Zebra mussel habitat preference, growth, and mortality in northeast Wisconsin and Upper Michigan

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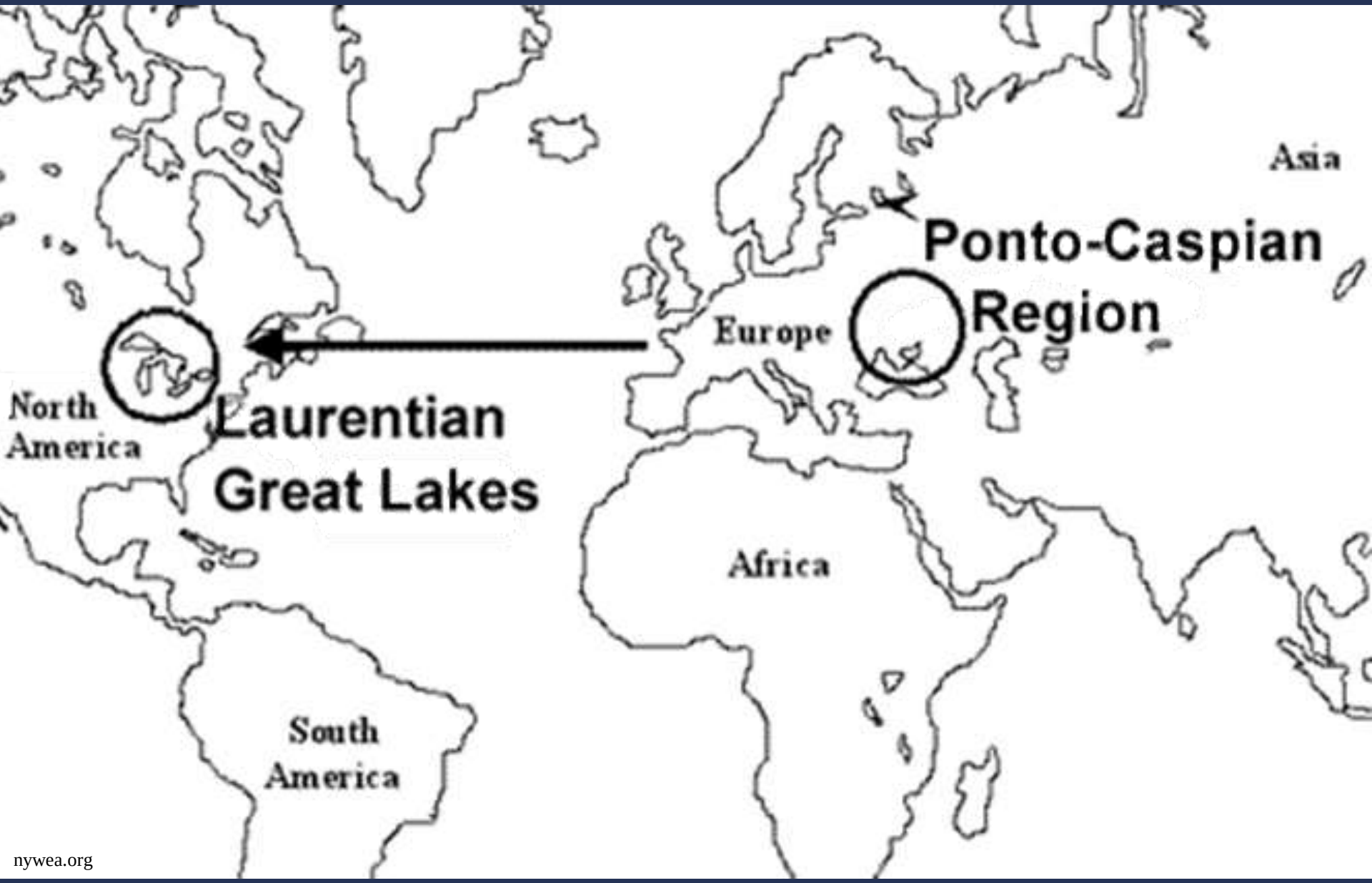
Invasive Species

- Non-native
- Outcompete
- Impacts


Asia
Ponto-Caspian
Region
Europe
North
America
Laurentian
Great Lakes
Africa
South
America

