

Michigan's Inland Lakes Status and Trends Program



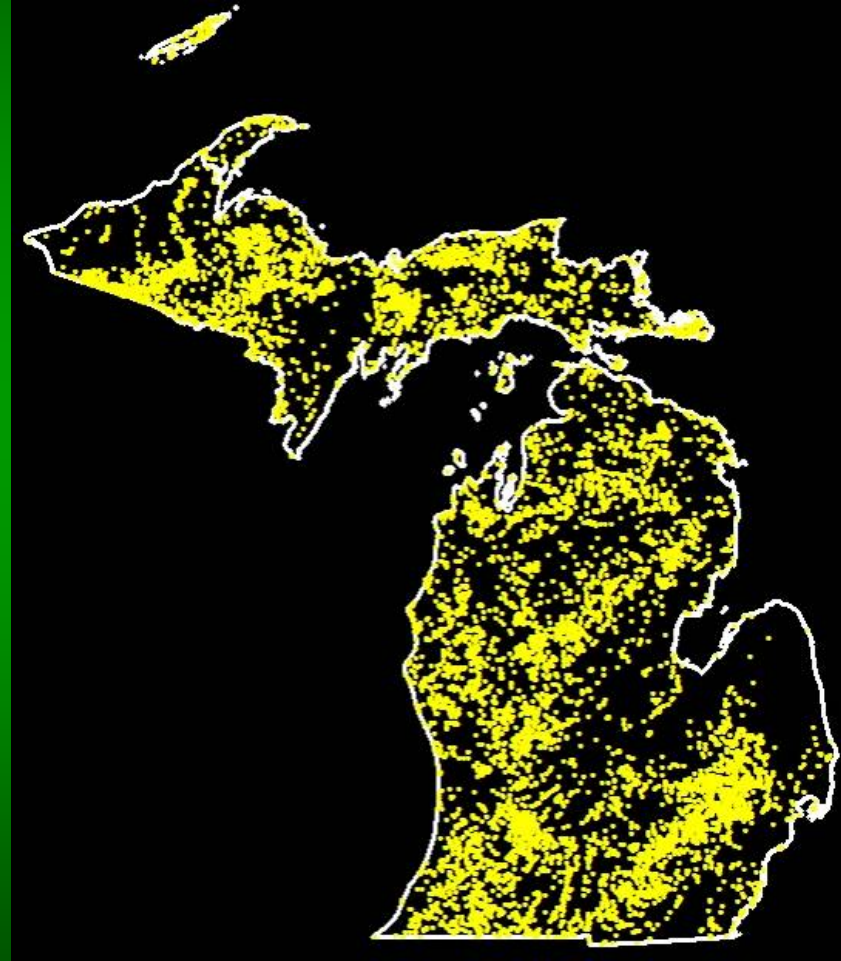
Kevin Wehrly

Michigan Department of Natural Resources
and Environment



Michigan Inland Lakes

“ to **protect and enhance** fish environments, habitat, populations, and other forms of aquatic life, and to **promote optimum use** of these resources for benefit of the people of Michigan”



