The Changing Environment for Fish and Fisheries in New York State

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Cornell Biological Field Station

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New York’s Freshwater Resources Include Over 7,5000 Lakes and Ponds and More Than 70,000 Miles of Rivers and Streams
New York State is Home to Some 179 Species of Fish That Spend All or Some of Their Lives in Freshwater
These Resources Support World Class Fisheries That Contribute Substantially To the State’s Economy

### Activities in New York by Residents and Nonresidents

#### Fishing

- **Anglers**: 1,882,000
- **Days of fishing**: 29,874,000
- **Average days per angler**: 16
- **Total expenditures**: $1,962,538,000
  - Trip-related: $1,057,916,000
  - Equipment and other: $904,622,000
- **Average per angler**: $907
- **Average trip expenditure per day**: $35

#### Hunting

- **Hunters**: 823,000
- **Days of hunting**: 18,433,000
- **Average days per hunter**: 22
- **Total expenditures**: $1,564,205,000
  - Trip-related: $810,119,000
  - Equipment and other: $754,086,000
- **Average per hunter**: $1,899
- **Average trip expenditure per day**: $44
Anglers Enjoy Fishing Opportunities Across the Full Range of Aquatic Resources in the State

Table 6. Freshwater Anglers, Trips, Days of Fishing, and Type of Water Fished: 2011
(Population 16 years old and older. Numbers in thousands)

<table>
<thead>
<tr>
<th>Anglers, trips, and days of fishing</th>
<th>Activity in New York</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total, state residents and nonresidents</td>
</tr>
<tr>
<td></td>
<td>Number</td>
</tr>
<tr>
<td>Total anglers</td>
<td>1,212</td>
</tr>
<tr>
<td>Total trips</td>
<td>13,121</td>
</tr>
<tr>
<td>Total days of fishing</td>
<td>19,200</td>
</tr>
<tr>
<td>Average days of fishing</td>
<td>16</td>
</tr>
</tbody>
</table>

**ANGLERS**

<table>
<thead>
<tr>
<th></th>
<th>Total, all types of water</th>
<th>Ponds, lakes, or reservoirs</th>
<th>Rivers or streams</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number</td>
<td>1,212</td>
<td>918</td>
<td>841</td>
</tr>
<tr>
<td>Percent</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>State residents</td>
<td>1,056</td>
<td>803</td>
<td>751</td>
</tr>
<tr>
<td>Percent</td>
<td>87</td>
<td>87</td>
<td>89</td>
</tr>
<tr>
<td>Nonresidents</td>
<td>156</td>
<td>*116</td>
<td>*91</td>
</tr>
<tr>
<td>Percent</td>
<td>13</td>
<td>*13</td>
<td>*11</td>
</tr>
</tbody>
</table>

**DAYS**

<table>
<thead>
<tr>
<th></th>
<th>Total, all types of water</th>
<th>Ponds, lakes, or reservoirs</th>
<th>Rivers or streams</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number</td>
<td>19,200</td>
<td>13,949</td>
<td>8,543</td>
</tr>
<tr>
<td>Percent</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>State residents</td>
<td>18,257</td>
<td>13,323</td>
<td>8,240</td>
</tr>
<tr>
<td>Percent</td>
<td>95</td>
<td>96</td>
<td>96</td>
</tr>
<tr>
<td>Nonresidents</td>
<td>942</td>
<td>*626</td>
<td>*303</td>
</tr>
<tr>
<td>Percent</td>
<td>5</td>
<td>*4</td>
<td>*4</td>
</tr>
</tbody>
</table>

* Estimate based on a sample size of 10–29.  
(X) Not applicable.

Note: Detail does not add to total because of multiple responses.
Fishing Opportunities Are Diverse and Include A Mix of Coldwater and Warmwater Species

Table 7. Freshwater Anglers and Days of Fishing in New York by Type of Fish: 2011
(Population 16 years old and older; Numbers in thousands)

<table>
<thead>
<tr>
<th>Anglers and days of fishing</th>
<th>Activity in New York</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total, state residents and nonresidents</td>
<td>State residents</td>
<td>Nonresidents</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Number</td>
<td>Percent of total types</td>
<td>Percent of anglers/days</td>
<td>Number</td>
</tr>
<tr>
<td>Total, all types of fish</td>
<td>1,212</td>
<td>100</td>
<td>100</td>
<td>1,056</td>
</tr>
<tr>
<td>Crappie</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Panfish</td>
<td>*140</td>
<td>*12</td>
<td>*100</td>
<td>*117</td>
</tr>
<tr>
<td>White bass, striped bass, striped bass hybrids</td>
<td>*120</td>
<td>*10</td>
<td>*100</td>
<td>*100</td>
</tr>
<tr>
<td>Black bass</td>
<td>452</td>
<td>37</td>
<td>100</td>
<td>373</td>
</tr>
<tr>
<td>Catfish, bullheads</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Walleye, sauger</td>
<td>*90</td>
<td>*7</td>
<td>*100</td>
<td>*85</td>
</tr>
<tr>
<td>Northern pike, pickerel, muskie, muskie hybrids</td>
<td>*58</td>
<td>*5</td>
<td>*100</td>
<td>589</td>
</tr>
<tr>
<td>Steelhead</td>
<td>647</td>
<td>53</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>Trout</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Salmon</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Anything¹</td>
<td>*149</td>
<td>*12</td>
<td>*100</td>
<td>*126</td>
</tr>
<tr>
<td>Other freshwater fish</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
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Fisheries Research Dates Back to 1957

Oneida Lake Work Continuous Since 1957

Periodic Statewide Studies
What Our Research is Telling Us About How New York’s Fish Resources Are Responding To Environmental Changes

