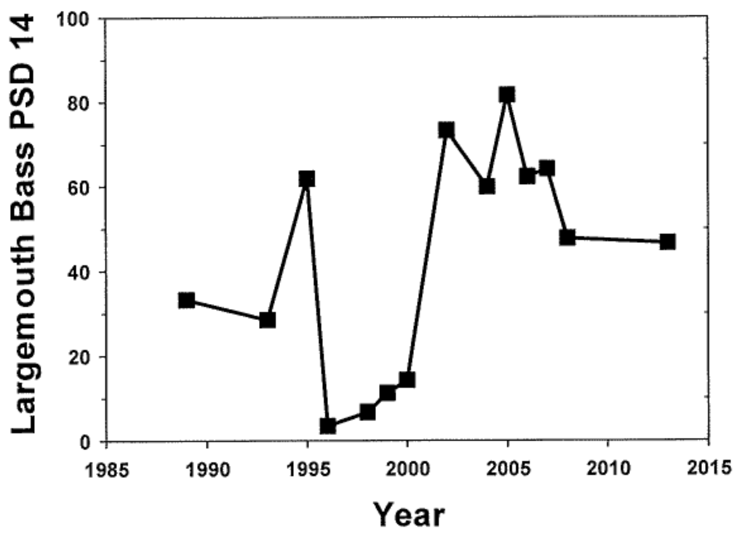



Figure 5. Time series of size structure indices for Bluegill including the proportion of Bluegill greater than 3 inches that were also greater than 6 inches (PSD; A) and greater than 7 inches (PSD 7; B) from standard DFW surveys on Glenn Flint Lake conducted 1989 to 2013.

A)




B)

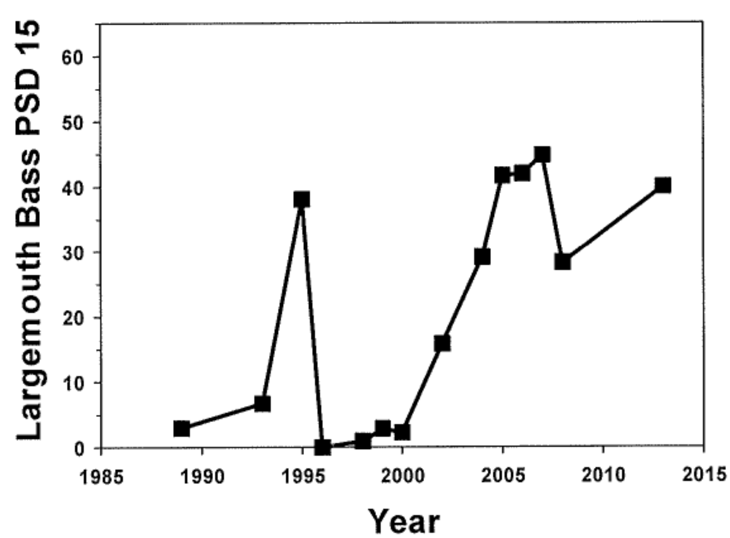



Figure 6. Time series of size structure indices for Largemouth Bass including the proportion of 8 inch and greater fish that were also greater than 14 inches (PSD 14; A) and greater than 15 inches (PSD 15; B) from standard DFW surveys on Glenn Flint Lake conducted 1989 to 2013.

Appendix 1. Standard fisheries survey forms summarizing water chemistry, fish community composition, size distributions, catch per unit effort, and fish growth data from the 2013 standard survey of Glenn Flint Lake.

## LAKE SURVEY REPORT

| Type of Survey | |
|---|---|
| [ ] Initial Survey | [X] Re-Survey |

| Lake Name | County | Date of survey (Month, day, year) |
|---|---|---|
| Glenn Flint Lake | Putnam | June 10-13, 2013 |
| **Biologist's name** | | **Date of approval (Month, day, year)** |
| Rhett Wisener, Ben Miller | | September 21, 2017 |

### LOCATION

| Quadrangle Name | Range | Section |
|---|---|---|
| Clinton Falls | 5W | 14, 22, 23 |
| **Township Name** | **Nearest Town** | |
| 15N | 6 miles NW of Greencastle, IN | |

### ACCESSIBILITY

| State owned public access site | Privately owned public access site | Other access site |
|---|---|---|
| | Boat Ramp and shore access owned by Little Walnut Creek Conservancy District | |

| Surface acres | Maximum depth | Average depth | Acre feet | Water level | Extreme fluctuations |
|---|---|---|---|---|---|
| 371 | 44 ft. | 15.6 | 5,788 | 759.6 MSL | Minimal |

Location of benchmark

### INLETS

| Name | Location | Origin |
|---|---|---|
| Owl Creek | Northeast | T15N, R4W, S8 |
| Unnamed tributary | Northwest | T15N, R5W, S17 |
| | | |

### OUTLETS

| Name | Location |
|---|---|
| Owl Creek | T15N, R5W, S22, (SE 1/4, SW 1/4) |

Water level control

| POOL | ELEVATION (Feet MSL) | ACRES |
|---|---|---|
| TOP OF DAM | 779.7 | |
| TOP OF FLOOD CONTROL POOL | 767.9 | 507 |
| TOP OF CONSERVATION POOL | 759.6 | 373.1 |
| TOP OF MINIMUM POOL | 720.6 | 5 |
| STREAMBED | 712.5 | |

**Bottom type**

- [ ] Boulder
- [X] Gravel
- [ ] Sand
- [X] Muck
- [X] Clay
- [ ] Marl

Watershed use

Primarily Agricultural, Residential on Eastern Shore

Development of shoreline

Numerous private docks and residences, wooded shorelines

Previous surveys and investigations

Lake surveys 1977, 1979, 1980, 1983, 1985, 1987, 1989, 1993, 1995, 1996, 1998, 2000

Creel surveys 1984 and 1999. Lake renovation 1995. Largemouth bass sampling 1999.