nywea.org


JAMES R. BARKER
THE INTERLAKE STEAMSHIP CO.
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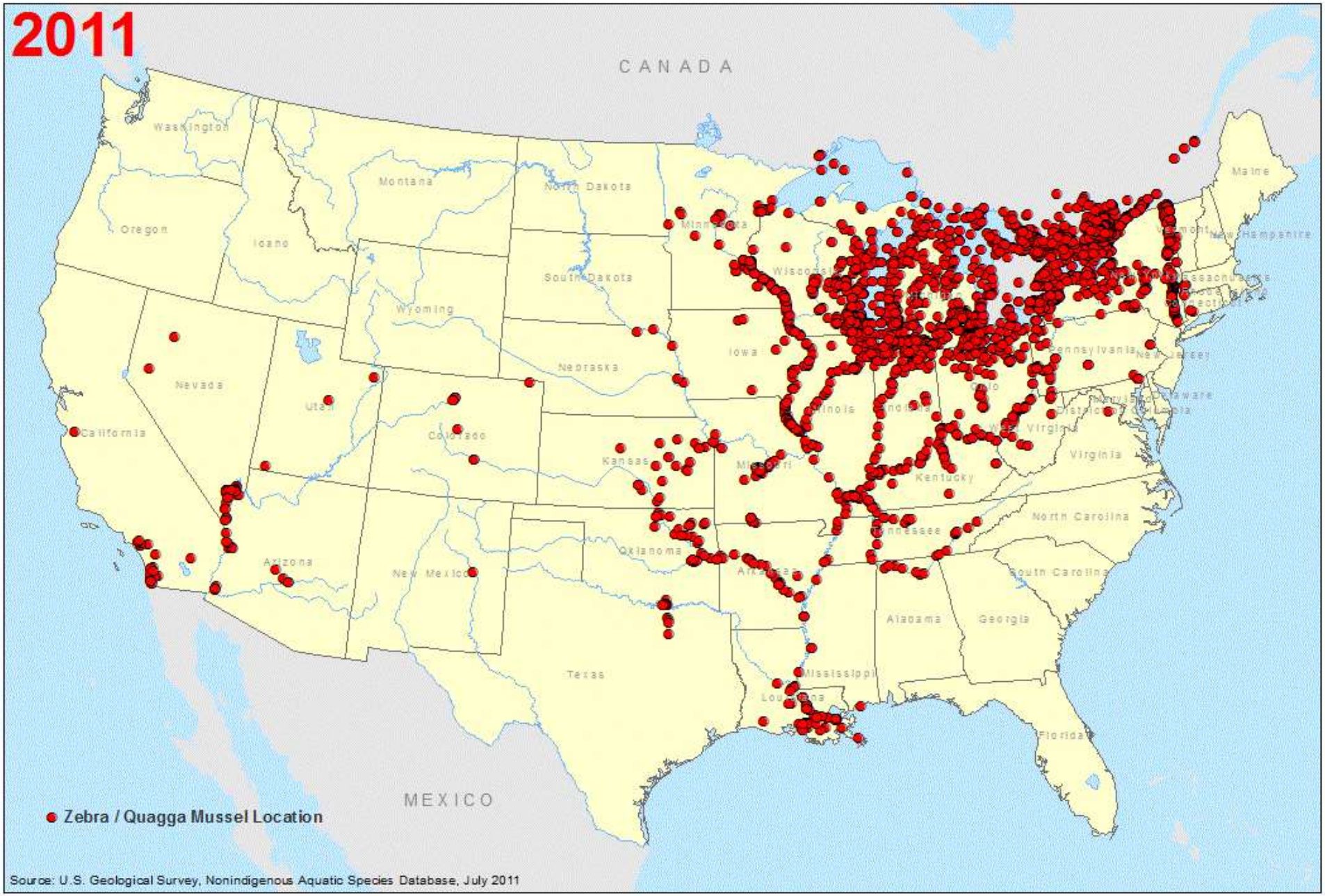
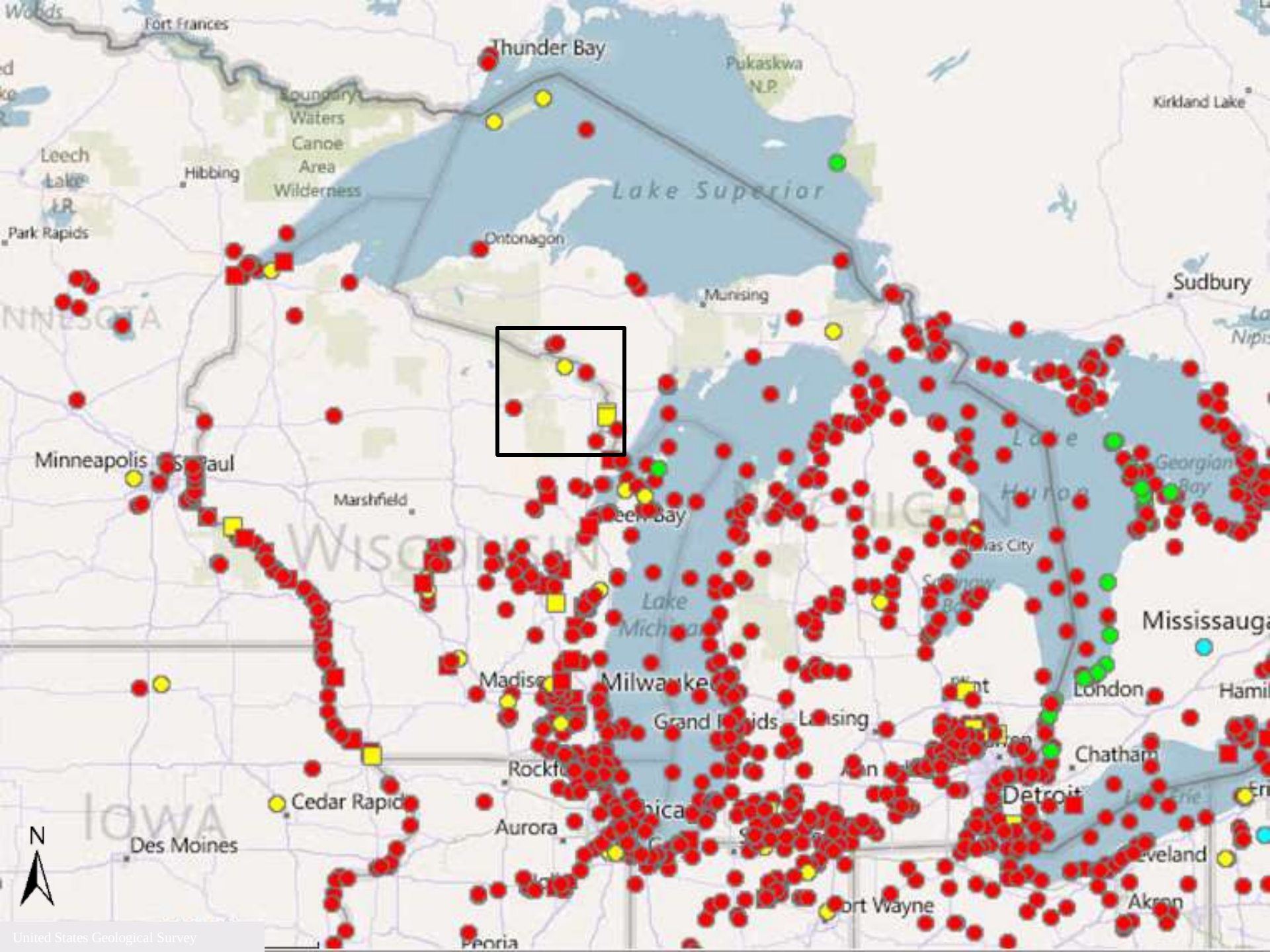
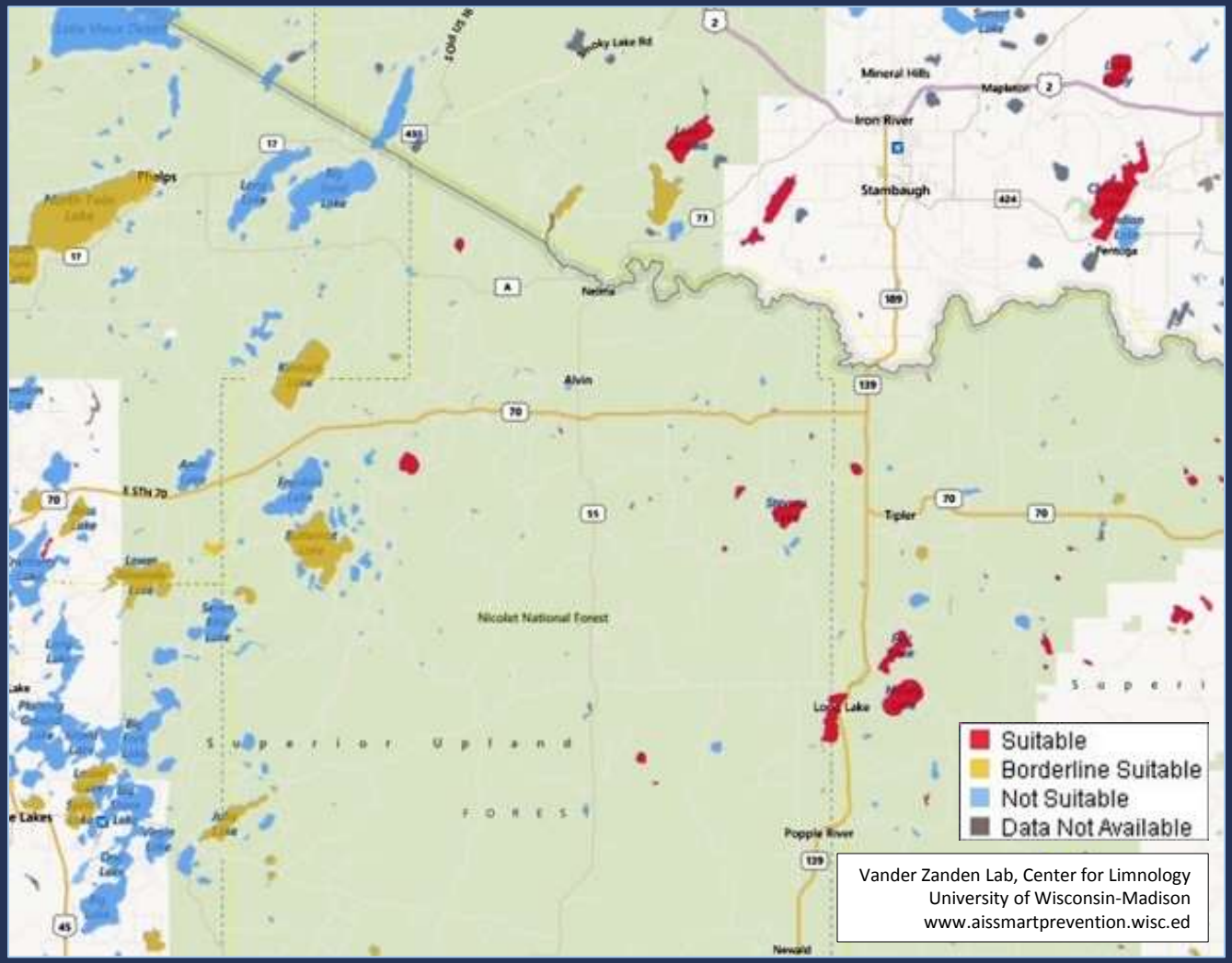

