Recent Developments in Water Withdrawal Management

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Overview

- What Water Withdrawals are regulated?
- Water Withdrawal Assessment Process
- Implementation
- Future Directions

All water sources covered

- Groundwater
- Surface water
- Great Lakes
- Inland waters
- Including: shallow wells, ponds, horizontal wells, etc.

Withdrawals less than 100,000 gpd (70 gpm) are not regulated.

Any withdrawal of 100,000 gpd or more is a "large capacity withdrawal (LCW)."

Beginning February 28, 2006, any new or increased withdrawal of 100,000 gpd or more is prohibited from causing an "Adverse Resource Impact (ARI)."

Baseline capacity

- If a LCW was used or developed to make a withdrawal on Feb 28, 2006, and
- if it is included in an annual report by April 1, 2009;
- then it is considered to be “baseline capacity.”

Beginning July 9, 2009, any new or increased withdrawals over 100,000 gpd will be evaluated by a "Water Withdrawal Assessment Tool."

Water Withdrawal Assessment Process

Decision-Making Standard

- 2006 Legislation

  "Adverse Resource Impact": "Stream's ability to support characteristic fish populations is functionally impaired"

- Goal: Quantify

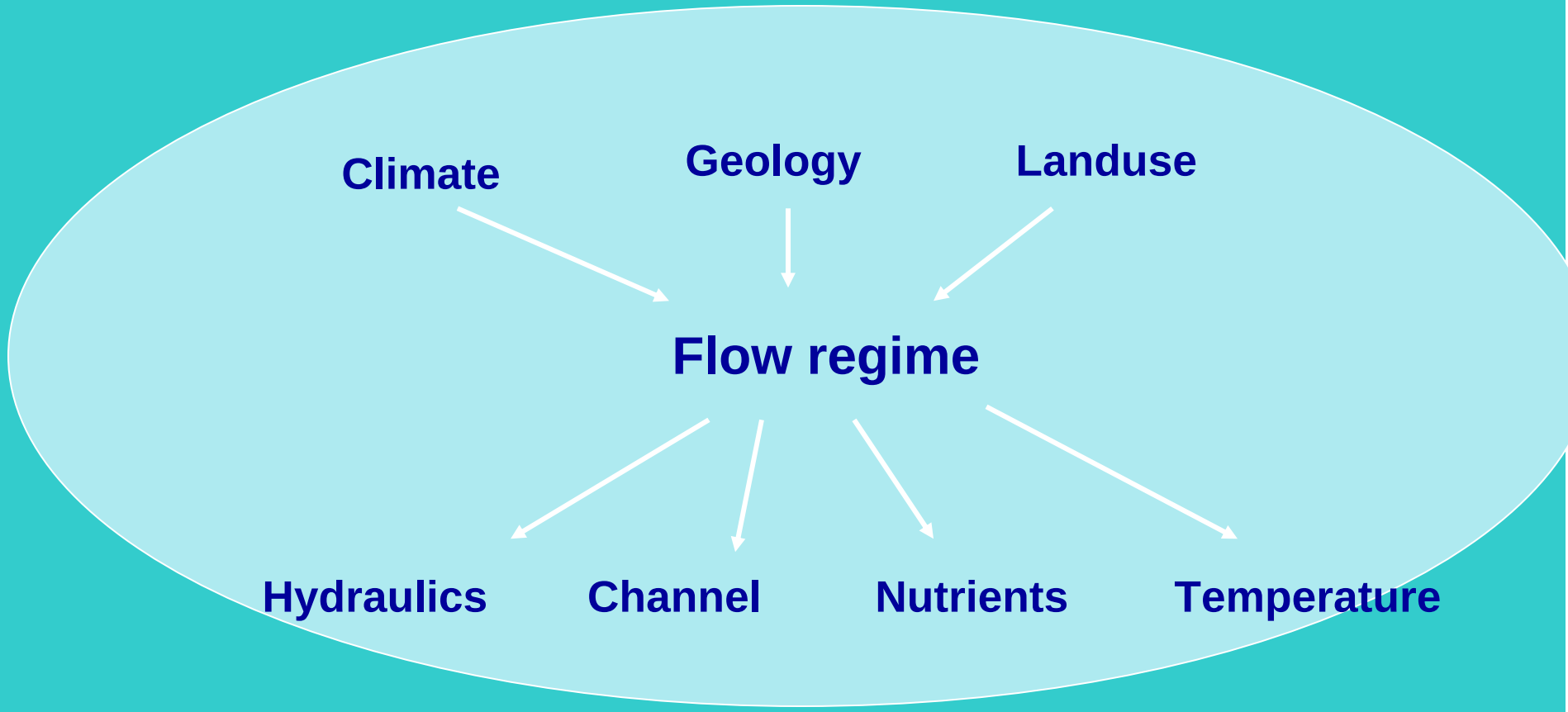
  Consistency

  Predictability

The Philosophy behind the Water Withdrawal Assessment Process

- Integrated, science-based approach
- Develop new thinking in integrating existing science
- Use a National Scientific Peer Review Panel
- Base the approach on Michigan data and State modeled relationships
  - Science team: USGS, MDEQ, MDNR, UM, MSU
- Run an open shop - inclusive, seek participation, communication:
  - Council & guests (across all sectors)
    - Technical and Legal and Mitigation Subcommittees
  - MDA, MDEQ & MDNR on Council

