The Oneida Lake Profile

Stuart Crabbe

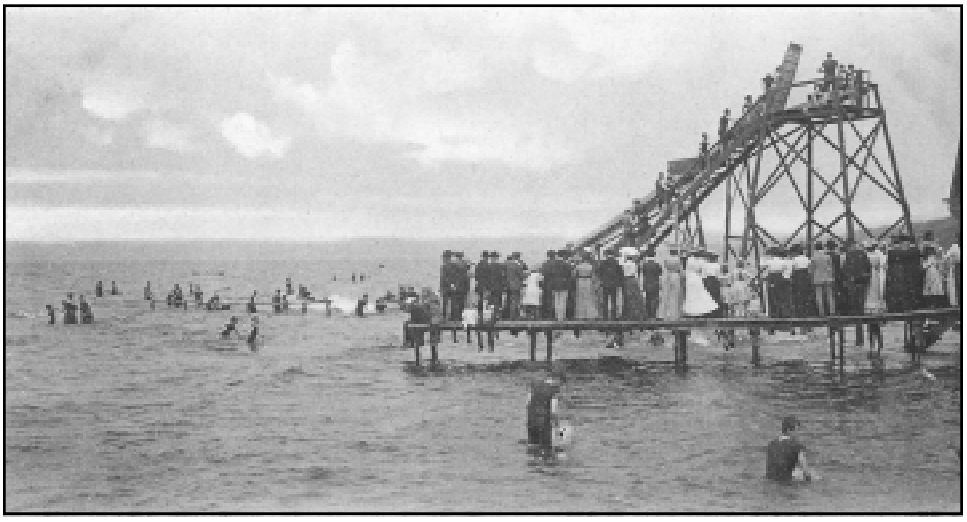
Oneida Lake has been and remains a giver of life to all who intertwine with its rhythms. Oneida is an amazing lake, remarkable for its productivity, its power, and for the passions it stirs among those who love it. Throughout history, the lake has provided nourishment, recreation, transportation, repose, and inestimable income to those who share the bounty of its waves. Yesterday's Oneida Lake folk netted vast schools of fish, smiled with steamboat rides, relaxed in bucolic retreats shaded within lakeside groves, and pastured their cattle amidst fields that gently inclined into the lake's waters. Today's lake people angle in high-tech fishing craft, fly across the surface in powerboats and jet skis, satisfy their taste buds' yearnings in a dizzying array of lakeside restaurants, and nest in an ever-widening spread of suburban subdivisions and renovated cottages.

Great biological and demographic changes engulf Oneida Lake. Fluctuating fish numbers, the proliferation of zebra mussels and other exotics, predation by double-crested cormorants, a drop in phosphorus levels, the advent of global warming, and the rapid development of borderlands have challenged the lake area's policy-makers. While the lake projects a vibrant health, it remains in a state of metamorphosis, its future uncharted.

Scientists from Cornell and Syracuse Universities have investigated the lake's ecology since the early 1900s and their research has amassed a notable reservoir of knowledge and understanding. The *Oneida Lake Profile* reflects these findings and contains general explanations of the lake's biology, history, and contemporary issues. This educational publication, prepared by the Cornell University Biological Field Station and the Oneida Lake Association, is designed to promote an Oneida Lake environmental literacy that will encourage the preservation of one of North America's finest inland waters.

A Brief History

Prior to European exploration, prehistoric Native Americans utilized Oneida Lake's fishery. Artifacts that document their lifestyle have been unearthed at Brewerton, Shackelton Point, and other sites near the lake. Later, the Oneidas and Onondagas, members of the powerful Iroquois confederacy, settled in the region. The Oneidas, who called the lake *Tsioqui* (meaning "white water," a reference to impressive wave action), constructed fishing villages near Oneida Creek's mouth and along Fish Creek, near Sylvan Beach. Their annual Atlantic salmon harvest yielded huge quantities of what was then a common Oneida Lake fish. The Onondagas also valued the lake's fishery and, from camps at the Oneida River outlet and near Chittenango Creek's mouth, they netted and speared eels, salmon, catfish, and pike. Archaeologists have recovered numerous Iroquois artifacts throughout the Oneida Lake region.



The toboggan slide was a popular attraction at Sylvan Beach during the village's heyday in the early twentieth century.

White settlers developed lands surrounding Oneida Lake in the latter eighteenth century. The Scriba Patent, a land company founded by George Scriba in the 1790s, marketed a significant acreage that stretched from Oneida's north shore to Lake Ontario. The Military Tract, an area of government land that embraced the lake's western end, was reserved for veterans of the American Revolution. Parcels not given to former patriots were eventually sold to the general public. The Oneida Lake region was sparsely settled until the early 1800s, when the "Yankee Invasion" of Upstate New York sparked the area's first major development. During this era, which lasted through the 1830s, thousands of New Englanders left their marginal farms, seeking better land. The Oneida Lake locale, especially its fertile south shore, attracted many Yankees.

A Constantia hatchery worker poses with fish propagation equipment around 1915.

The Erie Canal, completed in 1825, bypassed Oneida Lake. However, the lake was linked to the Erie by the Oneida River and through two Oneida Lake canals. The first of these, sometimes called the "Side Cut Canal," was built in the 1830s and connected the Erie with Fish Creek at a point about a half-mile east of Sylvan Beach. Logging, centered in Oneida's north shore communities, and the sand business, based along the lake's east end, brought modest prosperity to this waterway's users. The second Oneida Lake canal joined Upper South Bay with the Erie at Durhamville. Constructed in the 1870s during the heyday of New York State railroading, the canal proved to be a dismal economic failure.

The Erie-Barge Canal, an enlargement of the old Erie, was completed in 1918. Unlike its predecessor, this canal used Oneida Lake as a part of its course. The "Barge Canal," as most people called it, connected Oneida Lake with the Great Lakes and Hudson River, making the lake a significant cog in the state's water transportation network. Hundreds of tugs and barges used the lake during the Erie-Barge's peak years. Brewerton, Cleveland, and Sylvan Beach prospered as canal ports.

Many tourists enjoyed steamboats rides on Oneida Lake in the nineteenth and early twentieth centuries. These steamers were moored at Frenchman's Island.

Lakeside communities grew at different times. Constantia's and Brewerton's earliest settlers arrived in the 1790s. Bridgeport's genesis occurred around 1802 and Lakeport's by 1811. These villages served as commercial centers for the surrounding farm population and as summer retreats. North Bay was popular with sportsmen in the 1850s, while Sylvan Beach's initial growth occurred in the 1870s. The 1880s and 1890s witnessed Sylvan and Verona Beaches' transformation into the "Coney Island of Central New York." Scores of hotels, thousands of vacationers, two amusement parks, and even a boardwalk highlighted summers at "the Beach" during this era. Railroads carried upwards of fifty thousand tourists there on peak weekends.

