Role of NHD/NHDPlus for environmental-flow based legislation in Michigan and environmental-flow framework for the US Great Lakes Basin

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U.S. Department of the Interior
U.S. Geological Survey

Overview

- Great Lakes-St. Lawrence River Basin Water Resources Compact
  - Interstate Compact
    - Companion International Agreement
  - Implemented by each state
  - Regional goals for water conservation and efficiency
  - Prevent adverse resource impact from new or increased water withdrawals

http://www.cglslgp.org/projects/water-management/great-lakes-agreement-and-compact/

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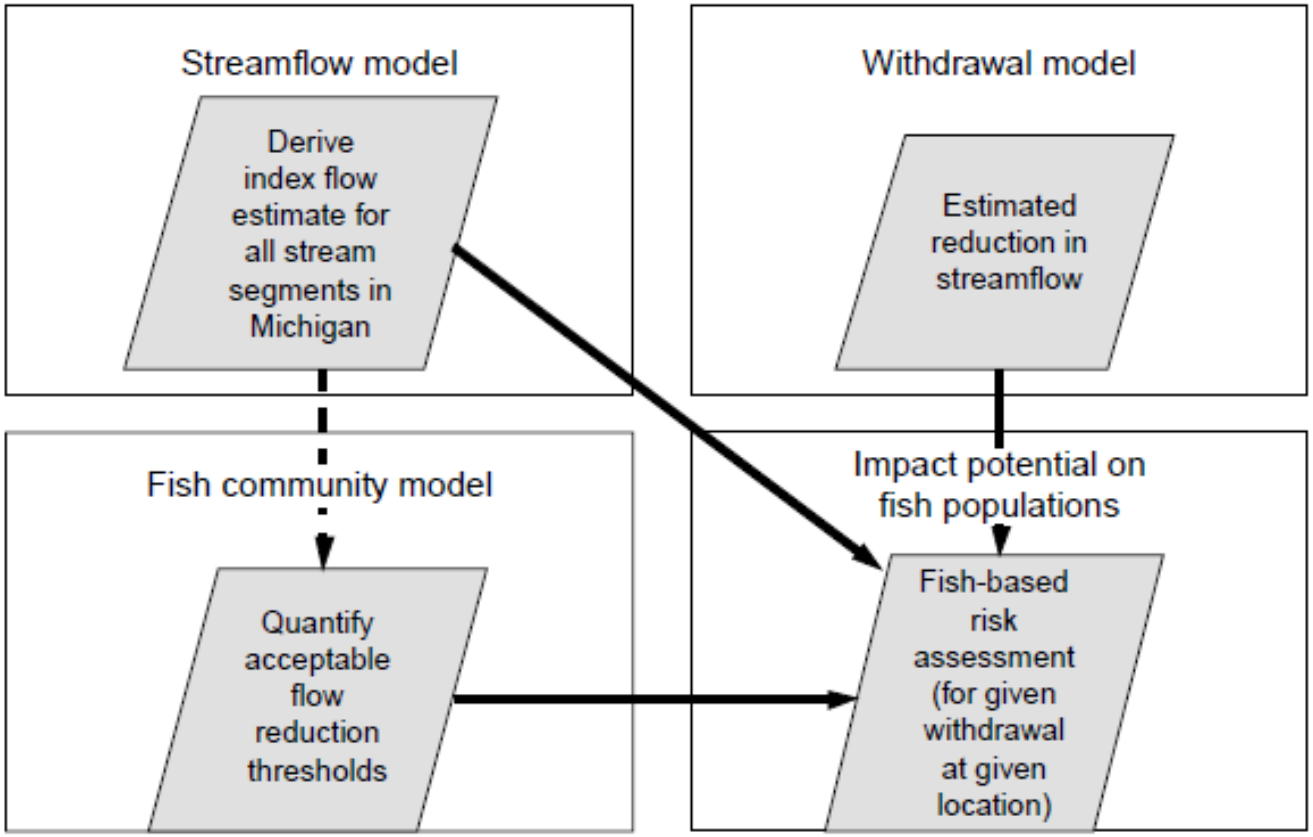
Michigan Water Withdrawal Assessment

- Streamflow data
- Fish presence and abundance
- Stream temperature
- Aquifer distribution and characteristics



Steinman and others, 2011.

Role of NHD and NHDPlus

- NHD connectivity and catchment information:
  - Streamflow estimates
  - Stream temperature modeling
  - Fish presence and abundance modeling
  - Streamflow classification
  - Withdrawal accounting for cumulative impact assessment

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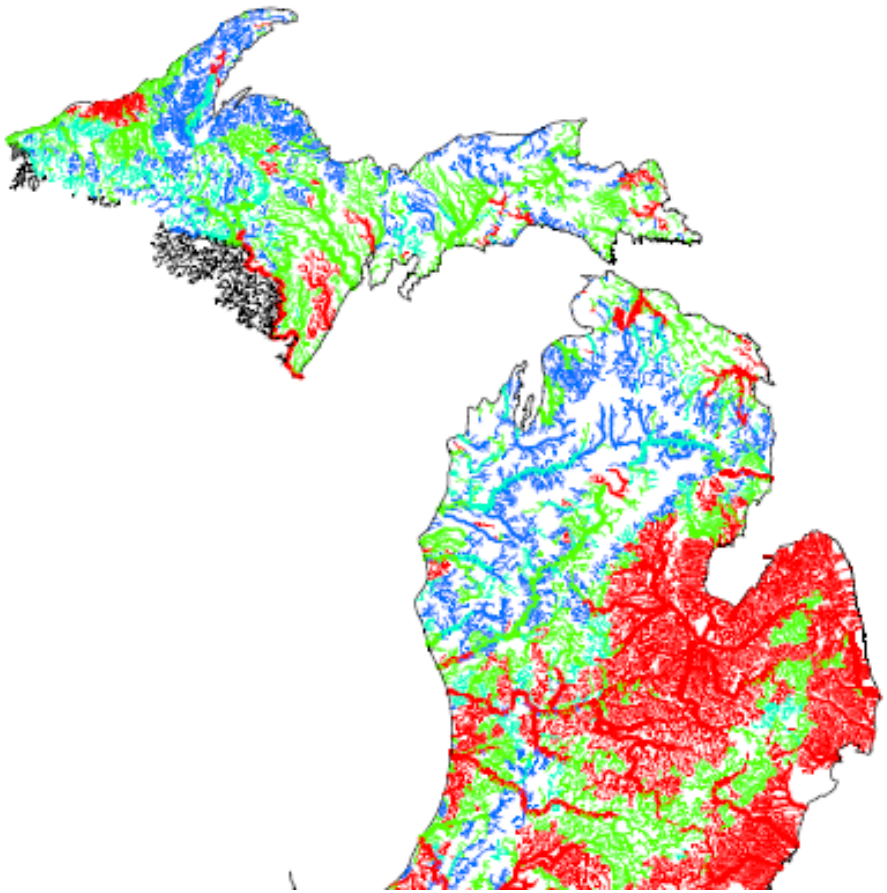
Stream Classification and Ecological Response