>10,000 lakes

Today's Presentation

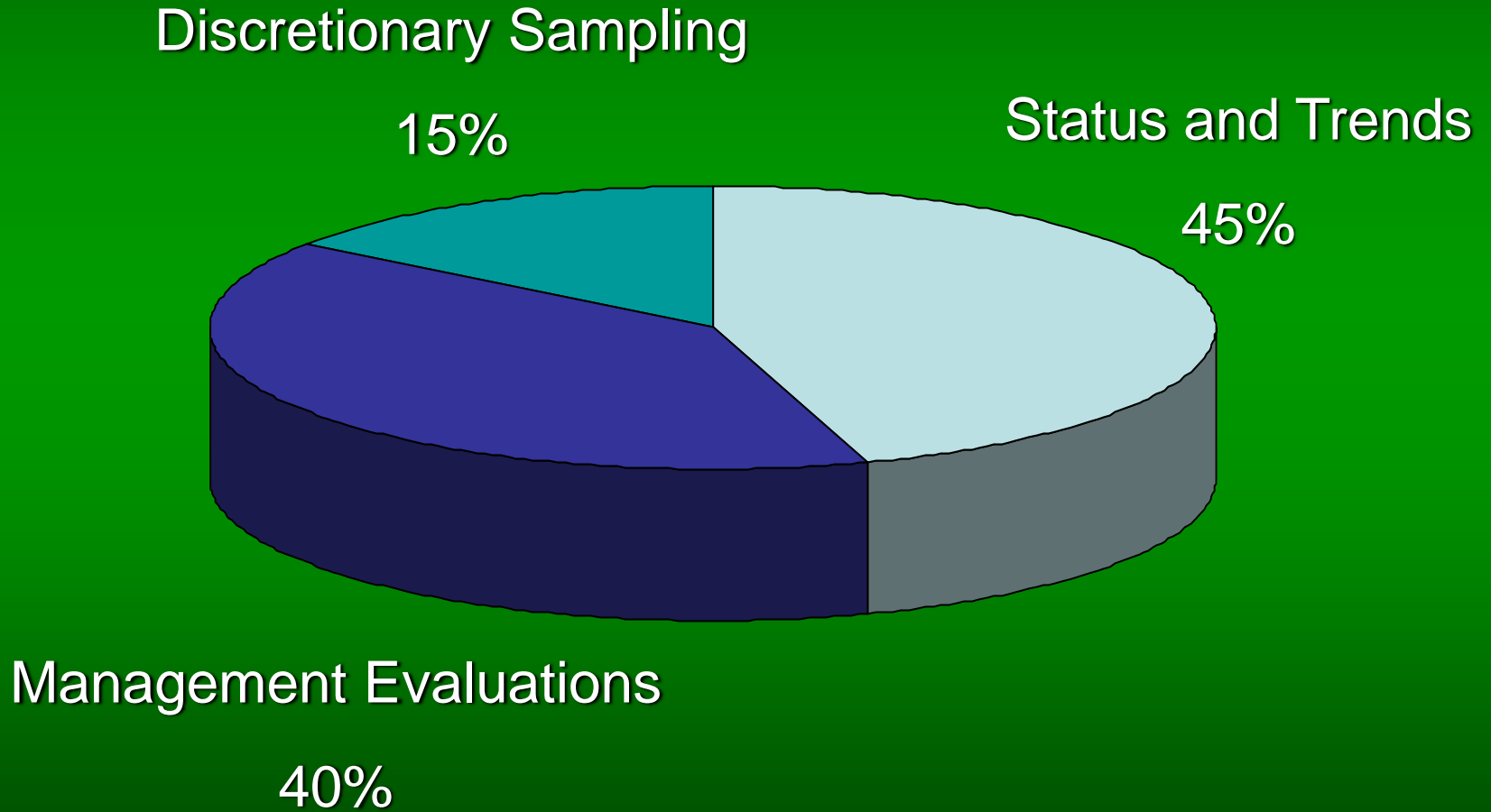
- Fisheries monitoring program



- Patterns of shoreline development



Fisheries Resource Inventory Strategy



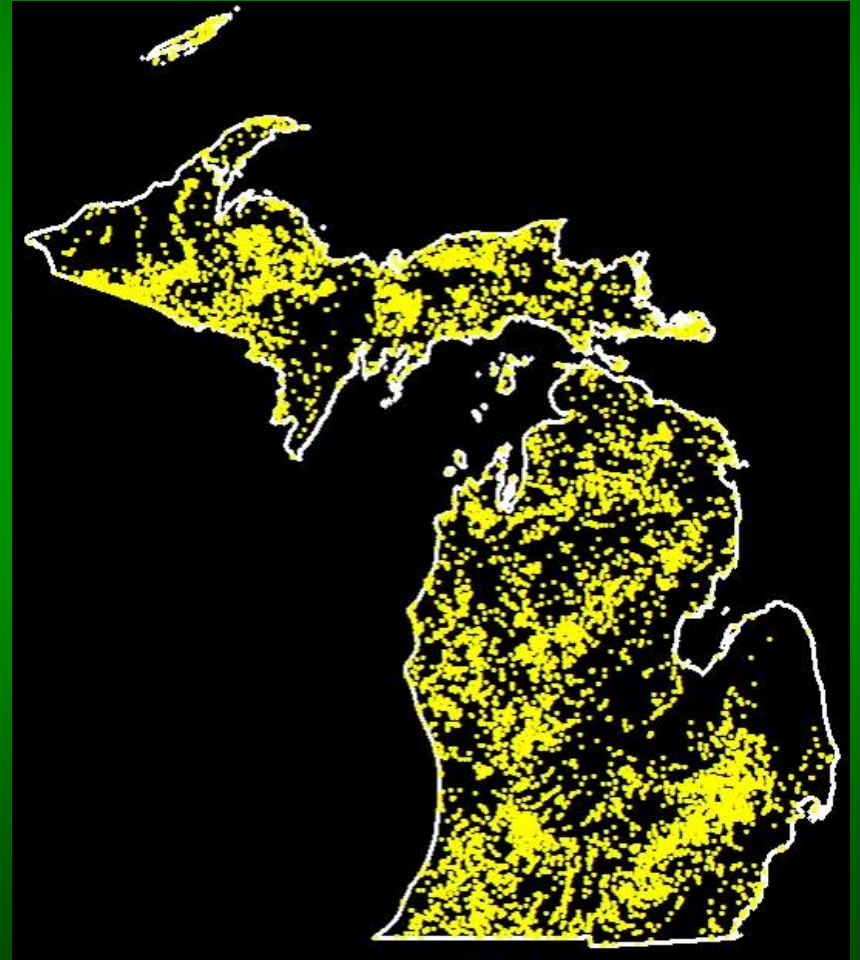
Inland Lakes Status and Trends

Goals

- Maintain statewide inventory
- Develop indices
- Assess current status and detect changes

Status and Trends Design

- Randomly selected
- 10 acres and larger
- Standardized methods
- Comprehensive



Chemical Indicators

- Alkalinity
- Nutrients
- Chlorophyll a
- pH
- Dissolved oxygen



Physical Indicators

- Surface temperature
 - Stratification pattern
 - Depth
 - Transparency
-
- Dwelling density
 - Shoreline armoring
 - Large woody debris
 - Dock density



