The Great Lakes Aquatic Habitat Framework: a geospatial framework and spatially referenced decision tools for Great Lakes management and research

SOLM Meeting

Catherine Riseng, University of Michigan
Kevin Wehrly, Michigan DNR – Institute for Fisheries Research

GLAHF
Great Lakes Aquatic Habitat Framework

Outline

- Context & goals
- Framework & data
- Classification framework
- Tools

Wang et al., 2015 JGLR

GLAHF
Great Lakes Aquatic Habitat Framework

GLAHF

GOALS:

To develop a consistent geographic framework that integrates and tracks data, facilitate data-sharing and integration

To obtain, process and incorporate consistent **bi-national** Great Lakes aquatic habitat data

To develop an ecologically based classification framework

To provide public access to framework for managers and researchers

To work with diverse advisory group for input on all key project decisions

GLAHF
Great Lakes Aquatic Habitat Framework

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Great Lakes Aquatic Habitat Framework

Collaborative, Integrative, Bi-national Project

Funded by:

Great Lakes Fishery Trust

Erb Family Foundation

WATER CENTER
UNIVERSITY OF MICHIGAN

GREAT LAKES BASIN
Fish Habitat Partnership

International Joint Commission · Commission Mixte Internationale

U.S. Fish & Wildlife Service

NOAA

Department of Natural Resources DNR Michigan

University of Windsor

USGS
science for a changing world

The Nature Conservancy

United States Environmental Protection Agency
Mid-Continent Ecology Division

MICHIGAN STATE UNIVERSITY

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UNIVERSITY OF TORONTO

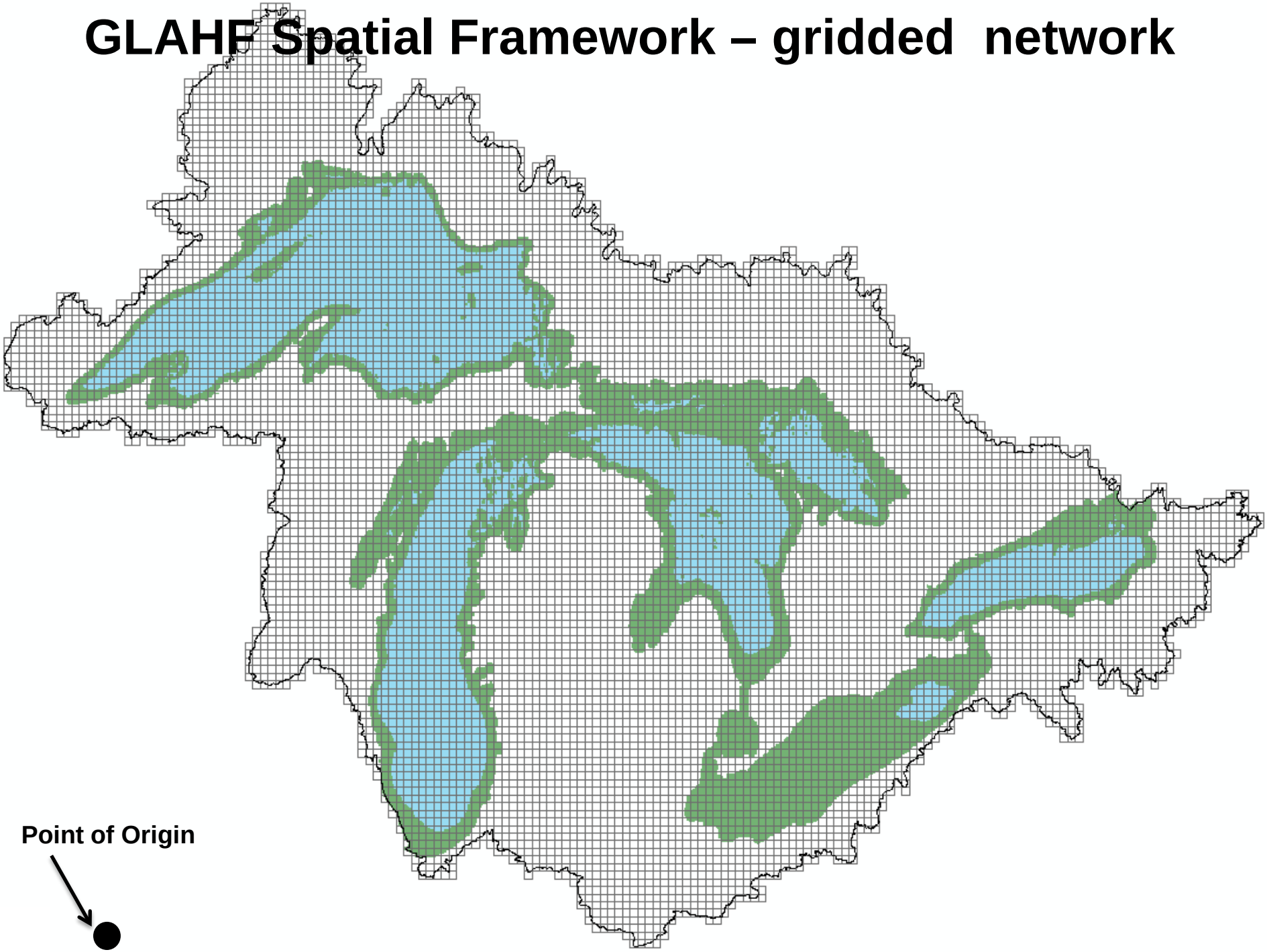
Natural Resources Research Institute
University of Minnesota Duluth
Driven to Discover