- Classification based on drainage area, stream temperature, and fish community
- Represents diversity in settings across the state
- Used to estimate impacts of withdrawal on fish communities
- Allows setting of thresholds
  - Thresholds are different for different settings
  - Set through legislative process
- ***Preserve the geography of flow***



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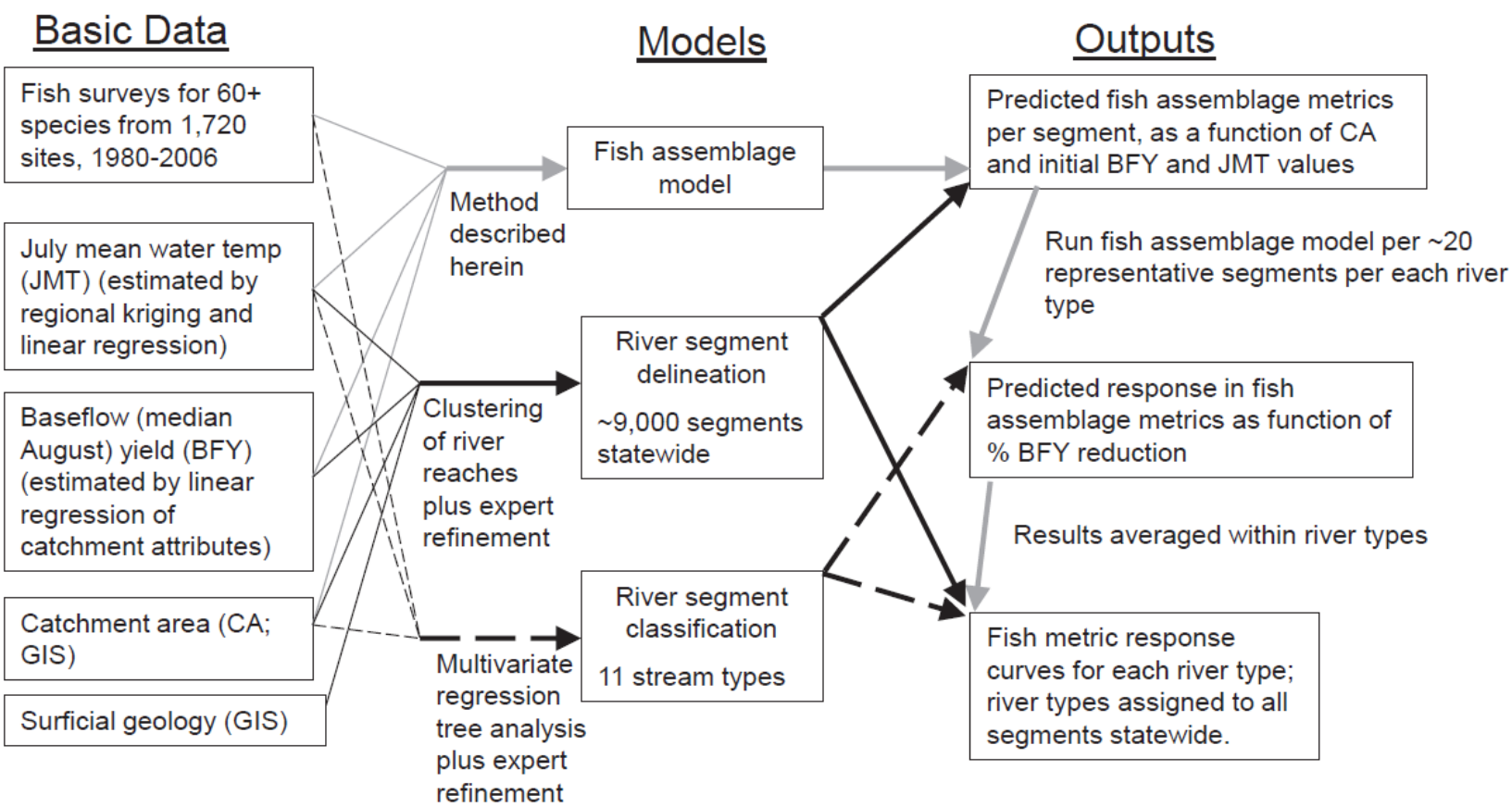
Ecological Response Curves