2011
CANADA
MEXICO
Washington
Oregon
California
Nevada
Idaho
Montana
Wyoming
Utah
Arizona
Colorado
New Mexico
North Dakota
South Dakota
Nebraska
Kansas
Oklahoma
Texas
Minnesota
Iowa
Missouri
Arkansas
Louisiana
Wisconsin
Illinois
Michigan
Indiana
Ohio
Kentucky
Tennessee
Mississippi
Alabama
Georgia
Florida
South Carolina
North Carolina
Virginia
West Virginia
Pennsylvania
New York
Vermont
New Hampshire
Maine
Massachusetts
Connecticut
New Jersey
Delaware
Maryland
District of Columbia
Zebra / Quagga Mussel Location
Source: U.S. Geological Survey, Nonindigenous Aquatic Species Database, July 2011



Potential Spread



Potential Spread

Potential Spread

Population Dynamics

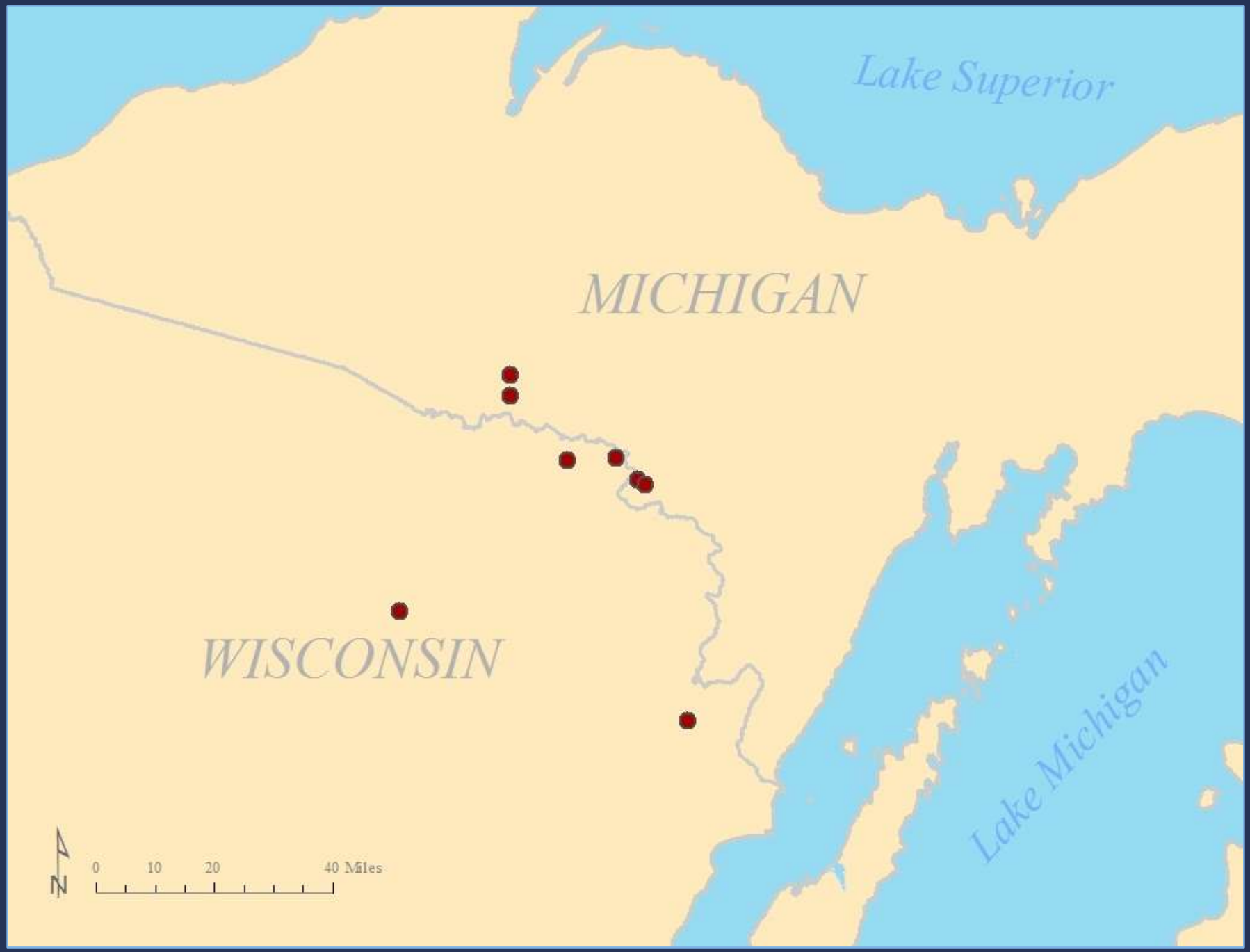
- Growth
- Mortality

Research Purpose

- Identify important habitats and lake-specific habitat limitations
- Compare aspects of zebra mussel demography at different phases of colonization

Objectives

1) Test whether zebra mussels select substrate
2) Test for differences in habitat selection among lakes and build a predictive model of potential habitat use
3) Test for differences in zebra mussel mean lengths-at-age among lakes
4) Test for differences in zebra mussel mortality rates among lakes