NATURAL RESOURCES AND ENVIRONMENT
UNIVERSITY OF MICHIGAN

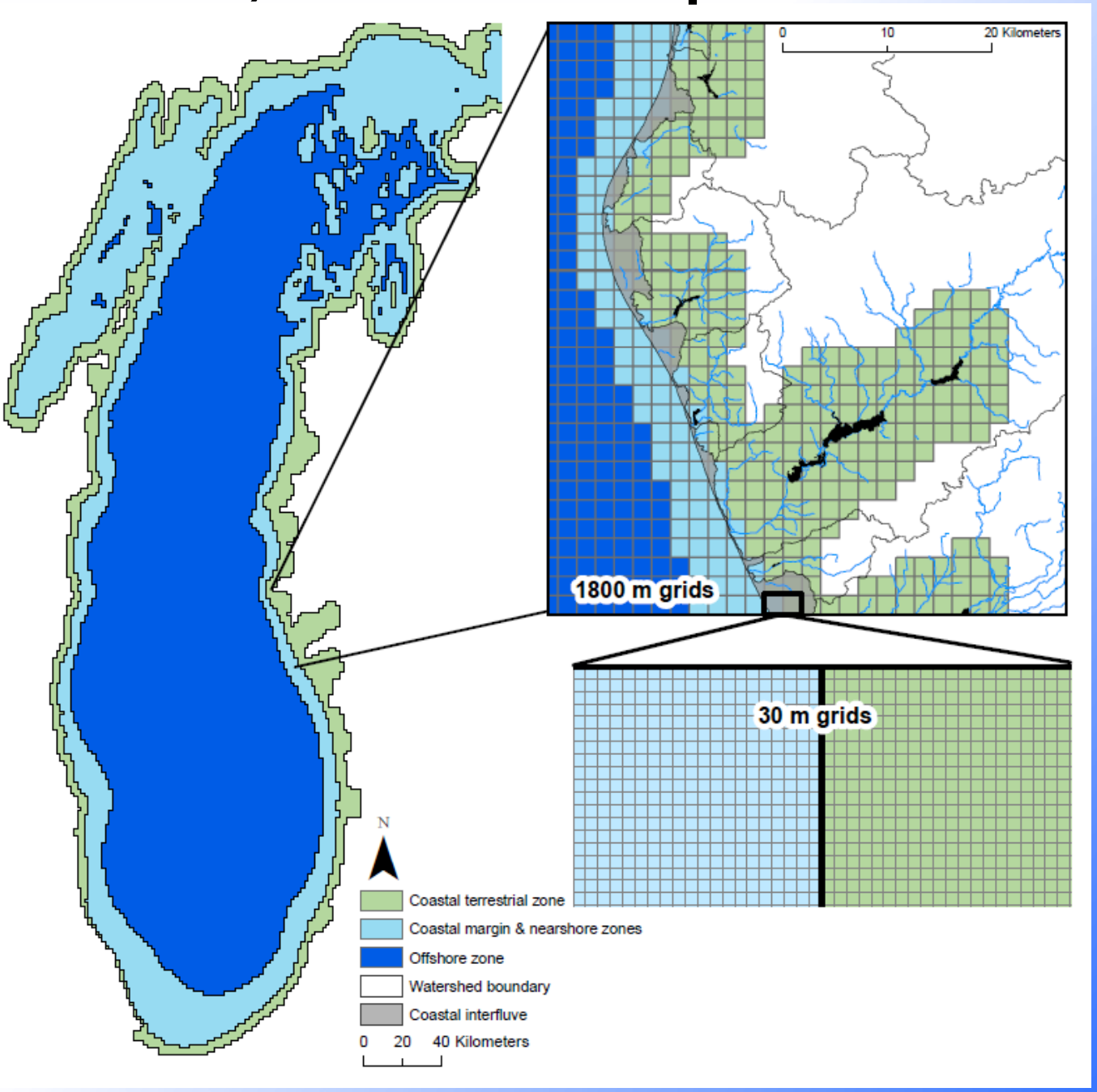
Collaborators

Michael Laitta	International Joint Commission
Conrad Wyrzykowski	Agriculture and Ag-Food Canada
Mike Robertson, John Gaiot, Kent Todd	Ontario Ministry of Natural Resources & Forestry
Alice Dove, Janette Anderson, Jodie McKenna	Environment Canada
Susan Doka	Fisheries and Oceans Canada
Pete Zuzek	Baird Consulting, Inc.
Cindy Chu	University of Toronto
Jan Ciborowski	University of Windsor
Colin Brooks, Robert Shuchman	Michigan Tech Research Institute
Dana Infante, Norine Dobiesz	Michigan State University
Pete McIntyre	University of Wisconsin
Abigail Fusaro	Wayne State University
Gust Annis , Mary Khoury	The Nature Conservancy
Tammy Newcomb, Gary Whelan, David Fielder	Michigan DNR
John Dettmers	GL Fishery Commission
Tom Hollenhorst, Peder Yurista	U.S. EPA
Jeff Schaeffer, Craig Johnston, Paul Seelbach, Maureen Walsh	U.S. Geological Survey
Chris Castiglione	U.S. Fish & Wildlife Service
Eric Anderson, Drew Gronewold, Brandon Krumwiede	NOAA-GLERL
Scudder Mackey, Eric Weimer, Ann Marie Gorman	Ohio DNR
Kelli Paige, Tad Slawecki	Great Lakes Observing System
Mark Coscarelli	Great Lakes Fishery Trust

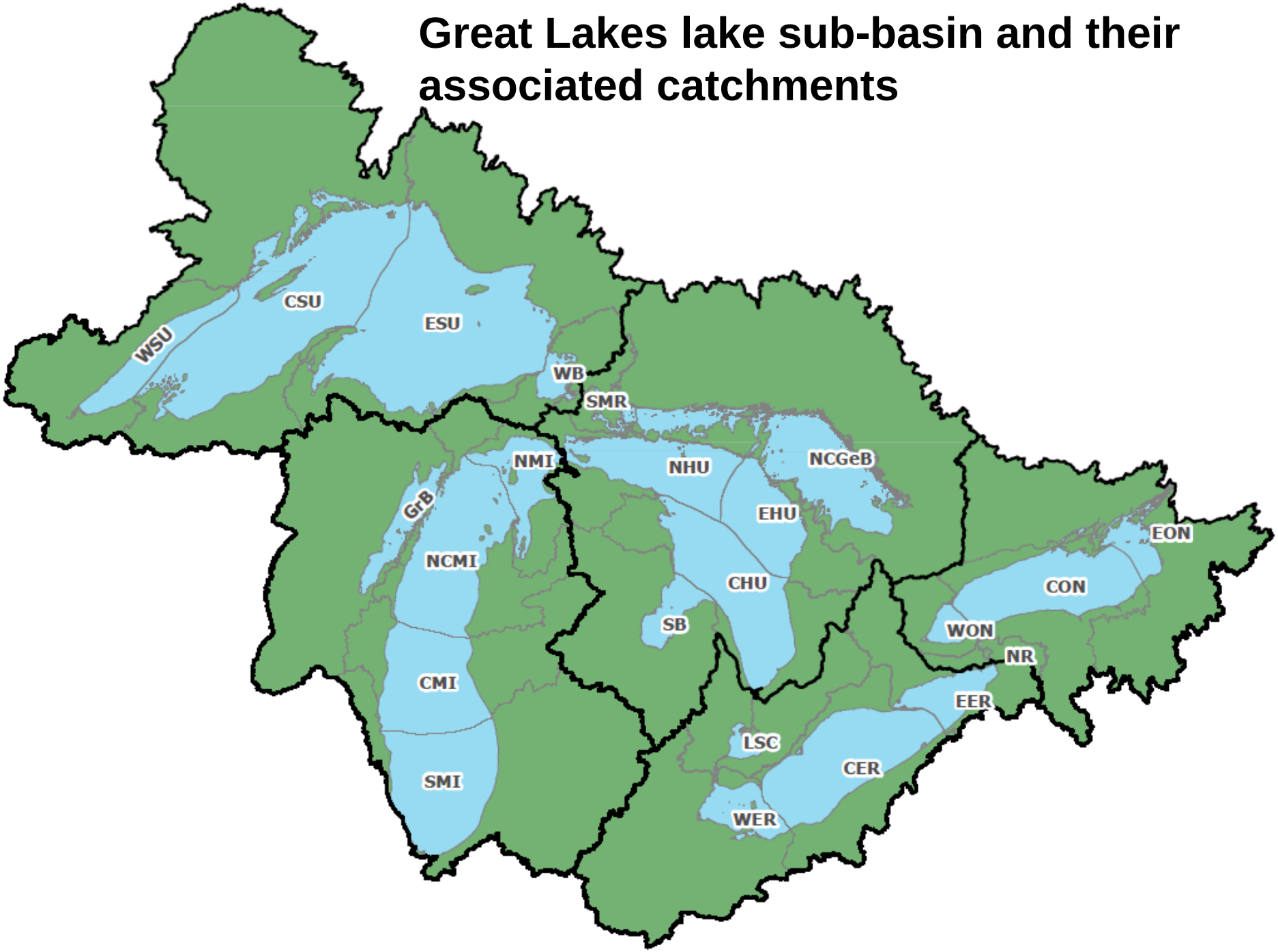
GLAHF Spatial Framework – gridded network



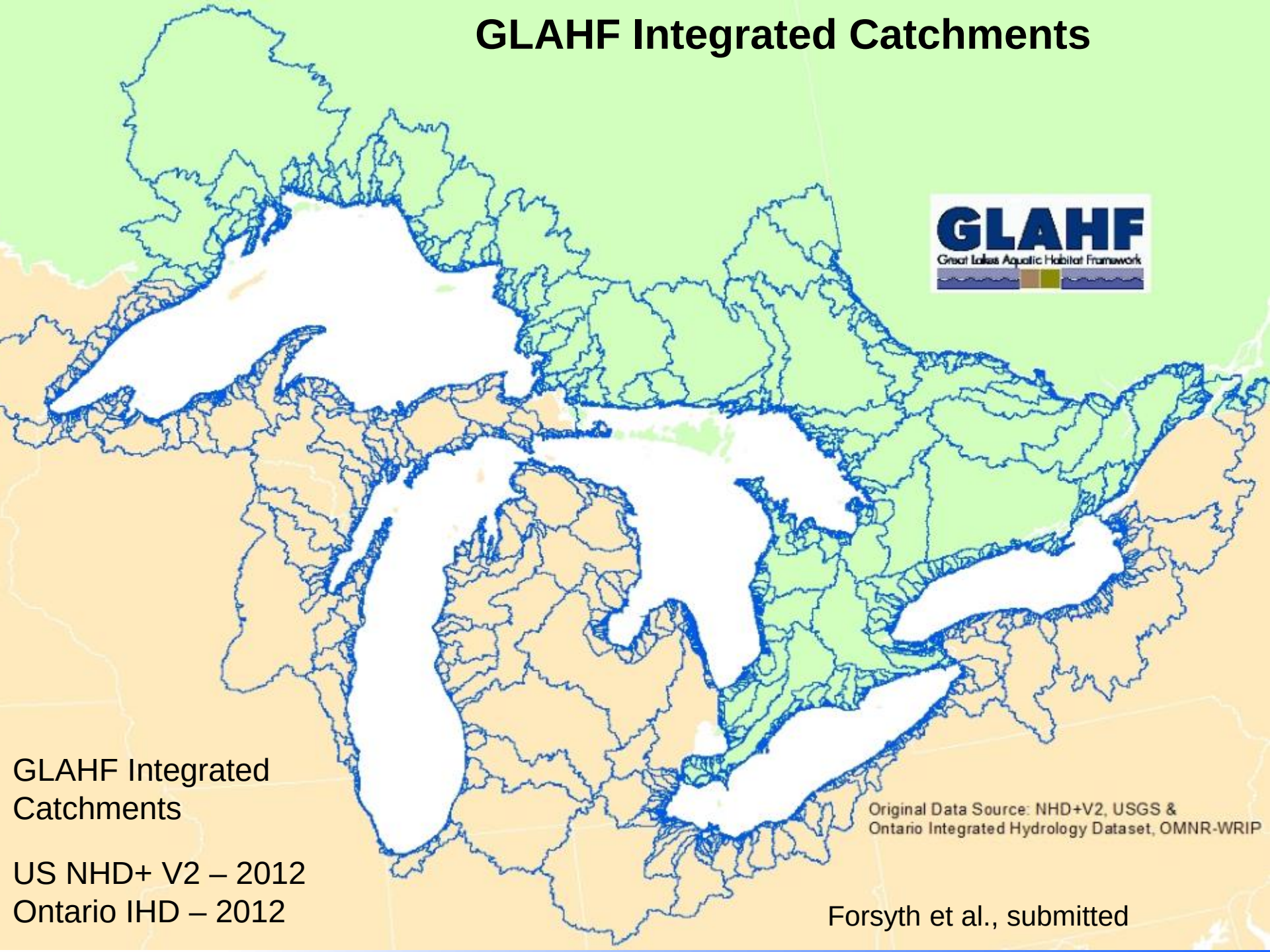
GLAHF: Nested, Hierarchical Spatial Framework