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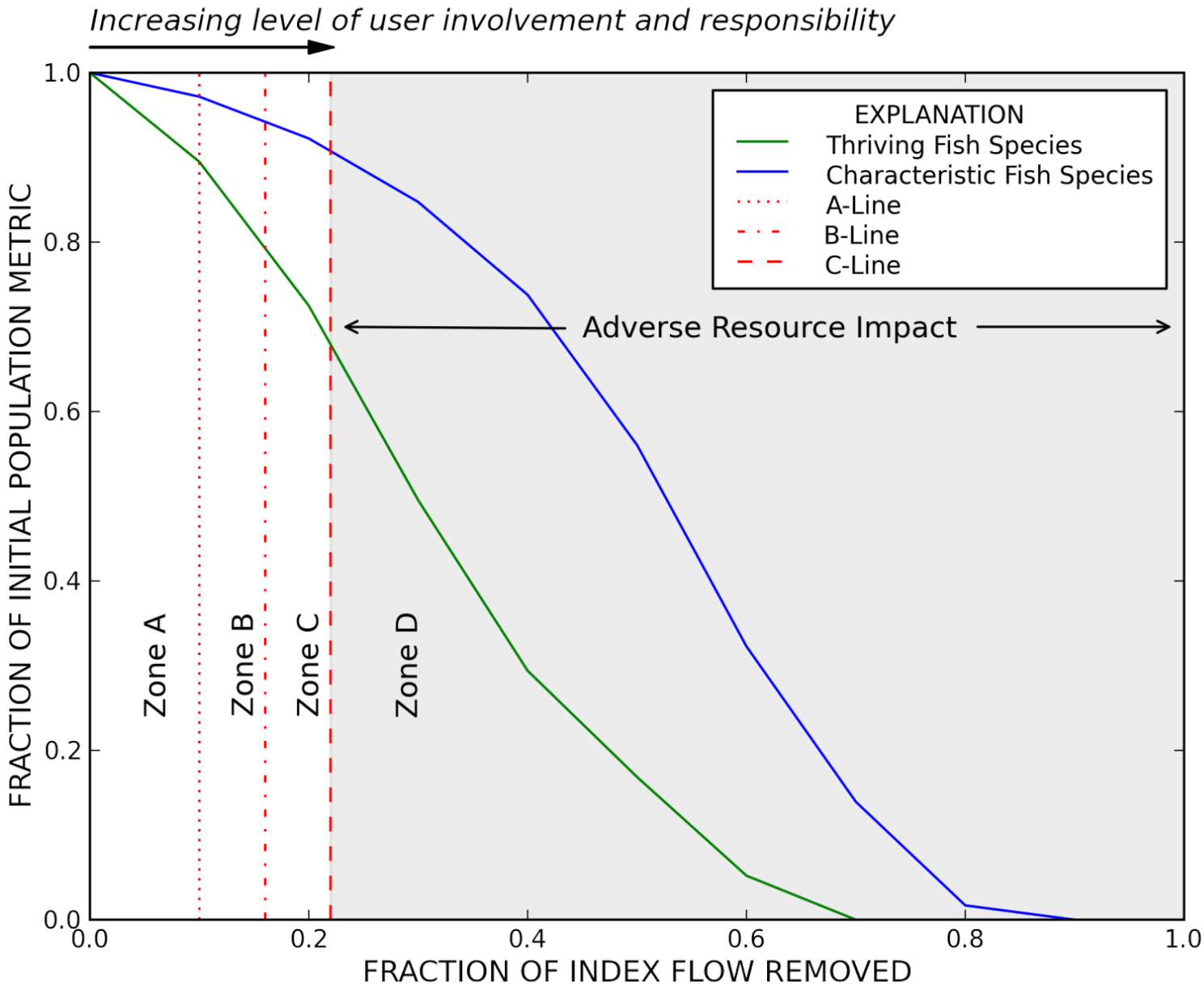
Zorn and others, 2012