Largemouth bass, bluegill, and gizzard shad sampling 2004, 2005, 2006, 2007, 2008

| SAMPLING EFFORT | | | | | |
|---|---|---|---|---|---|
| ELECTROFISHING | Day hours | | Night hours 1.25 | | Total hours 1.25 |
| TRAP NETS | Number of traps 4 | | Number of Lifts 1 | | Total effort 4 lifts |
| GILL NETS | Number of nets 8 | | Number of Lifts 1 | | Total effort 8 lifts |
| ROTENONE | Gallons | ppm | Acre Feet Treated | SHORELINE SEINING | Number of 100 Foot Seine Hauls |

| PHYSICAL AND CHEMICAL CHARACTERISTICS | |
|---|---|
| Color<br>greenish brown | Turbidity<br>3 Feet 0 Inches (SECCHI DISK) |
| Alkalinity (ppm)*<br>Surface: 102.6 Bottom: 102.6 | pH<br>Surface: 9.4 Bottom: |
| Conductivity:<br>230 microsiemens | Air temperature:<br>°F |
| Water chemistry GPS coordinates:<br>N W | |

**TEMPERATURE AND DISSOLVED OXYGEN (D.O.)**

| DEPTH (FEET) | Degrees (°F) | D.O. (ppm) | DEPTH (FEET) | DEGREES (°F) | D.O. (ppm) | DEPTH (FEET) | DEGREES (°F) | D.O. (ppm) |
|---|---|---|---|---|---|---|---|---|
| SURFACE | 73.0 | 10.0 | 36 | | | 72 | | |
| 2 | 73.0 | 10.0 | 38 | | | 74 | | |
| 4 | 71.2 | 6.5 | 40 | | | 76 | | |
| 6 | 70.9 | 6.3 | 42 | | | 78 | | |
| 8 | 70.5 | 5.6 | 44 | | | 80 | | |
| 10 | 70.0 | 4.2 | 46 | | | 82 | | |
| 12 | 69.6 | 3.1 | 48 | | | 84 | | |
| 14 | 68.4 | 0.9 | 50 | | | 86 | | |
| 16 | 66.6 | 0.7 | 52 | | | 88 | | |
| 18 | 63.3 | 0.7 | 54 | | | 90 | | |
| 20 | 59.7 | 0.7 | 56 | | | 92 | | |
| 22 | 56.5 | 0.7 | 58 | | | 94 | | |
| 24 | 55.0 | 0.7 | 60 | | | 96 | | |
| 26 | 54.5 | 0.7 | 62 | | | 98 | | |
| 28 | 54.1 | 0.7 | 64 | | | 100 | | |
| 30 | 53.8 | 0.7 | 66 | | | | | |
| 32 | | | 68 | | | | | |
| 34 | | | 70 | | | | | |

| COMMENTS |
|---|
| shocked 45 minutes on 6/5/13 and 30 minutes on 6/10/13 (530V, 60pps, 3+ pulse width) |
| netting conducted 6/10-12/13 |
| |

*ppm-parts per million

**Occurrence and Abundance of Submersed Aquatic Plants in Glenn Flint Lake.**

| | | | | | |
|---|---|---|---|---|---|
| County: | Putnam | Secchi (ft): | 3 | Mean species/site: | 0.14 |
| Date: | 8/15/2013 | Sites with plants: | 8 | SE Mean species/site: | 0.05 |
| Littoral Depth (ft): | 2 | Sites with native plants: | 7 | Mean native species/site: | 0.13 |
| Littoral Sites: | 70 | Number of species: | 5 | SE Mean natives/site: | 0.05 |
| Total Sites: | 70 | Number of native species: | 4 | Species diversity: | 0.74 |
| | | Maximum species/site: | 2 | Native species diversity: | 0.69 |

| All Depths Species | Frequency of Occurrence | Rake score frequency per species | | | | Plant Dominance |
|---|---|---|---|---|---|---|
| | | 0 | 1 | 3 | 5 | |
| Southern naiad | 1.4 | 98.6 | 1.4 | 0 | 0 | 0.3 |
| Sago pondweed | 5.7 | 94.3 | 5.7 | 0 | 0 | 1.1 |
| American pondweed | 2.9 | 97.1 | 2.9 | 0 | 0 | 0.6 |
| Leafy pondweed | 2.9 | 97.1 | 2.9 | 0 | 0 | 0.6 |
| Curly Leaf pondweed | 1.4 | 98.6 | 1.4 | 0 | 0 | 0.3 |
| Filamentous algae | 5.7 | | | | | |