Great Lakes lake sub-basin and their associated catchments



GLAHF Integrated Catchments



GLAHF Integrated Catchments

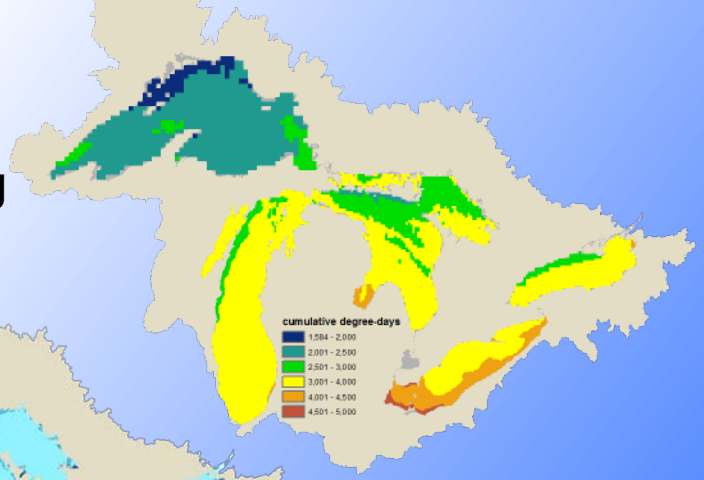
US NHD+ V2 – 2012
Ontario IHD – 2012

Forsyth et al., submitted

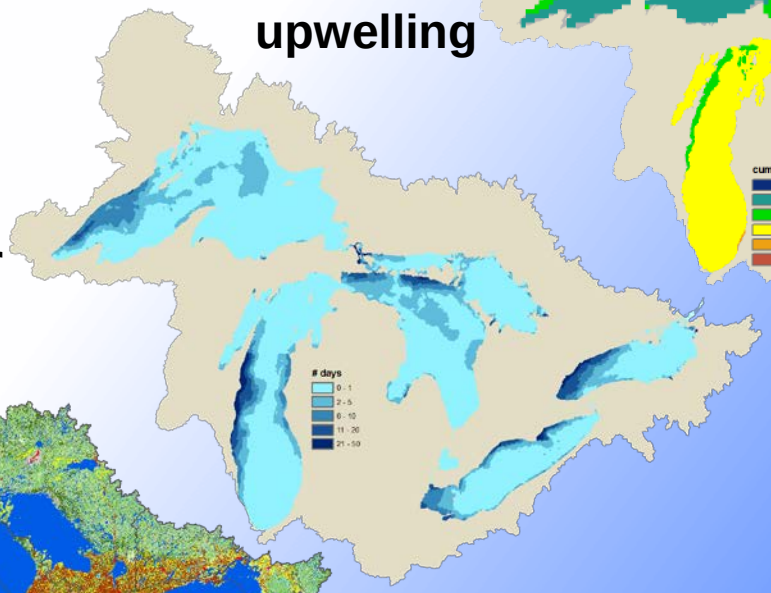
GLAHF Comprehensive Database

Administrative Boundaries - 16
Biological – 61+
Environmental/Chemical - 37
Geomorphology/Topobathymerty - 28
Landscape - 132
Mechanical Energy - 19
Rivers/Hydrology - 14
Temperature Energy - 19
Other Stressors - 4

cumulative degree-days



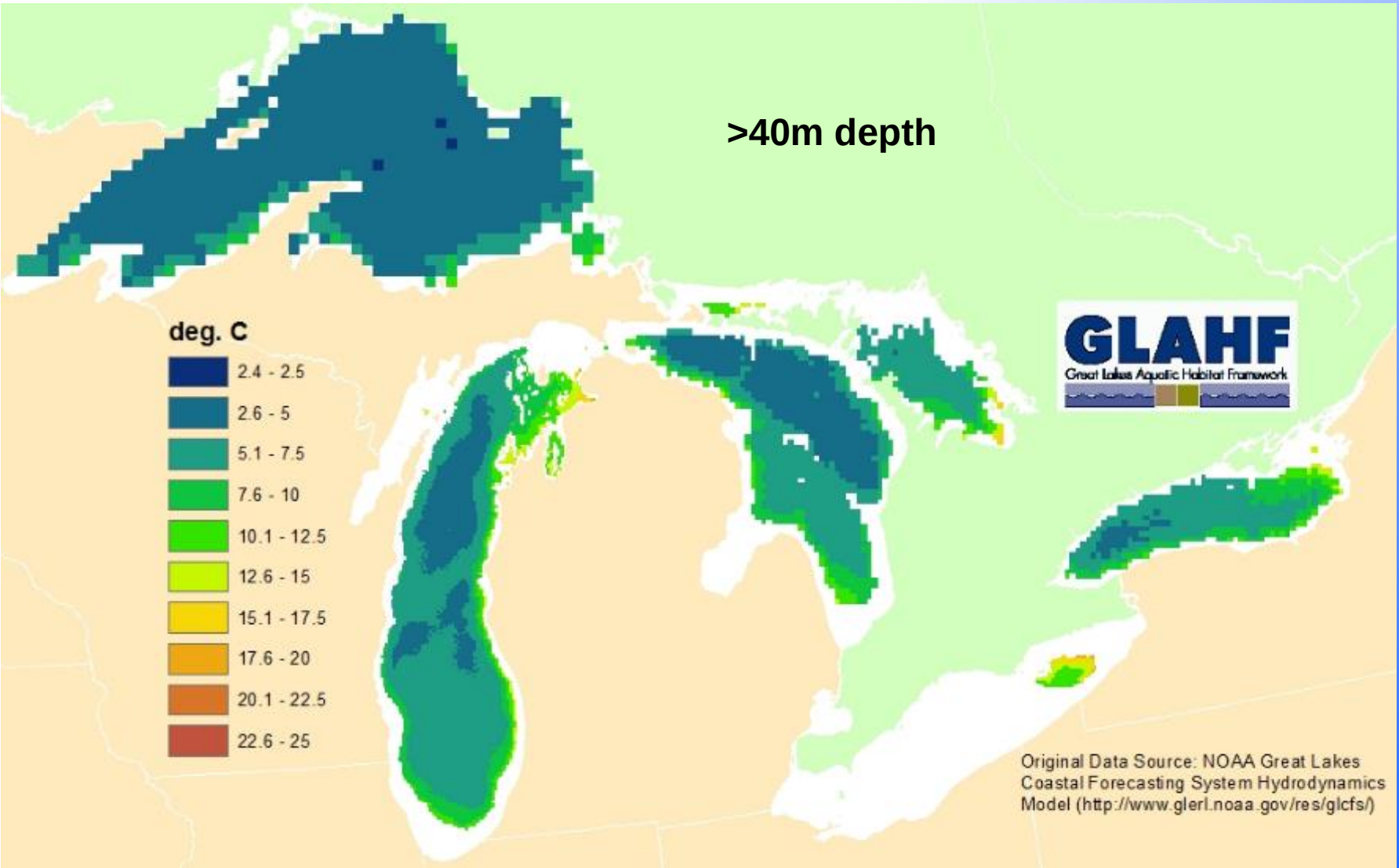
upwelling



landcover

- **basin-wide**
- **terrestrial & aquatic**
- **biological & environmental**
- **metadata**

Mean August Vertical Water Temperature 2006-2011



Source: NOAA Great Lakes Coastal Forecasting System and Hydrodynamics Model
Beletsky et al., 2006, Schwab et al., 2009

Harmonized Shoreline Classification

ACOE/NOAA Coastal Lidar data

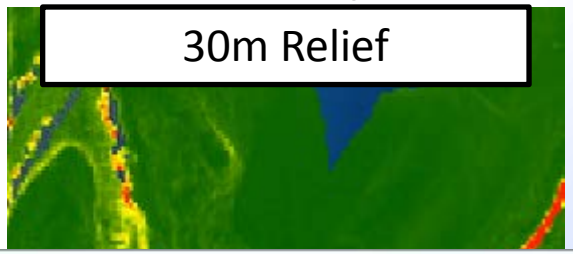
GLAHF acquired fine scale bathymetry to better characterize nearshore habitat