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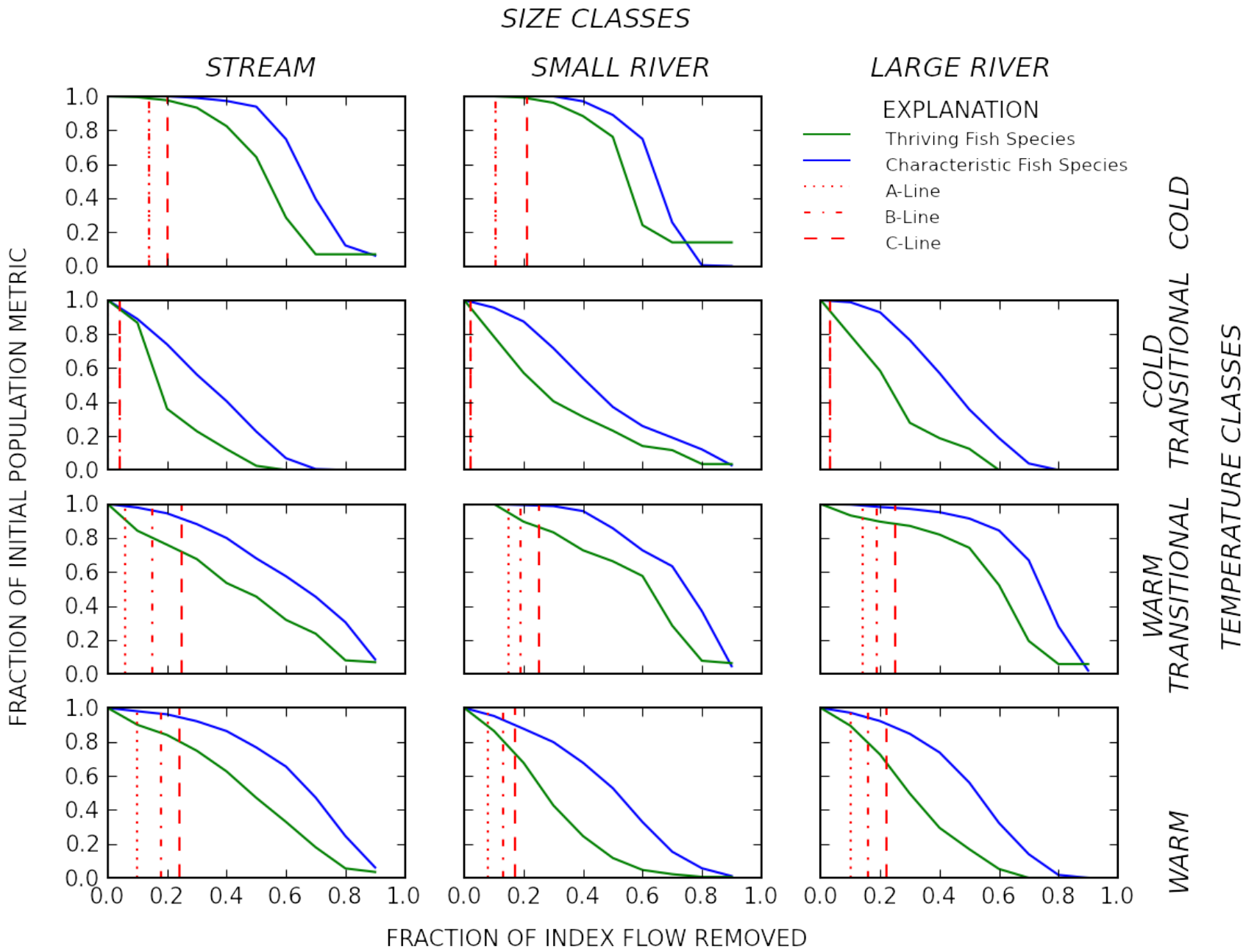
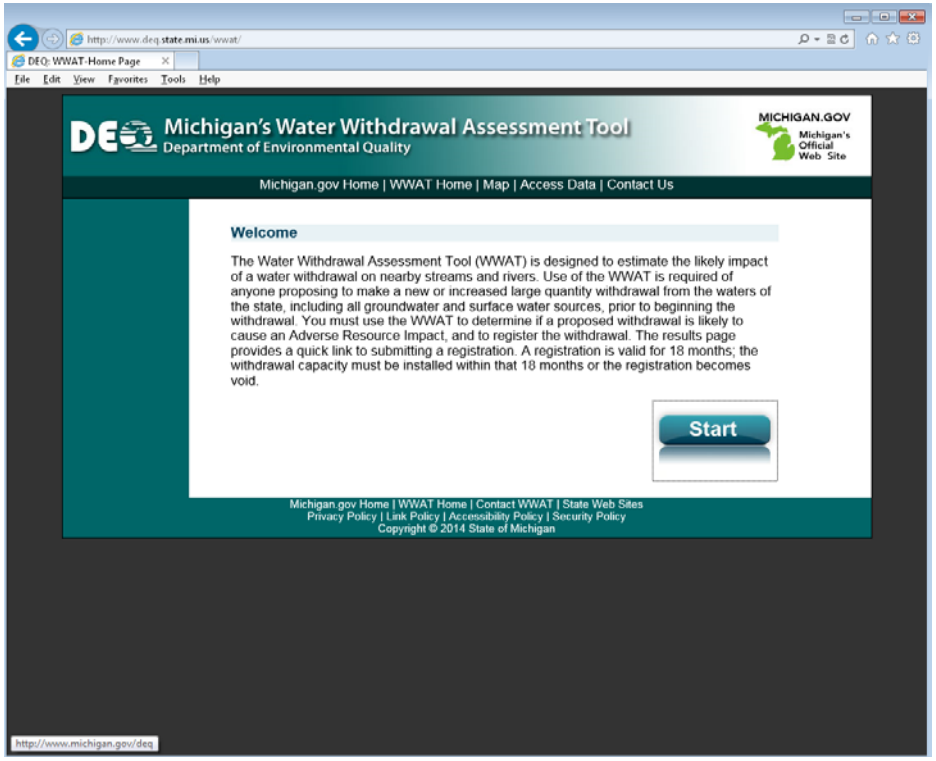
Hamilton and Seelbach, 2011


SIZE CLASSES
STREAM
SMALL RIVER
LARGE RIVER
EXPLANATION
Thriving Fish Species
Characteristic Fish Species
A-Line
B-Line
C-Line
COLD
COLD TRANSITIONAL
WARM TRANSITIONAL
WARM
TEMPERATURE CLASSES
FRACTION OF INITIAL POPULATION METRIC
FRACTION OF INDEX FLOW REMOVED
0.0
0.2
0.4
0.6
0.8
1.0

Screening Tool: Identify withdrawals less likely to cause adverse resource impacts

- Recognize and allow withdrawals that will likely not have adverse impacts register the use
- Increase efficiency and limit regulatory oversight
- Make system more user driven
- Withdrawals that do not pass screening may be submitted for site-specific review



http://www.deq.state.mi.us/wwat/

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Great Lakes Basin

- Given science components of Michigan implementation of the Compact – can we provide same information regionally?
- Great Lakes Restoration Initiative

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Role of NHD and NHDPlus

- Streamflow estimates: need stream network and catchments to get landscape information for ungaged stream estimates (Luukkonen and others, 2014)
- Stream temperature modeling
- Fish presence and abundance
- Streamflow classification

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AFINCH

- Analysis of Flows in Network of Channels
- Constrained regression technique
  - Linear regression to estimate yield from catchments
  - Yield * area = incremental flow from catchment
  - Sum incremental flow down the network -> streamflow
  - Estimates are corrected by adjusting incremental yields upstream of observed flows at streamgages
    - Resulting estimated monthly flows match observed at active gages used in the regression step