Biological Indicators

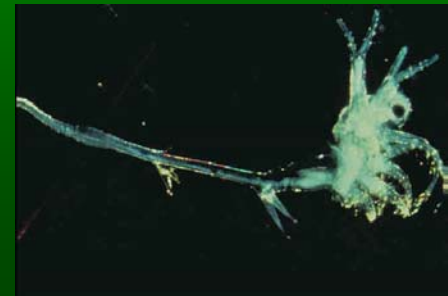
Fish

- Richness
- SGCN
- Non-natives
- Size structure
- Growth rate
- Abundance



Zooplankton

- Species composition
- Size structure
- Non-natives

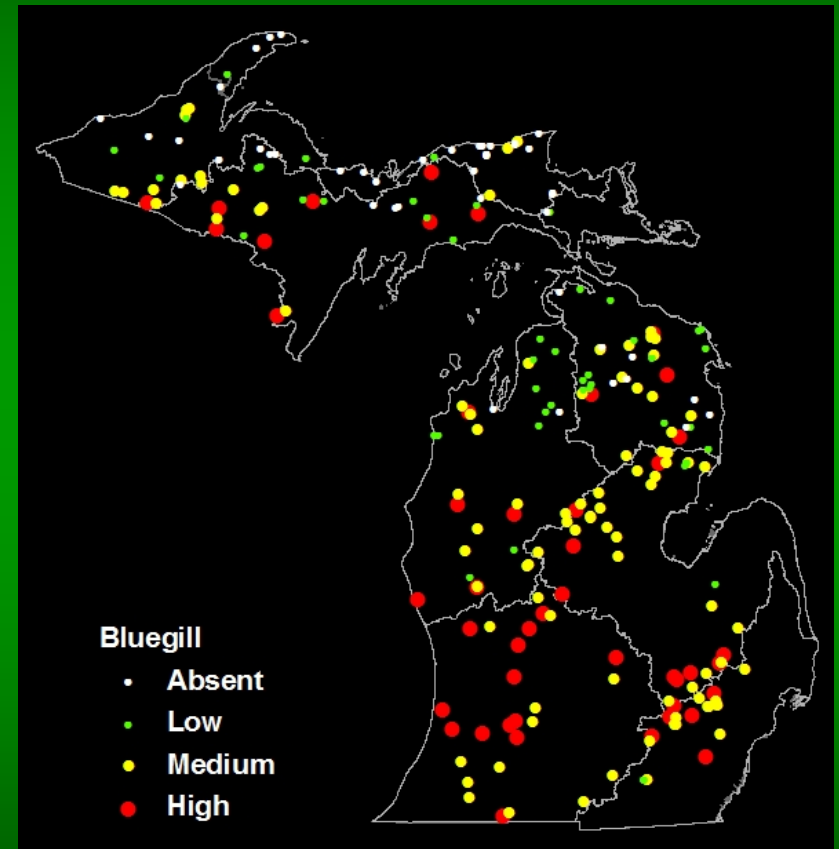


Statewide Status and Trends 2002-2007



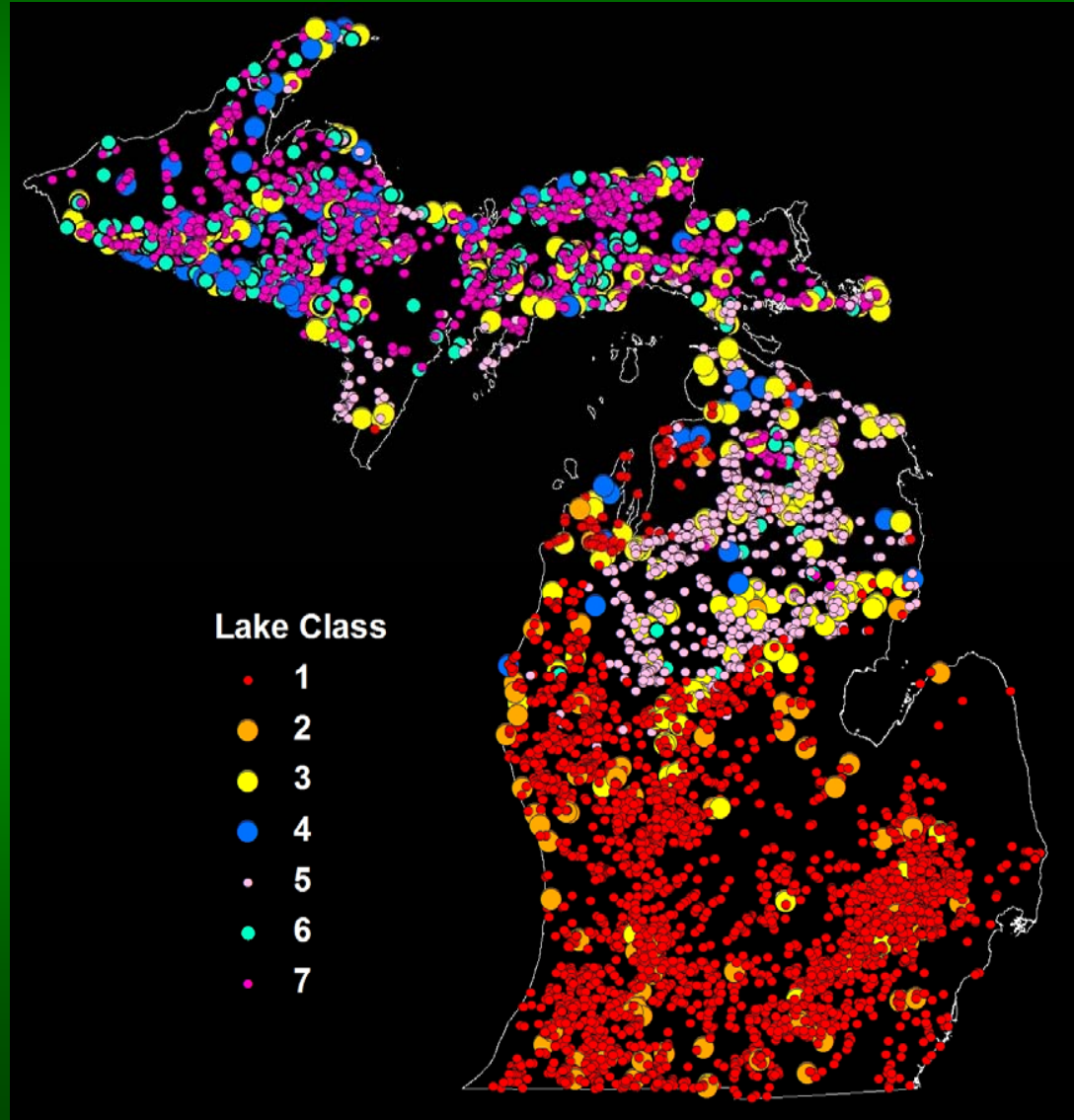
How are monitoring data used?

- Local management
- Statewide status and trends
- Decision support tools



Lake Classification

- 1— Bluegill, largemouth bass
- 2— Walleye, smallmouth bass
- 3— Rockbass, sucker
- 4— Smallmouth bass, walleye
- 5— Largemouth bass, pike
- 6— Sucker, pumpkinseed
- 7— Yellow perch, salmonids



Impacts of residential lakeshore development on littoral habitat of Michigan lakes



Issues

- Residential lakeshore development can alter lake ecosystems

Fish— Bryan and Scarnecchia 1992, Jennings et al. 1999, Schindler et al. 2000, Scheuerell and Schindler 2004, Sass et al. 2006

Frogs— Woodford and Meyer 2002

Macroinvertebrates— Banziger 1995, Brauns et al. 2007

Vegetation and CWD— Christiansen et al. 1996, Radomski and Goeman 2001, Elias and Meyer 2003, Jennings 2003, Marburg et al. 2006

Water quality— Bayne et al. 1990, Moore et al. 2003

Issues

An aerial photograph of a large, dark blue lake. The lake is surrounded by a mix of green fields, some brown agricultural plots, and residential areas with houses and roads. The text 'Issues' is overlaid in the top left corner, and a bulleted list is overlaid on the left side of the lake.