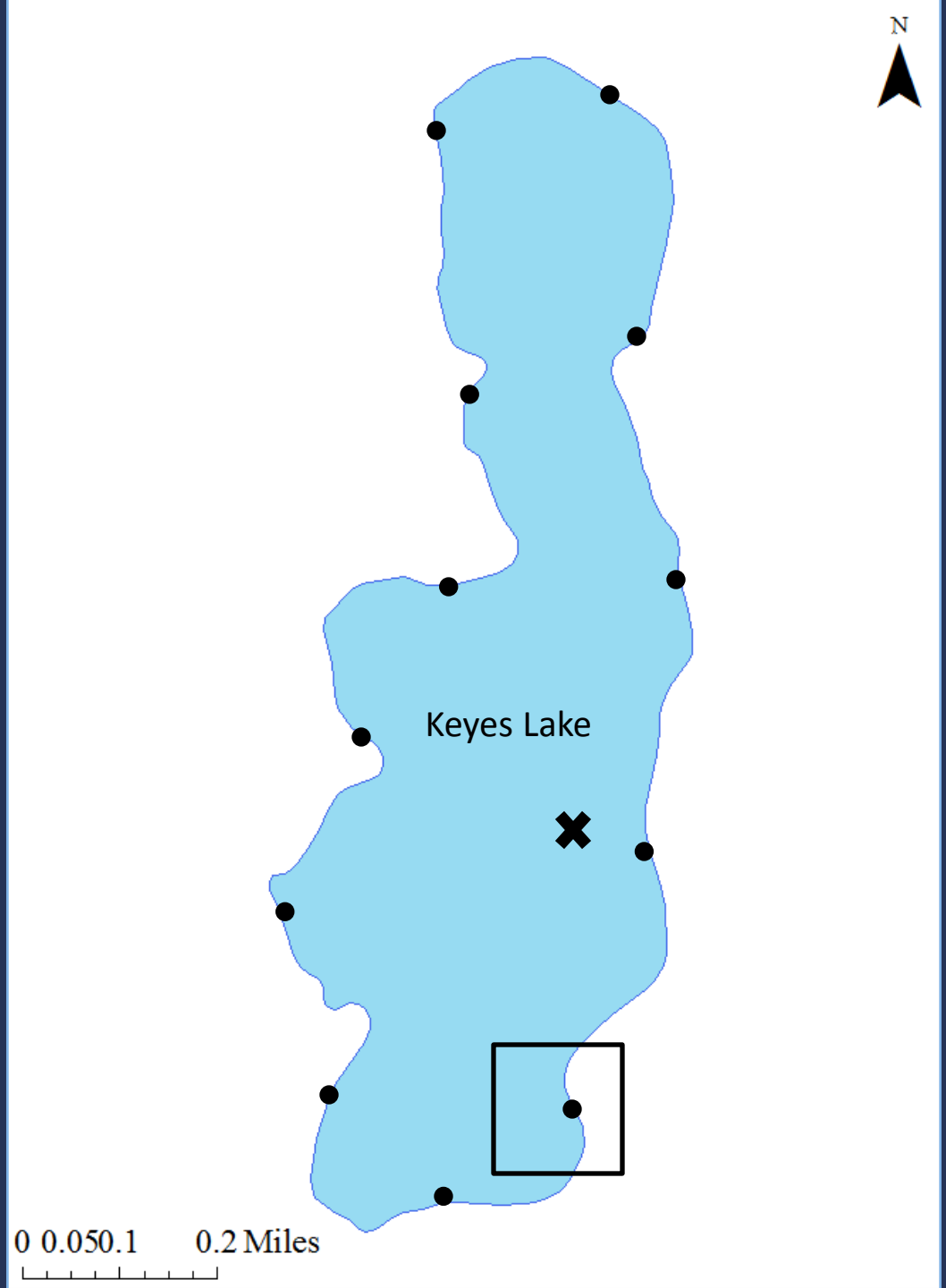

Lake Superior
MICHIGAN
WISCONSIN
Lake Michigan
N
0
10
20
40 Miles

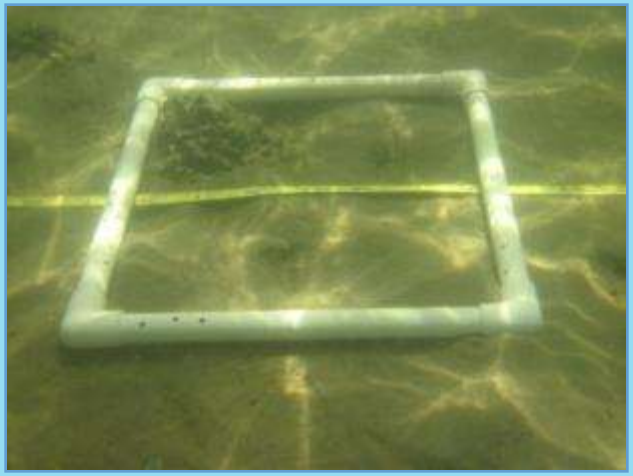
Study Lakes

- Detected: 1999 – 2012
- Area: 38 – 970 hectares
- Maximum depth: 8 – 62 meters

Field Methods

- Quadrats along transects

