



Executive Summary

2019 Creel Survey Results

- No creel survey was conducted in 2020 due to concerns associated with the spread of coronavirus,
- Mean targeted Walleye catch rate in June and July 2019 was 0.72/hr, more than three times the 0.25/hr rate considered an excellent fishery in New York State. Targeted catch rates in June and July for Walleye in 2019 were the highest seen since regular summer creel surveys were initiated in 2012. Open water harvest of Walleye in 2019 was 58,000 fish. Both Walleye catch rate and open water harvest represent returns to levels that were typical before Round Goby became common in 2016. Declines in both Walleye catch rate and harvest were observed in 2016 and 2017 after Round Goby became common.
- Oneida Lake's second most popular group of sport fish are the black bass, including smallmouth and largemouth bass. The June and July creel survey is not predictive of full season catch rates, but the summer creel does provide an index of trends in the quality of black bass fishing. Targeted catch rate of black bass was 0.54/hr in June 2019 and 0.38/hr in July. Black bass catch rates were well within the range observed in previous years of the survey and fall within the middle third of catch rates seen across the State.

2020 Species Reports

Walleye

- A 2019 mark-recapture estimate of the adult Walleye population resulted in an estimate of one million fish, the first time the population has reached that size since 1986. A large 2016 year class of Walleye recruited into the fishery in 2020 and led to an estimated increase in the adult walleye population to 1.2 million fish. This is the largest Walleye population estimated in our 64-year data series.
- Following nutrient reductions and establishment of invasive mussels, mortality of pelagic (larval and early juvenile stage) Walleye increased from an average of just over 90% to 99%. In recent years, survival has improved during years when White Perch numbers were low, allowing growth of the adult Walleye population.
- Concurrent with increases in the Walleye population is a decline in condition, estimated using relative weight of adults captured in fall. Relative weight of Walleye has decreased from 98 in 2016 to 87 in 2020 (100 is a fish that weighs the "average" for its length through its range), suggesting that available forage may not be sufficient to support the current population.



Yellow Perch

- The adult Yellow Perch population has also increased in the last three years. The adult population rose from 1.9 million fish in 2019 to 2.7 million in 2020. These increases appear, in part, to result from decreases in the White Perch population, contributing to improved larval survival and year classes at levels above what was observed through much of the 2000s.
- Given that 50% of Yellow Perch harvest is during the ice fishing season, and that the 2019-2020 and 2020-2021 ice seasons were relatively short, we expect no large drops in the Yellow Perch population over the next year.
- Young-of-year Yellow Perch are the primary component of the adult Walleye diet in spring and early summer before the late summer/fall hatch of Gizzard Shad become available as forage. All evidence suggests that the adult Walleye population has now exceeded a level that can be sustainably supported by available summer forage. Under these conditions, recruitment of Yellow Perch is likely to suffer in the near term.

Largemouth Bass & Smallmouth Bass

- Historically, Oneida Lake has been classified as eutrophic, but nutrient input reductions have resulted in a shift to a more mesotrophic state during recent decades. Zebra mussels were first detected in Oneida Lake in 1991, followed by quagga mussels in 2005, resulting in increases in water clarity and increases in nearshore aquatic macrophytes over the period 1990 to 2020. Oneida Lake is also exhibiting warming, with mean summer water temperature increasing 0.1 °F per year since the 1975. Warmer summers have been shown to enhance black bass year class size at northern latitudes like Oneida Lake.
- The Smallmouth and Largemouth Bass populations exhibited increases during the 1990s (particularly as evidenced by gill net catches of Smallmouth Bass), suggesting that current lake conditions are more favorable for black bass, with numbers as much as three times higher than before the lake cleared and nearshore productivity increased.
- Black bass have been censused via spring electrofishing two of every three years since 2011. 2020 catch rates were at the lower end of the range observed over that period, but still suggest a population well above abundance levels prior to nutrient reductions and mussel introductions. Catch rates of adult black bass in Oneida Lake fall in the middle of the range for black bass populations elsewhere in the State,
- During the falls of 2017 and 2018 a portion of the Smallmouth Bass population was observed with visible lesions which were also associated with detection of Largemouth Bass virus. Large scale mortality was not observed, but the timing of the appearance of the condition was roughly concurrent with a drop in electrofishing catch rates after high catches through 2017. No diseased adult Smallmouth Bass were observed in 2019 or 2020, but we did observe young-of-year Smallmouth Bass with similar external indicators of disease in 2020. No



signs of disease have been detected in Largemouth Bass, consistent with earlier research that has shown Largemouth Bass virus to be most active at water temperatures as that stress fish, and Largemouth Bass tolerate higher temperatures than Smallmouth Bass.