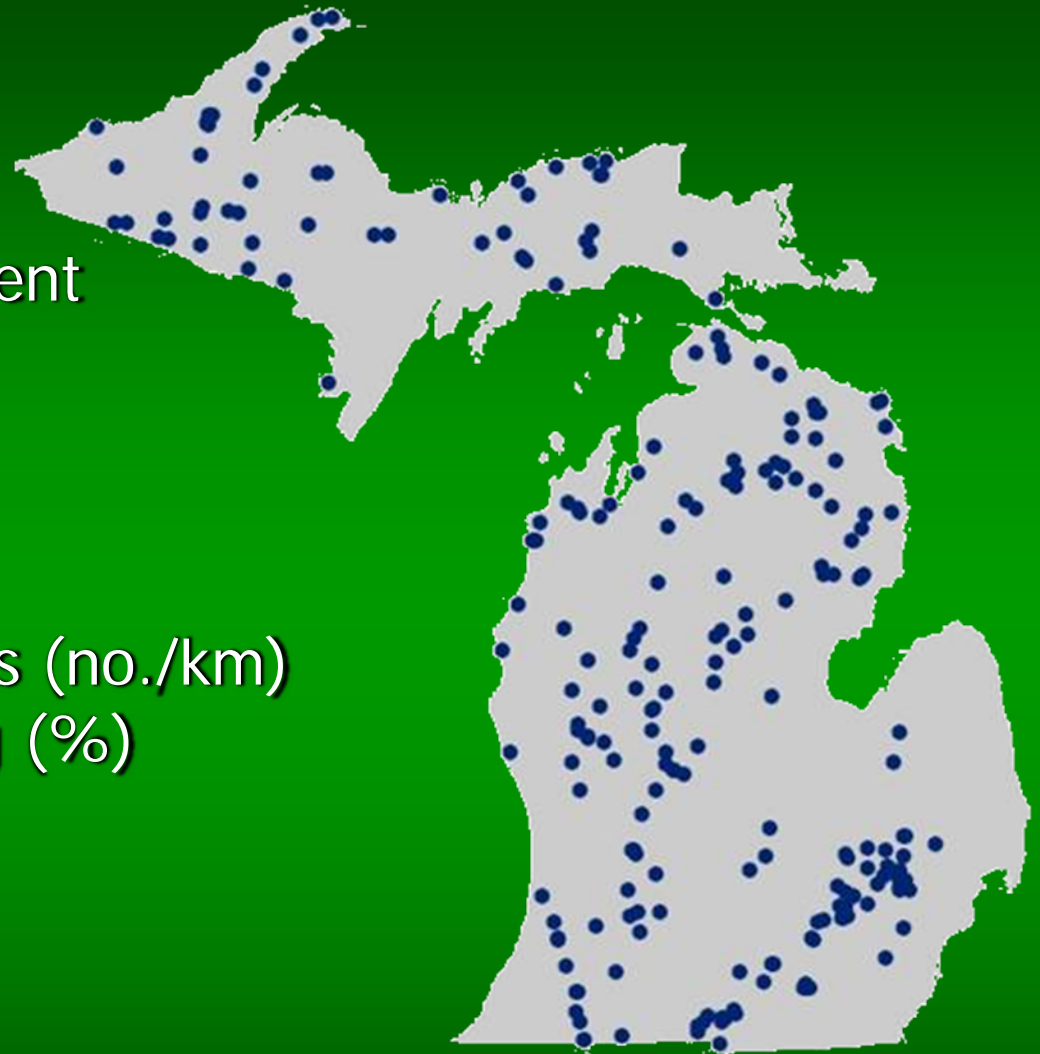
- Residential lakeshore development can alter lake ecosystems
- Lakes are under increasing development pressure
- Few broad-scale studies of residential lakeshore development and lake habitat

Objectives

- Quantify the relationships between residential development and littoral habitat structure in Michigan lakes
- Characterize the broad-scale patterns of shoreline residential development across Michigan

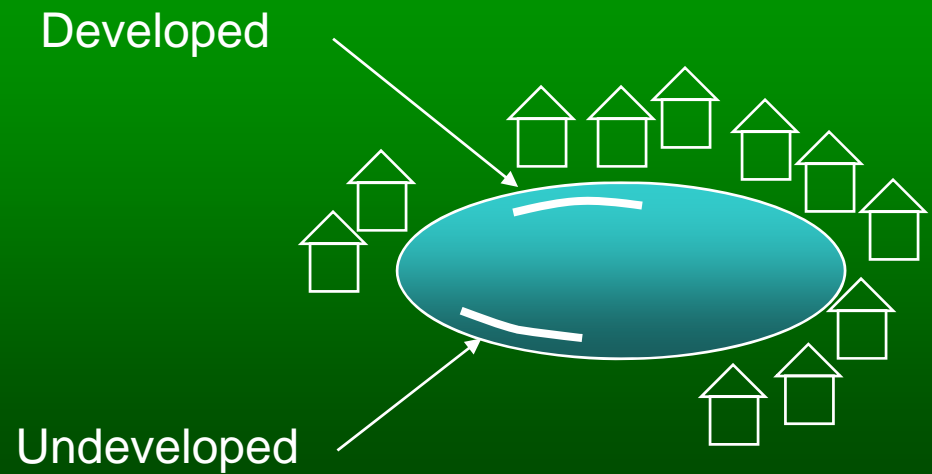
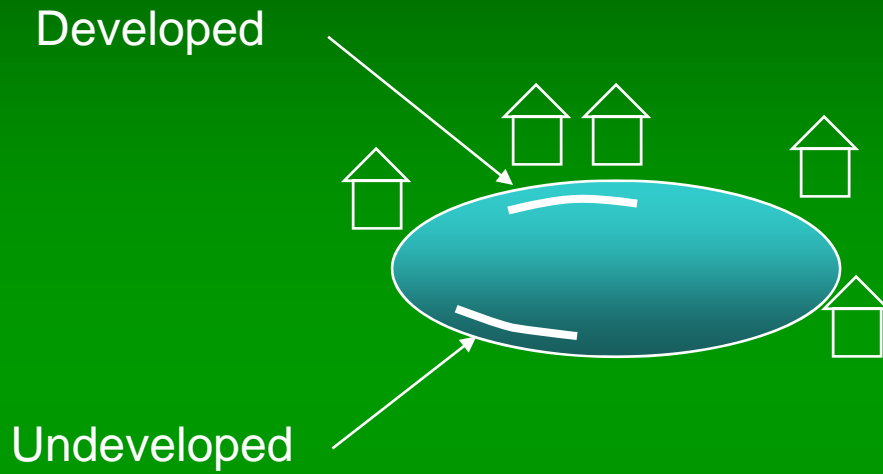
Lake Data