Other species observed: Cattail Sp., Water lillies, Bulrushes, Creeping water primrose

| SPECIES AND RELATIVE ABUNDANCE OF FISHES COLLECTED BY NUMBER AND WEIGHT | | | | | |
|---|---|---|---|---|---|
| *COMMON NAME OF FISH | NUMBER | PERCENT | LENGTH RANGE (inches) | WEIGHT (pounds) | PERCENT |
| Bluegill | 524 | 34.6 | 1.7 - 8.1 | 63.51 | 15.3 |
| Yellow Bass | 315 | 20.8 | 4.6 - 7.5 | 32.50 | 7.8 |
| Gizzard Shad | 218 | 14.4 | 1.2 - 14.2 | 61.43 | 14.8 |
| Brown Bullhead | 153 | 10.1 | 5.4 - 10.6 | 45.08 | 10.9 |
| White Crappie | 97 | 6.4 | 5.2 - 8.5 | 12.78 | 3.1 |
| White Sucker | 76 | 5.0 | 10.5 - 16.7 | 75.40 | 18.2 |
| Black Crappie | 56 | 3.7 | 5.8 - 8.5 | 12.67 | 3.1 |
| Common Carp | 19 | 1.3 | 14.3 - 25.9 | 60.92 | 14.7 |
| Channel Catfish | 18 | 1.2 | 12.5 - 25.3 | 24.78 | 6.0 |
| Largemouth Bass | 17 | 1.1 | 1.2 - 19.3 | 21.95 | 5.3 |
| Hybrid Sunfish | 7 | 0.5 | 4.9 - 7.9 | 1.24 | 0.3 |
| Longear Sunfish | 7 | 0.5 | 4.1 - 5.7 | 0.54 | 0.1 |
| Redear Sunfish | 4 | 0.3 | 6.0 - 8.0 | 0.98 | 0.2 |
| Green Sunfish | 3 | 0.2 | 4.8 - 5.4 | 0.25 | 0.1 |
| Yellow Bullhead | 1 | 0.1 | 11.0 | 0.66 | 0.2 |
| Warmouth | 1 | 0.1 | 5.2 | 0.10 | < 0.1 |
| TOTALS | 1,516 | | | 414.79 | |

*Common names of fishes recognized by the American Fisheries Society.

| NUMBER, PERCENTAGE, WEIGHT, AND AGE OF BLUEGILL | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| TOTAL LENGTH (inches) | NUMBER COLLECTED | PERCENT OF FISH COLLECTED | AVERAGE WEIGHT (pounds) | AGE OF FISH | TOTAL LENGTH (inches) | NUMBER COLLECTED | PERCENT OF FISH COLLECTED | AVERAGE WEIGHT (pounds) | AGE OF FISH |
| 1.0 | | | | | 19.0 | | | | |
| 1.5 | 1 | 0.2 | 0.01 | 0 | 19.5 | | | | |
| 2.0 | | | | | 20.0 | | | | |
| 2.5 | 5 | 1.0 | 0.01 | 1 | 20.5 | | | | |
| 3.0 | 19 | 3.6 | 0.02 | 1 | 21.0 | | | | |
| 3.5 | 28 | 5.3 | 0.03 | 1 | 21.5 | | | | |
| 4.0 | 10 | 1.9 | 0.04 | 1,2,3 | 22.0 | | | | |
| 4.5 | 13 | 2.5 | 0.06 | 2,3 | 22.5 | | | | |
| 5.0 | 54 | 10.3 | 0.08 | 3 | 23.0 | | | | |
| 5.5 | 158 | 30.2 | 0.11 | 3 | 23.5 | | | | |
| 6.0 | 188 | 35.9 | 0.15 | 3,4 | 24.0 | | | | |
| 6.5 | 37 | 7.1 | 0.20 | 4,5 | 24.5 | | | | |
| 7.0 | 8 | 1.5 | 0.25 | 4,5,6 | 25.0 | | | | |
| 7.5 | 1 | 0.2 | 0.31 | not aged | 25.5 | | | | |
| 8.0 | 2 | 0.4 | 0.38 | 6,7 | 26.0 | | | | |
| 8.5 | | | | | TOTAL | 524 | | | |
| 9.0 | | | | | | | | | |
| 9.5 | | | | | | | | | |
| 10.0 | | | | | | | | | |
| 10.5 | | | | | | | | | |
| 11.0 | | | | | | | | | |
| 11.5 | | | | | | | | | |
| 12.0 | | | | | | | | | |
| 12.5 | | | | | | | | | |
| 13.0 | | | | | | | | | |
| 13.5 | | | | | | | | | |
| 14.0 | | | | | | | | | |
| 14.5 | | | | | | | | | |
| 15.0 | | | | | | | | | |
| 15.5 | | | | | | | | | |
| 16.0 | | | | | | | | | |
| 16.5 | | | | | | | | | |
| 17.0 | | | | | | | | | |
| 17.5 | | | | | | | | | |
| 18.0 | | | | | | | | | |
| 18.5 | | | | | | | | | |

| | | | | | |
|---|---|---|---|---|---|
| ELECTROFISHING CATCH | 159.2/h | GILL NET CATCH | 0.9/lift | TRAP NET CATCH | 79.5/lift |