The glass industry supplemented Cleveland's and Bernhards Bay's nineteenth century agrarian economies, while Jewell and West Monroe benefited from being stations on the Oswego-Midland Railroad (later renamed the "Ontario and Western"). The Syracuse to Watertown Railroad connected Brewerton with the state's population corridor, enabling that village's considerable number of commercial fishermen to export their catches. A trolley line brought Syracuse tourists to Lower South Bay, where grand steamboats like the Sagamore and the Manhattan awaited. Thirty-five licensed steamboats navigated Oneida's waters during this era. Cottage and camp construction altered the lakeshore in the latter 1800s and early 1900s, and accelerated as post-World War I prosperity and the "Golden 20's" embraced the United States.

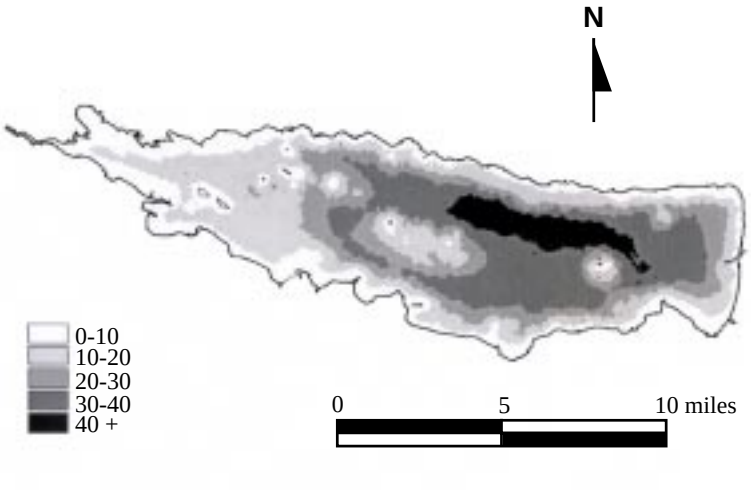
Although slowed by the Great Depression, the development of Oneida Lake's periphery proceeded throughout the twentieth century to the point where, by 2000, few parcels of wild lakeshore remained. Despite this, productive wetlands still thrive near Toad Harbor, the Cicero Swamp, and the Verona Beach State Park. While woodlands lend their greens throughout the north shore vista, the south shore and west end are rapidly suburbanizing. The completion of Route 81 around 1960 made the lake an easy commute for people working in Syracuse. The Town of Cicero is the fastest growing township in Onondaga County today, and similar development spreads throughout Madison and Oswego Counties. The last remaining lake-bordering crop field, a lush meadow west of Lakeport, now sprouts condominiums. Federal and state monies recently financed renovation of Sylvan Beach and Brewerton harbors and these places hum with pleasure craft all summer. The Oneida Lake scene of 2006 presents vivid contrasts with its rustic, bucolic past.

The Lake and Its Watershed

Oneida Lake is a remnant of Lake Iroquois, a large body of water that formed nearly 12,000 years ago as glaciers from the last ice age receded and dammed the St. Lawrence River. Lake Iroquois covered much of central New York, including present day Lake Ontario and Oneida Lake. As temperatures warmed, the St. Lawrence outlet to the ocean opened, and most of the waters of Lake Iroquois drained. Water captured in a glacial depression became today's Oneida Lake.

	1900	2006
Top predator	Walleye, eel and pickerel	Walleye
Number of non-native species	8	18
Watershed population	413,000	886,000
Avg. duration of ice cover	112 days	95 days

Drainage area	1382 sq. mi.	Width (maximum)	5.8 mi.
Surface area	79.8 sq. mi.	Depth	
Length	20.9 mi.	maximum	55 ft.
Length of shoreline	54.7 mi.	average	23 ft.

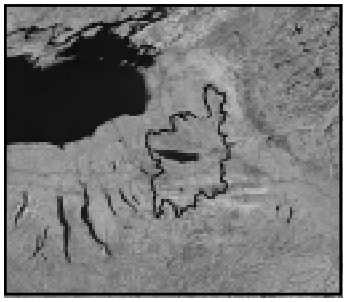


Jeremy T.H. Coleman

A bathymetric (depth) map of Oneida Lake.

The Watershed: The Oneida Lake watershed, the area of land from which water drains into the lake, encompasses over 800,000 acres (Figure 2). Around seventy percent of the water that flows into the lake comes from the Tug Hill uplands to the north. This part of the watershed is heavily forested, and its waters are low in productivity. About eighty percent of the nutrients flow in from the more fertile agricultural lands to the south. Nutrients, phosphorus in particular, are utilized by algae and other plants, which in turn provide energy that radiates throughout the food web.

Soil transport from the watershed to the lake is a natural process. However, excessive erosion is an environmental concern. Agricultural lands and urban areas have a greater potential to deliver both nutrients and soils to the lake than do forested areas. For example Oneida Creek, a southern tributary, contributes waters much richer in sediment than does Fish Creek, which drains lands to the north.



NASA

A satellite view of central New York, showing Oneida Lake and its watershed (black outline).

Water carries sediments, and when excessive loads of sediments are deposited, they can smother organisms on the lake bottom. Heavy sediment loads also contribute to the formation of low oxygen zones and destroy spawning habitat for fish. Sedimentation in Oneida Lake has increased since the 1970s and has been associated with tributary flows, flooding, and shoreline erosion related to low water levels.

Google Maps

Eastern Oneida Lake, showing sediment swirls created by the convergence of Erie-Barge Canal (Fish Creek) waters with murkier waters of Oneida Creek.

Water Levels: Oneida Lake's water levels fluctuated naturally before 1910, the year the Caughdenoy Dam was built. Around this time, the elevation of the lake's water levels varied between 370 and 373 feet (113 - 114 m) above sea level. Water levels increased gradually from October to April and then dropped throughout summer and fall. Planned adjustments of the lake's level did not start until improvements to the Caughdenoy Dam were made in 1951.

Today, the New York State Canal Corporation's Syracuse office is responsible for water level maintenance for navigation. The Canal Corporation's management scheme serves to decrease flood damage within the basin and to lessen property erosion from winter's ice scour. During the summer and fall, lake levels are stabilized for maximum recreational use. The Canal Corporation considers three criteria when making water level decisions for Oneida Lake – minimizing habitat destruction, optimizing the lake's biological productivity, and reducing potential harm to lakeside properties in the open water season. Balancing these standards is the key to successful lake level management.

The Canal Corporation uses minimum and maximum target elevations to maintain water levels during the navigation season (May - November). The minimum desired target elevation increases from 370.30 ft on April 1 to 371.15 ft by June 1. The target level then decreases to 370.60 ft on September 1 and 370.30 ft on December 1. The maximum desired elevation on April 1 is set at 371.00 ft and increases to 371.20 ft by June 1. It remains constant until August 15 and then decreases to 370.70 ft by December 1. The variation between the minimum and maximum targets does not exceed nine inches.

The gates at the Caughdenoy Dam are opened or closed incrementally during the navigation season to achieve targeted water levels. All gates are fully open by December 1 and remain that way throughout the winter and spring. The gates are not closed until at least April 1, depending on lake levels.