- Residential Development
 - Houses (no./km)
- Littoral habitat
 - Large woody debris (no./km)
 - Shoreline armoring (%)
 - Docks (no./km)



10 to 20,000 acres

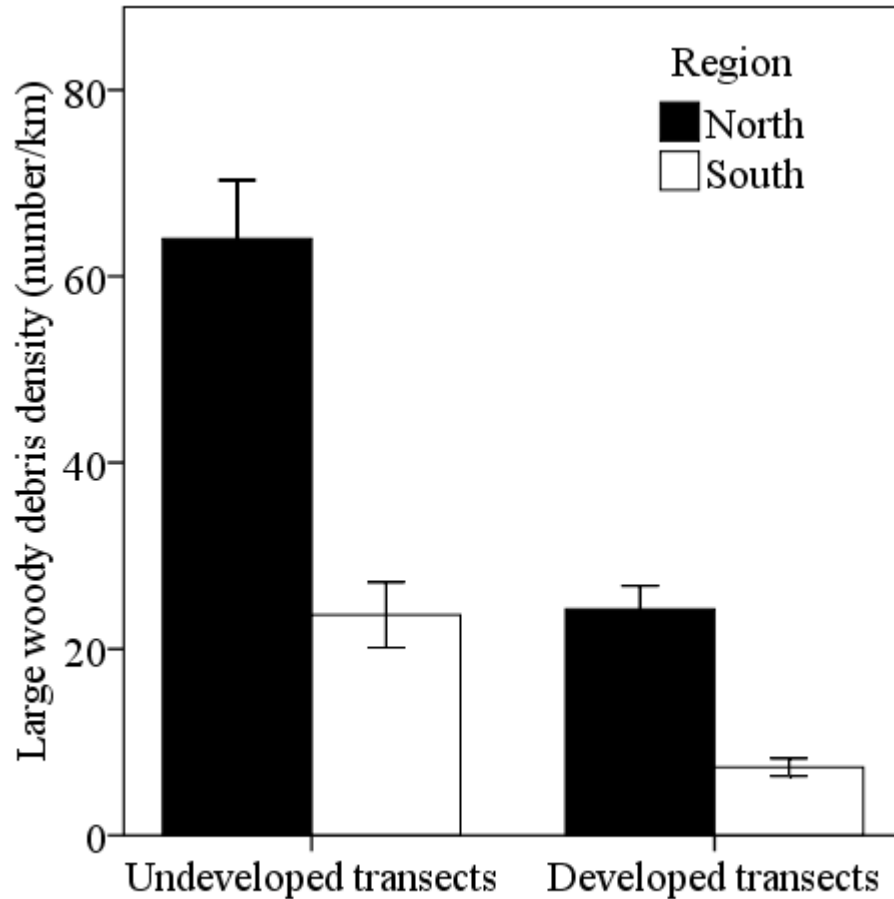
Local Patterns



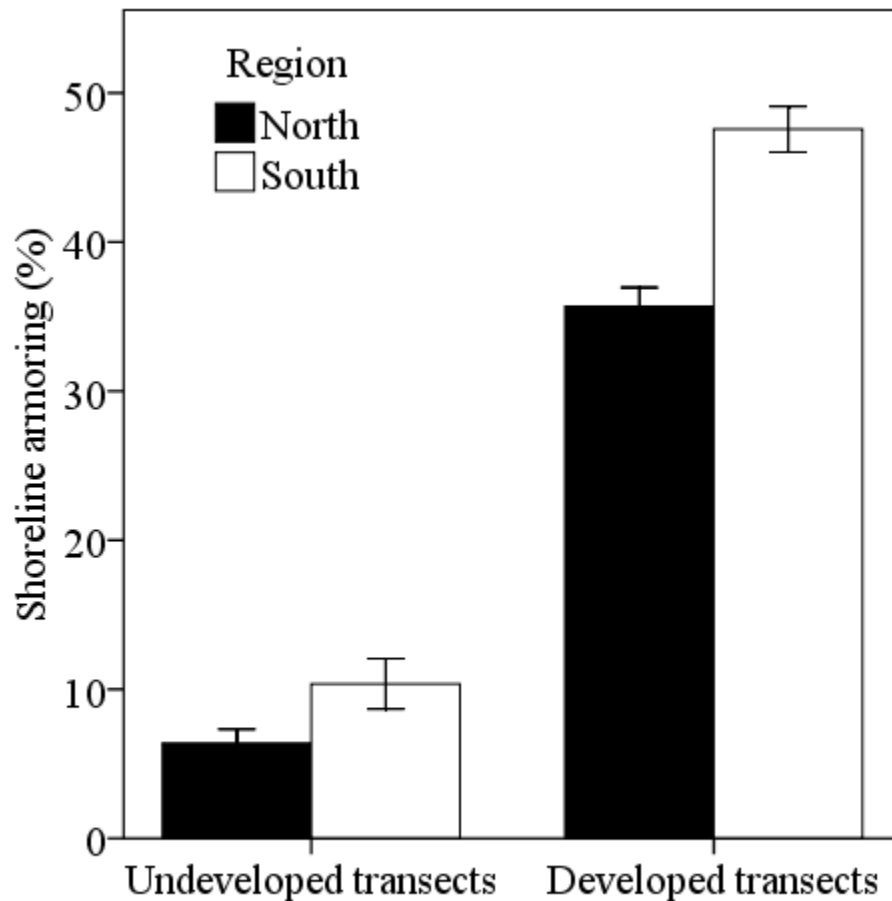
Local Patterns

- Does littoral habitat differ between undeveloped and developed transects?
- Does the relationship between development and habitat vary by region?
- Does the relationship between development and habitat vary by lake wide development intensity?