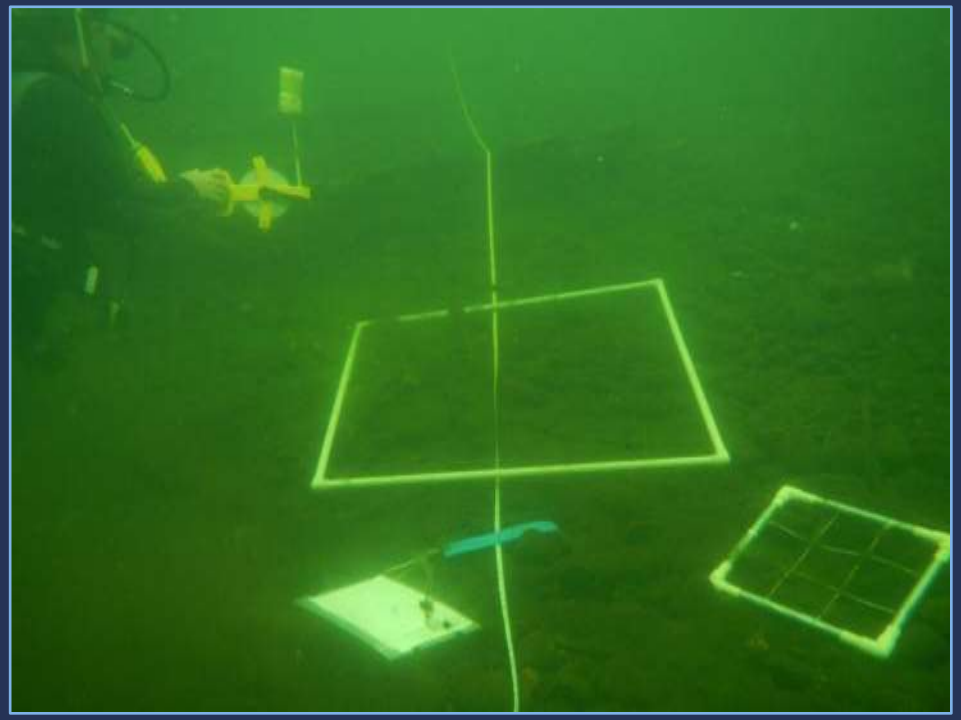

N
Keyes Lake
0 0.050.1 0.2 Miles

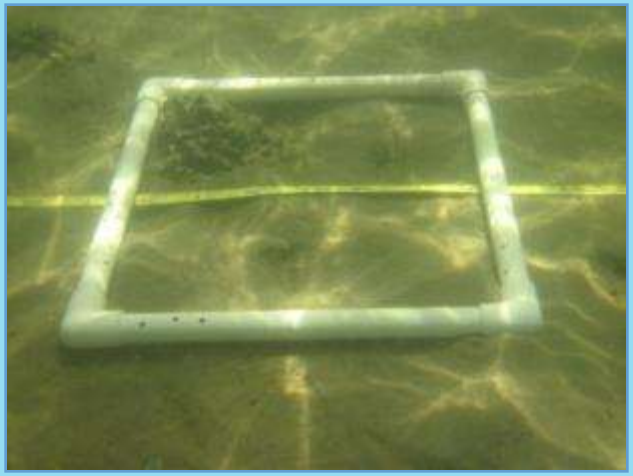


Keyes Lake

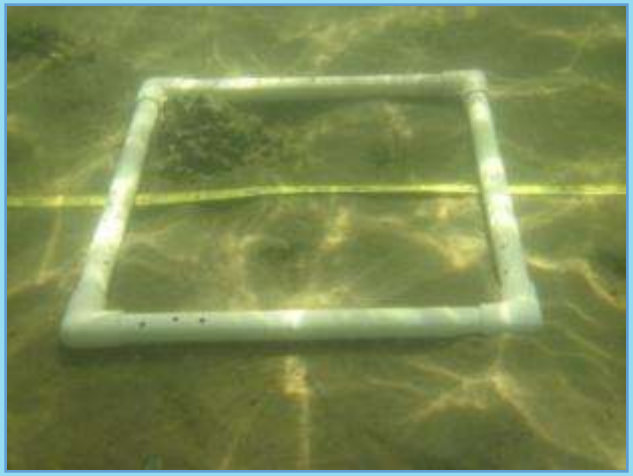
Field Methods

- Quadrat data
  - Depth
  - Substrate
  - Substrate use





Keyes Lake

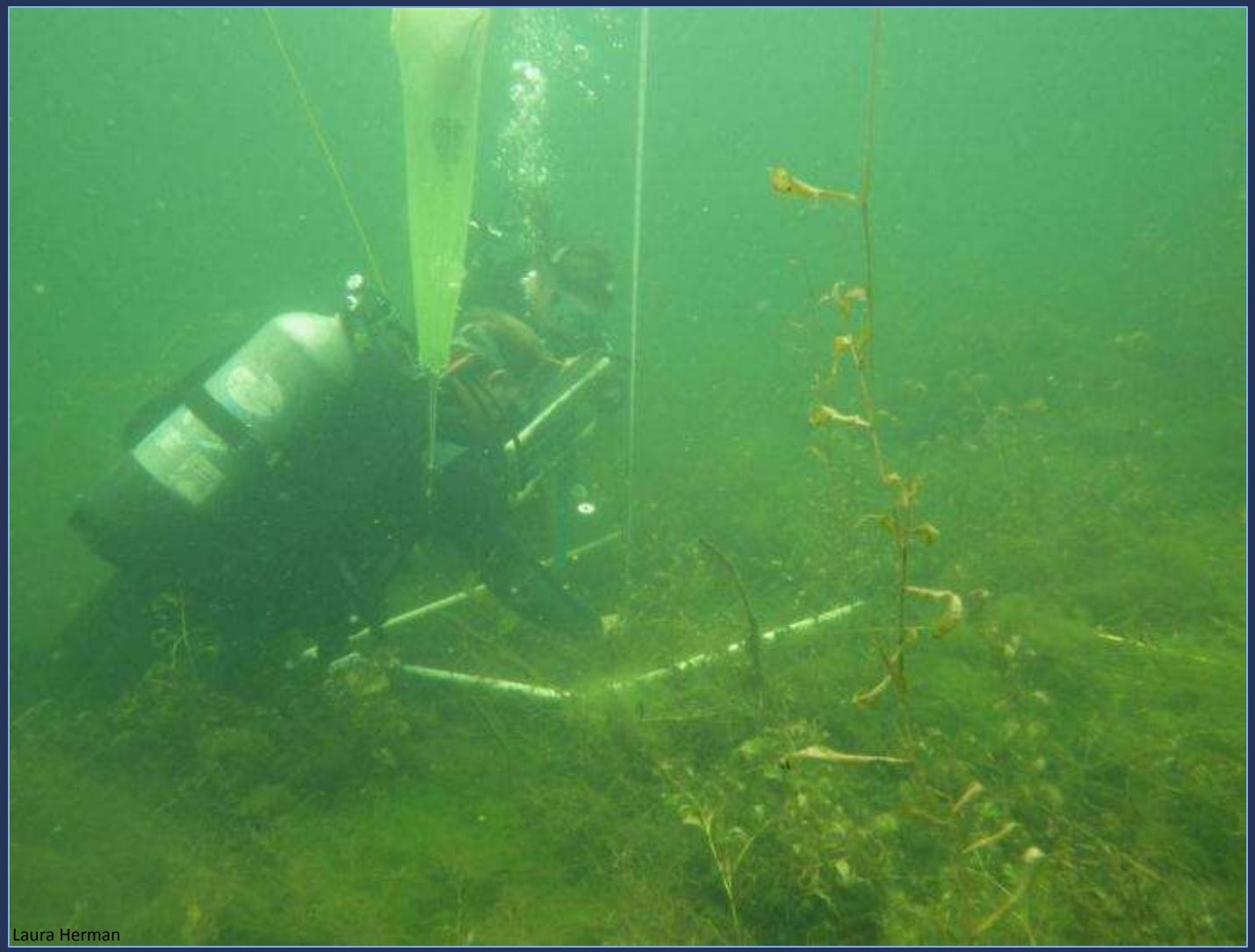