CBFS

The Caughdenoy Dam's gates on the Oneida River.

Since the advent of water level management, lake water levels have typically ranged between 368 and 371 feet (112 - 113 m). Peak elevation still occurs in the spring, but averages much less than in the early 1900s. Water levels are maintained at a relatively stable level throughout the navigation season, after which they are allowed to gradually recede when the gates at Caughdenoy are opened.

This managed pattern of water level fluctuation is quite different from what would occur naturally, resulting in several environmental changes. At low water, wetlands can become disconnected from Oneida Lake. Also, recreational opportunities decrease when lowered lake levels handicap marinas, boat launches, and private docks.

Wetlands: Wetlands surround Oneida Lake. Two familiar wetland areas are the Cicero Swamp to the south and the Toad Harbor - Big Bay area in the northwest.

CBFS

The Cicero Swamp, a large wetland south of Oneida Lake.

Wetlands provide habitat for wildlife, serve as sources of groundwater renewal, act as filters for water entering the lake from the watershed, and help prevent and reduce flooding by serving as water storage tanks after excessive precipitation or snowmelt.

Preventing further loss of Oneida Lake's wetlands to development or non-native species introductions is critical to the ecosystem's health and stability. Continued residential and commercial construction has resulted in the loss of wetland areas during recent decades, reducing water storage capacity and increasing flooding risk. During the same time, non-native plants such as purple loosestrife displaced native cattails, making wetlands less suitable habitat for wildlife. Biological control strategies aimed at eradicating purple loosestrife have been successful in the Cicero Swamp, but continuous monitoring is necessary to limit the spread of established non-native species and protect against potential invaders.

Land management, water quality, and water levels have direct effects on Oneida Lake's food web and the lake's ability to sustain a recreational fishery.

The Food Web

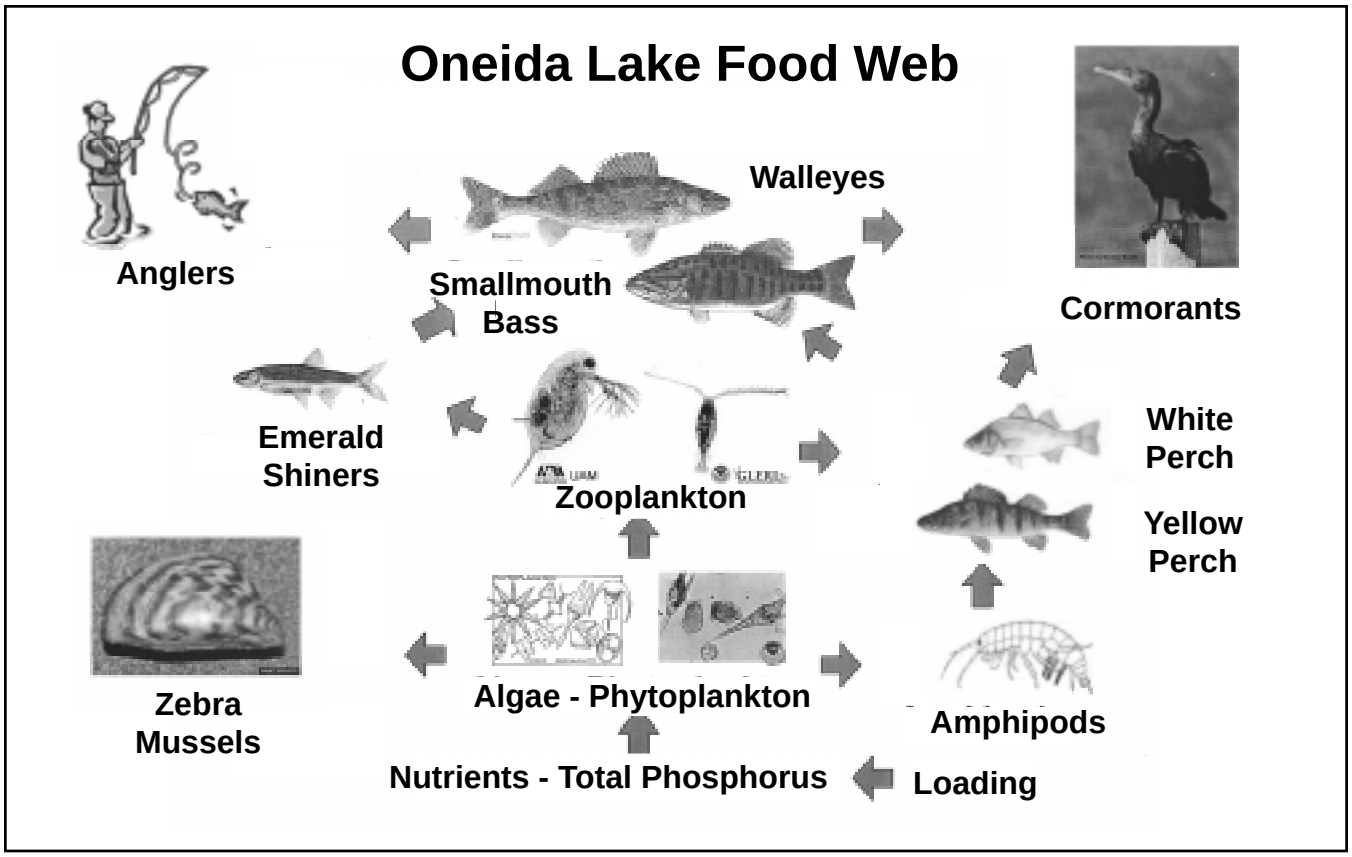
The Oneida Lake food web is a complex network of organisms, each providing an important pathway for moving energy through the system.

Algae (phytoplankton) make up the food web's heart. These tiny plants use sunlight, phosphorus, and other nutrients for growth and reproduction. Algae are consumed by zooplankton (small crustaceans) in the lake's waters, and also by benthic (bottom-dwelling) organisms such as amphipods and zebra mussels. Zooplankton are the primary food source for small fish such as young yellow perch, gizzard shad, and white perch. When these young fish are abundant, they have the potential to consume most of the lake's large-bodied filter-feeding zooplankton like *Daphnia*. This allows algae blooms to occur, thus decreasing water clarity.

Small yellow perch and shad are important prey for yearling and older walleyes. In years when these forage fish are scarce, adult walleyes turn to eating their own young. When other food fish are plentiful, young walleyes are buffered from older walleyes' predation. This results in high survival of young walleyes - what biologists call a strong "year class."

The Oneida Lake food web has been shaped by thousands of years of natural succession and over two hundred years of human disturbance. Activities such as construction of the Erie-Barge Canal, development of the lake's shoreline, and population growth within the watershed have altered the food web by introducing non-native species, destroying habitat, and changing the water quality.

Several examples support this point. Spawning areas for northern pike and pickerel have been drastically reduced through the separation of the lake from nearby wetlands. Extensive shoreline filling for cottage construction, beginning in the 1920s, eliminated acres of aquatic vegetation vital to these game fish. Non-native species such as purple loosestrife and zebra mussels arrived through the canal system. Decreased phosphorus inputs, combined with the filtering of algae by zebra mussels, increased water clarity. These changes have altered the dynamics of Oneida Lake's fishery.