| NUMBER, PERCENTAGE, WEIGHT, AND AGE OF YELLOW BASS | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| TOTAL LENGTH (inches) | NUMBER COLLECTED | PERCENT OF FISH COLLECTED | AVERAGE WEIGHT (pounds) | AGE OF FISH | TOTAL LENGTH (inches) | NUMBER COLLECTED | PERCENT OF FISH COLLECTED | AVERAGE WEIGHT (pounds) | AGE OF FISH |
| 1.0 | | | | | 19.0 | | | | |
| 1.5 | | | | | 19.5 | | | | |
| 2.0 | | | | | 20.0 | | | | |
| 2.5 | | | | | 20.5 | | | | |
| 3.0 | | | | | 21.0 | | | | |
| 3.5 | | | | | 21.5 | | | | |
| 4.0 | | | | | 22.0 | | | | |
| 4.5 | 12 | 3.9 | 0.03 | not aged | 22.5 | | | | |
| 5.0 | 29 | 9.4 | 0.06 | | 23.0 | | | | |
| 5.5 | 65 | 21.1 | 0.07 | | 23.5 | | | | |
| 6.0 | 66 | 21.4 | 0.10 | | 24.0 | | | | |
| 6.5 | 99 | 32.1 | 0.14 | | 24.5 | | | | |
| 7.0 | 36 | 11.7 | 0.16 | | 25.0 | | | | |
| 7.5 | 1 | 0.3 | 0.19 | | 25.5 | | | | |
| 8.0 | | | | | 26.0 | | | | |
| 8.5 | | | | | TOTAL | 308 | | | |
| 9.0 | | | | | | | | | |
| 9.5 | | | | | | | | | |
| 10.0 | | | | | | | | | |
| 10.5 | | | | | | | | | |
| 11.0 | | | | | | | | | |
| 11.5 | | | | | | | | | |
| 12.0 | | | | | | | | | |
| 12.5 | | | | | | | | | |
| 13.0 | | | | | | | | | |
| 13.5 | | | | | | | | | |
| 14.0 | | | | | | | | | |
| 14.5 | | | | | | | | | |
| 15.0 | | | | | | | | | |
| 15.5 | | | | | | | | | |
| 16.0 | | | | | | | | | |
| 16.5 | | | | | | | | | |
| 17.0 | | | | | | | | | |
| 17.5 | | | | | | | | | |
| 18.0 | | | | | | | | | |
| 18.5 | | | | | | | | | |

| | | | | | |
|---|---|---|---|---|---|
| ELECTROFISHING CATCH | 18.4/h | GILL NET CATCH | 35.6/lift | TRAP NET CATCH | 1.8/lift |

| NUMBER, PERCENTAGE, WEIGHT, AND AGE OF GIZZARD SHAD | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| TOTAL LENGTH (inches) | NUMBER COLLECTED | PERCENT OF FISH COLLECTED | AVERAGE WEIGHT (pounds) | AGE OF FISH | TOTAL LENGTH (inches) | NUMBER COLLECTED | PERCENT OF FISH COLLECTED | AVERAGE WEIGHT (pounds) | AGE OF FISH |
| 1.0 | 1 | 0.5 | <0.01 | not aged | 19.0 | | | | |
| 1.5 | | | | | 19.5 | | | | |
| 2.0 | | | | | 20.0 | | | | |
| 2.5 | | | | | 20.5 | | | | |
| 3.0 | | | | | 21.0 | | | | |
| 3.5 | | | | | 21.5 | | | | |
| 4.0 | | | | | 22.0 | | | | |
| 4.5 | | | | | 22.5 | | | | |
| 5.0 | | | | | 23.0 | | | | |
| 5.5 | | | | | 23.5 | | | | |
| 6.0 | 5 | 2.3 | 0.07 | | 24.0 | | | | |
| 6.5 | 11 | 5.0 | 0.09 | | 24.5 | | | | |
| 7.0 | 2 | 0.9 | 0.11 | | 25.0 | | | | |
| 7.5 | 1 | 0.5 | 0.14 | | 25.5 | | | | |
| 8.0 | 3 | 1.4 | 0.17 | | 26.0 | | | | |
| 8.5 | 19 | 8.7 | 0.21 | | TOTAL | 218 | | | |
| 9.0 | 54 | 24.8 | 0.24 | | | | | | |
| 9.5 | 58 | 26.6 | 0.29 | | | | | | |
| 10.0 | 37 | 17.0 | 0.34 | | | | | | |
| 10.5 | 9 | 4.1 | 0.39 | | | | | | |
| 11.0 | 13 | 6.0 | 0.45 | | | | | | |
| 11.5 | 1 | 0.5 | 0.52 | | | | | | |
| 12.0 | 2 | 0.9 | 0.58 | | | | | | |
| 12.5 | 1 | 0.5 | 0.69 | | | | | | |
| 13.0 | | | | | | | | | |
| 13.5 | | | | | | | | | |
| 14.0 | 1 | 0.5 | 0.97 | | | | | | |
| 14.5 | | | | | | | | | |
| 15.0 | | | | | | | | | |
| 15.5 | | | | | | | | | |
| 16.0 | | | | | | | | | |
| 16.5 | | | | | | | | | |
| 17.0 | | | | | | | | | |
| 17.5 | | | | | | | | | |
| 18.0 | | | | | | | | | |
| 18.5 | | | | | | | | | |

| | | | | | |
|---|---|---|---|---|---|
| ELECTROFISHING CATCH | 74.4/h | GILL NET CATCH | 15.6/lift | TRAP NET CATCH | 0/lift |