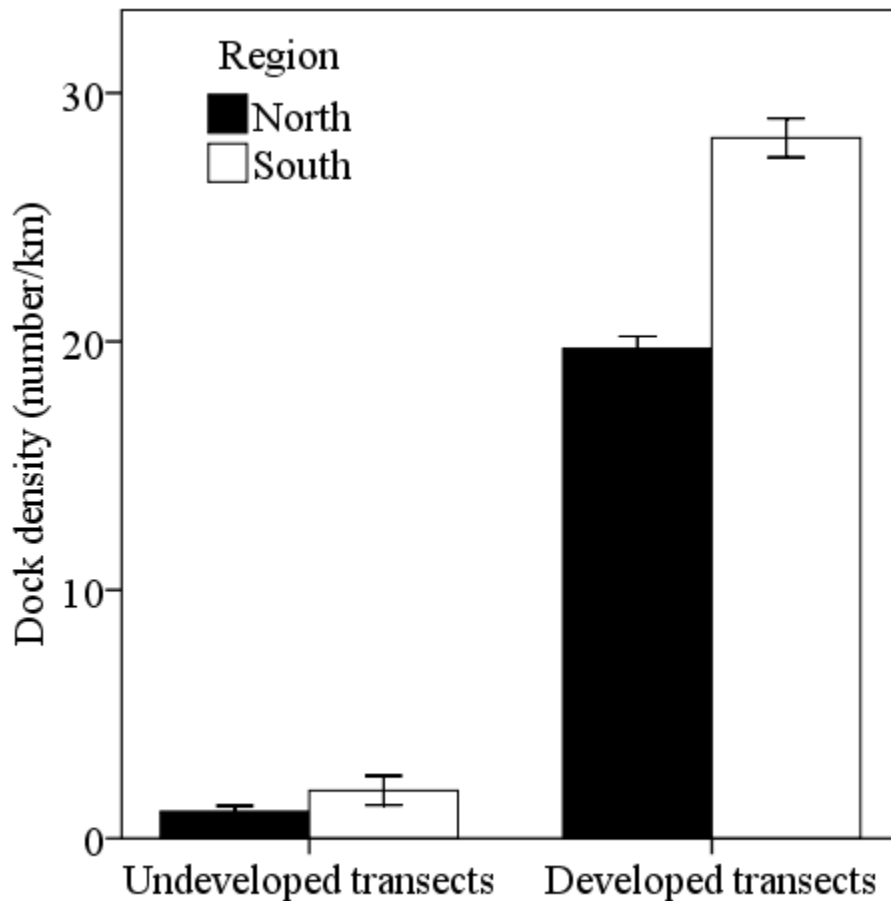
Local Development Large Woody Debris



Local Development Shoreline Armoring



Local Development Boat Docks



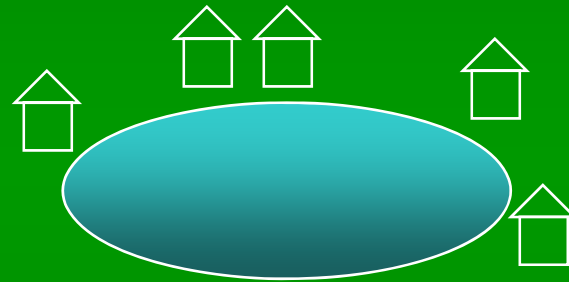
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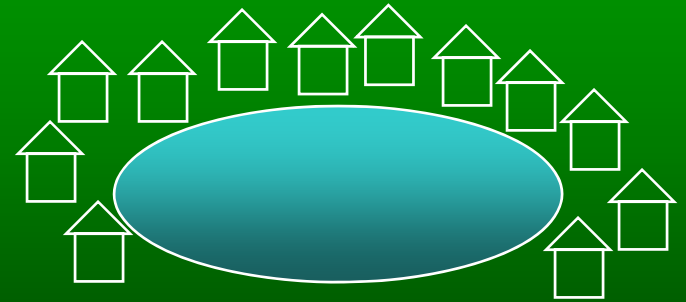
Whole Lake Patterns