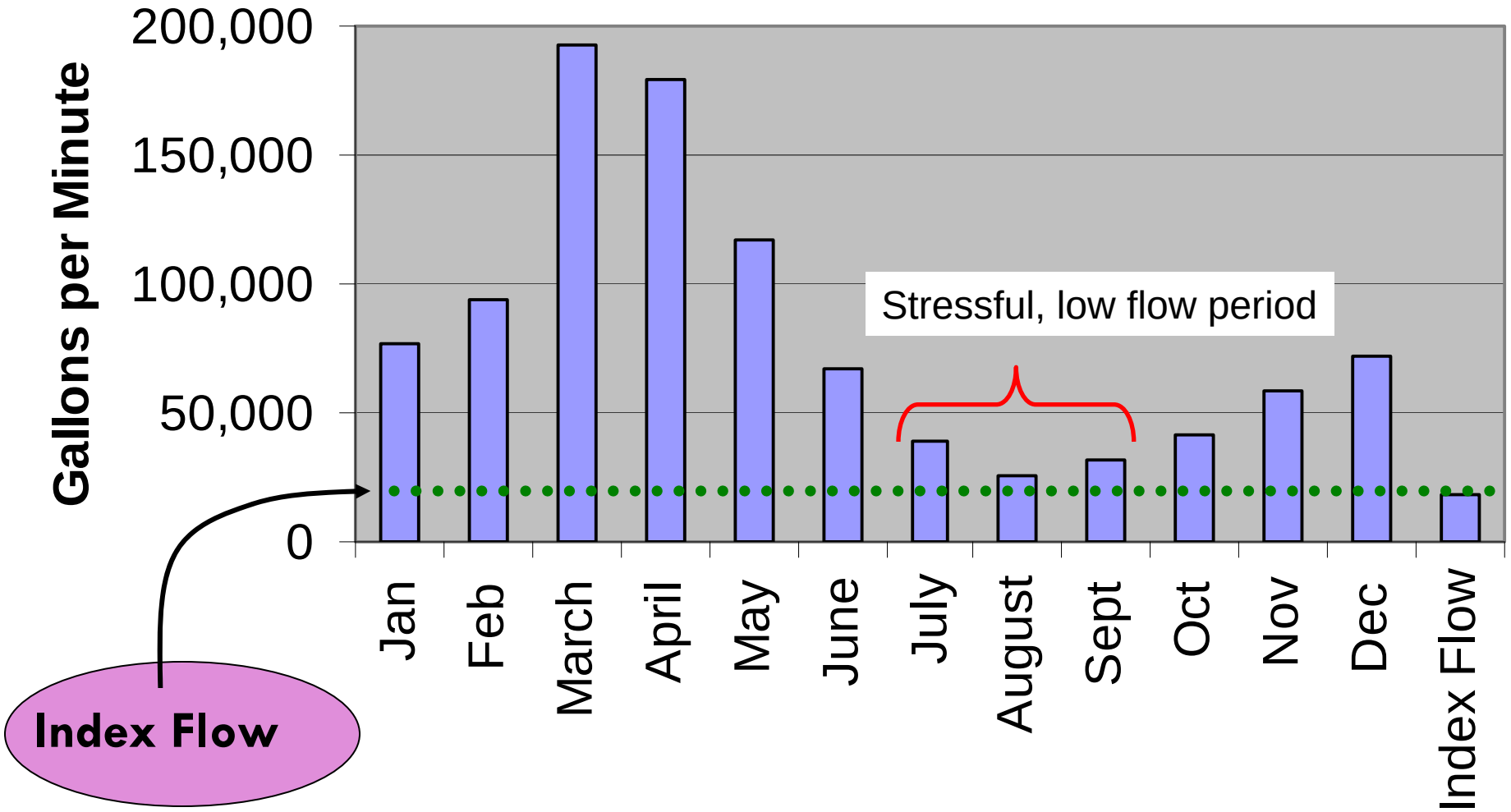
The Flow Regime Paradigm

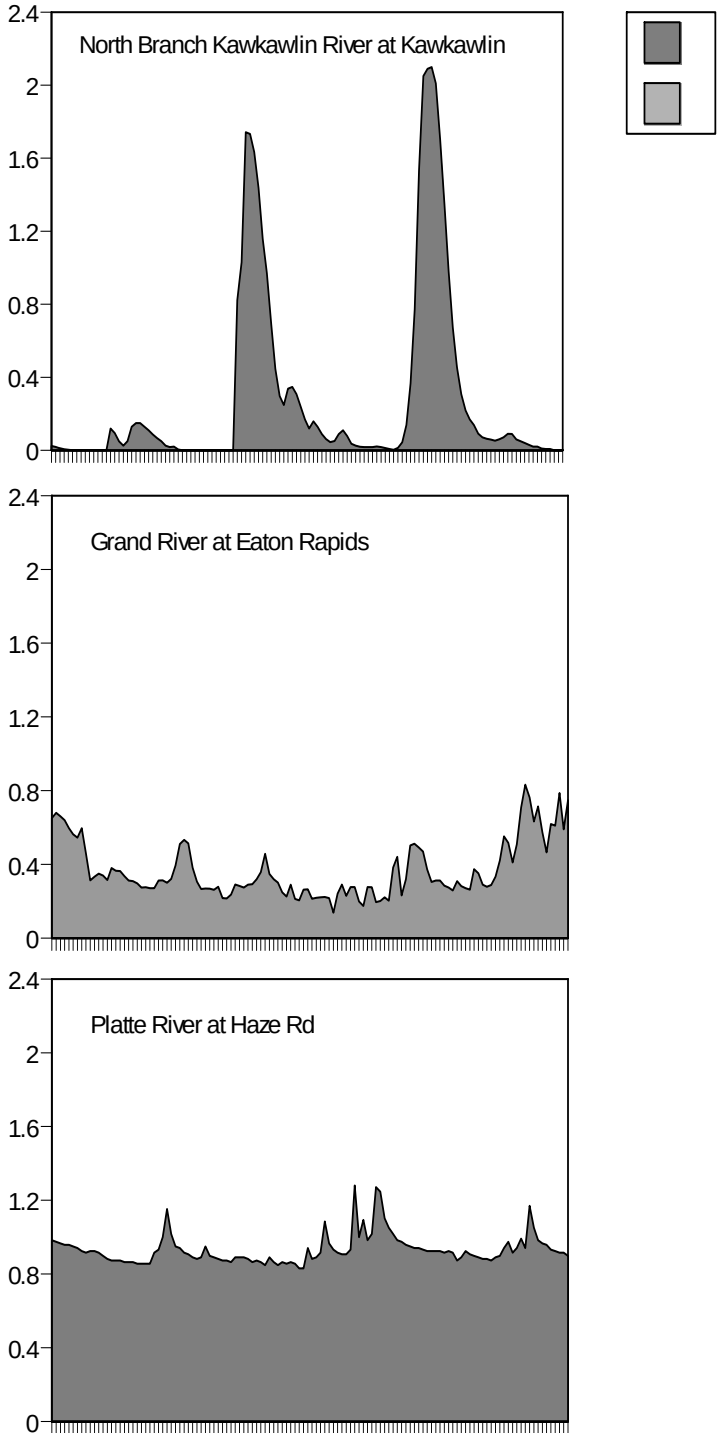


-- There is a geography of flow regimes

-- Fish species are adapted to habitats controlled by certain quantities of, and variability in, river flows

Looking Glass River near Eagle
Mean Monthly Flows





Michigan rivers naturally have different flow regimes, and thus different habitat conditions, biological communities, sensitivity to disturbance, and potential for fishery management .