- It remains to be seen if the virus has run its course with Smallmouth Bass and if, or how quickly, the population recovers from its apparent drop in abundance.

Prey Fish

- Young-of-year and yearling Yellow Perch form the cornerstone of the prey base for Oneida Lake's piscivores. Other important forage species include Emerald Shiner, Round Goby, young-of-year sunfish (in nearshore habitats), and Gizzard Shad (seasonal, late summer into winter prior to an annual winter kill in most seasons).
- In most years, Gizzard Shad dominate the late season diet of Walleye numerically, comprising on average, nearly half of walleye diets. Yellow Perch still represent, on average, a quarter of fish biomass consumed during this season.
- Availability of alternate forage, such as Gizzard Shad, White Perch and Round Goby has modified the historically strong predator-prey linkage between Walleye and Yellow Perch.
- In 2019 and 2020, years when numbers of Gizzard Shad available in fall were anomalously low (numerical percentage of diet fell from 51% to 31%), Yellow Perch increased to approximately 30% of walleye diets both numerically and in terms of biomass (as compared to 23% in years when Gizzard Shad were more available).
- Low survival of young-of-year Gizzard Shad in 2019 and 2020 are further indicators that the adult Walleye population is too large to be sustainably supported by available prey.

Round Goby

- The Round Goby was first confirmed in Oneida Lake from stomachs of winter-caught Yellow Perch in 2013. Numbers in most sampling gears increased through 2016, when an apparent winterkill (anecdotal evidence of rafts of dead Round Goby over the winter was received) reduced numbers. Numbers increased slowly through 2018.
- A video survey representing all lake bottom habitats was instituted in 2018. Densities of Round Goby density was estimated at 0.6/m² in 2018, but increased to 3.1/m² in 2019 and remained stable at that level in 2020.
- Round Goby have potential to exert a large influence on the Oneida Lake ecosystem. There is already evidence that they will out compete for space and resources similar species such as Johnny Darter; reduce abundance of benthic invertebrates, thereby competing with multiple species; reduce mussel density and biomass, thereby reversing clearing of the water column and reducing benthic productivity; and provide additional forage for the lake's predator population.



- All predators use Round Goby as forage to some extent. However, summer diet data from gill net samples show no species uses them at a rate of more than 20% of total diet on a numerical basis. They appear to be most important to species that use them at small sizes (Yellow Perch and White Perch) or cooccur with them in nearshore areas (Smallmouth Bass and Chain Pickerel).

Lake Sturgeon

- Since 1995, just under 12,000 juvenile Lake Sturgeon have been stocked into Oneida Lake as part of an effort to establish a self-sustaining population, many in a single large stocking of 5,000 fish in 1995. Just over 8,100 fish were stocked between 1995 and 2004. No additional stocking took place until 2014 due to VHSV in the source waters, after which 500 fish have been stocked annually (1000 in one year) to improve genetic diversity of the population.
- Growth rates of Lake Sturgeon exceed or rival those from any other system with available data (the largest fish caught by Cornell so far weighed just under 160 pounds), and natural reproduction has been documented in six of seven years since 2008 (none from 2013).
- Sturgeon consume primarily benthic invertebrates until they reach about 800 mm and mussels then become the dominant diet item. While unverified here, it is reasonable to speculate that Oneida Lake Sturgeon receive an important annual diet supplement when Gizzard Shad winterkill, as they do in Lake Winnebago, where shad dynamics are similar and growth rates are high. We have also observed small Round Goby in diets of some Lake Sturgeon.