Lake Michigan, Muskegon Lake,MI

Lake Superior- Raspberry Island Lighthouse, WI

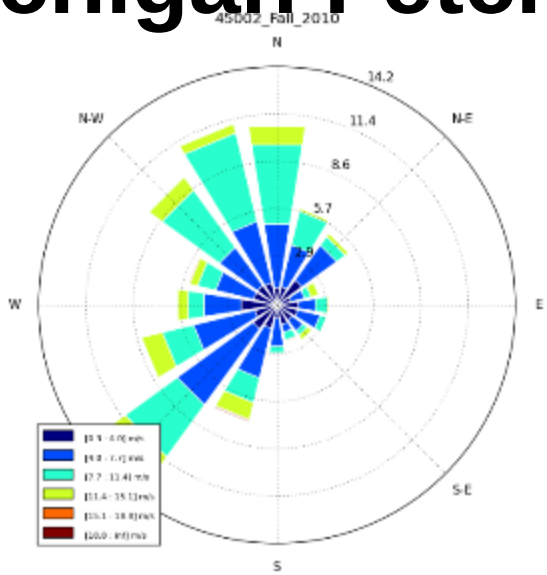
James Stack

Site Example: Grand Island/Pictured Rocks

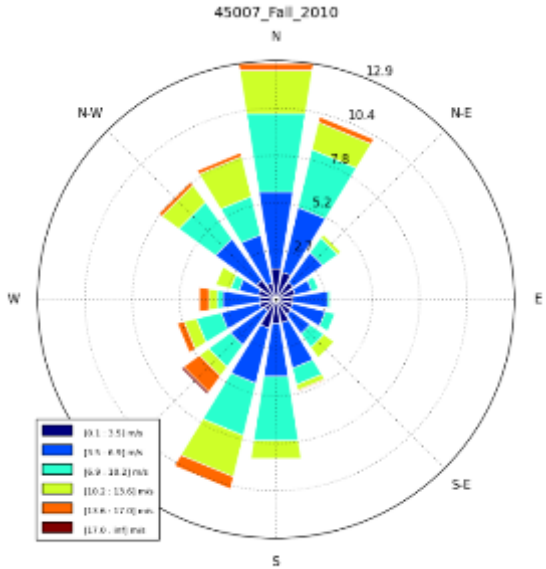


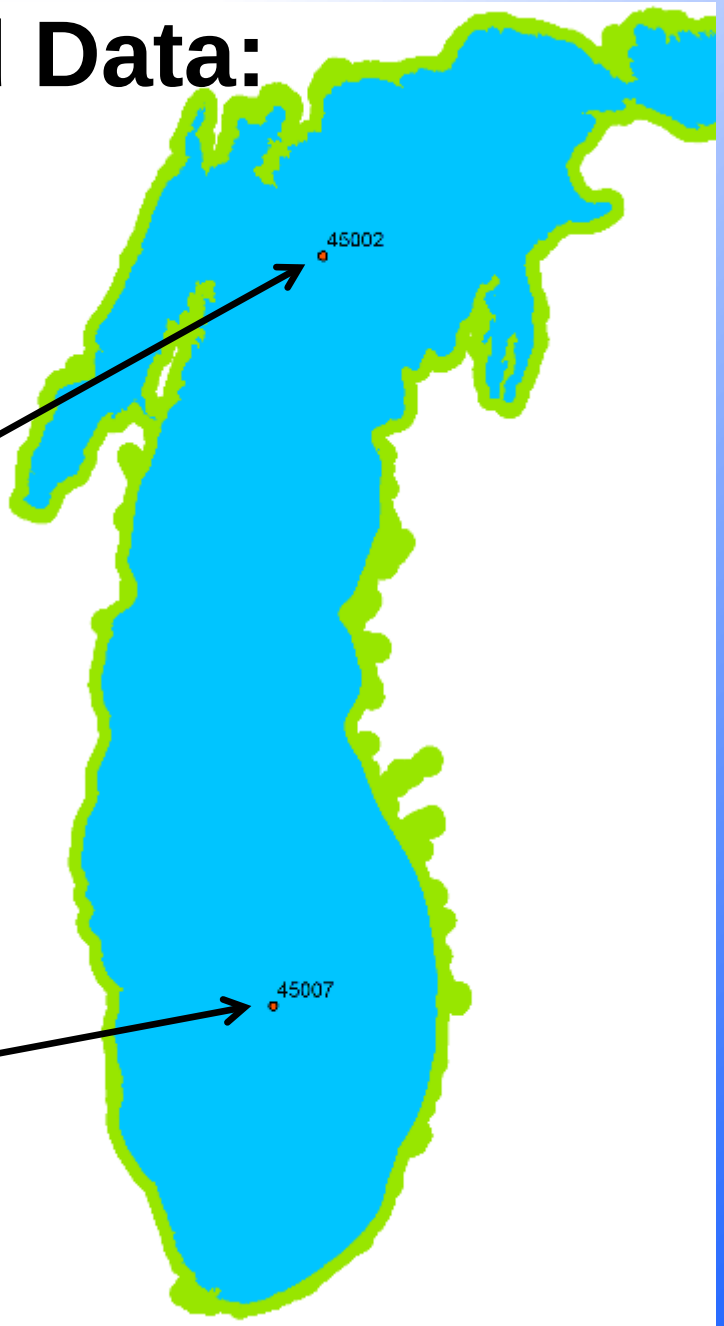
Incorporating GL Wind Data: Lake Michigan Fetch

