Health of Shorelines and Effects on Fisheries

Joe Nohner
Overview
Overview
Status and Trends of Michigan Inland Lake Resources

- Collect chemical, physical, and biological indicator data
- Uses a stratified random design to select lakes
- Indicator for patterns at the state-wide scale
- Partnership between DNR / DEQ
- ~430 lakes complete from 2002 – Present
- ~30 lakes per year
Shoreline development

Dwellings
- Low
- Medium
- High

[Map of Michigan with various shades indicating different levels of shoreline development]
Local effects – Boat docks
Local effects – Woody debris
Local effects – Shoreline armoring
Status and Trends Lake Habitat Viewer
National Lakes Assessment

- 50 randomly drawn lakes in MI
- Results from 2007 and 2012 reports
- Highlights major issues facing lakes in the state, country
Condition and Stressors

2012 Michigan NLA Lake Condition and Stressors

- Lake Habitat Complexity
- Methylmercury (Sediment)
- Riparian Vegetation Cover
- Total Mercury (Sediment)
- Shallow Water Habitat
- Lakeshore Disturbance
- Total Nitrogen
- Total Phosphorus
- Turbidity
- Lake Drawdown Exposure
- Dissolved Oxygen
- Atrazine

Legend:
- Most Disturbed
- Moderately Disturbed
- Least Disturbed
- Not Assessed
NLA: Riparian vegetation

Michigan NLA Condition trends based on Riparian Vegetation Cover Indicator

- Least Disturbed
- Moderately Disturbed
- Most Disturbed
- Not Assessed

Percentage of Lakes

- 2007
- 2012
NLA: Shallow water habitat

Michigan NLA Condition trends based on Shallow Water Habitat Indicator

- Least Disturbed
- Moderately Disturbed
- Most Disturbed
- Not Assessed

Percentage of Lakes

- 2007
- 2012
NLA: Lakeshore disturbance
Fisheries Division Management Recommendations

- Special Reports
- Policies and Procedures
- Status of the Fishery Reports
- Fish habitat prescriptions
Management recommendations
Fisheries Division Policies

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<tr>
<th>Fisheries Division</th>
<th>Program</th>
<th>Field Operation</th>
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<tr>
<td>Policy &amp; Procedure</td>
<td>Chapter</td>
<td>Resource Management</td>
<td>Habitat Management Unit</td>
<td>REVISED 02/25/2009</td>
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<td>Riparian Vegetation Protection</td>
<td>Number</td>
<td>02.02.011</td>
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Buffer: >100 ft. + 5 feet per 1% increase in slope

No cutting of trees >4” dbh within 25 ft.

Selective cutting from 25 ft. to landward edge of buffer
Fisheries Division Policies

...In many cases structures fail to have a positive effect on fish populations or angler catch rates and are not the most cost effective form of habitat improvement...

...artificial structures should be designed to improve existing habitat or riparian conditions within a system if habitat is limiting fish production...
Lake-Level Control Structures

• Legal lake levels established by Courts

• Control structures = Dams
  – Barriers to movement of fish and other aquatic life
  – Inundate wildlife nesting and foraging areas
  – Lead to hardening of shoreline as shoreline erosion increases
Lake-Level Control Structures

• Negative downstream effects

• Alter seasonal high and low water levels
  • Changes composition of wetland plant communities
  • Prevents aeration of soils, slows decomposition rates

• Mitigate for fish passage

• Require management plan
- Barrier to fish movement
- No flow to downstream system
...Fisheries Division discourages the construction of lake level controls and does not support establishment of legal lake levels...

...Fisheries Division will recommend lake level management operations which minimize disruption to annual or seasonal hydrological regimes, protect and maintain aquatic communities, and protect recreational uses.
Fisheries Division does not generally support use of groundwater augmentation wells to enhance water level of inland lakes since the practice has not proven practical and has the potential to result in adverse effects...

Fisheries Division will recommend denial of any groundwater withdrawal that will interfere with the natural flow of water to other water bodies...
Beach Sanding

- Typically in vegetated areas with soft substrates
- Productive habitats for fish and macroinvertebrates
- If permitted minimize the area
- Require a mixture of pea gravel and sand
...Shoreline modification can have significant adverse effects on the fishery and the overall integrity of a lake or stream. Shoreline modification will not be supported except in documented cases where the erosion is serious, such as a threat to primary residence, and cannot be managed by alternative approaches. When shoreline modification is justified, natural materials or soft engineering techniques will be recommended...
Marina and dock construction are subject to review to protect Michigan’s aquatic resources and maintain boating densities that do not exceed the carrying capacity of the subject water body.

Before new development proceeds in natural portions of the shoreline, redevelopment of existing marinas or previously disturbed areas should be considered...
Overview
Habitat: Global scale drivers
Habitat: Watershed scale drivers
Habitat: Lake scale drivers
Habitat: Microhabitat scale drivers
Fish rely on littoral zones

- Provides critical habitat for at least 65 native fish species.
  - Spawning
  - Nursery
  - Feeding
  - Predator avoidance
  - Entire life cycle or seasonal use
Don’t take my word for it…
Fish responses to structural habitat changes

Production

Attraction
Large Woody Debris
Large Woody Debris

- Split a lake into two basins and removed large woody debris from one
- Largemouth Bass at less fish, more terrestrial prey, and grew more slowly
- Yellow perch recruitment extremely low and high predation mortality

Sass et al. 2006
Large Woody Debris

- Then, Sass et al. ADDED wood to a basin and...
- NO fish population-level effects in the short term

Sass et al. 2012
Mesocosm experiment

- 0% Vegetation coverage
- 50% Vegetation coverage
- 100% Vegetation coverage
Vegetation increases length

![Graph showing the increase in total length of vegetation over the experimental period. The graph includes data points for July, August, and September, with treatments indicated by different symbols: 0%, 50%, and 100%.]
Vegetation increases weight

![Graph showing growth vs. experimental period for moderate and high density with different treatment levels (0%, 50%, 100%).]
Fish-Habitat-people relationships

- Decreased woody debris, emergent vegetation, and floating vegetation  
  (Christensen et al. 1996; Radomski and Goeman 2001; Jennings et al. 2003)

- Removal of shoreline vegetation on 60% of properties in Michigan 
  (Nohner, unpublished)

- Negative association between developed shorelines and:
  - Muskellunge spawning habitat  
    (Nohner and Diana 2015)
  - Largemouth Bass and Yellow Perch  
    (Sass et al. 2006)
  - Lake Trout, Lake Whitefish, Cisco  
    (Clingerman et al. 2012)
  - Pike, Bluegill, Pumpkinseed  
    (Radomski and Goeman 2001)
  - Fish diversity  
    (Jennings et al. 1999)
Overview
Fisheries

• Affects to fish populations

• Concentrates fishes to remaining structure

• Changes the aesthetic

• Lessons learned on the water
Take homes

- Shoreline habitat quality matters for lake ecosystem health, fish populations, and fisheries.
- Fisheries Division has recommendations and resources to promote healthy shorelines
Take homes

• Shoreline habitat quality matters for lake ecosystem health, fish populations, and fisheries.

• Fisheries Division has recommendations and resources to promote healthy shorelines

Follow up:
Joe Nohner
NohnerJ@Michigan.gov