| NUMBER, PERCENTAGE, WEIGHT, AND AGE OF BROWN BULLHEAD | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| TOTAL LENGTH (inches) | NUMBER COLLECTED | PERCENT OF FISH COLLECTED | AVERAGE WEIGHT (pounds) | AGE OF FISH | TOTAL LENGTH (inches) | NUMBER COLLECTED | PERCENT OF FISH COLLECTED | AVERAGE WEIGHT (pounds) | AGE OF FISH |
| 1.0 | | | | | 19.0 | | | | |
| 1.5 | | | | | 19.5 | | | | |
| 2.0 | | | | | 20.0 | | | | |
| 2.5 | | | | | 20.5 | | | | |
| 3.0 | | | | | 21.0 | | | | |
| 3.5 | | | | | 21.5 | | | | |
| 4.0 | | | | | 22.0 | | | | |
| 4.5 | | | | | 22.5 | | | | |
| 5.0 | 1 | 0.7 | 0.08 | not aged | 23.0 | | | | |
| 5.5 | | | | | 23.5 | | | | |
| 6.0 | | | | | 24.0 | | | | |
| 6.5 | | | | | 24.5 | | | | |
| 7.0 | 1 | 0.7 | 0.16 | | 25.0 | | | | |
| 7.5 | 6 | 3.9 | 0.19 | | 25.5 | | | | |
| 8.0 | 26 | 17.0 | 0.25 | | 26.0 | | | | |
| 8.5 | 48 | 31.4 | 0.26 | | TOTAL | 153 | | | |
| 9.0 | 45 | 29.4 | 0.32 | | | | | | |
| 9.5 | 18 | 11.8 | 0.37 | | | | | | |
| 10.0 | 7 | 4.6 | 0.47 | | | | | | |
| 10.5 | 1 | 0.7 | 0.55 | | | | | | |
| 11.0 | | | | | | | | | |
| 11.5 | | | | | | | | | |
| 12.0 | | | | | | | | | |
| 12.5 | | | | | | | | | |
| 13.0 | | | | | | | | | |
| 13.5 | | | | | | | | | |
| 14.0 | | | | | | | | | |
| 14.5 | | | | | | | | | |
| 15.0 | | | | | | | | | |
| 15.5 | | | | | | | | | |
| 16.0 | | | | | | | | | |
| 16.5 | | | | | | | | | |
| 17.0 | | | | | | | | | |
| 17.5 | | | | | | | | | |
| 18.0 | | | | | | | | | |
| 18.5 | | | | | | | | | |

| | | | | | |
|---|---|---|---|---|---|
| ELECTROFISHING CATCH | 45.6/h | GILL NET CATCH | 8.3/lift | TRAP NET CATCH | 7.5/lift |

| NUMBER, PERCENTAGE, WEIGHT, AND AGE OF WHITE CRAPPIE | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| TOTAL LENGTH (inches) | NUMBER COLLECTED | PERCENT OF FISH COLLECTED | AVERAGE WEIGHT (pounds) | AGE OF FISH | TOTAL LENGTH (inches) | NUMBER COLLECTED | PERCENT OF FISH COLLECTED | AVERAGE WEIGHT (pounds) | AGE OF FISH |
| 1.0 | | | | | 19.0 | | | | |
| 1.5 | | | | | 19.5 | | | | |
| 2.0 | | | | | 20.0 | | | | |
| 2.5 | | | | | 20.5 | | | | |
| 3.0 | | | | | 21.0 | | | | |
| 3.5 | | | | | 21.5 | | | | |
| 4.0 | | | | | 22.0 | | | | |
| 4.5 | | | | | 22.5 | | | | |
| 5.0 | 4 | 4.1 | 0.05 | 1 | 23.0 | | | | |
| 5.5 | 5 | 5.2 | 0.07 | 1,2 | 23.5 | | | | |
| 6.0 | 13 | 13.4 | 0.10 | 2 | 24.0 | | | | |
| 6.5 | 36 | 37.1 | 0.12 | 2,3 | 24.5 | | | | |
| 7.0 | 30 | 30.9 | 0.16 | 2,3,4 | 25.0 | | | | |
| 7.5 | 6 | 6.2 | 0.19 | 2,3,5 | 25.5 | | | | |
| 8.0 | 2 | 2.1 | 0.22 | 3,4 | 26.0 | | | | |
| 8.5 | 1 | 1.0 | 0.27 | 3 | TOTAL | 97 | | | |
| 9.0 | | | | | | | | | |
| 9.5 | | | | | | | | | |
| 10.0 | | | | | | | | | |
| 10.5 | | | | | | | | | |
| 11.0 | | | | | | | | | |
| 11.5 | | | | | | | | | |
| 12.0 | | | | | | | | | |
| 12.5 | | | | | | | | | |
| 13.0 | | | | | | | | | |
| 13.5 | | | | | | | | | |
| 14.0 | | | | | | | | | |
| 14.5 | | | | | | | | | |
| 15.0 | | | | | | | | | |
| 15.5 | | | | | | | | | |
| 16.0 | | | | | | | | | |
| 16.5 | | | | | | | | | |
| 17.0 | | | | | | | | | |
| 17.5 | | | | | | | | | |
| 18.0 | | | | | | | | | |
| 18.5 | | | | | | | | | |

| | | | | | |
|---|---|---|---|---|---|
| ELECTROFISHING CATCH | 14.4/h | GILL NET CATCH | 1.6/lift | TRAP NET CATCH | 16.5/lift |