Buoy 45002: Fall 2010



Buoy 45007: Fall 2010



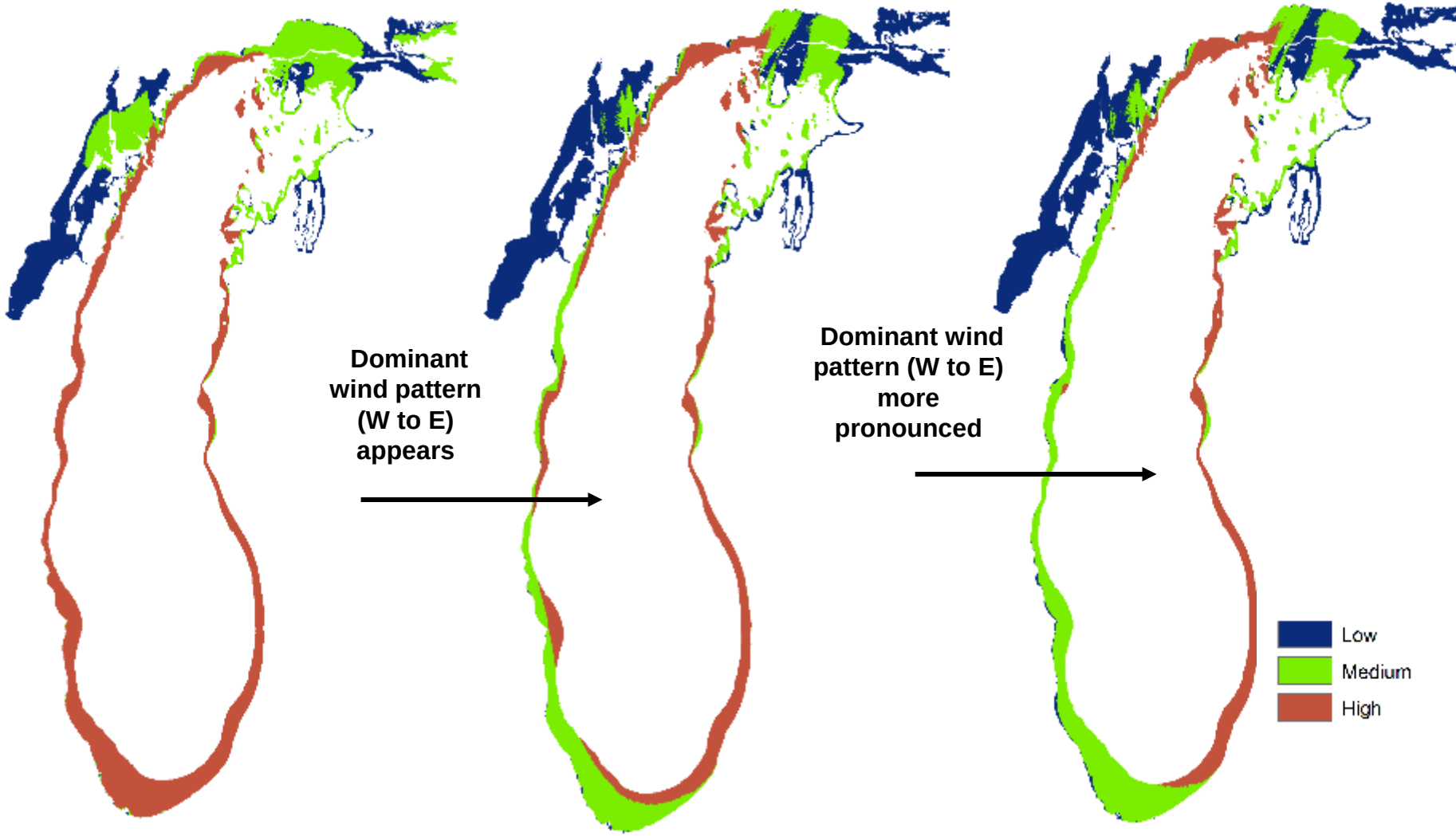


Andrew Layman

Fetch

Fetch * % frequency of wind direction

Fetch * % frequency of wind direction * avg. wind velocity



-Directions equally weighted; summed
-Does not account for buoy data

-Fetch* % freq. of wind; summed
-Two buoys, composite; 2006-2014

Relative Exposure Index (Keddy 1982)
-Two buoys, composite; 2006-2014

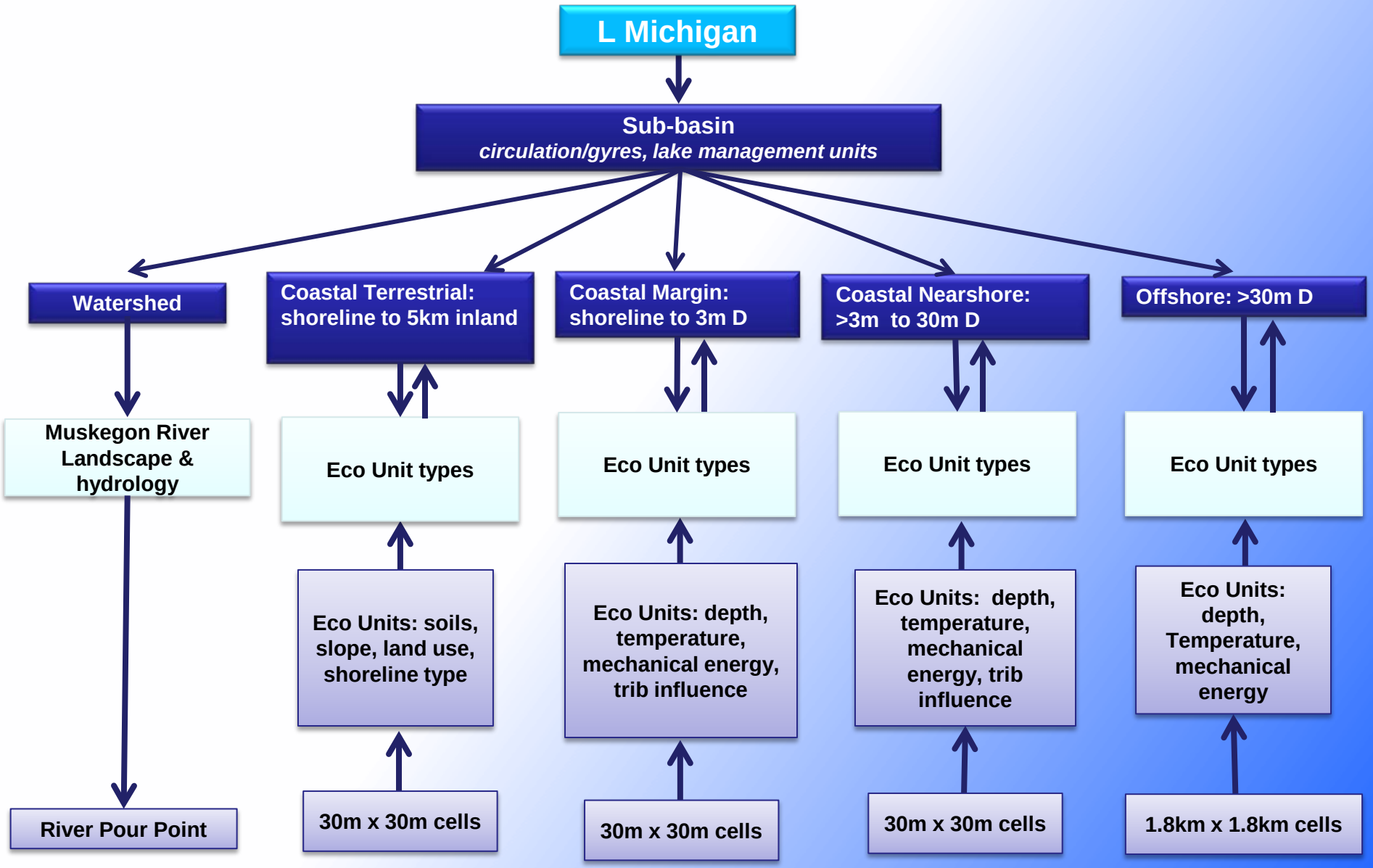
GLAHF Products

Products

- **Publicly available**, basin-wide GIS database of habitat variables summarized on a common framework
- Ecological **Classification** of Coastal & Open Water Aquatic Habitats
- Condition **assessment** of coastal fish habitat
- Web-based **Tools**