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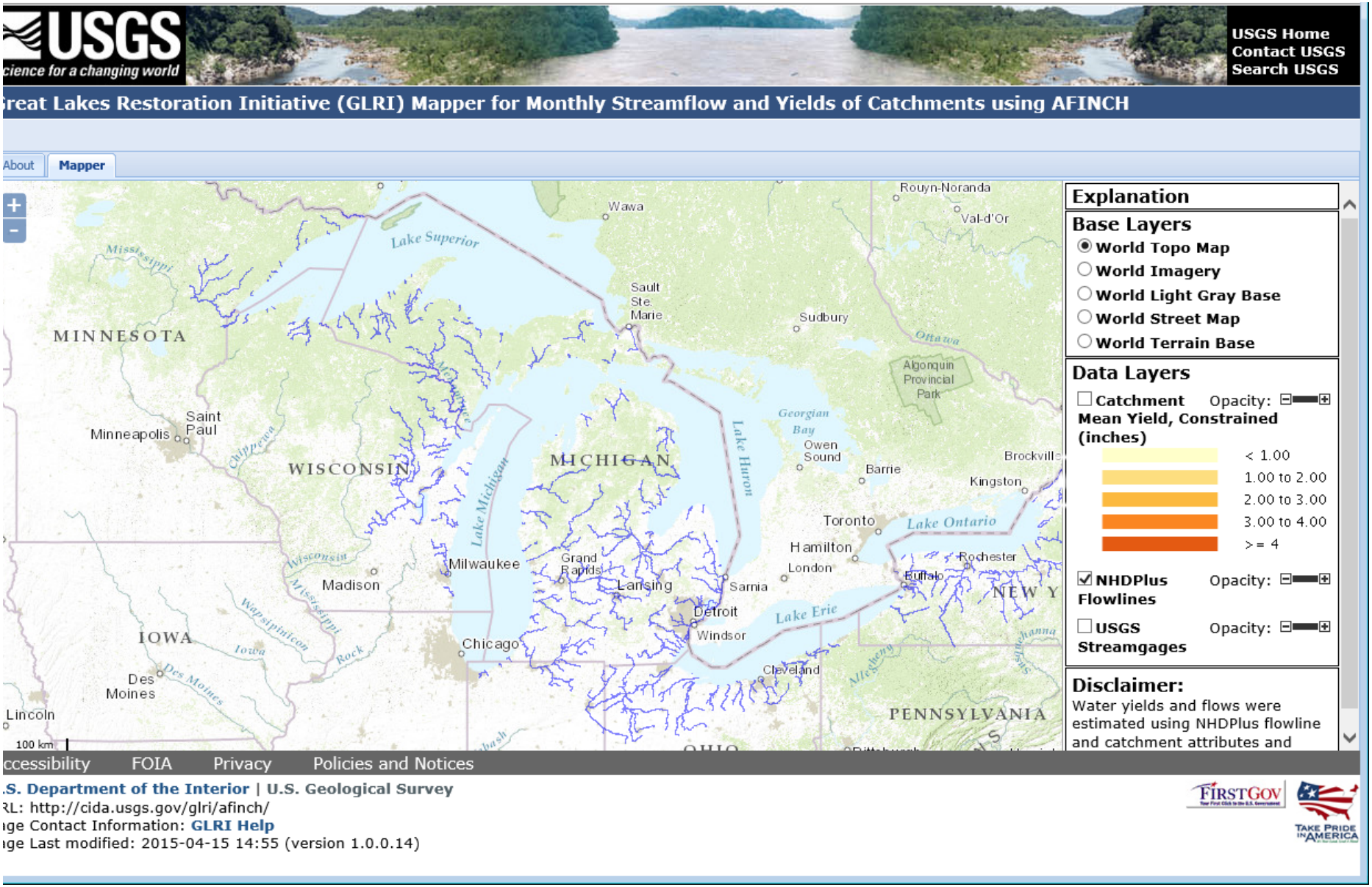

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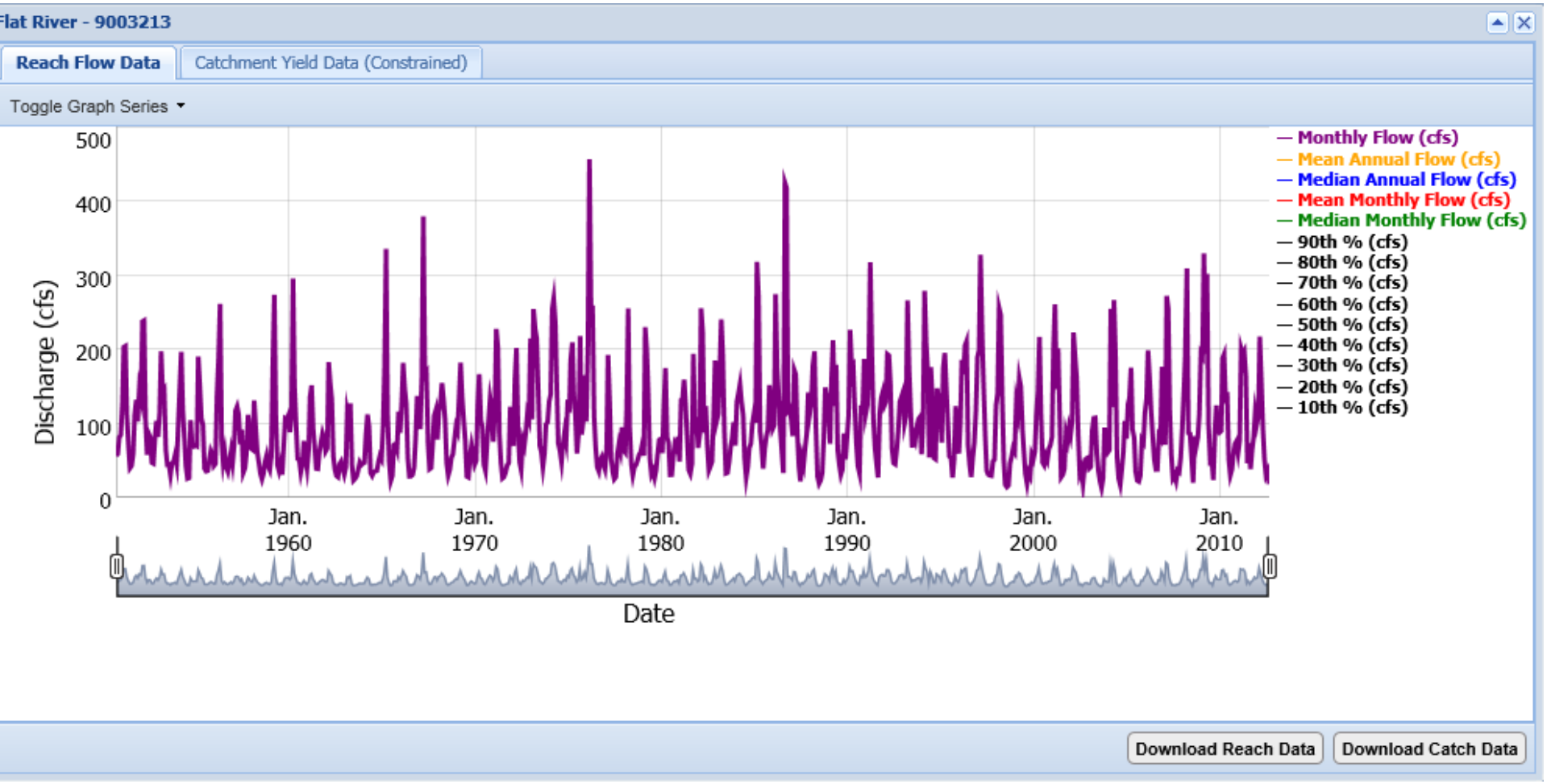
http://cida.usgs.gov/glri/afinch/