| NUMBER, PERCENTAGE, WEIGHT, AND AGE OF BLACK CRAPPIE | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| TOTAL LENGTH (inches) | NUMBER COLLECTED | PERCENT OF FISH COLLECTED | AVERAGE WEIGHT (pounds) | AGE OF FISH | TOTAL LENGTH (inches) | NUMBER COLLECTED | PERCENT OF FISH COLLECTED | AVERAGE WEIGHT (pounds) | AGE OF FISH |
| 1.0 | | | | | 19.0 | | | | |
| 1.5 | | | | | 19.5 | | | | |
| 2.0 | | | | | 20.0 | | | | |
| 2.5 | | | | | 20.5 | | | | |
| 3.0 | | | | | 21.0 | | | | |
| 3.5 | | | | | 21.5 | | | | |
| 4.0 | | | | | 22.0 | | | | |
| 4.5 | | | | | 22.5 | | | | |
| 5.0 | | | | | 23.0 | | | | |
| 5.5 | 2 | 3.6 | 0.08 | 1,3 | 23.5 | | | | |
| 6.0 | 1 | 1.8 | 0.11 | 2 | 24.0 | | | | |
| 6.5 | 2 | 3.6 | 0.14 | 2,3 | 24.5 | | | | |
| 7.0 | 3 | 5.4 | 0.18 | 3,4 | 25.0 | | | | |
| 7.5 | 25 | 44.6 | 0.22 | 3,4,5 | 25.5 | | | | |
| 8.0 | 22 | 39.3 | 0.26 | 3,4 | 26.0 | | | | |
| 8.5 | 1 | 1.8 | 0.32 | 5 | TOTAL | 56 | | | |
| 9.0 | | | | | | | | | |
| 9.5 | | | | | | | | | |
| 10.0 | | | | | | | | | |
| 10.5 | | | | | | | | | |
| 11.0 | | | | | | | | | |
| 11.5 | | | | | | | | | |
| 12.0 | | | | | | | | | |
| 12.5 | | | | | | | | | |
| 13.0 | | | | | | | | | |
| 13.5 | | | | | | | | | |
| 14.0 | | | | | | | | | |
| 14.5 | | | | | | | | | |
| 15.0 | | | | | | | | | |
| 15.5 | | | | | | | | | |
| 16.0 | | | | | | | | | |
| 16.5 | | | | | | | | | |
| 17.0 | | | | | | | | | |
| 17.5 | | | | | | | | | |
| 18.0 | | | | | | | | | |
| 18.5 | | | | | | | | | |

| ELECTROFISHING CATCH | 2.4/h | GILL NET CATCH | 5.8/lift | TRAP NET CATCH | 1.8/lift |
|---|---|---|---|---|---|

| NUMBER, PERCENTAGE, WEIGHT, AND AGE OF CHANNEL CATFISH | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| TOTAL LENGTH (inches) | NUMBER COLLECTED | PERCENT OF FISH COLLECTED | AVERAGE WEIGHT (pounds) | AGE OF FISH | TOTAL LENGTH (inches) | NUMBER COLLECTED | PERCENT OF FISH COLLECTED | AVERAGE WEIGHT (pounds) | AGE OF FISH |
| 1.0 | | | | | 19.0 | | | | |
| 1.5 | | | | | 19.5 | | | | |
| 2.0 | | | | | 20.0 | | | | |
| 2.5 | | | | | 20.5 | | | | |
| 3.0 | | | | | 21.0 | | | | |
| 3.5 | | | | | 21.5 | | | | |
| 4.0 | | | | | 22.0 | 1 | 5.6 | 3.98 | |
| 4.5 | | | | | 22.5 | | | | |
| 5.0 | | | | | 23.0 | | | | |
| 5.5 | | | | | 23.5 | | | | |
| 6.0 | | | | | 24.0 | | | | |
| 6.5 | | | | | 24.5 | | | | |
| 7.0 | | | | | 25.0 | 1 | 5.6 | 6.58 | |
| 7.5 | | | | | 25.5 | | | | |
| 8.0 | | | | | 26.0 | | | | |
| 8.5 | | | | | TOTAL | 18 | | | |
| 9.0 | | | | | | | | | |
| 9.5 | | | | | | | | | |
| 10.0 | | | | | | | | | |
| 10.5 | | | | | | | | | |
| 11.0 | | | | | | | | | |
| 11.5 | | | | | | | | | |
| 12.0 | | | | | | | | | |
| 12.5 | 4 | 22.2 | 0.56 | not aged | | | | | |
| 13.0 | 5 | 27.8 | 0.67 | | | | | | |
| 13.5 | 2 | 11.1 | 0.73 | | | | | | |
| 14.0 | 1 | 5.6 | 0.83 | | | | | | |
| 14.5 | | | | | | | | | |
| 15.0 | | | | | | | | | |
| 15.5 | 1 | 5.6 | 1.17 | | | | | | |
| 16.0 | 1 | 5.6 | 1.33 | | | | | | |
| 16.5 | | | | | | | | | |
| 17.0 | | | | | | | | | |
| 17.5 | 1 | 5.6 | 1.81 | | | | | | |
| 18.0 | 1 | 5.6 | 2.02 | | | | | | |
| 18.5 | | | | | | | | | |