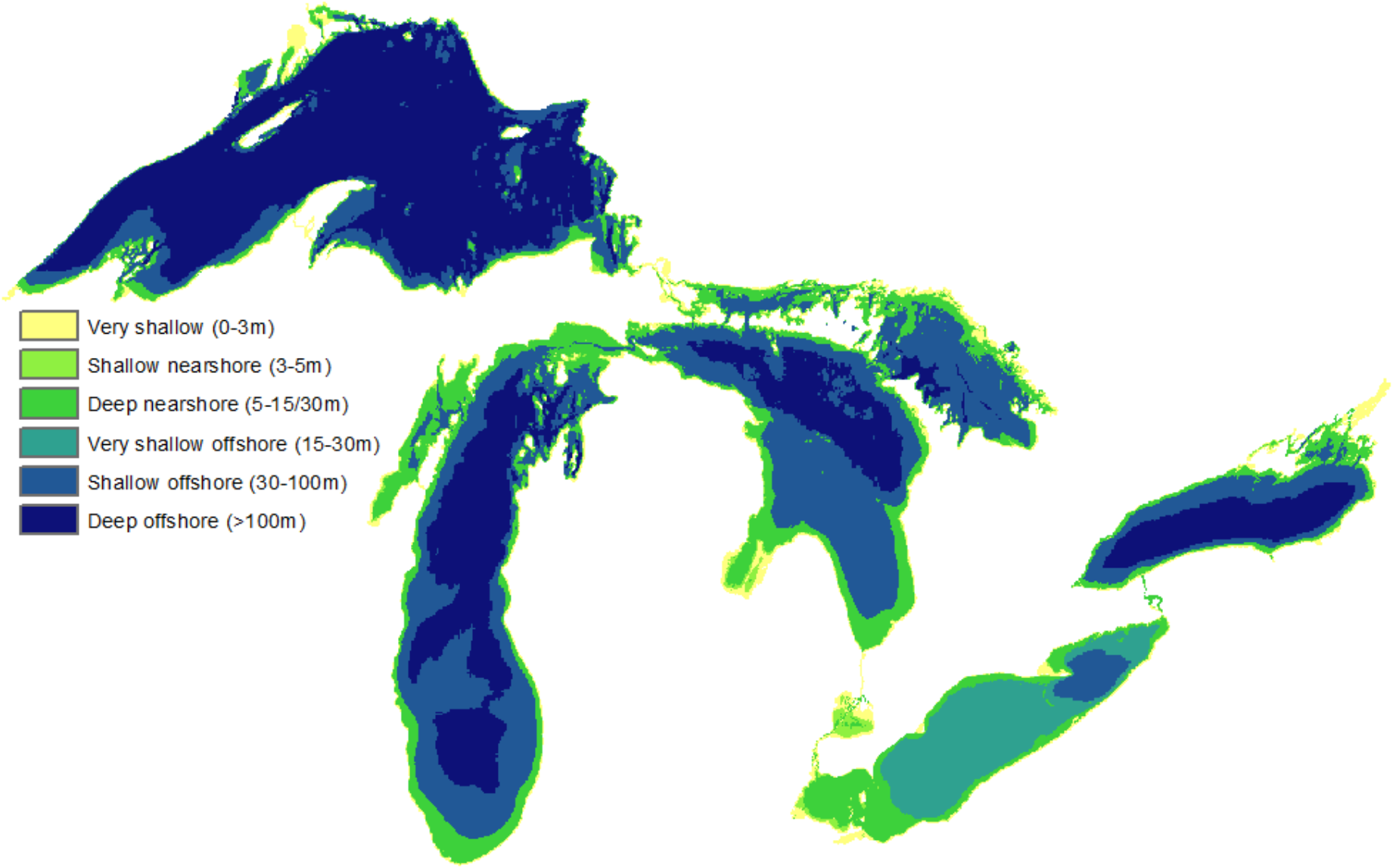
GLAHF Aquatic Ecological Classification

Hierarchical Spatial Classification Framework

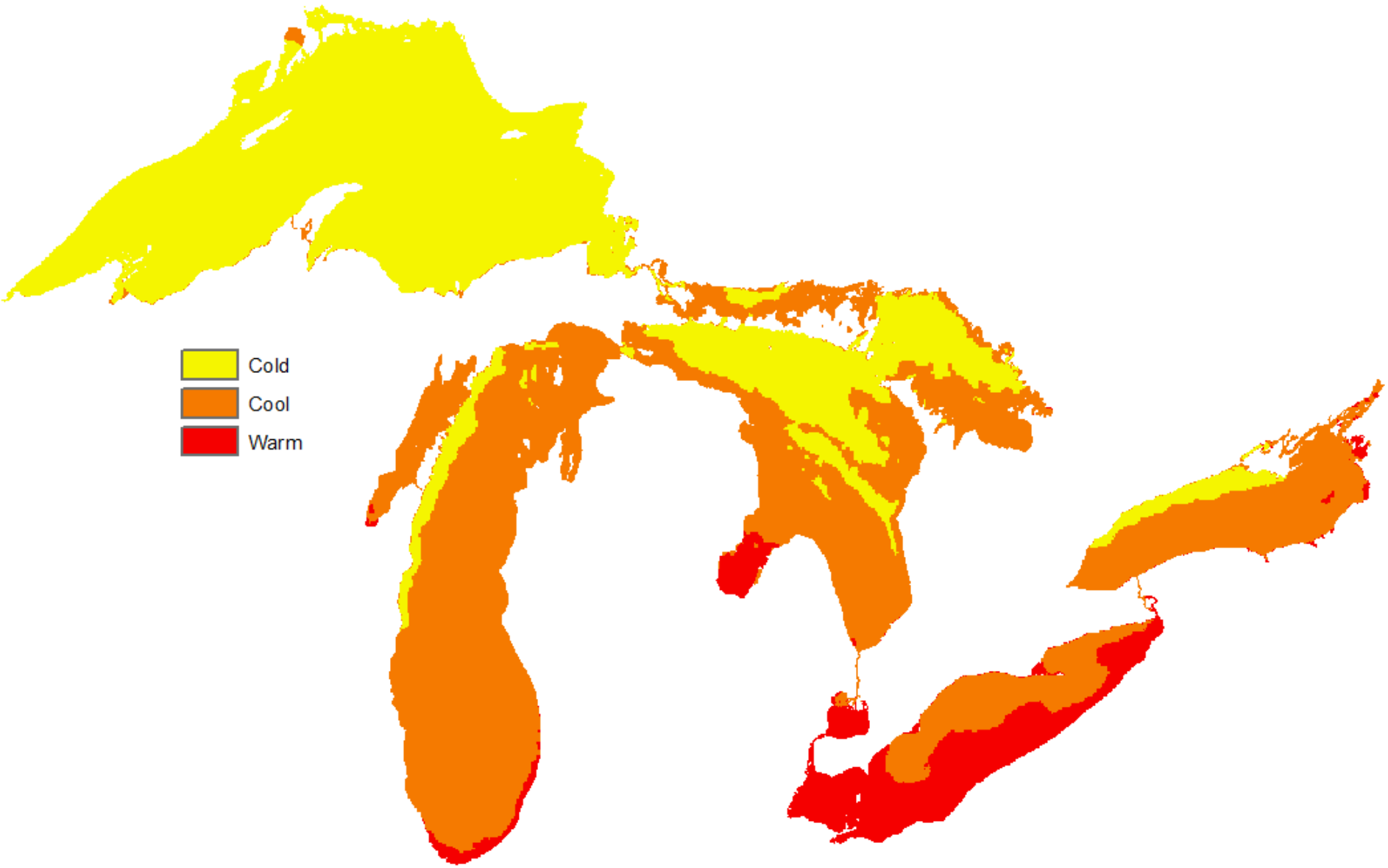


GLAHF

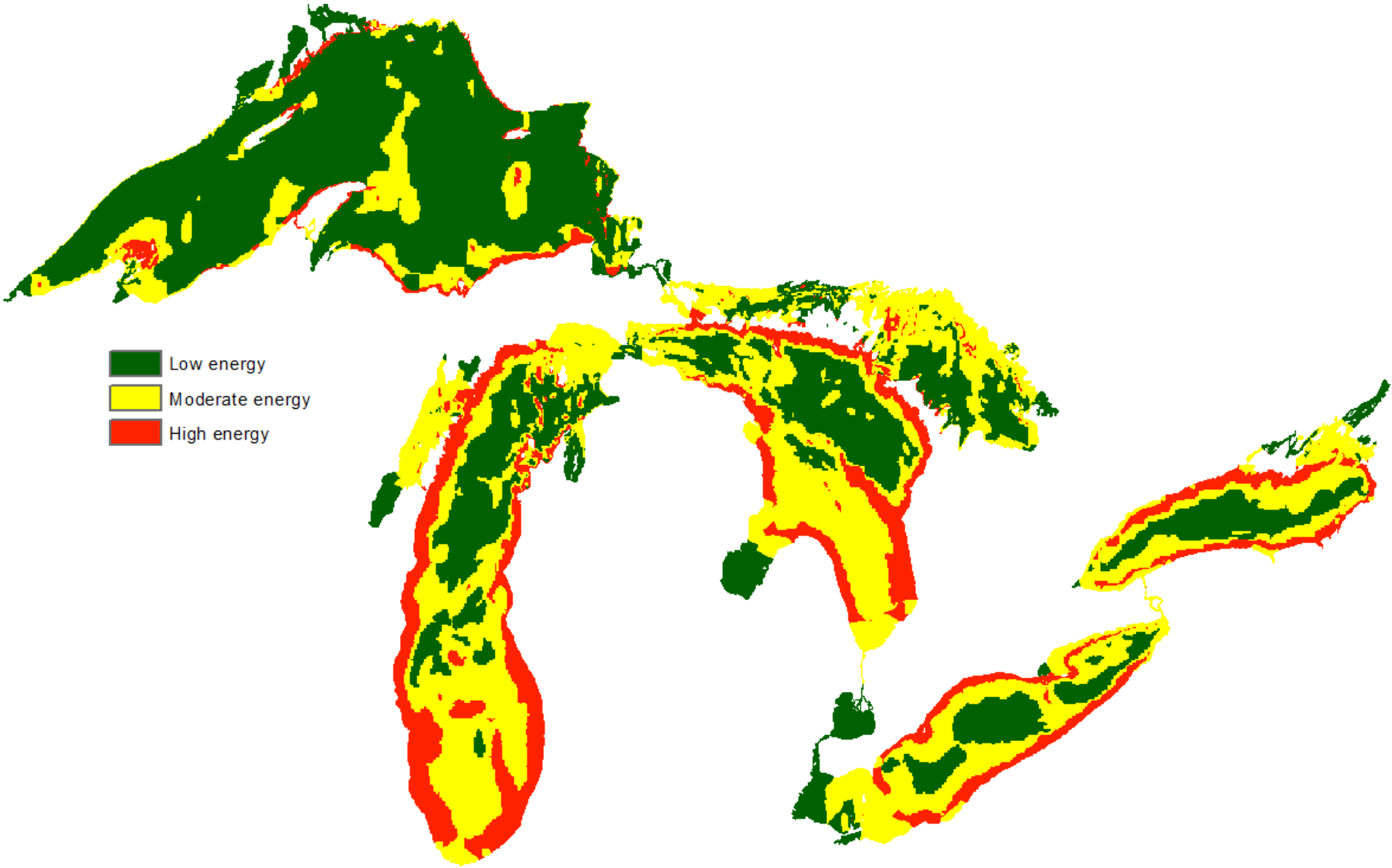
Depth Classes



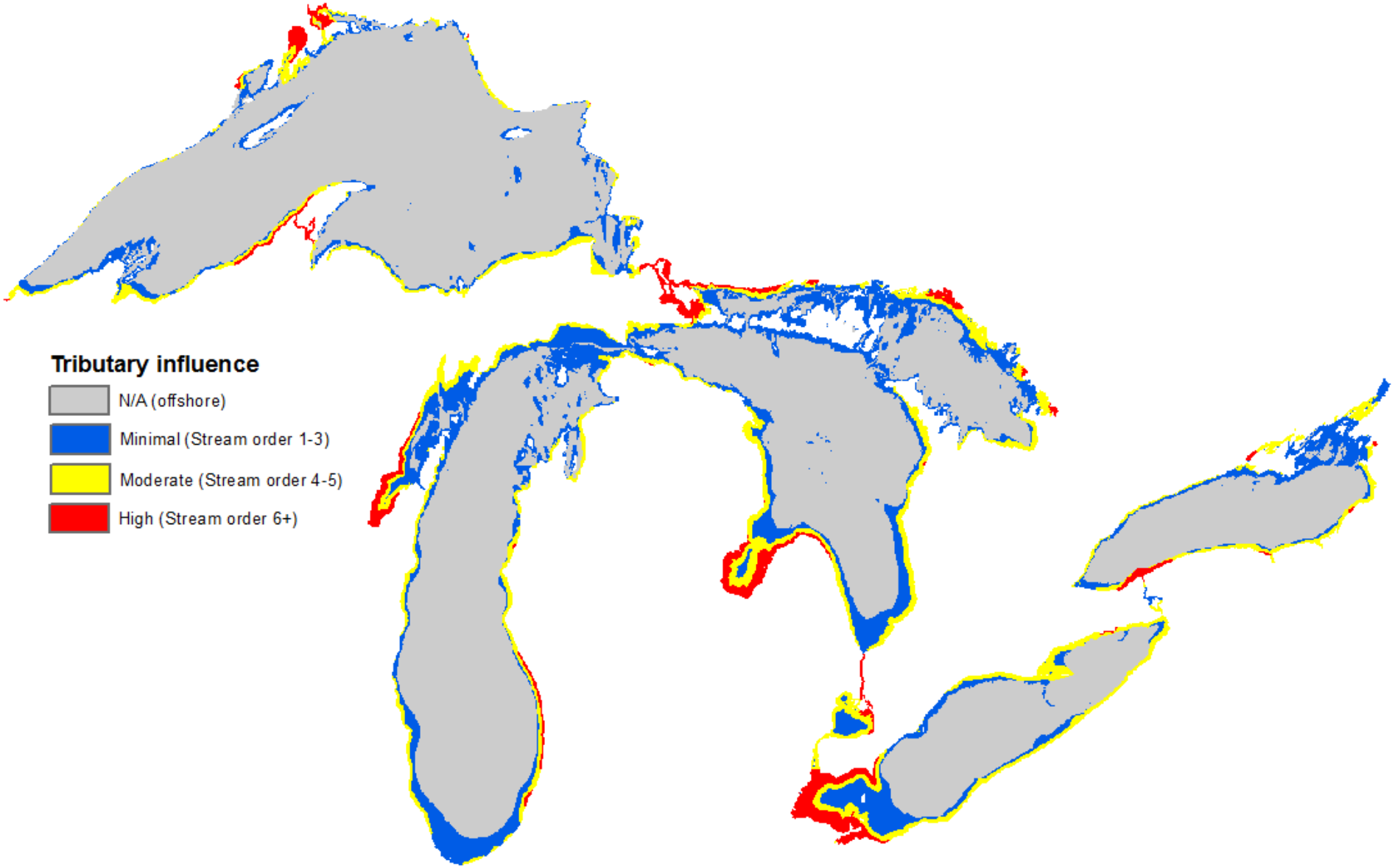