The Water Withdrawal Assessment Process

- Three Models Interact within the impact assessment model

  Withdrawal Model - How much water is in the aquifer, is being withdrawn, and from where and how it will affect stream flow

  Streamflow Model - How much water is flowing in the stream during summer low flow periods

  Fish Impact Model - What fish are in the stream and what is the likely effect of removing water on those groups of fish

Characteristics of the Withdrawal Model

- Distance Matters
  - A well adjacent to a river will very quickly get water either from water that would have gone to the river or directly from the river
  - A well farther from a river will get more water from storage and require a longer time to affect the stream
- Geology and Soil Matters
  - Clay soils are “tight” and water does not move easily
  - Sandy soils are “porous” and water flows quickly

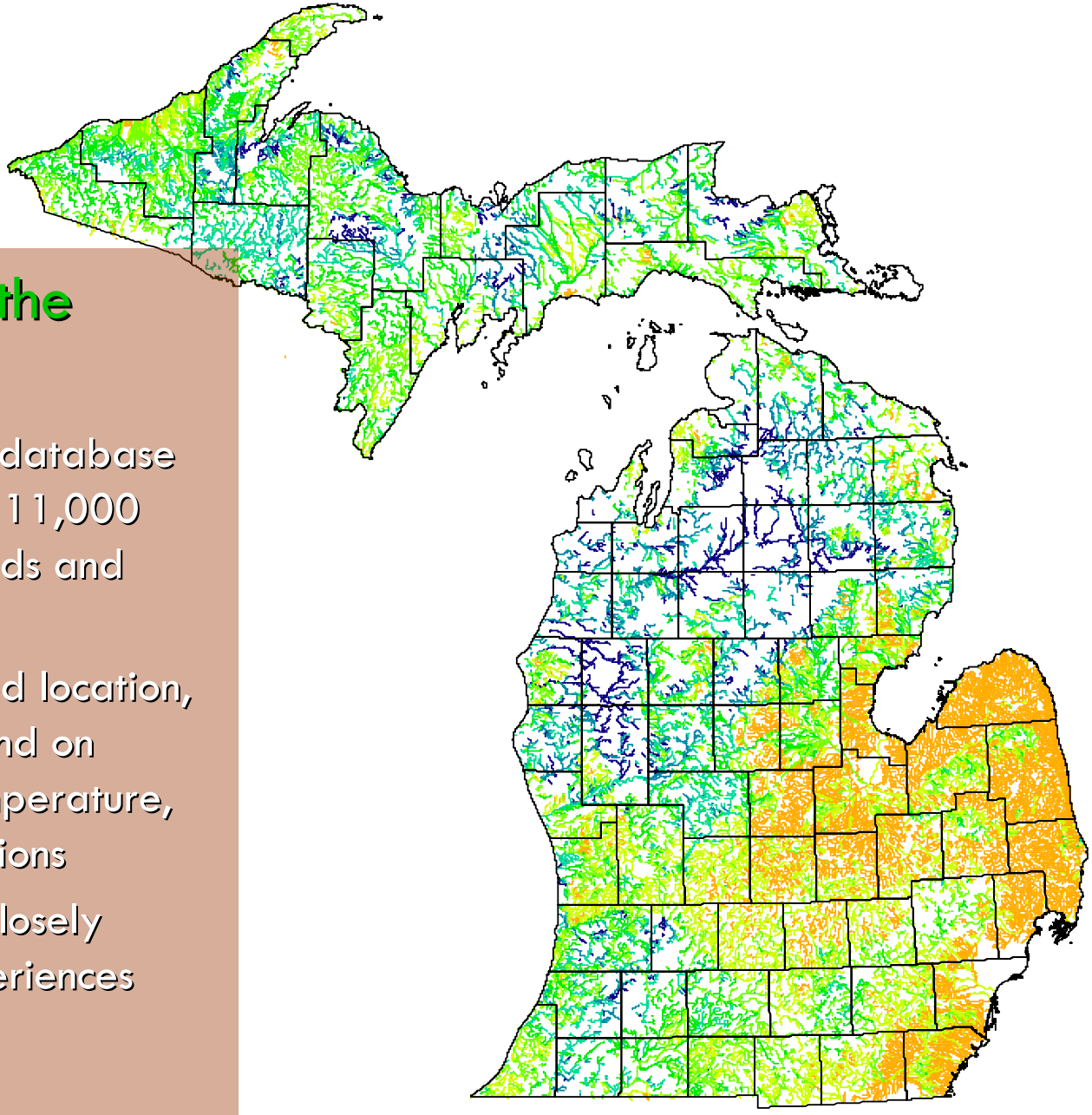
The Streamflow Model

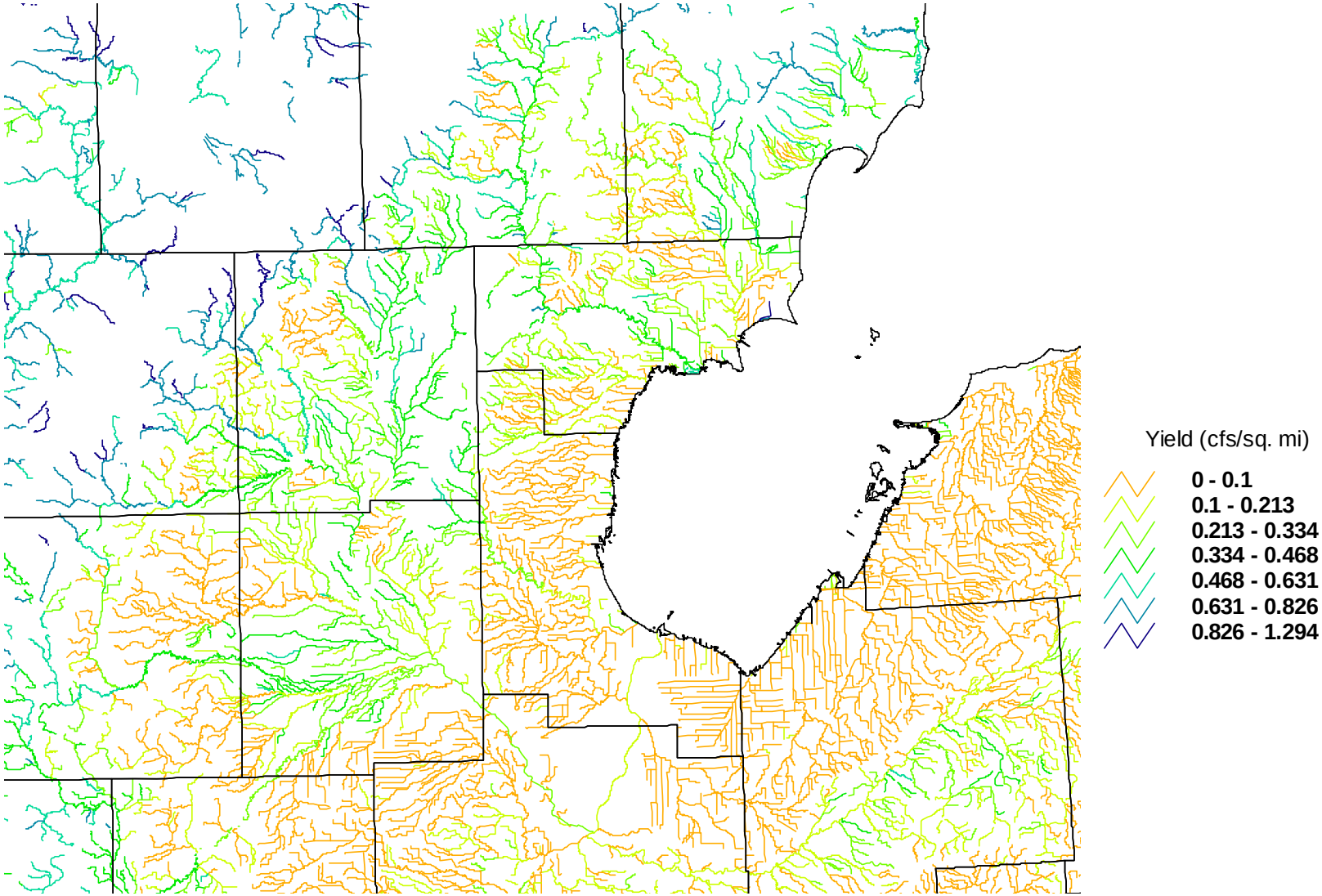
- Need to Know How Much Flow is in **any** Stream Segment
- "Index flow"; low flow period in the year
- Look at the segments where we know the flow (147 stream gauges in the State) and extrapolate these to the streams that are not gauged