Other Species

- Oneida Lake hosts one of, if not the, most diverse fish communities of any water in New York State. Of the 167 species documented in the state as of 2015, 85 have been reported in Oneida Lake. Of these, 73 are considered native and 12 introduced. The community represents 22 different families of fish and 52 genera.
- Species arguably underutilized as sport fish resources include White Perch and Chain Pickerel, both common to abundant but little appreciated locally as sport fish.

Invasive Species

- Oneida Lake has been host to invasive species since immigrants first came to the area, some introduced intentionally as part of early management efforts such as Brown Trout, Rainbow Trout, and Common Carp. Arrival of most of the rest was facilitated by the construction of the canal system and the ensuing flow of traffic across watersheds.
- At least 12 nonnative species of fish, six molluscs, five invertebrates, and seven plants have been documented in Oneida Lake. Most recently, and potentially problematic is the spiny water flea in 2019.



- Most nonnative species do not have measurable impacts on their new ecosystems, but some do have marked impacts on the dynamics of the systems they are introduced into.
- Zebra mussels were established in Oneida Lake in the early 1990s, with quagga mussels following in the mid-2000s and coming to dominate the mussel community. The biomass of mussels established after initial invasion efficiently filtered phytoplankton, leading to clearer water, macrophyte growth to greater depths and a shift of energy flow from pelagic to benthic pathways. A shift to a more copepod dominated zooplankton community was occurring by the mid-2000s.
- Gizzard Shad likely invaded Oneida Lake from the Great Lakes via the canal in mid-century. A population of adults persists annually that produces a crop of young-of-year shad. The abundant forage provided by young shad likely helps support a larger sport fish population than the lake could otherwise sustain as well as provide a buffer from predation for more desirable species such as Walleye and Yellow Perch. In most years uneaten shad winterkill, preventing overpopulation, something that could change with continued lake warming.
- White Perch likely invaded from the Atlantic coast up the canal system in mid-century. They may be as abundant as Yellow Perch in many years. Their young-of-year provide additional forage for sport fish, but adults can also serve as competitors for benthic invertebrates with popular species such as Yellow Perch. More recently, White Perch have been shown to be effective predators on larval Walleye and Yellow Perch, increasing annual mortality of larvae after mussels cleared the water and reducing abundance of young Walleye and Yellow Perch well below pre-mussel levels.
- Round Goby established in 2014. Their impacts have yet to be fully understood, but could include roles as valuable additional forage, competitor with species with similar lifestyles such as darters, competitor for invertebrate food resources, and consumer of mussels, which could reverse processes associated with the establishment of mussels and associated water clearing.
- The spiny water flea was discovered in Oneida Lake in fall 2019. Mean annual biomass had almost tripled by 2020. This zooplankton is a predator on Daphnia, an efficient grazer of phytoplankton and preferred prey for many small fishes and could further disrupt the plankton community. It can also serve as a plentiful additional forage for planktivores, but digestion of the long tail spine can be problematic for smaller fishes. Their ultimate role in Oneida Lake is yet to be determined.

Lower Trophic Assessment

- The lake is warming significantly, with summer (June-August) water temperatures increasing 0.1 °F per year, and the period of ice cover decreasing six days per decade.



- Oneida Lake was naturally eutrophic (highly productive) even before the area was settled, surrounded by abundant, fertile swampy areas and prone to floods that helped decaying plant matter into the lake. Oneida was also well known for its blue-green algae blooms before modern run off issues arose. The establishment of zebra and quagga mussels, as well as nutrient input reductions resulting from international agreements, has resulted in the lake reaching a more mesotrophic state (moderate nutrient levels). All major indicators suggest a stable mesotrophic limnological state for over a decade. Water clarity (Secchi disc), Chlorophyll-a, Soluble and reactive phosphorus have all been statistically stable (no detectable time trend) since 2007. Similarly, total zooplankton biomass and Daphnia biomass have remained unchanged over the same period, but percent of the zooplankton community represented by Daphnia has dropped significantly.
- It is looking more and more likely that Round Gobies can suppress the mussel density in Oneida Lake. If this is true, limnological conditions could exhibit major changes.