Temperature Classes



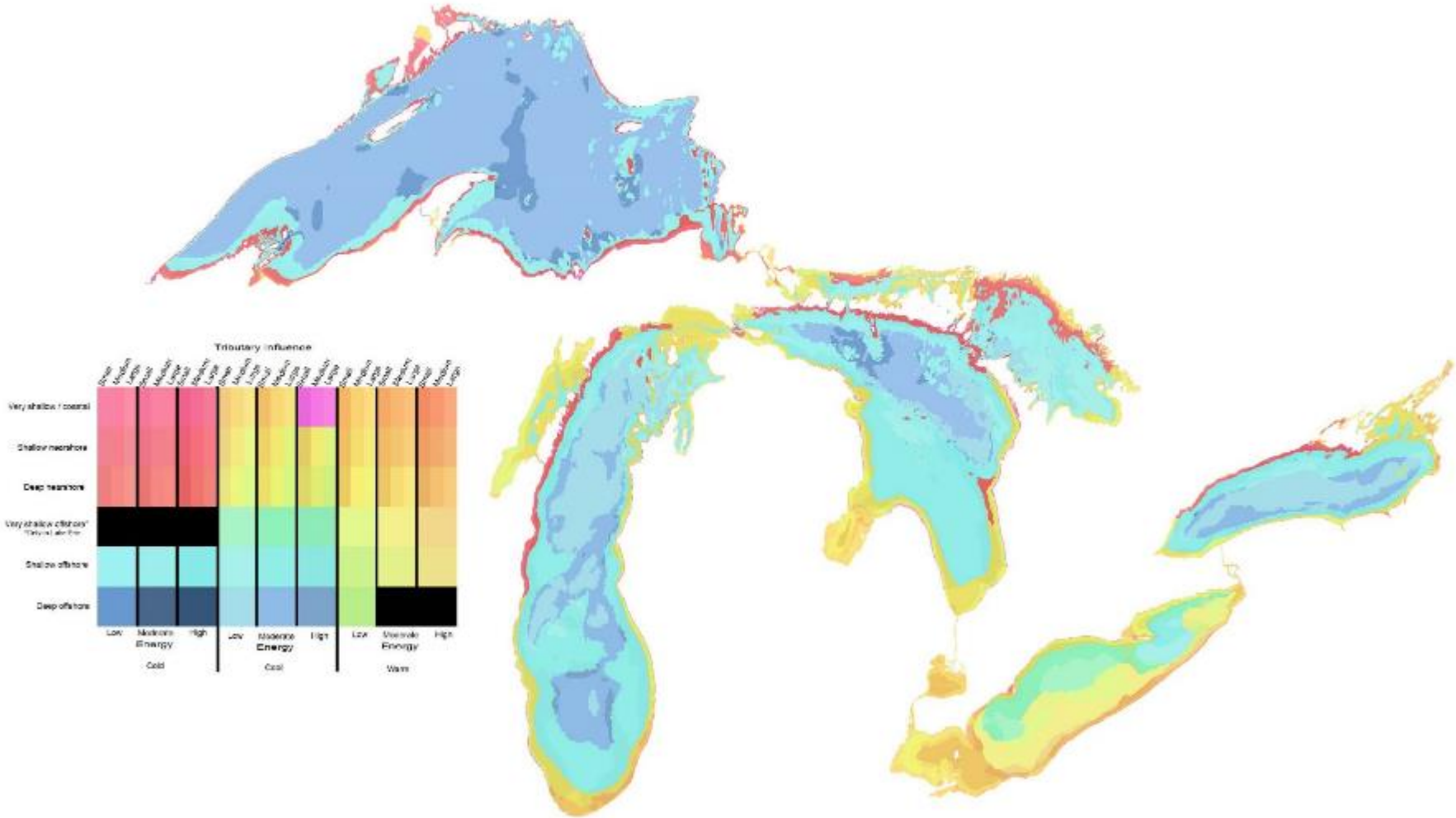
Mechanical Energy Classes



Tributary Influence Classes

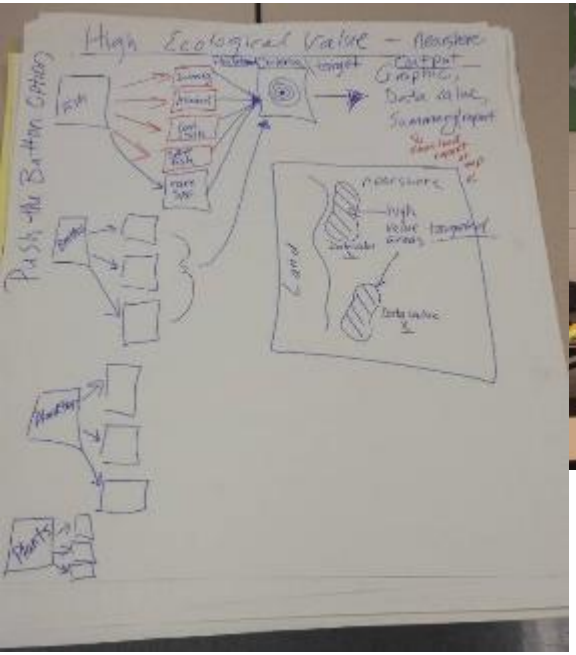


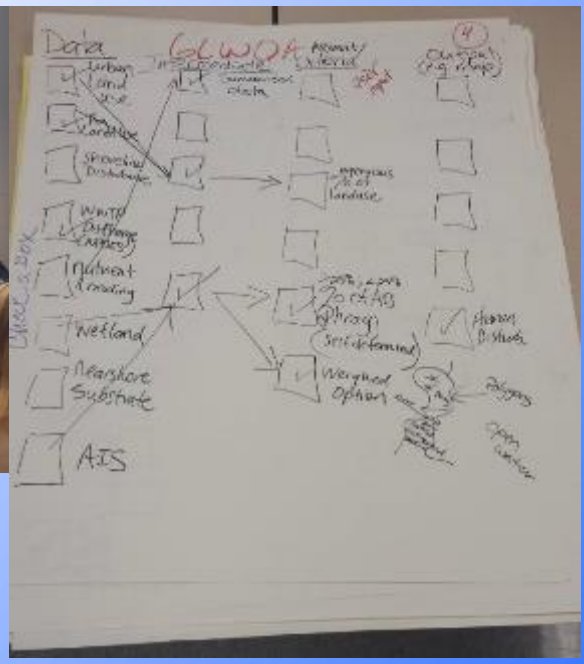
Great Lakes Environmental Classification