The Oneida Lake food web.

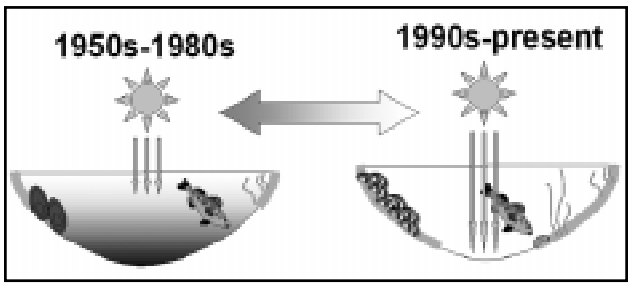
Ecological Change

During the 1950s and 1960s, large quantities of phosphorus entered the lake from the watershed, resulting in bothersome algae blooms during summers. These blooms reduced water clarity and made the lake unsuitable for swimming. Pungent odors drifted from the lake when the algae died and decayed.

In the 1970s, the United States and Canada agreed to reduce phosphorus inputs to the Great Lakes. Because the Oneida Lake watershed is part of the Great Lake's basin, funding became available for sewer system upgrades, new sewer system construction, and the implementation of better management practices on agricultural lands. Phosphorus in detergents was banned in 1973 and, by the mid-1980s, Oneida Lake's phosphorus levels had been reduced by half.

Oneida Lake still experiences summer algae blooms, but they are not as severe or long-lasting as in the past. Large, noxious algae blooms and low oxygen events in deeper waters, both common in the 1950s and 1960s, are rare today. Aquatic plants and animals need phosphorus and the Oneida Lake food web depends on this nutrient. Fish are an integral part of the food web and the fishery has always played a significant role in the lake's ecology and heritage. Consequently, a productive fishery and a healthy Oneida Lake ecosystem require phosphorus. Cornell biologists believe that current phosphorus levels can support Oneida Lake's robust fish populations. Any further reductions in phosphorus, however, may reduce the fishery's productive capacity.

Oneida Lake's waters are clearer now than they were historically. Low light penetration was common prior to the 1980s, but the lake has experienced heightened transparency in the 1990s. Zebra mussels, which took root in Oneida around 1991, are a big reason the lake is clearer today. These non-native mollusks filter algae from the water. An increased abundance of bottom dwelling organisms and a wider depth distribution of aquatic plants accompanied these changes. Biologists use the term "benthification" to describe this process.



Oneida Lake cleared substantially as a result of water quality improvements and zebra mussels.

Aquatic plants grow along Oneida Lake's shore and beneath its surface. They are an important part of the ecosystem and create habitat for fish, reduce shoreline erosion, and improve water quality. The availability of light strongly influences the abundance and distribution of plants. As water clarity increases, the amount of light for submersed plants also increases. Light penetration determines the maximum depth at which these plants can grow.

*Native eelgrass (*Vallisneria americana*) is a common plant in Oneida Lake.*

Washington Sea Grant

Oneida Lake's clearer water has helped increase aquatic vegetation. Prior to the 1990s, most plants were found in waters less than six feet deep. Today, vegetation thrives in waters from six to thirteen feet, and some plants have been collected from depths exceeding 20 feet.

Despite improved water quality, Oneida Lake's overall health remains vulnerable. Established non-native species are altering the structure and function of the food web, while new invaders lurk near. Subtle changes in climate may be affecting the lake in ways that we are only beginning to understand.

Established Aquatic Invaders: Non-native species have often affected Oneida Lake's food web, especially since completion of the Erie-Barge Canal in 1918. Early invaders included sea lampreys, European faucet snails, Eurasian milfoil, and white perch. Other non-native fish that have played a prominent role in Oneida Lake's history are carp, gizzard shad, and freshwater drum.

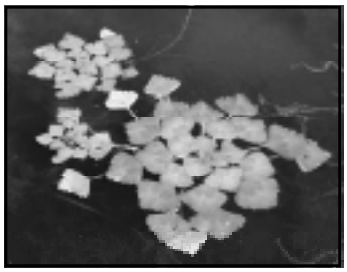
The following species highlight the list of Oneida's recent invaders:

One might call **zebra mussels** (*Dreissena polymorpha*) the "headline grabbers" of the invasive species list. Publicity abounds about zebra mussels, which were discovered in Oneida Lake in 1991. By autumn 1992, mussel densities soared to over 100,000 per square meter at some locations. Densities declined dramatically two years after the invasion, but biomass (the total weight of mussels in Oneida Lake) has remained relatively constant because the average zebra mussel is larger than in the earlier years.


Scott Camazine

Benthic invertebrate numbers (mainly amphipods and snails) have increased in the shallow, clearer habitats where zebra mussels thrive, but zebra mussels caused the loss of three native clam species. Mussels competed with clams for food resources and, perhaps more important, colonized atop clamshells, effectively preventing them from feeding.

The **water chestnut** (*Trapa natans*) is a plant native to Europe and Asia that was introduced into New York State in the late 1800s. Water chestnuts cause environmental problems because, in areas of dense growth, the plant's floating leaves carpet the water's surface and prevent light from reaching native aquatic vegetation. Water chestnuts also clog waterways, hindering navigation. An established population was not observed in Oneida Lake until 1999, when boaters discovered a large infestation in a bay west of Interstate 81 near Brewerton.



Mechanical harvesting was initially used to control the plant (2000-2002), followed by herbicide treatments (2004). This herbicide effectively checked the Brewerton infestation. Additional small-scale outbreaks have been sighted, primarily in the western part of the lake. Citizens' groups, led by Cornell Cooperative Extension, organized water chestnut pulling projects to eliminate these undesirable plants.

European frog-bit (*Hydrocharis morsus-ranae*) is a free-floating (not rooted) aquatic plant that resembles a tiny water lily. It was imported into Canada for cultivation in an arboretum pond connected to the Rideau Canal. Frog-bit was found in eastern Oneida Lake at the mouth of Oneida Creek in 2004 (the first sighting in New York State). By June 2005, frog-bit appeared in the Oneida River, Big Bay, and in six marinas.


Richard Carignan

This species can be spread when people dump aquarium water into natural environments. Frog-bit has also been introduced as food for waterfowl, and can hitchhike on boat trailers. The plant can form dense floating mats that restrict the availability of light, nutrients, and dissolved gases that nourish submerged native plants.

Starry stonewort (*Nitellopsis obtusa*) is a macroalga (a large algae, not a true plant), native to Eurasia that probably arrived in ballast water that a transoceanic ship discharged into the Great Lakes.