Undeveloped



Low 1-10 houses/km



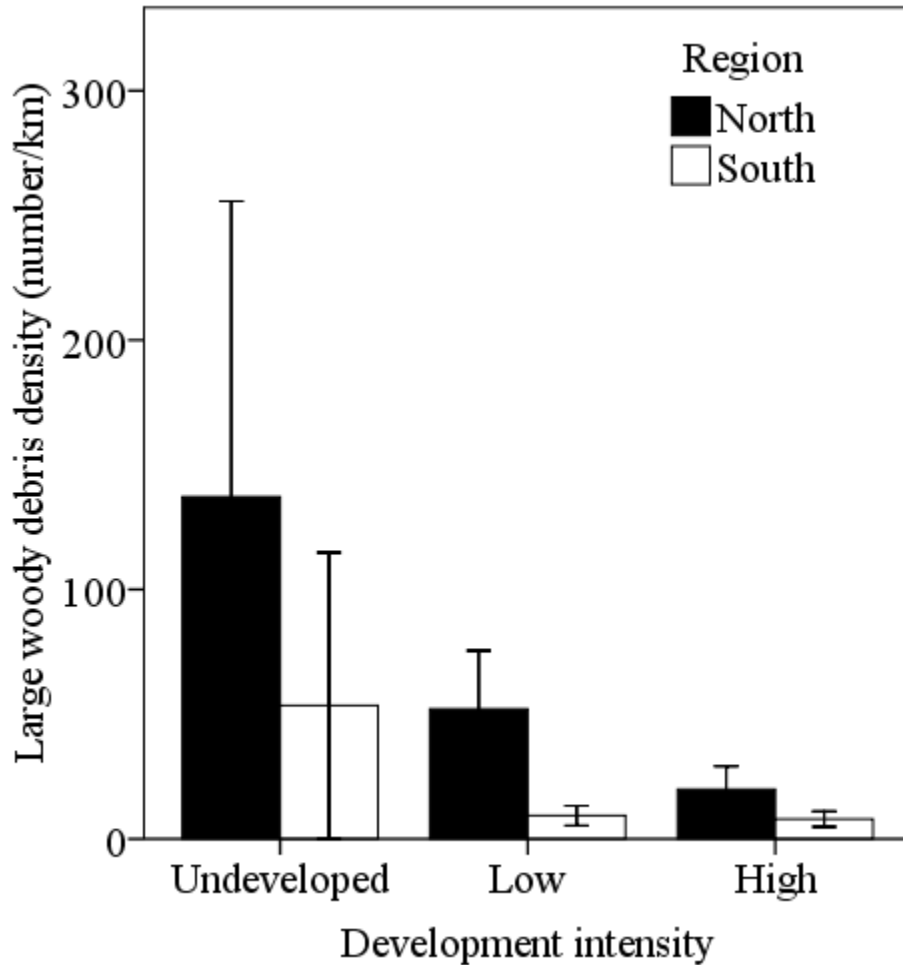
High > 10 houses/km

Whole Lake Patterns

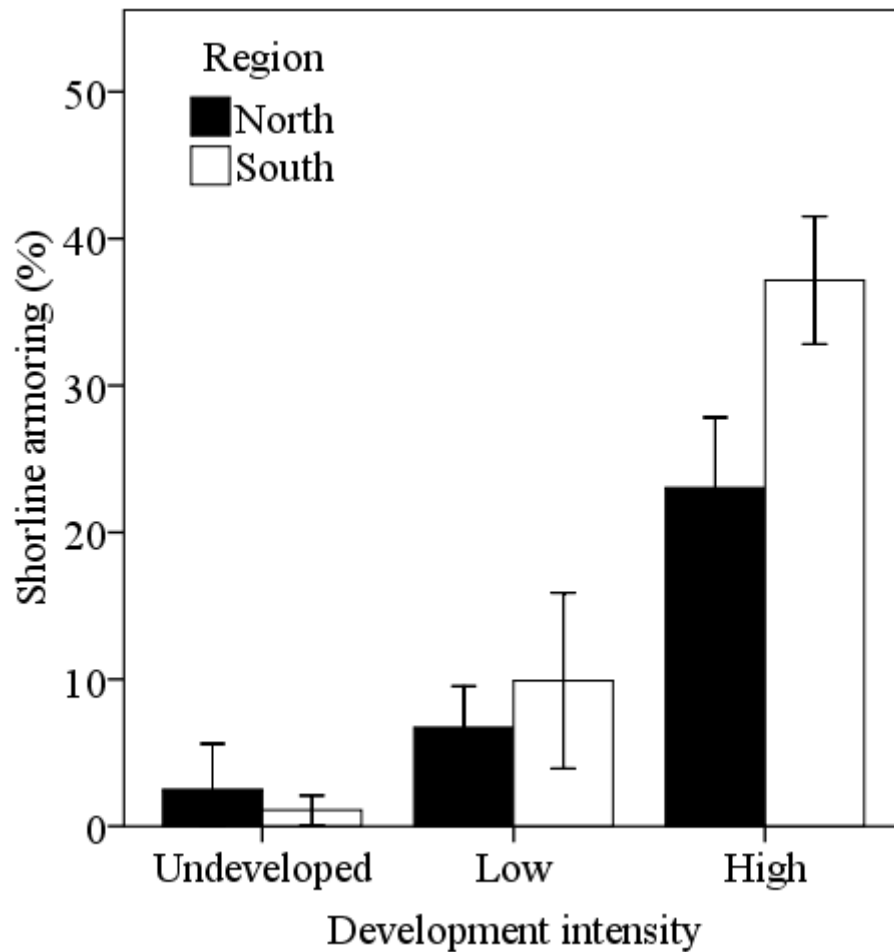
- Does littoral habitat differ among undeveloped, low development, and high development lakes?
- Does the relationship between development intensity and habitat vary by region?
- Does the relationship between development intensity and habitat vary by lake size?