| | | | | | |
|---|---|---|---|---|---|
| ELECTROFISHING CATCH | 0.8/h | GILL NET CATCH | 2.1/lift | TRAP NET CATCH | 0/lift |

| NUMBER, PERCENTAGE, WEIGHT, AND AGE OF LARGEMOUTH BASS | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| TOTAL LENGTH (inches) | NUMBER COLLECTED | PERCENT OF FISH COLLECTED | AVERAGE WEIGHT (pounds) | AGE OF FISH | TOTAL LENGTH (inches) | NUMBER COLLECTED | PERCENT OF FISH COLLECTED | AVERAGE WEIGHT (pounds) | AGE OF FISH |
| 1.0 | 1 | 5.9 | <0.01 | 0 | 19.0 | 1 | 5.9 | 3.82 | not aged |
| 1.5 | | | | | 19.5 | | | | |
| 2.0 | | | | | 20.0 | | | | |
| 2.5 | | | | | 20.5 | | | | |
| 3.0 | | | | | 21.0 | | | | |
| 3.5 | | | | | 21.5 | | | | |
| 4.0 | 1 | 5.9 | 0.03 | 1 | 22.0 | | | | |
| 4.5 | | | | | 22.5 | | | | |
| 5.0 | | | | | 23.0 | | | | |
| 5.5 | | | | | 23.5 | | | | |
| 6.0 | | | | | 24.0 | | | | |
| 6.5 | | | | | 24.5 | | | | |
| 7.0 | | | | | 25.0 | | | | |
| 7.5 | | | | | 25.5 | | | | |
| 8.0 | 1 | 5.9 | 0.23 | 2 | 26.0 | | | | |
| 8.5 | 1 | 5.9 | 0.28 | 3 | TOTAL | 17 | | | |
| 9.0 | 1 | 5.9 | 0.33 | 2 | | | | | |
| 9.5 | 1 | 5.9 | 0.40 | 3 | | | | | |
| 10.0 | 3 | 17.6 | 0.46 | 3 | | | | | |
| 10.5 | | | | | | | | | |
| 11.0 | 1 | 5.9 | 0.63 | 3 | | | | | |
| 11.5 | | | | | | | | | |
| 12.0 | | | | | | | | | |
| 12.5 | | | | | | | | | |
| 13.0 | | | | | | | | | |
| 13.5 | 1 | 5.9 | 1.20 | 4 | | | | | |
| 14.0 | | | | | | | | | |
| 14.5 | | | | | | | | | |
| 15.0 | | | | | | | | | |
| 15.5 | | | | | | | | | |
| 16.0 | 1 | 5.9 | 2.15 | not aged | | | | | |
| 16.5 | | | | | | | | | |
| 17.0 | 1 | 5.9 | 2.62 | not aged | | | | | |
| 17.5 | 2 | 11.8 | 2.84 | not aged | | | | | |
| 18.0 | 1 | 5.9 | 3.18 | not aged | | | | | |
| 18.5 | | | | | | | | | |

| ELECTROFISHING CATCH | 11.2/h | GILL NET CATCH | 0.4/lift | TRAP NET CATCH | 0/lift |
|---|---|---|---|---|---|

| Lake: Glenn Flint Lake | | | Species: Bluegill (General Survey 2013) | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Length | Total | Sub- | Age | | | | | | |
| group (in) | number | sample | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 1.5 | 1 | 1 | | | | | | | |
| 2.0 | | | | | | | | | |
| 2.5 | 5 | 5 | 5 | | | | | | |
| 3.0 | 19 | 5 | 19 | | | | | | |
| 3.5 | 28 | 5 | 28 | | | | | | |
| 4.0 | 10 | 5 | 2 | 6 | 2 | | | | |
| 4.5 | 13 | 4 | | 3 | 10 | | | | |
| 5.0 | 54 | 5 | | | 54 | | | | |
| 5.5 | 158 | 5 | | | 158 | | | | |
| 6.0 | 188 | 4 | | | 141 | 47 | | | |
| 6.5 | 37 | 5 | | | | 7 | 30 | | |
| 7.0 | 8 | 5 | | | | 2 | 5 | 2 | |
| 7.5 | 1 | 0 | | | | | | | |
| 8.0 | 2 | 2 | | | | | | 1 | 1 |
| Total | 524 | 51 | 55 | 9 | 365 | 56 | 35 | 3 | 1 |

| Bluegill (General Survey 2013) | | | | | Lower | Upper |
|---|---|---|---|---|---|---|
| Age | Number | Mean TL | Var | SE | 95%CI | 95%CI |
| 1 | 55 | 3.5 | 0.13 | 0.05 | 3.4 | 3.6 |
| 2 | 9 | 4.4 | 0.06 | 0.08 | 4.3 | 4.6 |
| 3 | 365 | 5.8 | 0.17 | 0.02 | 5.8 | 5.9 |
| 4 | 56 | 6.3 | 0.05 | 0.03 | 6.3 | 6.4 |
| 5 | 35 | 6.8 | 0.03 | 0.03 | 6.8 | 6.9 |
| 6 | 3 | 7.6 | 0.38 | 0.38 | 6.9 | 8.4 |
| 7 | 1 | 8.3 | . | . | . | . |

| Lake: Glenn Flint Lake | | | Species: White Crappie (General Survey 2013) | | | | |
|---|---|---|---|---|---|---|---|
| Length | Total | Sub- | | | Age | | |
| group (in) | number | sample | 1 | 2 | 3 | 4 | 5 |
| 5.0 | 4 | 4 | 4 | | | | |
| 5.5 | 5 | 5 | 4 | 1 | | | |
| 6.0 | 13 | 4 | | 13 | | | |
| 6.5 | 36 | 5 | | 29 | 7 | | |
| 7.0 | 30 | 5 | | 6 | 18 | 6 | |
| 7.5 | 6 | 5 | | 1 | 4 | | 1 |
| 8.0 | 2 | 2 | | | 1 | 1 | |
| 8.5 | 1 | 1 | | | 1 | | |
| Total | 97 | 31 | 8 | 50 | 31 | 7 | 1 |