Adri van Beem

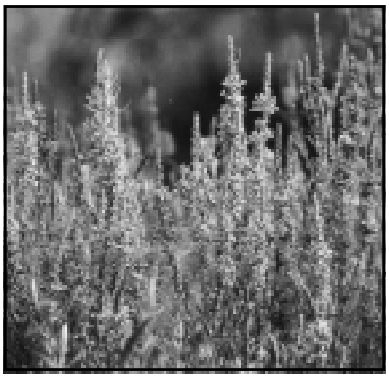
Stonewort was discovered in Lower South Bay in 2005, during a routine plant sampling conducted by Cornell biologists. The total weight of the stonewort at this site was heavier than that of any native plant collected that year. Thick stonewort mats blanketed the bottom, preventing the growth of other plants.

A **freshwater amphipod** species native to Eurasia, and also introduced through ballast water, is *Echinogammarus ischnus*. Biologists found it in the Great Lakes in 1995. Scientists believe that this amphipod was present in Oneida Lake in 2001, but confirmation didn't occur until 2005, when it was collected in shallow water habitats colonized by zebra mussels. This shrimp-like freshwater species resembles


Colin van Overdijk

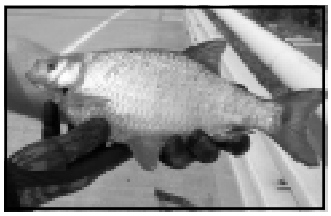
other common Oneida Lake amphipods and may thrive in the lake's zebra mussel colonies.

Scientists believe that the long-established wetland plant, **purple loosestrife** (*Lythrum salicaria*), was brought to the Atlantic Coast of North America in the early 1800s. It may have spread inland to the Great Lakes basin along railroads and canals. The construction of the Erie-Barge Canal may have expedited this plant's migration to Oneida Lake. Stands of loosestrife occupy wetlands and ditches around the lake, as well as stretches of the lake's shoreline. Purple loosestrife can displace native cattails and provides less suitable habitat for waterfowl.



Bernd Blossey

A commonly observed fish in Oneida Lake's shallows, especially during spring, is the **rudd** (*Scardinius erythropthalmus*). Rudd were discovered in the lake in 1990 and were likely introduced as baitfish. This highly visible fish has brightly colored fins. Look for them in marinas on sunny, calm days during April.



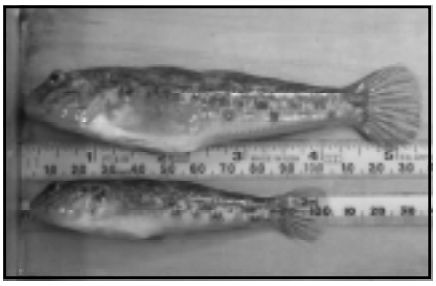
Sandra Rapp

Potential Aquatic Invaders: History clearly demonstrates that Oneida Lake's people must be alert to detect future non-native species.

Quagga mussels (*Dreissena bugensis*), close relatives of zebra mussels, were discovered in the Great Lakes in 1989. Scientists found a few specimens at the Onondaga Lake outlet in 1991. Quagga mussels are better able to live in the soft sediments and deeper parts of the lake that zebra mussels cannot colonize. Quaggas have been slowly displacing zebra mussels in the Great Lakes and may repeat this process if they enter Oneida Lake.

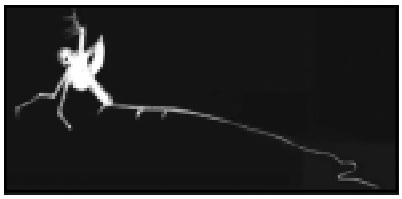
US Geologic Survey

The **round goby** (*Apollonia melanostomus*) is a small, prolific, bottom-dwelling fish that was first observed in the St. Clair River on the Michigan-Ontario border in 1990. These fish now occur in Oswego Harbor, the western portion of the Erie-Barge Canal, and the St. Lawrence River. Round gobies are bottom feeders, consuming benthic organisms, zebra mussels, and fish eggs. When large numbers of gobies eat fish eggs, it can hurt a game fish population. Smallmouth bass and lake sturgeon eggs are part of the diverse diet of the goby in the Great Lakes. Conversely, piscivorous (fish-eating) species such as walleyes and smallmouth bass feed on gobies. It is unlawful to possess gobies in New York State.



US Geologic Survey

The **fishhook waterflea** (*Cercopagis pengoi*), first detected in Lake Ontario in 1998, appeared in the Finger Lakes region the following year. *Cercopagis* is commonly found in Onondaga Lake in summer. They prey on zooplankton and can compete for food with small fish.



Soili Saesmaa

Climate change: Oneida Lake's water temperatures have been gradually warming and the duration of winter ice cover decreasing, providing local evidence of global climate change.

Temperature readings taken by Cornell University's water temperature monitor, located six feet below the lake's surface near Shackelton Point, show that the average August water temperature from 1991 - 2005 is 1.5°F warmer than that of the previous fifteen years (1975 - 1990). The warmest year on record, 2005, boasted an average August water temperature of 77.7°F (25.4 °C). Daily water temperatures in excess of 80°F have been more common in the last decade. From 1995 to 2005, there were forty-three days when the monitor recorded a temperature over 80°F, an event that occurred only on four days from 1968 to 1994.

Oneida Lake typically freezes by late December or early January and thaws by mid-March or early April. As water temperatures rise, however, the lake remains ice-covered for less time. For example, the average annual time of stable ice cover from 1990 to 2005 was one week shorter than from 1975 - 1990. Also, recent years (1975-2005) have experienced seventeen fewer days of complete ice cover than in the latter half of the nineteenth century (1866 - 1899).

When Oneida Lake's ice breaks up, a strong wind can pile it along the shore. This scene occurred at Sylvan Beach, around 1910.

The Fish and the Fishery

Oneida Lake nurtures a diverse fish community of over seventy-five species of warm water and cool water fish. The present fish population differs markedly from that encountered by European settlers. Historical records show that Oneida Lake provided Native Americans with American eels and Atlantic salmon. The Iroquois used weirs to trap eels leaving the lake to spawn in the ocean. Natives constructed brush dams to catch salmon spawning in the lake's tributaries. Salmon and eels were also speared at night from canoes, lit by torches.

By the nineteenth century, early settlers established a commercial salmon fishery, but this enterprise was doomed by dam construction on the lake's tributaries and the Oswego River, which blocked the migration of these fish. Over-fishing may have helped deplete this species.

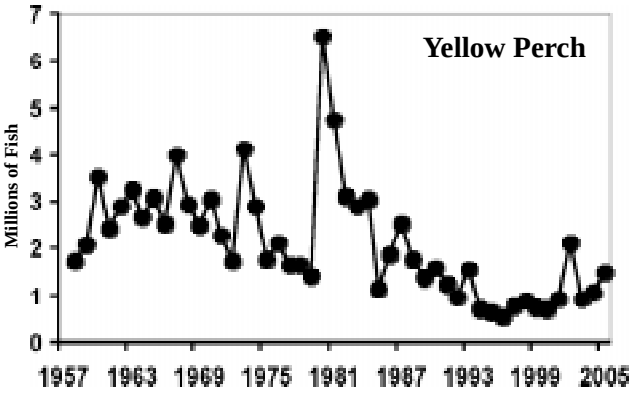
Conflicts between sport anglers and commercial fishermen contributed to a state ban on netting in 1897. This law gave rise to the "Oneida Lake fish pirates," a group of outlaw netters who boldly harvested the lake throughout the first half of the twentieth century. Rivalries between fish pirates and the lake's "game protectors" produced colorful stories that adorn the lake's history.