Whole Lake Development

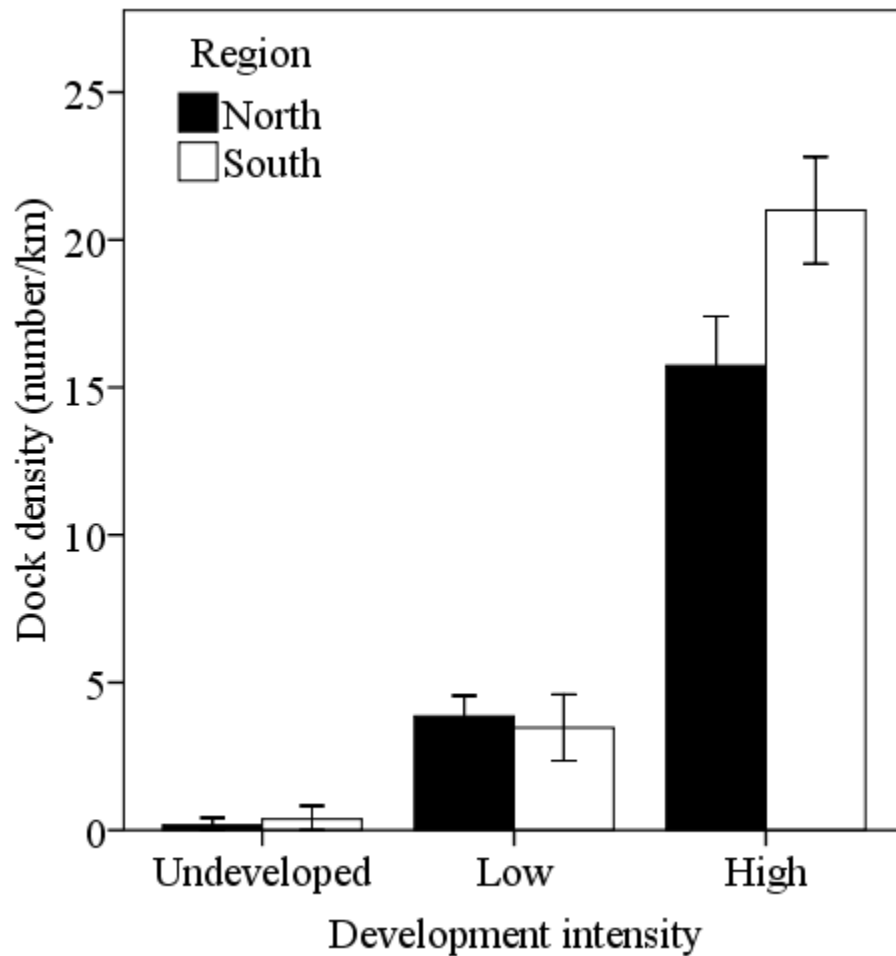
Large Woody Debris



Whole Lake Development Shoreline Armoring



Whole Lake Development Boat Docks



Whole Lake Patterns

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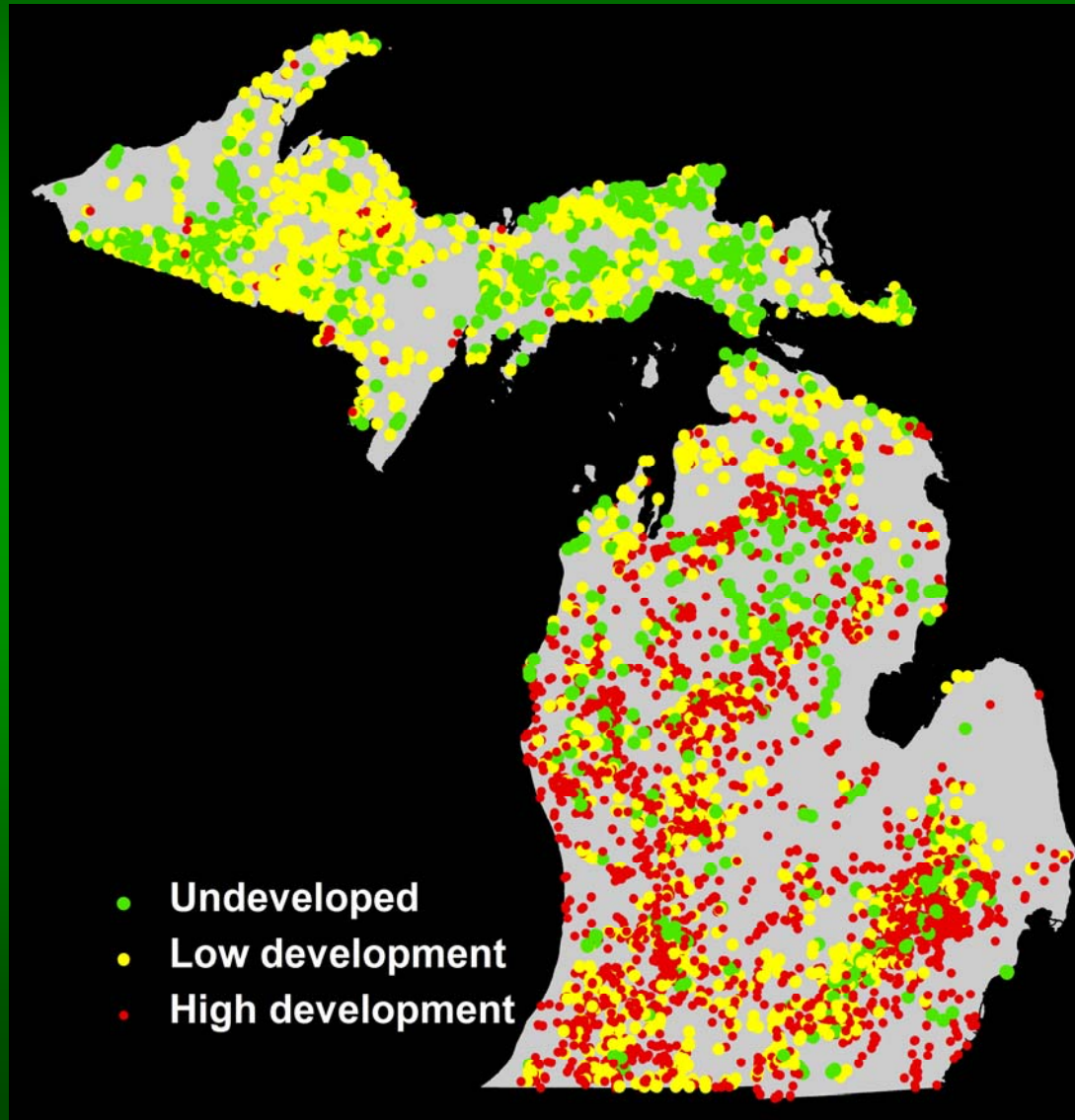
Statewide Development Patterns



Predictor Variables

- + Urban in Buffer
- - Wetland in Buffer
- - Public ownership
- - Distance from Detroit

Estimated Development



Summary

- Residential development has significant influence on littoral habitats at local and whole lake scales
- Strong regional effect on the relationship between development intensity and littoral habitat condition
- Majority of lake shorelines are developed