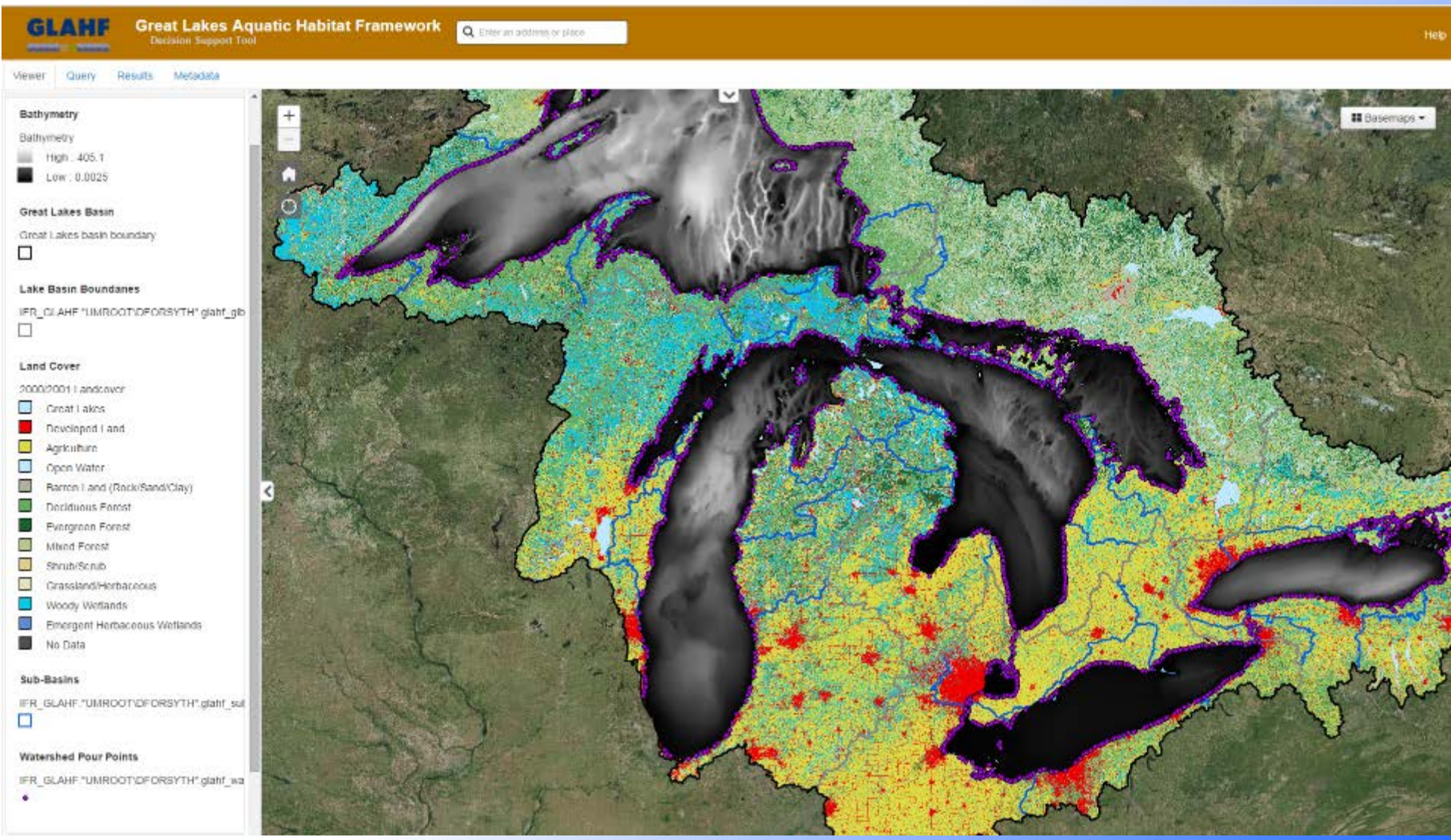
Decision Support Tools

…..are often not used by practitioners because there is a gap between developers and practitioners (Uran and Janssen, 2003; Shim et al. 2002)

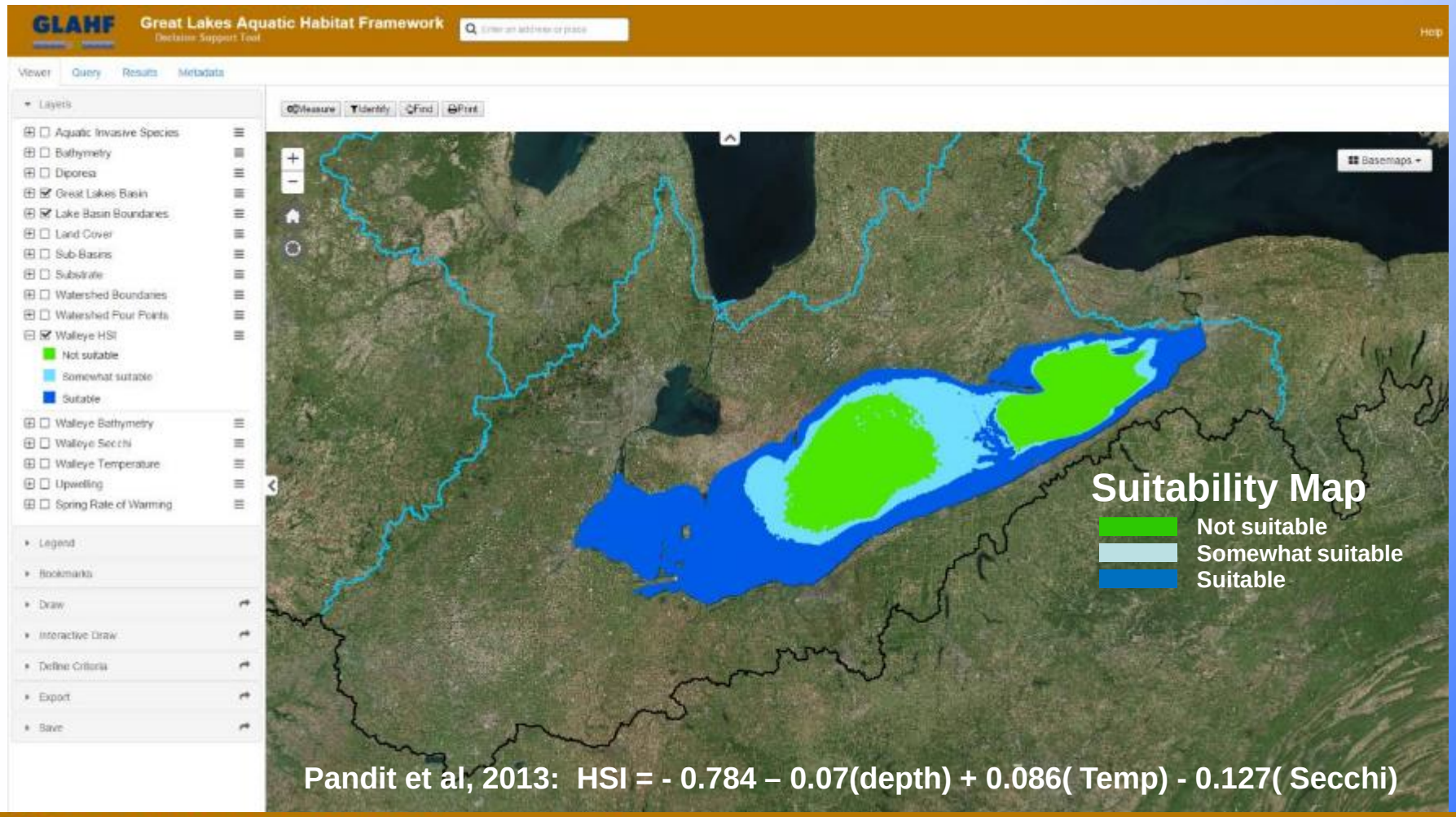




- **Aquatic Habitat Suitability**
- **Coastal Management & Planning**


GLAHF
Great Lakes Aquatic Habitat Framework
Decision Support Tool
Enter an address or place
Help
Viewer
Query
Results
Metadata
Basemaps
Bathymetry
Bathymetry
High : 405.1
Low : 0.0025
Great Lakes Basin
Great Lakes basin boundary
Lake Basin Boundaries
IFR_GLAHF."UMROOT\DFORSYTH".glahf_glb
Land Cover
2000/2001 Landcover
Great Lakes
Developed Land
Agriculture
Open Water
Barren Land (Rock/Sand/Clay)
Deciduous Forest
Evergreen Forest
Mixed Forest
Shrub/Scrub
Grassland/Herbaceous
Woody Wetlands
Emergent Herbaceous Wetlands
No Data
Sub-Basins
IFR_GLAHF."UMROOT\DFORSYTH".glahf_sub
Watershed Pour Points
IFR_GLAHF."UMROOT\DFORSYTH".glahf_wa

Great Lakes Aquatic Habitat Explorer
Habitat Suitability for Walleye in Lake Erie – Integrated



Pandit et al, 2013: HSI = - 0.784 – 0.07(depth) + 0.086(Temp) - 0.127(Secchi)

Walleye habitat suitability query summary

Class	Area (sq. km)
Not suitable	8335.9
Somewhat suitable	4755.6
Suitable	4755.612641.1

What is GLAHF?

A spatial classification framework with

…a GIS database of georeferenced data

…for Great Lakes coastal, large rivermouth, & open water habitats

…that consistently integrates habitat data bi-nationally

…with a focus on nearshore and coastal areas

GLAHF
Great Lakes Aquatic Habitat Framework

Project Staff and Co-PIs

CoPIs

Lucinda Johnson	**University of Minnesota-Duluth**
Jim McKenna	**U.S. Geological Survey**
Catherine Riseng - PI	**University of Michigan**
Ed Rutherford	**NOAA-GLERL**
Scott Sowa	**The Nature Conservancy**
Lizhu Wang	**International Joint Commission**
Kevin Wehrly	**MDNR – Institute for Fisheries Research**

Project Staff- Institute for Fisheries Research

Danielle Forsyth
Lacey Mason
Ben Schoenfeldt
Beth Sparks-Jackson
Ken Yeh
James Stack
Andrew Layman

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