- Major Factors Used
  - Drainage Basin Size
  - Forest Cover
  - Geology and Soils
  - Precipitation

Major Factors in the Analysis

- The geographic database contains info for 11,000 distinct watersheds and streams
- Info on watershed location, size, geology; and on stream flow, temperature, and fish populations
- Resulting maps closely match field experiences

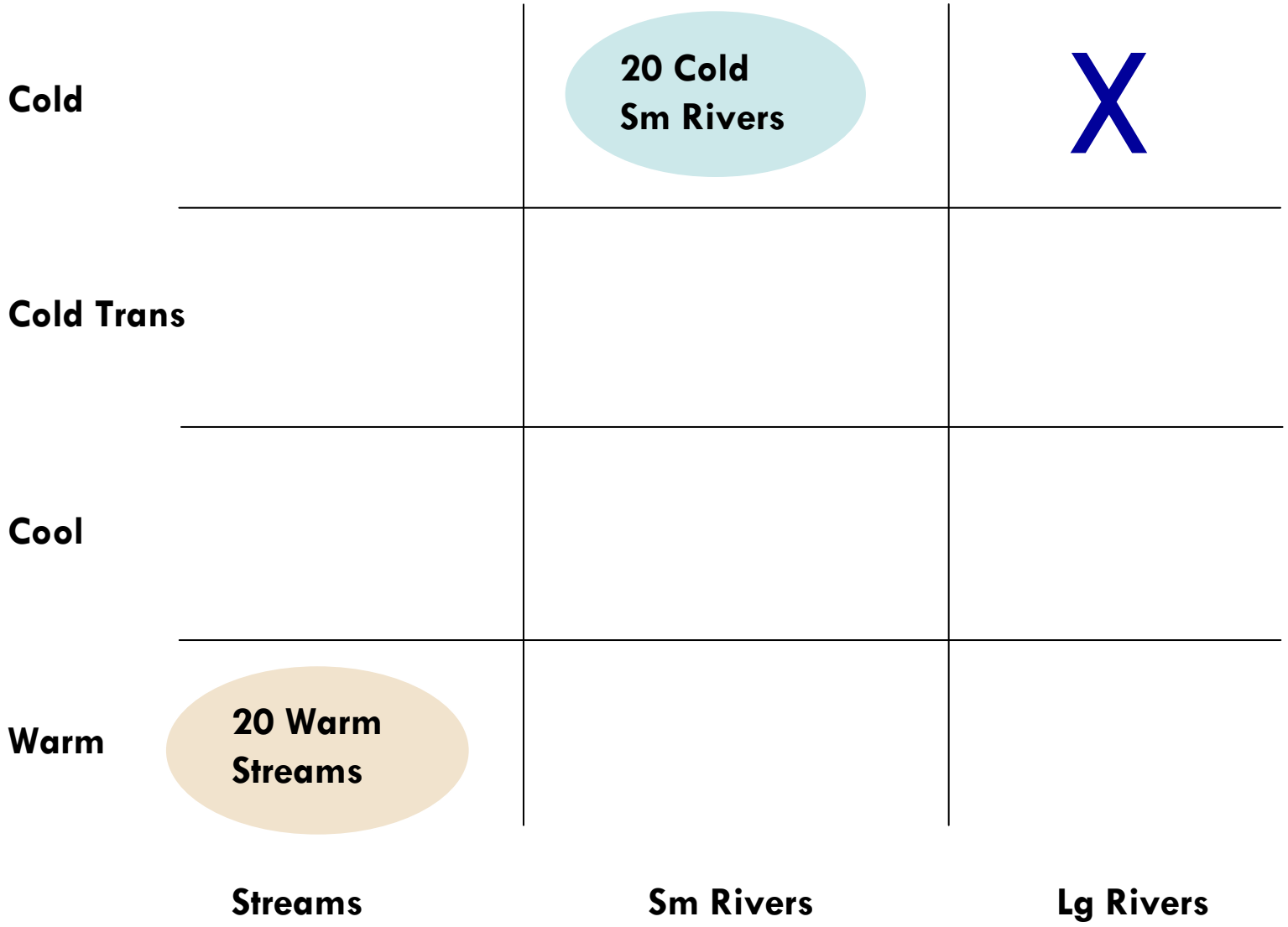


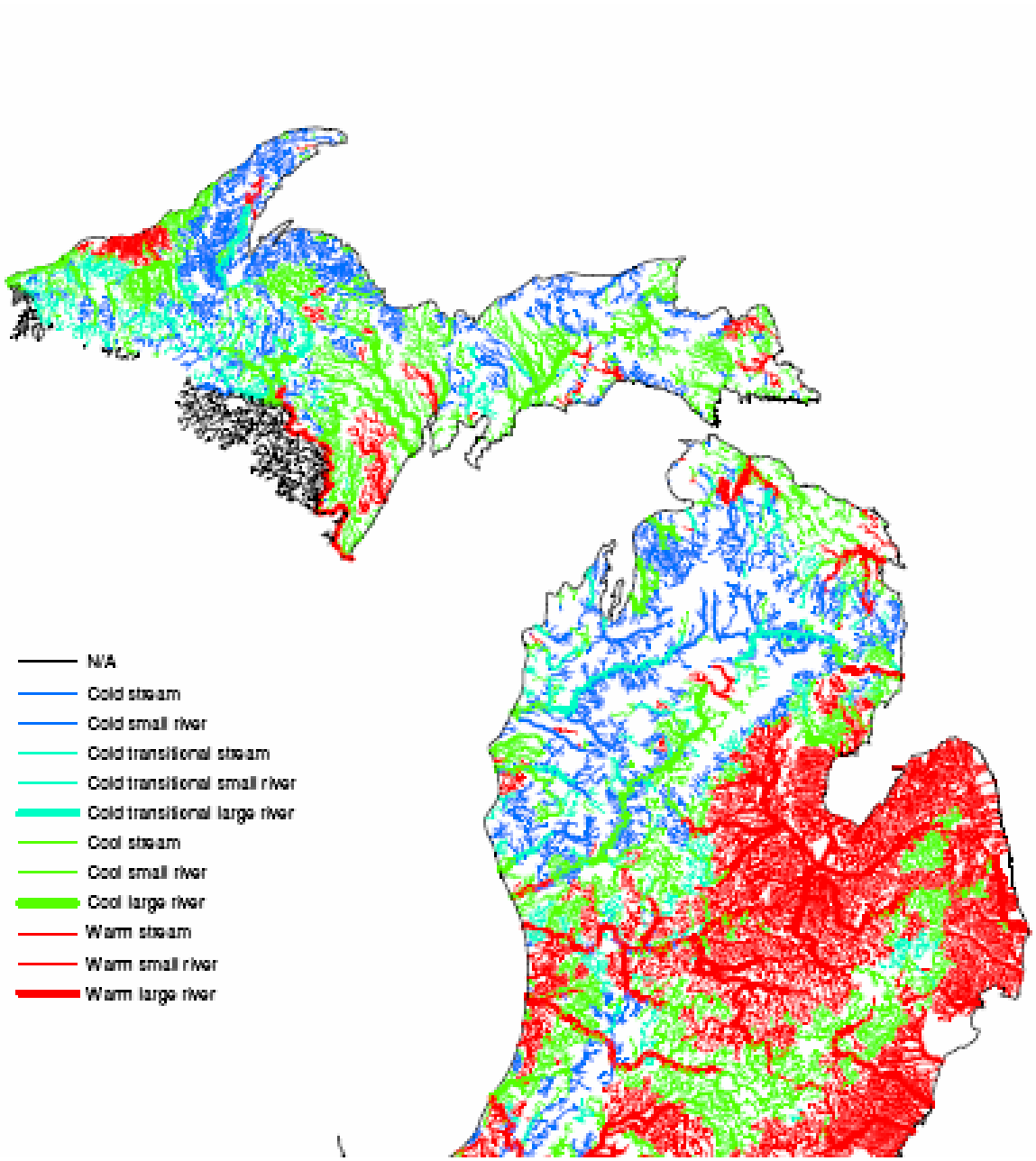

Yield (cfs/sq. mi)
0 - 0.1
0.1 - 0.213
0.213 - 0.334
0.334 - 0.468
0.468 - 0.631
0.631 - 0.826
0.826 - 1.294