1. Fisheries of Oneida Lake (Landscape Modification, Invasive Species, Climate Change)

2. Statewide Stream Fish Surveys (Climate Change)
1. Fisheries of Oneida Lake 
(Landscape Modification, Invasive Species, Climate Change)
In Oneida Lake, Our Studies Have Been Largely in the Context of their Impacts on the System and Modern Fisheries in Place in the mid-1900s

But We Have Some Context for Understanding What the “Natural” State of Lake Fisheries Was
Vanderkemp (1792):

“Oneyda Lake, as handsome, as rich in fish as any lake in the western world.”
“Never did I see yet a country, where all kind of fish was so abundant and good. It may be equalled, it cannot be excelled. I salted within a short time more than a dozen different species....Salmon, pike, pickerel, cat-fish, Otzewgo baas, yellow perch, sun-fish, tziob, three species of trout, river lobsters, turtle, sword-fish, and a green coloured fish of an exquisite taste, white-fish, &c,&c.” - Vanderkemp
From the Jesuit Relations (1656):

“... our savages construct their dams and sluices so well, that they catch at the same time the Eels, that descend, and the Salmon, that always ascend.”

“[Oneida Lake] furnishes fish to nearly all the Iroquois.”
De Witt Clinton’s Travels

One of the best early descriptions of the natural history of central New York

Map drawn by Dr. Webster.
For most of the history of human use of Oneida Lake fishes, salmon and eel supported the major fisheries.
De Witt Clinton’s Travels Directed at Development of a Canal System to Connect Eastern New York and the Great Lakes

Map drawn by Dr. Webster.
The Erie Canal – opened in 1825
The Oswego River canal was completed in 1827, major improvements as part of the New York barge canal project completed in 1917.
Larry's acute sense of awareness served him well...
Ice-Out Frequently led to Property Damage
Spring floods sometimes brought fishing opportunities too close to home.
Improvements on the dam at the outlet facilitated water control starting in the 1950s.
Lake Description in the 1920s:
“primarily a shallow water lake with low, extensive and swampy wooded shores.”
When We Think of Invasive Species Impacts Today We Think Mostly in Terms of Impacts on One of the State’s Premier Walleye Fisheries

But We Should Not Lose Sight of the Fact That the Walleye Fishery Arose Due to Severe Alterations of the System
ONEIDA LAKE AS A MELTING POT: THE EFFECTS OF INVASIVE SPECIES ON MODERN FISHERIES
Most Modern Invasions Have Been Facilitated by the New York Barge Canal Project, Which Included Oneida Lake After Completion in 1917 (but also Oswego Canal in 1827)
INTRODUCED MOLLUSCS

- Elimia’s and a Hornsnail
- European Faucet Snail
- Pink Heelsplitter
- European Valve Snail

Timeline:
- 1800
- 1900
- 2000
INTRODUCED CRUSTACEA

1950

Gammarus fasciatus

Eubosmina coregoni

2000

Echinogammarus ischnus

Hemimysis

Rusty Crayfish WATCH
INTRODUCED FISH
INTRODUCED FISH
NONNATIVE BIRD
TIMELINE CONTEXT

1800 1900 2000

10 10 12
Only a Few Invasives Have Demonstrable Impacts on the Fisheries Of Oneida Lake
Mussel Impacts Have Been Well-Studied, and Broad Impacts on Systems Fairly Consistent
We Have Observed a Significant Decrease in Chlorophyll a and Concurrent Increase in Water Clarity in Oneida Lake Since Dreissenid Mussels Became Established
What is Oneida Lake’s Current Trophic State?

(Trophic State Index, Carlson 1977)

- Oligotrophic
- Mesotrophic
- Eutrophic
- Hypereutrophic

Secchi Disc
Chlorophyll-a
Total Phosphorus
Increased Water Clarity Has Nearly Tripled the Depth at Which Aquatic Macrophytes Occur
Declines in Zooplankton Density Lagged, But are Now Evident – Particularly in Daphnia
We Can Not Discount Concurrent Influence of Nutrient Reductions Resulting From The Great Lakes Water Quality Agreement (1972), But Timing More Consistent With Mussels
Impacts of the Most Successful Invasive Fish Species Not As Obvious as We Might Like
The First Cornell Result from Oneida Lake:

Science finds a use for gizzard shad:

Shad appeared in Oneida lake in the mid-1950s, declining walleye catch rates led to concerns that ecology of New York’s premier walleye lake could be in jeopardy.
Forney proposed to the New York Department of Conservation a 3 year study to assess the walleye population in Oneida Lake – study was initiated in 1957.
In Southern Systems Shad Can Represent 50% or more of Fish Biomass

But in Oneida:

- Represent a valuable fall/early winter food for sport fish
- Uneaten young typically winterkill
- Selected for by cormorants
- May well serve valuable role as buffer for yellow perch against walleye predation
In Recent Years White Perch Commonly Outnumber Yellow Perch in Gill Net Catches – They May Now Be the Most Abundant Fish in Oneida Lake
High Overlap in Diets of Yellow Perch and White Perch Creates Potential for Competitive Interactions

But We Don’t See Reduced Growth of Either Species as White Perch Abundance has Increased, Suggesting Resources are Sufficient to Support Both So Far
Cormorant Impacts a Bit More Conspicuous
Declines in walleye and yellow perch correlate with establishment of cormorants.
Locals bring out the welcome wagon for cormorants:

Aquatic Killing Fields of Oneida Lake Fish!

An Economic Armageddon!
Despite Aggressive Cormorant Management Throughout the 2000s, Percid Populations Have Not Returned to Historic Abundances