Flat River - 9003213
Reach Flow Data
Catchment Yield Data (Constrained)
Toggle Graph Series
Discharge (cfs)
500
400
300
200
100
0
Jan. 1960
Jan. 1970
Jan. 1980
Jan. 1990
Jan. 2000
Jan. 2010
Date
Monthly Flow (cfs)
Mean Annual Flow (cfs)
Median Annual Flow (cfs)
Mean Monthly Flow (cfs)
Median Monthly Flow (cfs)
90th % (cfs)
80th % (cfs)
70th % (cfs)
60th % (cfs)
50th % (cfs)
40th % (cfs)
30th % (cfs)
20th % (cfs)
10th % (cfs)
Download Reach Data
Download Catch Data

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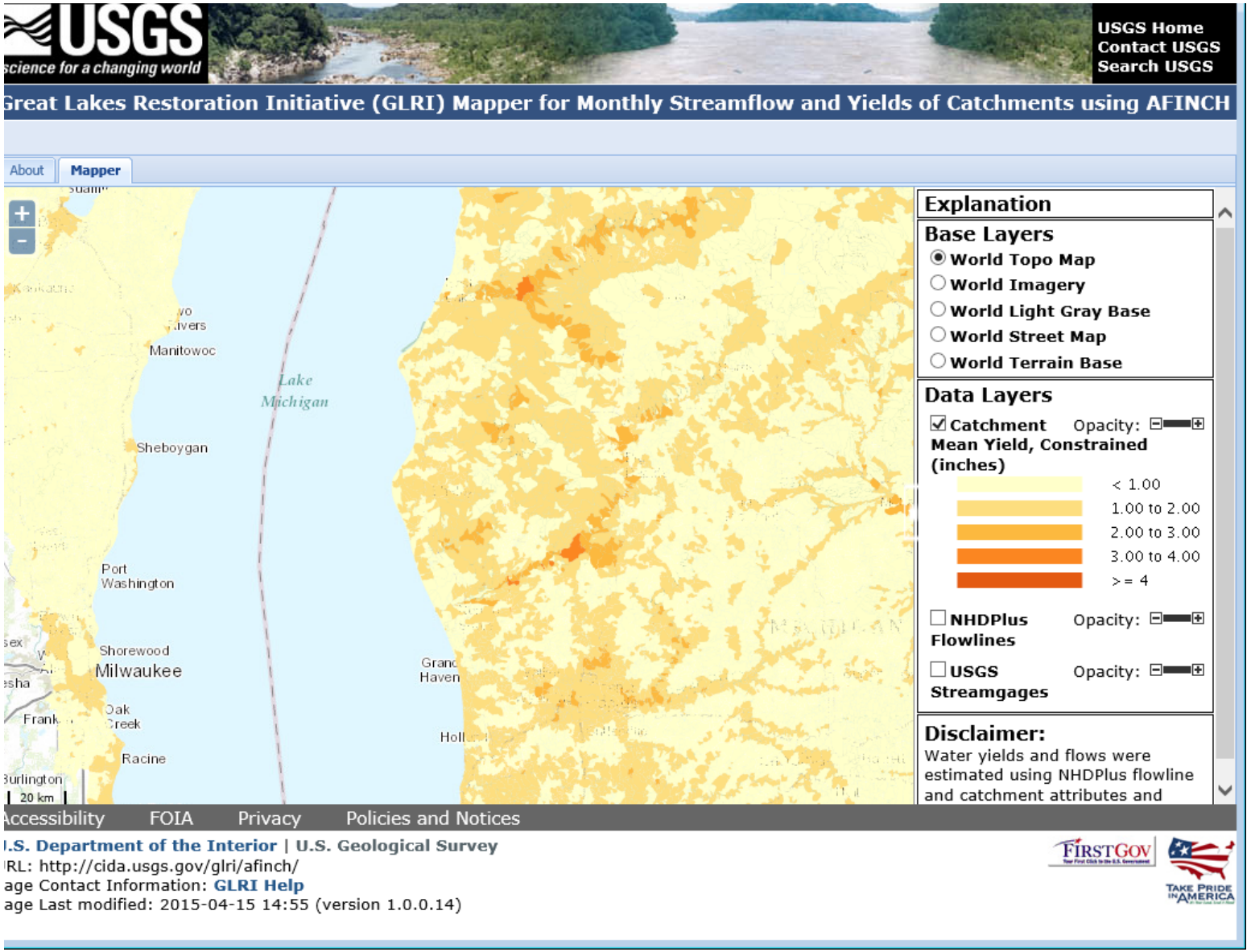
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Great Lakes Restoration Initiative (GLRI) Mapper for Monthly Streamflow and Yields of Catchments using AFINCH
About
Mapper
Manitowoc
Lake Michigan
Sheboygan
Port Washington
Shorewood
Milwaukee
Racine
20 km
Explanation
Base Layers
World Topo Map
World Imagery
World Light Gray Base
World Street Map
World Terrain Base
Data Layers
Catchment Mean Yield, Constrained (inches)
Opacity:
< 1.00
1.00 to 2.00
2.00 to 3.00
3.00 to 4.00
>= 4
NHDPlus Flowlines
USGS Streamgages
Disclaimer:
Water yields and flows were estimated using NHDPlus flowline and catchment attributes and
Accessibility
FOIA
Privacy
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U.S. Department of the Interior | U.S. Geological Survey
URL: http://cida.usgs.gov/glri/afinch/
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Page Last modified: 2015-04-15 14:55 (version 1.0.0.14)
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Ecoflows Flow-Response Curves - *Provisional*

- Period of Record 1979-2011 August median yield (cfs/mi^2).
- Cumulative Catch-per-unit-effort versus yield is graphed
  - Look for areas of rapid change: population sensitive to yield
- Response curves show reductions in suitable habitat with changes in flow.