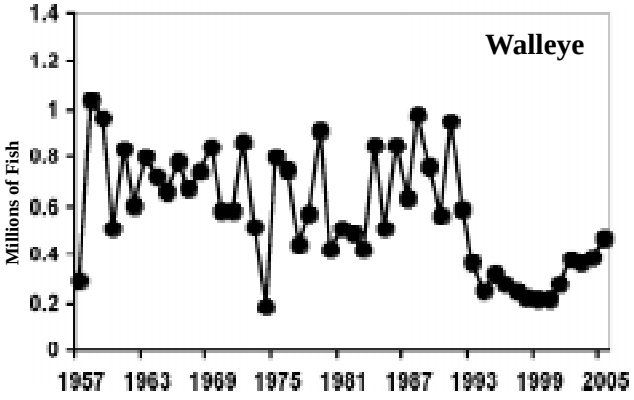
Perhaps the most significant change to the fishery resulted from the completion of the Erie-Barge Canal in 1918. The combination of barriers and water level stabilization changed the lake's fish population dramatically. New dams and locks further restricted movements of migratory species such as eels. The draining of wetlands and marshes decreased spawning areas for northern pike and pickerel. Lakeside development, which accelerated in the 1920s, eliminated aquatic grass beds near the shores, another significant area for pike and pickerel propagation.

By the 1940s, a fishery once dominated by bass, walleye, yellow perch, pickerel, eels and bullheads had transformed to primarily a walleye fishery, with smallmouth and largemouth bass a distant second. Yellow perch thrived under these conditions and continued to be popular. This fishery has endured (Figure 9), affirming Oneida Lake's reputation as one of the premier walleye and bass destinations in the nation. The walleye fishery is maintained and enhanced by a combination of natural reproduction and a continuous stocking program, started by New York State's Oneida Fish Cultural Station at Constantia in 1897.

Anglers reported severe fluctuations in Oneida's walleye catches during the latter 1950s. "Feast or famine" years characterized the fishery. Many worried about the walleye population's health and, indeed, survival. Two significant events occurred because of this. The Oneida Lake Association, led by President Millard Rogers, successfully lobbied for a law, passed by the legislature in 1960, which banned the sale of walleyes. In addition, a research program was begun to examine the factors influencing trends in the lake's fish populations. Early studies by Dr. John Forney and colleagues at the Cornell Biological Field Station indicated that anglers accounted for most of the adult

walleye mortality and that prey abundance had a dramatic effect on walleye survival, as well as their vulnerability to angling. For example, in years where forage fish were scarce, walleyes were eager to take anglers' offerings. However, walleyes also cannibalized their young during those times. These circumstances resulted in fewer adult walleyes for the future In years with abundant young yellow perch, white perch, or gizzard shad, fishing was poor and young walleyes survived in quantities that provided more adults in subsequent years.





Oneida Lake yellow perch and walleye populations, 1957 – 2005.

Walleye: For years, Oneida Lake has boastsed New York State's premier walleye fishery and all indications are that it will continue to provide quality fishing opportunities for years to come.

Captain Tony Buffa

Walleyes are the preferred sport fish on Oneida Lake.

The population of adult walleyes has ranged from as few as 187,000 to as many as one million over the past five decades. A unique biological scenario that affected walleyes occurred during the 1990s. Oneida's walleye population declined dramatically because of two factors. Several consecutive years saw low baitfish numbers, causing a poor survival of walleye young. Concurrently, sub-adult walleyes (fish that are three years old or less) suffered intense predation from a growing cormorant population, further reducing the recruitment of walleyes into the fishery. Over the period 1995-2000, cormorants annually consumed as many as 189,000 sub-adult walleyes (1996). The adult walleye population plummeted to just over 200,000 by the end of the decade. In response, state and federal agencies implemented cormorant harassment programs in 1998 and 2003. This, combined with a brief period of restricted walleye harvest regulations, spurred the population toward a rapid recovery.

The goal of Oneida Lake's walleye management is to sustain a high quality recreational fishery that is in balance with available food resources, particularly yellow perch. To achieve this, the New York State Department of Environmental Conservation raises or lowers size and creel limits in response to changes in walleye abundance and the predicted survival of young fish. The Oneida Fish Cultural Station in Constantia annually stocks 150 million walleye fry to support management goals. About two-thirds of the fry in the lake in May come from this stocking program. In response to cormorants' predation, the NYSDEC and the U.S. Department of Agriculture Animal and Plant Health Inspection Service (APHIS) limit these birds' numbers to 100 through a harassment program during the open water season.

Yellow Perch: Yellow perch have long been the most abundant fish in Oneida Lake. The perch population can produce between forty and sixty billion eggs each spring, but only two to eighteen percent of these survive to become tiny fish called "fry." Yellow perch that grow beyond this stage are a favorite food of predators such as walleyes. As a result, the chance that a young yellow perch will reach adulthood is, at best, one tenth of one percent.

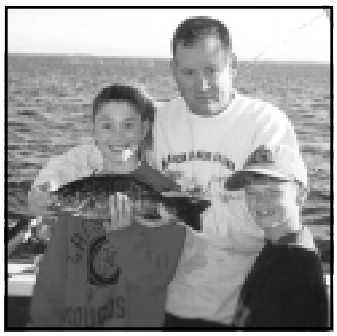
CBFS

Yellow perch are a preferred prey of walleyes.

The adult yellow perch population peaked at six million in 1980, but has since declined. The reasons for the drop are not completely understood, but increased water clarity may have made perch fry more vulnerable. Cormorant predation played a big role in reducing the survival of larger perch. For example, cormorant consumption estimates (1995-2000) on yellow perch were impressive, with the birds eating two million sub-adult yellow perch in 1996 alone.

Angling and natural causes account for the loss of approximately one-third of the adult yellow perch population annually. Recently, the population increased slightly and is expected to hover around one million in 2006. Current cormorant management should help perch as well as walleyes.

Smallmouth and Largemouth Bass: Smallmouth and largemouth bass (often referred to as the black basses) have been popular sport fish in Oneida Lake since the nineteenth century. Recent changes in the lake have benefited bass and their numbers have risen since the mid-1980s. The basses are warm water fish, and trends towards higher summer temperatures have increased production and growth of their young. Clearer waters, resulting from the establishment of zebra mussels, and the availability of high quality forage such as gizzard shad, have also been good for Oneida's bass populations. Because of these changes in the lake's environment, smallmouth bass may be as much as three times more abundant now than they were before 1985. Largemouth bass numbers are also increasing, as near-shore vegetation, which provides valuable nursery habitat for their young, spreads.

