Keuka Lake State of the Lake 2017
Lake Characteristics

• Third largest by area of the Finger Lakes 11,730 ac
• Deep and steep sided - max 185 ft – mean 101 ft
• Two story fishery (warmwater/coldwater)
• 178,800 angler days in 2007
  ▪ 3rd in Finger Lakes
  ▪ 16th in all of New York
  ▪ 40% effort toward black bass
  ▪ 28% effort toward trout and salmon (mostly lake trout)
Keuka Lake Fish History and important introductions

Historically present

1868 (1830's?)

1897

1960's

1980

1994

2000's?

Lake trout stocked regularly late 1800's - 1970

1Crooked Lake Canal – 1833 - 1877
Keuka Lake Fishery - current

Lake trout
Smallmouth bass
yellow perch
Brown trout, landlocked salmon, and rainbow trout
Panfish (bullheads, bluegills, etc.)
Chain pickerel and northern pike
Forage Species – current?

Alewives?

Rainbow Smelt?

Sculpin

Freshwater Shrimp
Current Stocking

Atlantic Salmon (1979)
- Yearlings – 22,300

Brown Trout (1980)
- Yearlings – 9,400

Rainbow trout (2010)
- Fall fingerlings-5,000 (100% clipped)
Existing Regulations

Keuka Lake - trout
• All year, 15” min size limit
• 5 in combo (no more than 3 LLS or 1 RT)
  ▪ (removed 3 LT limit)
• Northern pike – 22”

Cold Brook (Keuka Lake Inlet) and Sugar Creek - trout
• April 1 – Dec 31
• 15”, 3 in combo (no more than 1 RT)
  ▪ (removed 3 RT limit)

*October 2012*
Thermal Stratification-Summer

• Epilimnion - Warm surface water called the subject to mixing from wind (red layer)
• Metalimnion - Rapid temperature change is the (yellow/green layer)
  ▪ The “thermocline” is the point at which temperature change is the fastest
• Hypolimnion - The deep cold water is the (green/blue layer)
Lake Trophic Status Classification

- Eutrophic – Waneta, Lamoka,
  - High nutrient loading
  - Extremely productive
  - Anoxic hypolimnion during summer stratification
- Mesotrophic – Hemlock
  - Mid-nutrients level
  - Relatively productive
  - Hypolimnion remains oxygenated during summer stratification
- Oligotrophic – Keuka, Seneca
  - Deep, cold, well oxygenated hypolimnion during summer stratification
  - Least productive, relatively low in nutrients
Primary Production in Aquatic Ecosystems

• Determines the amount of energy available in the ecosystem
• Affected by light penetration and nutrient availability, primarily nitrogen and phosphorus
• Chlorophyll a – measure of algal abundance
Plagiarized (with permission) Dr. Tim Sellers, Keuka College
Keuka Lake Food Web

Nutrients – Phosphorus/Nitrogen

Decaying plants and animals

Phytoplankton

Zooplankton

Forage/prey

Predator

Invertebrates
Keuka Lake Food Web

- **Keuka Lake Food Web**

  - **Dreisennias**
  - **Zooplankton**
  - **Phytoplankton**
  - **Decaying plants and animals**
  - **Nutrients – Phosphorus/Nitrogen**
  - **Forage/prey**
  - **Invertebrates**
  - **Predator**

Images of fish and invertebrates indicate predator-prey relationships.
What does this all mean?

- Keuka Lake is becoming less productive and….

Keuka Lake will not be able to support the biomass of fish that it once did.
Data Collection Efforts

Angler diary - annually

Electrofishing Cold Brook (annually) — rainbow trout

Fall production Cold Brook, Sugar (3 yr - 2017) — rainbow trout

Gillnetting (3-5 yr - 2016) – lake trout

Angler surveys (As needed – 2017)


Biomonitoring (periodically)
Long-Term Objectives for Warmwater Fish

Current data is lacking (mostly anecdotal)
# Long-Term Objectives for Warmwater Fish

<table>
<thead>
<tr>
<th>Species</th>
<th>Goals</th>
<th>Sampling Methods</th>
</tr>
</thead>
<tbody>
<tr>
<td>Black Bass</td>
<td>• Angler catch rate – 0.5 fish per hour</td>
<td>Gill Netting/Electrofishing? Creel survey? Angler Diary?</td>
</tr>
<tr>
<td></td>
<td>• Half of catch ≥ 12 inches</td>
<td></td>
</tr>
<tr>
<td>Yellow Perch</td>
<td>Maintain as viable component of the fishery</td>
<td>Gill Netting/Electrofishing? Creel survey? Angler Diary?</td>
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</table>

*Update to Black Bass Sampling Plan – Cornell University – 2017*

*Canandaigua Lake – 2017*
Long-Term Objectives for Coldwater Fish

Catch Rates: 0.40 legal size fish per hour (2.5 hours per legal fish)

- Lake Trout: 0.30 legal/hr
- Rainbow Trout: 0.04 legal/hr
- Brown Trout: 0.03 legal/hr
- Atlantic salmon: 0.03 legal/hr

Average Length of Harvested Fish:

- Lake Trout – 21.5 inches
- Rainbow Trout – 20.0 inches
- Brown Trout – 20.5 inches
- Atlantic salmon – 19.0 inches

Data obtained from Angler Diary Program

- Goal of 325 days fished a year from 25 diary cooperators
- Lengths for 100 lake trout, 40 rainbow trout, 30 brown trout, 20 Atlantic salmon
Angler Diary Program
Number of cooperators - Diary

The graph shows the number of cooperators from 1968 to 2016. The number of cooperators fluctuates over the years, with some peaks and troughs. The target line is indicated at 20 cooperators, showing the desired number of cooperators for this period.
Number of Hours To Catch One Legal Salmonine - Diary