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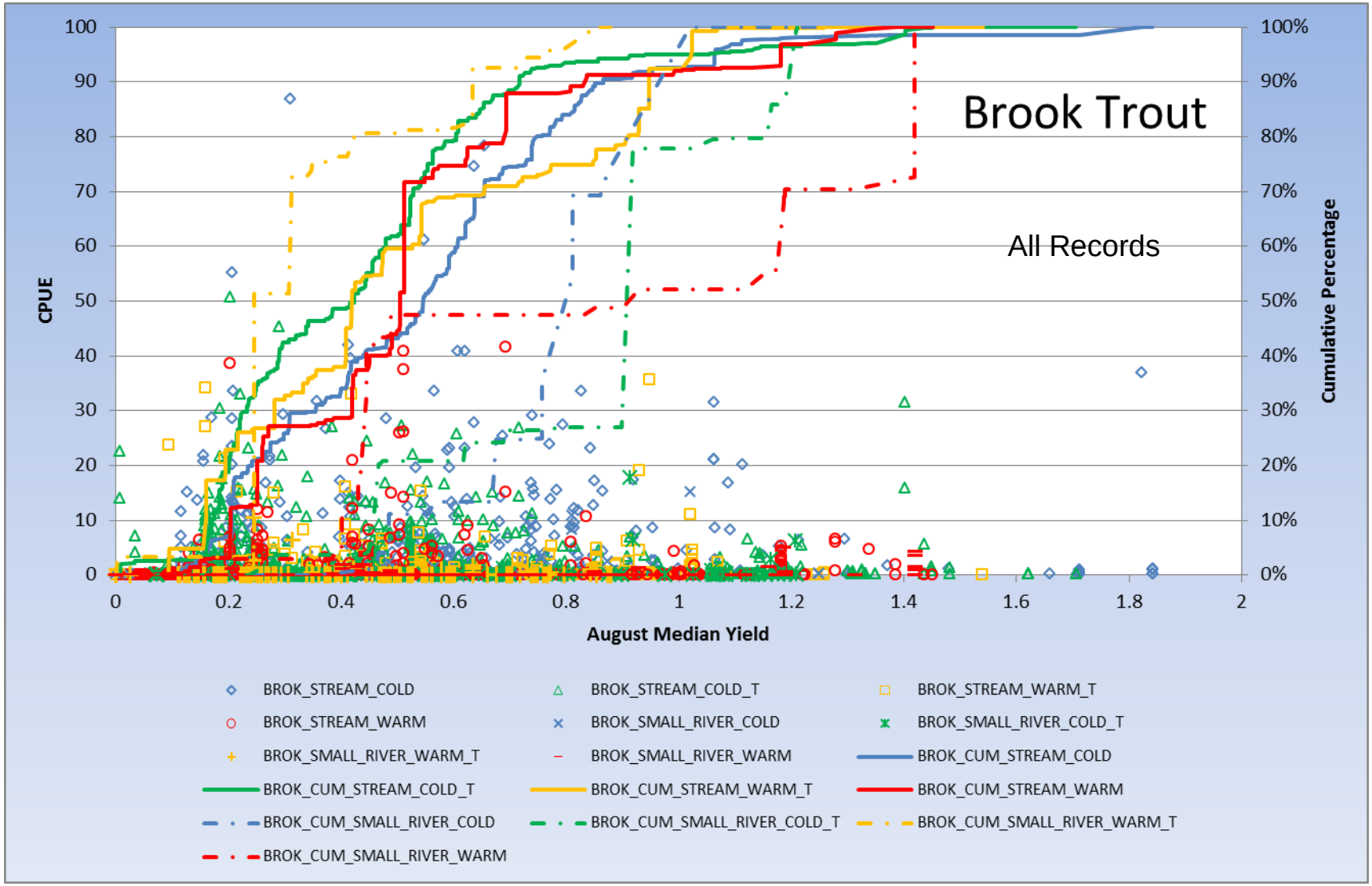