Keyes Lake

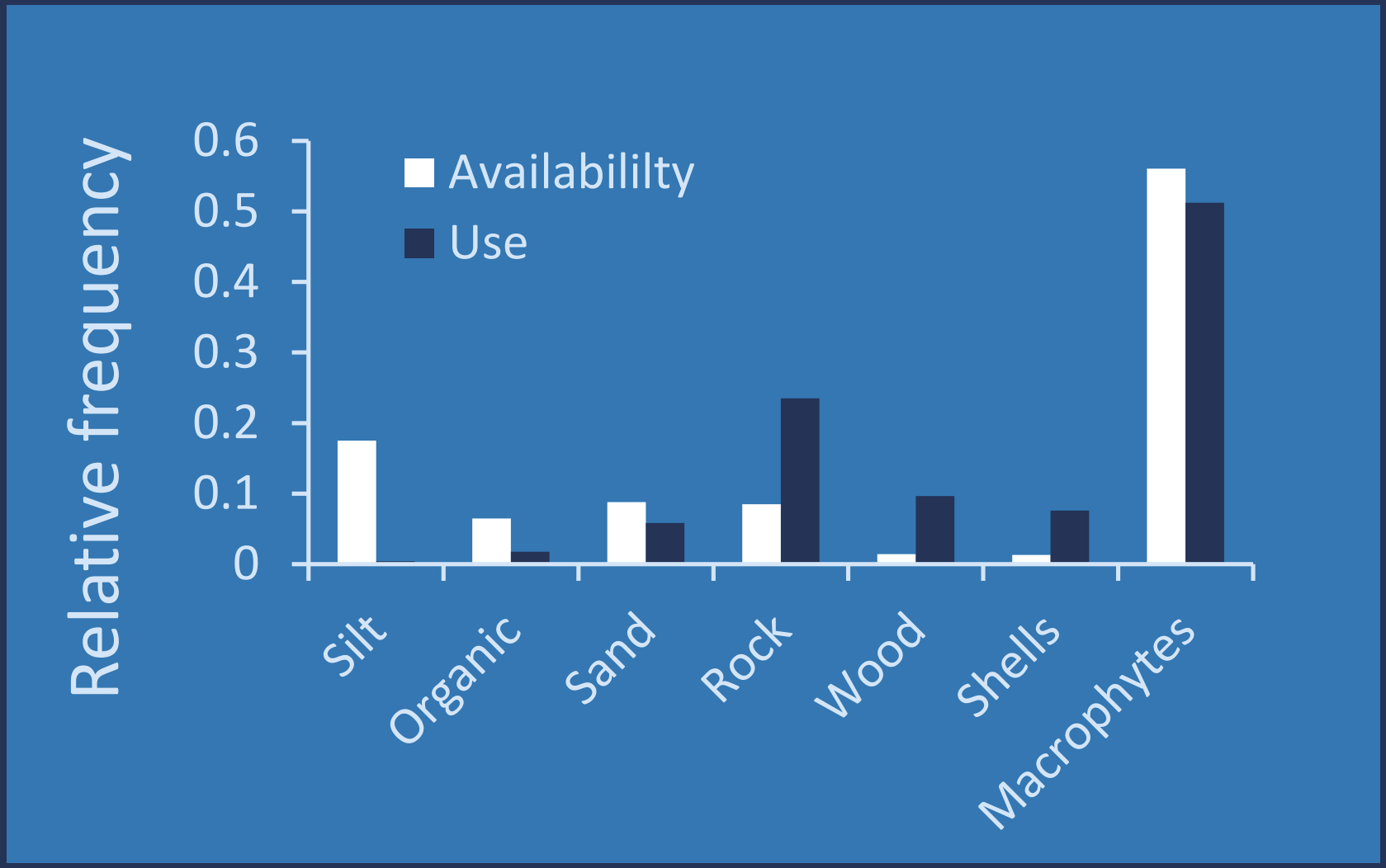
Laboratory Methods

- 12 quadrats per lake
  - Length
  - Age

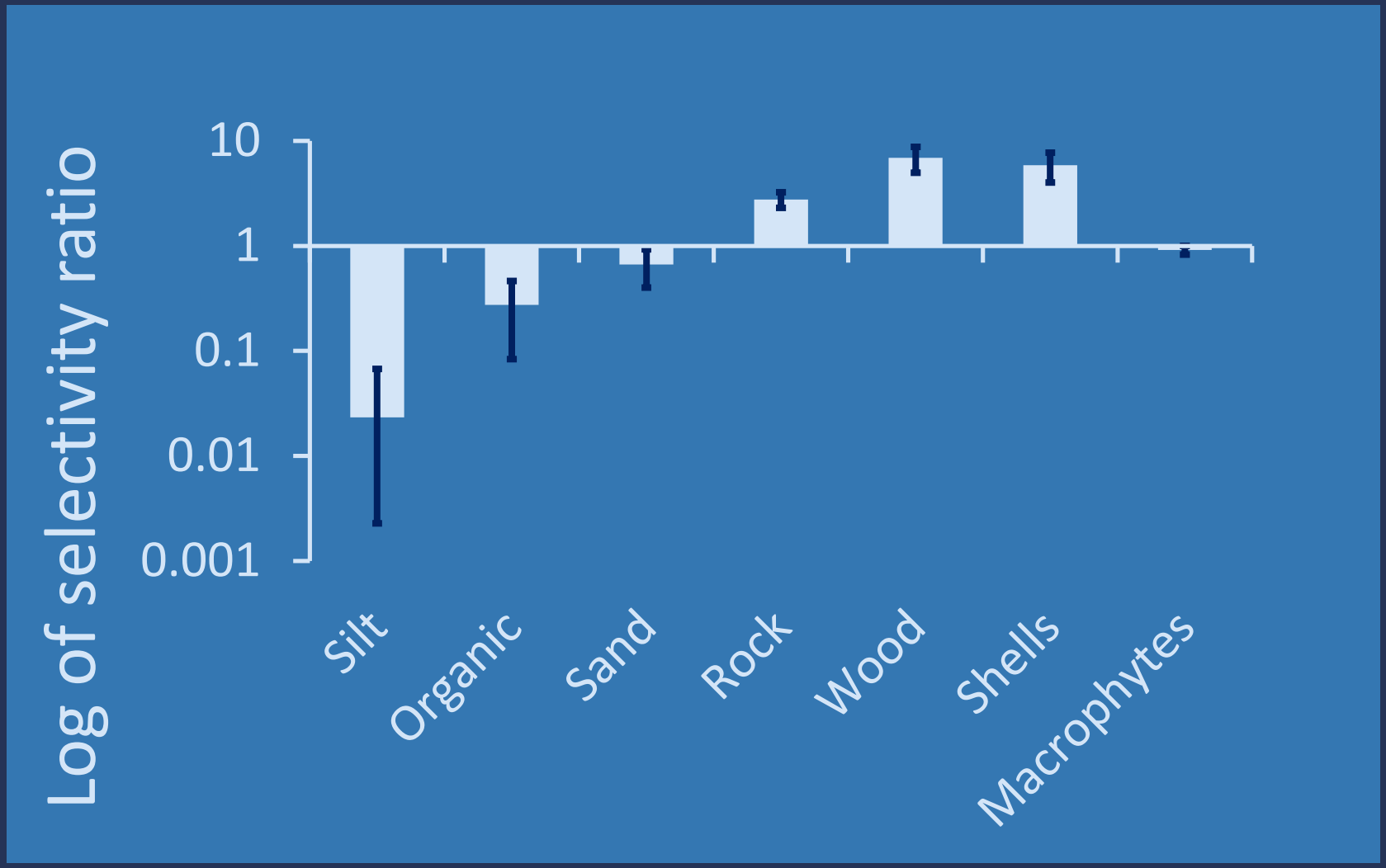
Habitat



Habitat


Relative frequency
0.6
0.5
0.4
0.3
0.2
0.1
0
Availabililty
Use
Silt
Organic
Sand
Rock
Wood
Shells
Macrophytes