- Target
- 5 yr running average

Hrs to catch a legal salmonine

Data from 1988 to 2016
Species composition of angler catch
Gillnetting
Lake Trout Catch Per Lift - gillnet
Growth Trends For Lake Trout - gillnet

Length (mm) vs. Year

Lake trout

- Age 6
- Age 7
- Age 8

Relative weight of lake trout - gillnets
Rainbow Smelt and Alewife Catch Per Lift - gillnet

Zebra mussels
Forage Assessment Nets (fish health monitoring)

2007 – 2 nets (1 floating, 1 bottom)
• 487 alewives
• 12 smelt

2011 - 1 net (1 floating)
• 38 alewives
• 0 smelt

2016 – 7 nets (4 floating, 3 bottom)
• 0 alewives and smelt
• Note: collected 7 large alewives in shallow warmwater gillnets (Finger Lake Institute mercury study)
# Hydroacoustic survey results (fish/ha)

<table>
<thead>
<tr>
<th></th>
<th>2007</th>
<th>2011</th>
<th>2016</th>
</tr>
</thead>
<tbody>
<tr>
<td>Upper Layer (Alewives?)</td>
<td>1,506</td>
<td>899</td>
<td>143</td>
</tr>
<tr>
<td>Lower Layer (Smelt?)</td>
<td>168</td>
<td>37</td>
<td>25</td>
</tr>
<tr>
<td>Average</td>
<td>888</td>
<td>468</td>
<td>85</td>
</tr>
</tbody>
</table>

![Graph showing fish population over years](image-url)
What happened to the forage?

- Lake productivity declining
What happened to the forage?

- Lake productivity declining
- Lake trout overabundant
What happened to the forage?

- Lake productivity declining
- Lake trout overabundant
- Back to back cold winters 13-14 and 14-15
- Alewife known to not tolerate cold winters (Lake Ontario)
Keuka Lake –

Atlantic salmon - 1978

Brown trout - 1980

Zebra mussels

Diary CR 0.63 2014

Mono net Correction factor
Cisco and Lake whitefish Catch Per Lift - gillnet

Number fish per net night

- Cisco
- Lake whitefish

One more interesting side note from 2016 netting

- Fish collection for Finger Lakes Institute for mercury study
- 2 nets in Branchport arm
- Collected 4 walleye all btw 12-13"
Cold Brook
Cold Brook – Rainbow trout

- 1897- 30,000 “California strain”
- Popular spring fishery
- Stocking reinitiated 1978-1988 with wild Finger Lake strain but discontinued due to poor success
- 2010 – 5,000 fall fings
Spring rainbow trout electrofishing

![Image of electrofishing]

![Graph showing number of rainbow trout from 1953 to 2013]
Cold Brook Rainbow trout production

Rainbow trout/acre

YOY
1+ and older

Beaver dams!!!!!!!
What we think may have happened

70’s and 80’s – lower LT abundance - abundant forage – buffer for RT entering lake

90’ and 00’s – higher LT abundance – lower forage abundance- no buffer for RT into lake

Plus – beaver dams/access to spawning grounds, intro BT (1980), Atlantic salmon (1979)

More competition from resident brown trout in recent years

= Lower numbers of adult rainbow trout
Rainbow trout – Management actions

Habitat restoration
• Bond Act 2007
• Bank stabilization, shading, pool diggers

Regulations (2012)
• Reduce rainbow creel to 1 in tribs and lake
• Reduce lake predators

Experimental stocking (2010)
• 5,000 clipped fall fingerlings

Monitor beaver dams
Summary

• Do not know much about the warm water fishery
• Lake is becoming less productive
• Lake trout dominant
• Lake trout growth and condition declining
• Rainbow trout abundance down
• Brown trout and Atlantic salmon contribute little to overall fishery
• Significant decline in forage
Potential management strategies to address forage issues

1. Stock alewives
2. Let alewives recover on their own
3. Reintroduce native forage fish
   - Cisco (lake herring)
   - Lake whitefish
4. Reduce/eliminate temporarily/permanently Atlantic salmon and/or brown trout stocking
Potential reasons to maintain alewives

- In Keuka Lake since 1860’s
- Only documented collapse 1960’s and 2015-16
- Fishery thrived for a long time with alewives as important food source
Potential concerns for stocking alewives

- Trap and transfer no longer allowed across watersheds
- Alewife culture not practical or on DEC’s list
- Stocking alewives is not recognized as prudent
  - EMS (not Keuka – unless changed)
  - Prone to huge crashes
- Could not stock enough
Potential reasons to reintroduce Cisco

• Long-lived (8-15 yrs)
• Thrive in nutrient poor
• Stabilize food web
  • Large alewife die-offs
• Occupy similar niche as alewives
• Eat spiny water flea (maybe eat spinier water flea (fish hook))
• Recreational fishery – can eat them
Potential concerns for cisco stocking

- Source
  - Genetics – Chaumont Bay
- Population disappeared before
  - Smelt, alewives, abundant lake trout
- If alewives (smelt) rebound, likely would not be able to compete
- No guarantee it will work
Management Actions/Proposals

• Continue monitoring salmonine populations
  ▪ Gillnetting (3 yr), Angler diary (annually), spring RT (annually), RT production (3 yr), Biomonitoring (coordinate agencies)

• Stock Finger Lakes strain rainbow trout yearlings
  ▪ Hatchery limited

• Eliminate brown trout and/or Atlantic salmon stocking

• Develop plan to monitor warmwater fishery

• Determine status of walleye population

• Develop forage fish assessment plan

• Stock cisco
Questions