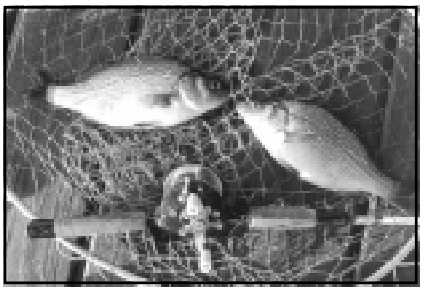


Ray Brown Fishing Charters

Angling for smallmouth bass has become more popular in recent years. Increased plant coverage provides excellent bass habitat.

Walleyes will likely always remain Oneida Lake's primary sport fish, but bass now account for as much as seventeen percent of the fishing effort on the lake. Bass angling's popularity has skyrocketed since the 1980s. Oneida's high quality bass fishing attracts anglers from the far reaches of New York, as well as from other states. Bass have become an important stimulus for the area's tourism, and Oneida Lake has been the site of several major tournaments since 2002, bringing even more attention to this excellent resource.

White Perch: The presence of this fish in Oneida Lake was not documented until 1951. Early concerns arose that white perch might threaten the lake's walleye-yellow perch dominance, but this scenario never materialized.



Karen Howlett

White perch are abundant in Oneida Lake.

White perch became a significant species by the early 1970s, and sporadic reproductive successes maintained their prominence until the late 1980s, when disease ravaged the population. Numbers remained low for about ten years.

White perch increased in the early 2000s, and should remain abundant for at least the near future. White perch are a popular table fish in other areas of the northeast; Oneida Lake's anglers should take advantage of this prolific, delicious resource.

Sturgeon: The lake sturgeon is an ancient species that was once abundant throughout the Great Lakes. Sturgeons can live for more than 100 years, making them one of the longest-lived freshwater fish. The largest lake sturgeon on record weighed an impressive 310 pounds! Specimens over 100 pounds were once

common in the Great Lakes and have been documented in Oneida Lake's history.

Initially scorned by European settlers because of the damage they did to whitefish and trout nets, sturgeons became the most valuable commercial species in the Great Lakes when the demand for caviar grew in the late nineteenth century. Lake Ontario and its tributaries supported commercial sturgeon fisheries. Over-fishing and dam construction, that blocked access to spawning areas, led to drastic declines in sturgeon populations. The lake sturgeon is now listed as "endangered" or "threatened" in most of its range, including New York. Sturgeon records from Oneida Lake date back to the 1800s, although they have been very rarely reported during the modern era.

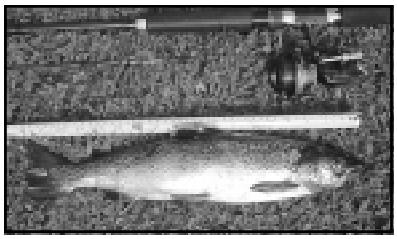
Tom Brooking, CBFS

Lake sturgeon restoration in Oneida Lake began in 1995.

In 1995, the NYSDEC started a hatchery program for lake sturgeon restoration. Oneida Lake received almost 8,000 fingerling sturgeons, reared at the Constantia hatchery, between 1995 and 2004. Surveys indicate that the lake provides excellent sturgeon habitat. Bottom dwelling invertebrates, sturgeons' preferred food, abound in the lake's zebra mussel beds. Sturgeons longer than 25 inches consume the mussels themselves.

Oneida's sturgeons' growth has been outstanding. As of 2005, the largest fish recorded was over fifty inches long and weighed well over 40 pounds. Sturgeons do not mature until late in life, sometimes at 18 to 20 years for females. Time will tell if these fish can find habitat to spawn and create a self-sustaining population. For now, remember that the sturgeon is listed as threatened and, if caught, must be released.

Atlantic Salmon: Records indicate that Atlantic salmon were very abundant in Oneida Lake in the early 1800s. By the 1870s, few salmon remained. Dam building on the Oswego River and Oneida Lake's tributaries blocked migration routes and access to spawning grounds. Overharvesting also took its toll.



Arley Morey

A 19-inch Atlantic salmon caught in the East Branch of Fish Creek in 2004.

The Fish Creek Atlantic Salmon Club began a fingerling stocking program in 1997. The club has enjoyed some success. Anglers and researchers have reported catching salmon in both Fish Creek and Oneida Lake.

Angling and Fish Harvest: The variety and abundance of Oneida Lake's fishes astounded early visitors to the area and quickly established the lake as one of the state's premier fisheries. Throughout history, anglers have pursued northern pike, smallmouth and largemouth bass, lake whitefish, walleyes, bullheads, sunfish, and yellow perch. In modern times, however, walleyes reign supreme as the lake's most popular game fish.

Rochester Bassmasters

Anglers spend 200,000 to 300,000 hours of fishing effort on Oneida Lake each year.

Creel surveys conducted between 2002 and 2005 revealed that Oneida's rich fish resources annually generate between 200,000 and 300,000 angler-hours during the open water season. Ice fishing inspires up to 70,000 hours of additional effort, depending on the duration of safe ice conditions.

More than seventy percent of Oneida Lake's anglers target walleyes. Total annual catches in the early 2000s ranged from 45,000-190,000 fish, anglers harvested 20,000-40,000 walleyes annually. Ice fishing resulted in catches of an additional 2,000-14,000 walleyes per year.

Oneida Lake's smallmouth and largemouth bass attracted media attention in the early 2000s and are now the second most popular quarry of the lake's summer and fall anglers. Bass fishing accounted for between 25,000 and 35,000 hours of fishing effort during the creel survey years. This generated catches of up to 64,000 fish, most of which were released.

Yellow perch have long been a popular all-season species. Perch annually attract some 20,000-70,000 hours of effort, accompanied by harvests of from 12,000-150,000 fish.

Oneida Lake's fish resources are truly one of the jewels of the region, providing opportunities for tens of thousands of anglers. With conscientious stewardship, the fishery should thrive for generations to come.

Colonial Water Birds

Oneida Lake supports thousands of waterfowl and other birds throughout the year, hosting migrating and resident species alike. Scores of bird species nest near the lake to take advantage of the fish, insects, crayfish, mollusks, and vegetation it provides.

Ospreys, kingfishers, and various herons are among the less common birds that fish in the lake through the summer months. Bald eagles can often be observed along the shore or on the ice. Wantry, Long, and Little Islands, south of Constantia, are designated an "important bird area" by the Audubon Society of New York. These isles are home to five different species of colonial nesting birds, which migrate to the lake annually to breed.

Colonial water birds are generally long-lived species that nest in large groups for better defense against predators and to increase feeding efficiency. Oneida Lake's colonial water birds are top predators in the food web, and generally feed on fish and crayfish.

Common terns are the smallest colonial water bird on Oneida Lake, yet they are the ones that migrate the farthest every winter. Cornell biologists have marked terns with leg bands and found that these pigeon-sized birds fly thousands of miles each year in order to return to Oneida Lake to breed. Leg band recoveries have been reported from as far away as Brazil, Ecuador, and Bolivia. Common terns are listed as a "threatened" species in New York, so their nesting islands are protected to prevent human disturbance and chick predation by larger birds and other predators.