Habitat

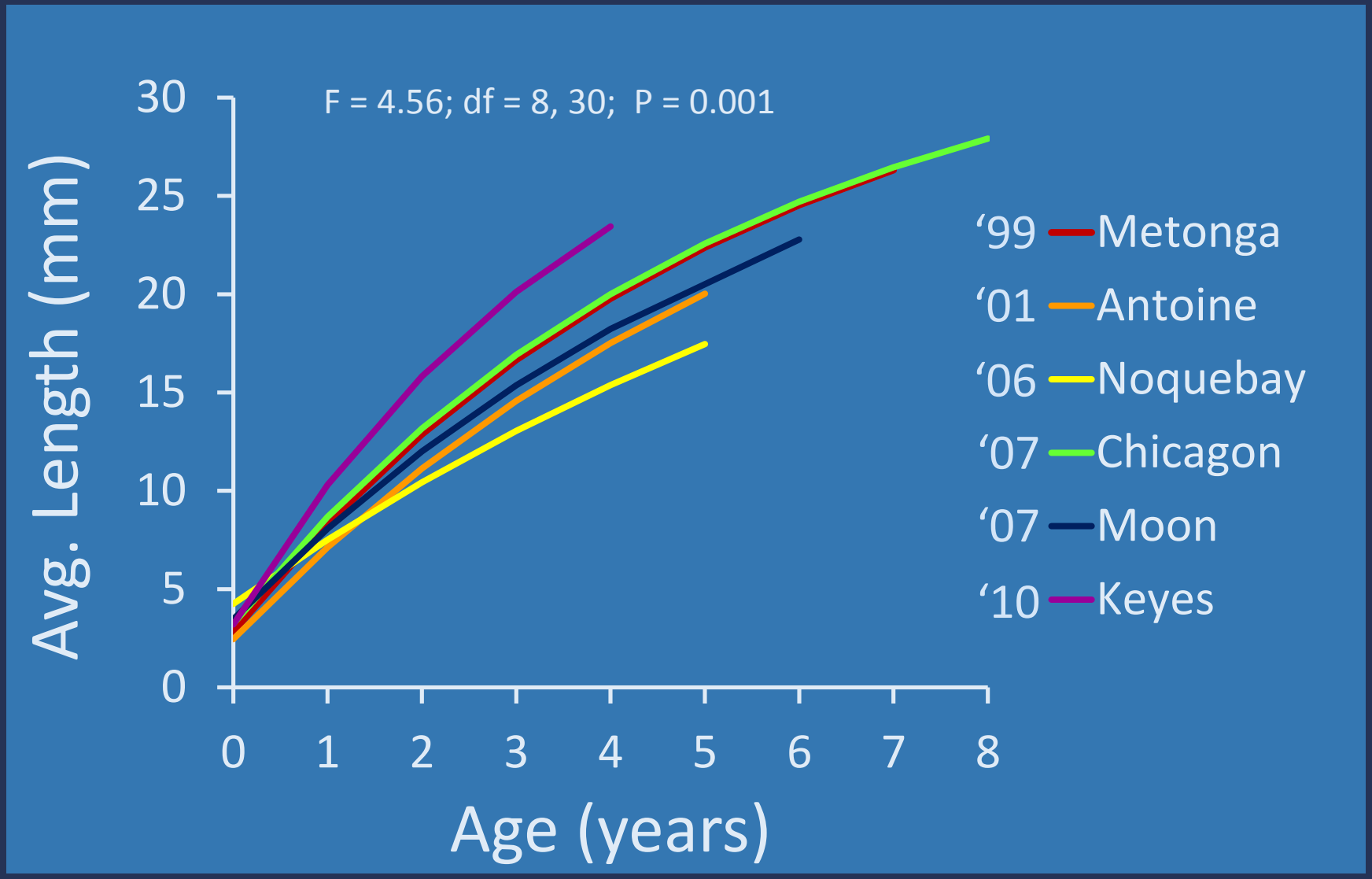

Log of selectivity ratio
10
1
0.1
0.01
0.001
Silt
Organic
Sand
Rock
Wood
Shells
Macrophytes

Predictive model

Variables	Coefficient	SE	Wald	P
Silt	-0.011	0.002	23.564	<0.001
Organic	-0.031	0.007	20.636	<0.001
Rock	0.009	0.003	9.818	0.002
Wood	0.051	0.018	7.667	0.006
Depth	0.001	0.00	13.33	<0.001
Constant	0.317	0.127	6.192	0.013

Growth

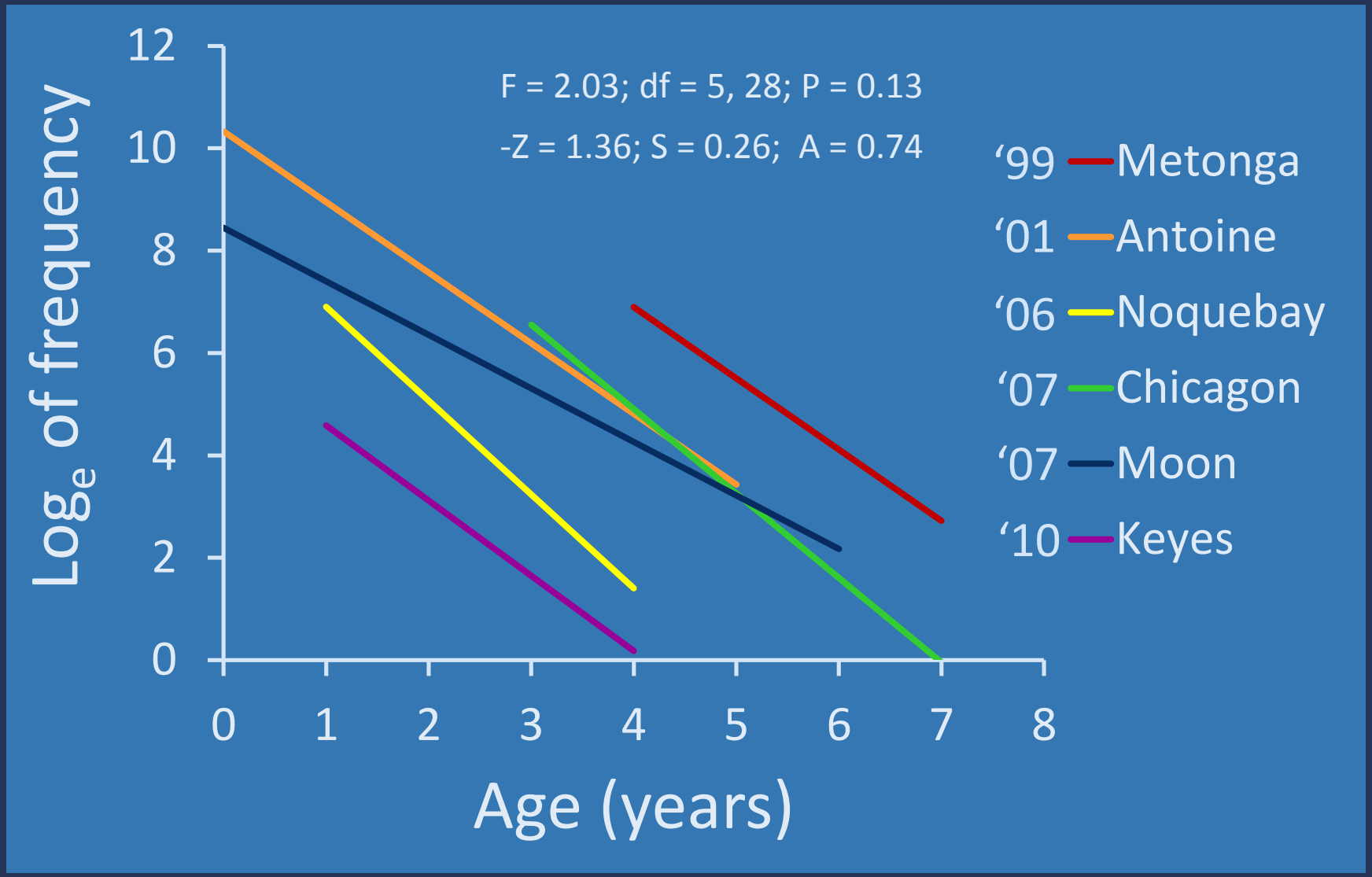
Growth


F = 4.56; df = 8, 30; P = 0.001
Avg. Length (mm)
30
25
20
15
10
5
0
0
1
2
3
4
5
6
7
8
Age (years)
'99 Metonga
'01 Antoine
'06 Noquebay
'07 Chicagon
'07 Moon
'10 Keyes

Mortality

Laura Herman

Mortality


F = 2.03; df = 5, 28; P = 0.13
-Z = 1.36; S = 0.26; A = 0.74
Log$_e$ of frequency
12
10
8
6
4
2
0
0
1
2
3
4
5
6
7
8
Age (years)
'99 Metonga
'01 Antoine
'06 Noquebay
'07 Chicagon
'07 Moon
'10 Keyes

Conclusions

- Habitat selection is occurring
- Growth varies among lakes
- Mortality does not differ

Management Applications

- Improve early detection
- Evaluate growth and mortality over time

Acknowledgements

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Questions?