White Crappie (General Survey 2013)

| Age | Number | Mean TL | Var | SE | Lower 95%CI | Upper 95%CI |
|---|---|---|---|---|---|---|
| 1 | 8 | 5.5 | 0.07 | 0.09 | 5.3 | 5.7 |
| 2 | 50 | 6.7 | 0.14 | 0.05 | 6.6 | 6.8 |
| 3 | 31 | 7.3 | 0.20 | 0.08 | 7.1 | 7.4 |
| 4 | 7 | 7.4 | 0.14 | 0.14 | 7.1 | 7.7 |
| 5 | 1 | 7.8 | . | . | . | . |

| Lake: Glenn Flint Lake | | | Species: Black Crappie (General Survey 2013) | | | | |
|---|---|---|---|---|---|---|---|
| Length | Total | Sub- | | | Age | | |
| group (in) | number | sample | 1 | 2 | 3 | 4 | 5 |
| 5.5 | 2 | 2 | 1 | | 1 | | |
| 6.0 | 1 | 1 | | 1 | | | |
| 6.5 | 2 | 2 | | 1 | 1 | | |
| 7.0 | 3 | 3 | | | 2 | 1 | |
| 7.5 | 25 | 6 | | | 8 | 13 | 4 |
| 8.0 | 22 | 5 | | | 13 | 9 | |
| 8.5 | 1 | 1 | | | | | 1 |
| Total | 56 | 20 | 1 | 2 | 26 | 22 | 5 |

| Black Crappie (General Survey 2013) | | | | | Lower | Upper |
|---|---|---|---|---|---|---|
| Age | Number | Mean TL | Var | SE | 95%CI | 95%CI |
| 1 | 1 | 5.8 | . | . | . | . |
| 2 | 2 | 6.5 | 0.13 | 0.25 | 6.0 | 7.0 |
| 3 | 26 | 7.9 | 0.35 | 0.12 | 7.6 | 8.1 |
| 4 | 22 | 7.9 | 0.08 | 0.06 | 7.8 | 8.0 |
| 5 | 5 | 7.9 | 0.19 | 0.19 | 7.6 | 8.3 |

| Lake: Glenn Flint Lake | | | Species: Largemouth Bass (General Survey 2013) | | | | |
|---|---|---|---|---|---|---|---|
| Length | Total | Sub- | Age | | | | |
| group (in) | number | sample | 1 | 2 | 3 | 4 | 5 |
| 1.0 | 1 | | | | | | |
| 1.5 | | | | | | | |
| 2.0 | | | | | | | |
| 2.5 | | | | | | | |
| 3.0 | | | | | | | |
| 3.5 | | | | | | | |
| 4.0 | 1 | 1 | 1 | | | | |
| 4.5 | | | | | | | |
| 5.0 | | | | | | | |
| 5.5 | | | | | | | |
| 6.0 | | | | | | | |
| 6.5 | | | | | | | |
| 7.0 | | | | | | | |
| 7.5 | | | | | | | |
| 8.0 | 1 | 1 | | 1 | | | |
| 8.5 | 1 | 1 | | | 1 | | |
| 9.0 | 1 | 1 | | 1 | | | |
| 9.5 | 1 | 1 | | | 1 | | |
| 10.0 | 3 | 3 | | | 3 | | |
| 10.5 | | | | | | | |
| 11.0 | 1 | 1 | | | 1 | | |
| 11.5 | | | | | | | |
| 12.0 | | | | | | | |
| 12.5 | | | | | | | |
| 13.0 | | | | | | | |
| 13.5 | 1 | 1 | | | | 1 | |
| 14.0 | | | | | | | |
| 14.5 | | | | | | | |
| 15.0 | | | | | | | |
| 15.5 | | | | | | | |
| 16.0 | 1 | 0 | | | | | |
| 16.5 | | | | | | | |
| 17.0 | 1 | 0 | | | | | |
| 17.5 | 2 | 0 | | | | | |
| 18.0 | 1 | 0 | | | | | |
| 18.5 | | | | | | | |
| 19.0 | 1 | 0 | | | | | |
| Total | 17 | 10 | 1 | 2 | 6 | 1 | 0 |

| Largemouth Bass (General Survey 2013) | | | | | Lower | Upper |
|---|---|---|---|---|---|---|
| Age | Number | Mean TL | Var | SE | 95%CI | 95%CI |
| 1 | 1 | 4.3 | . | . | . | . |
| 2 | 2 | 8.8 | 0.50 | 0.50 | 7.8 | 9.8 |
| 3 | 6 | 10.1 | 0.67 | 0.33 | 9.4 | 10.8 |
| 4 | 1 | 13.8 | . | . | . | . |