Terns generally eat shiners and small fish found close to the water's surface, and can be seen diving after prey from heights of twenty to thirty feet. Their shrill cries add a nice falsetto to the lake's summer symphony. Common terns usually lay two to three eggs per nest, fledging one or two chicks.

William Brown

A common tern guards its eggs. Terns are a threatened species in New York and their nesting sites are protected.

Oneida Lake's terns have been intensively managed and studied by the NYSDEC, Cornell University, and the New York Cooperative Fish and Wildlife Research Unit (United States Geological Survey) since 1979. A stable population of approximately 400 pairs breeds on the lake.

Three species of **gulls** nest on Oneida Lake - **ring-billed**, **herring**, and **great black-backed**. The populations of all three species have been changing in recent years.

Ring-billed gulls, the smallest of the three, numbered in the thousands in the late 1980s and early 1990s, but have declined to about 100 pairs since 2000. Herring gulls, on the other hand, have been increasing steadily from twenty-two pairs in 1979 to almost seventy pairs in 2005. This may not sound like a lot of birds but, with a wingspan of almost five feet, these are large animals capable of eating a lot of tern chicks, as well as those of other water birds.

Numbers of great black-backed gulls have also been increasing, from one nest in 1993 to five pairs in 2005. Great black-backed gulls are the largest gull in the world, and boast a wingspan of almost five and a half feet.

Ring-billed gulls are generally found in fields or landfills, feeding on insects, worms, small mammals, and refuse. Herring and great black-backed gulls are larger and more aggressive. These gulls eat live and dead fish, eggs and chicks within bird colonies, and just about anything else they can grasp.

Double-crested cormorants are probably the most recognizable colonial water bird on Oneida Lake because of their large body size and the publicity surrounding their population's growth. Numbers of double-crested cormorants have been increasing throughout the Great Lakes since the early 1980s, and Oneida Lake's colony likewise expanded from a single pair in 1984 to over 360 pairs in 2000. As indicated earlier, these birds consumed immense numbers of Oneida Lake's sub-adult walleyes and yellow perch in the 1990s, leading to the precipitous decline of adult populations of these fish.

Jeremy T.H. Coleman

Double-crested cormorants feed on popular sport fish and have had a significant impact on walleye and yellow perch populations.

In response to declining walleye and yellow perch populations, the NYSDEC inaugurated an Oneida Lake cormorant management plan in 1998. This initial plan was strengthened in 2003. The plan was designed to reduce the size of the colony and quickly move migrating cormorants off the lake (upwards of 2000 migrant birds fed on Oneida's fish during August and September). The NYSDEC contracted with the Department of Agriculture's APHIS Wildlife Services to implement the management plan. The latter agency uses egg oiling and various hazing techniques to limit cormorants' influence. This program has been very effective in reducing the cormorant population.

The Oneida Lake Association (OLA)

The Oneida Lake Association is the only organization whose sole purpose is the preservation and enhancement of the Oneida Lake environment. Since its inception in 1945, the Association's lobbying efforts have significantly improved the quality of life of those who use this superb natural resource.

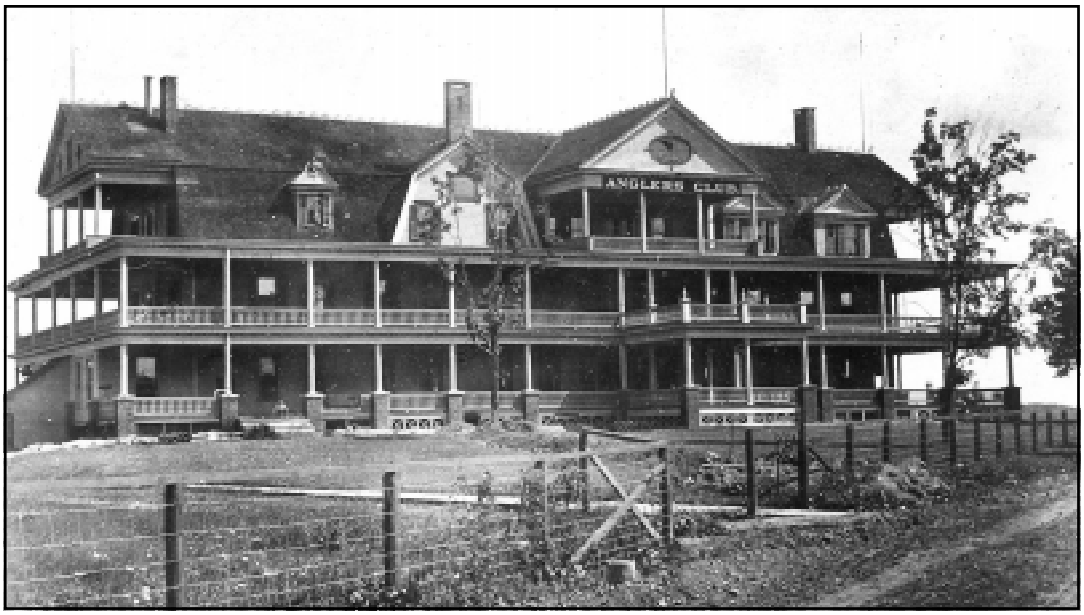
The OLA has exhibited leadership and environmental stewardship, exemplified in many successful projects. These include: the management of double-crested cormorants, the monitoring and control of water chestnuts, the construction of the Oneida Fish Cultural Station at Constantia, the renovation of the South Shore Boat Launch near Bridgeport and the Godfrey Point Launch by Cleveland, and the promotion of youth angling through annual "Take a Youngster Fishing" derbies.

We encourage you to join the OLA and support their efforts to foster a healthy Oneida Lake ecosystem. To join, send your name, address, and a check for $5 to the Oneida Lake Association, Box 3536, Syracuse, New York, 13220-3536.

About This Publication

The Oneida Lake Profile was created by Edward L. Mills, Kristen T. Holeck, James R. Jackson, Tony VanDeValk, Jeremy T. H. Coleman, and Lars G. Rudstam of the Cornell Biological Field Station, Rebecca L. Schneider of the Department of Natural Resources at Cornell University, Howard Goebel of the New York State Canal Corporation, and Jack Henke of the Oneida Lake Association. The Central New York Community Foundation, the Oneida Lake Association, Cornell University, the Central New York Regional Planning and Development Board, and the U.S. Environmental Protection Agency funded the Profile. Special thanks go to the Oneida Lake Watershed Advisory Council and the 69 municipalities in the Oneida Lake watershed that have provided outstanding support for this project. Please visit www.oneidalakeinitiative.org for more information on Oneida Lake.

Successful walleye anglers proudly display their catch in this restored tin-type, taken at Sylvan Beach around 1890.



The Anglers' Club, located on Norcross Point, catered to Syracuse area sportsmen in the early twentieth century.