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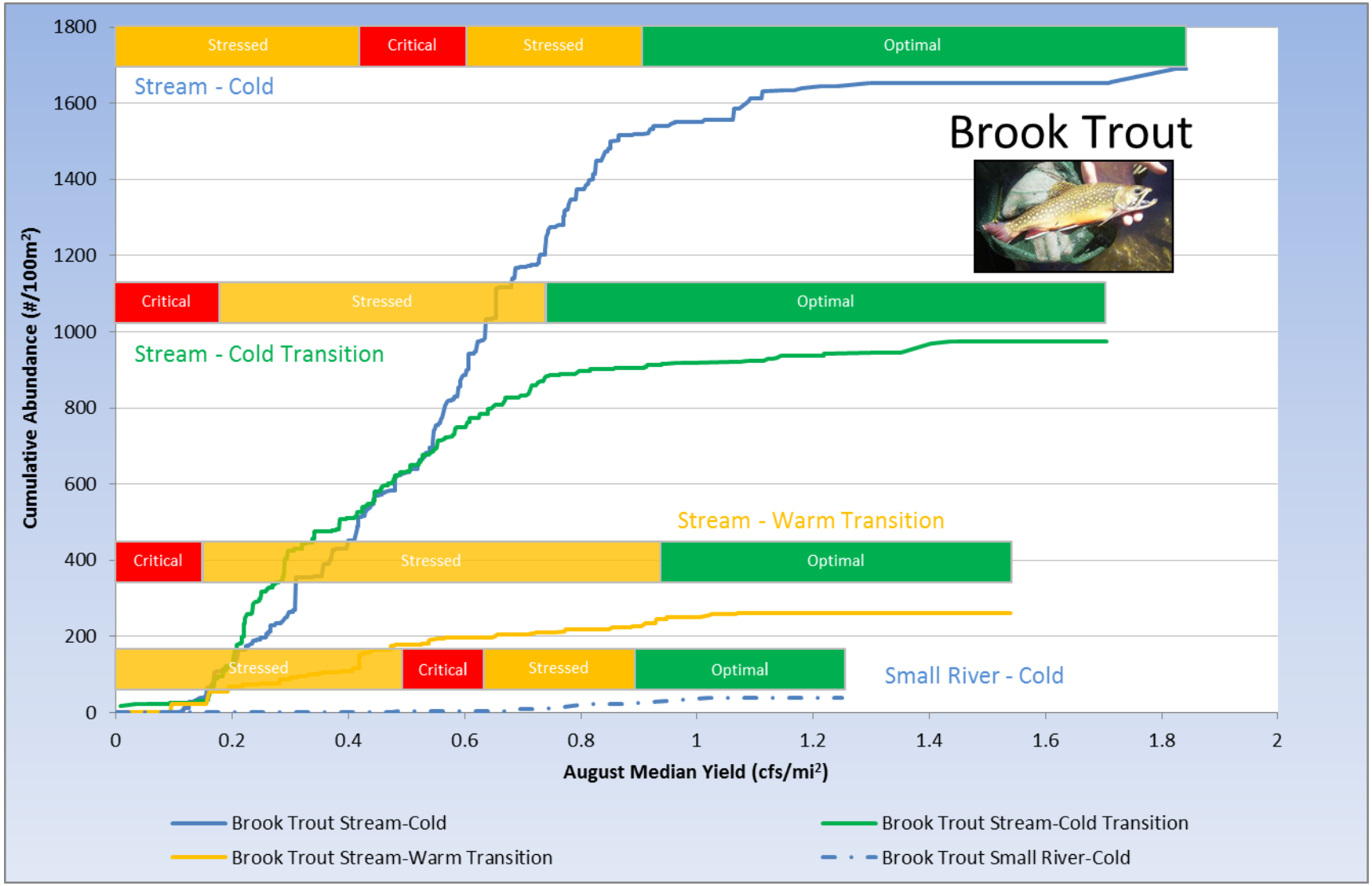
Provisional: for illustration only



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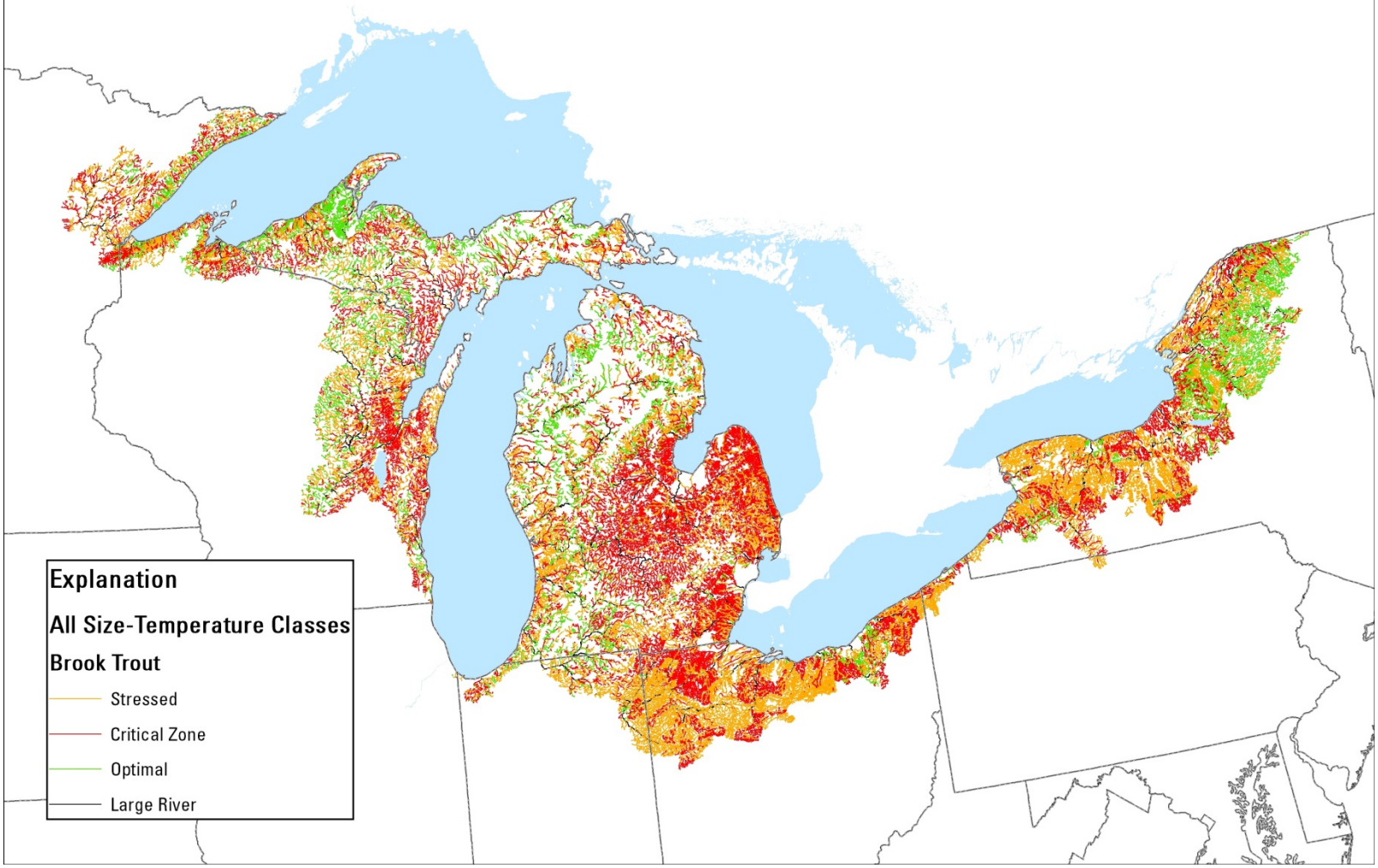
Brook Trout - Applied to all streams & small rivers. Based on the slopes of abundance trendlines.
Note that the slope curves have different shapes for different size-temperature classes.



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Resources

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