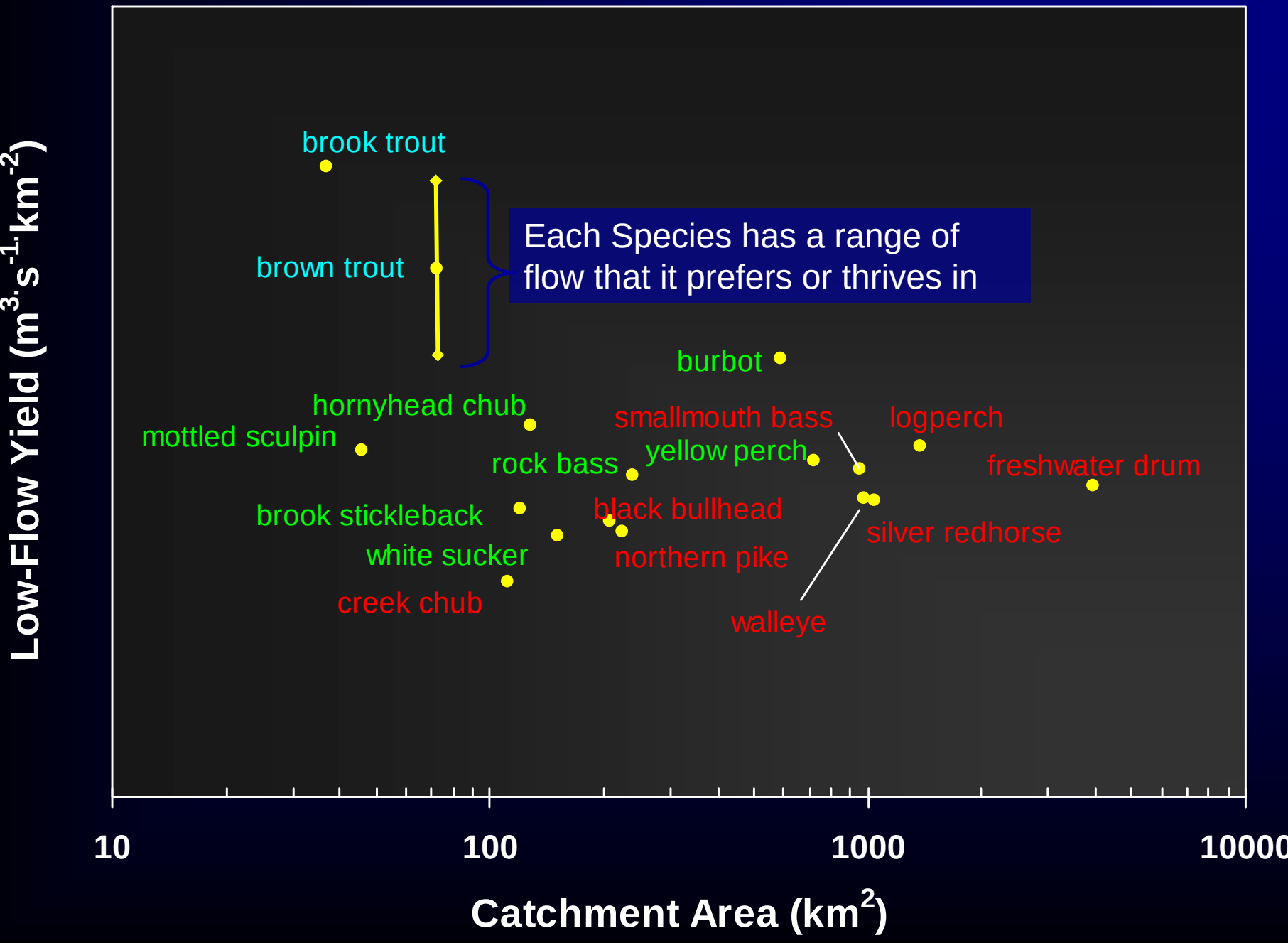
Fish Response Model

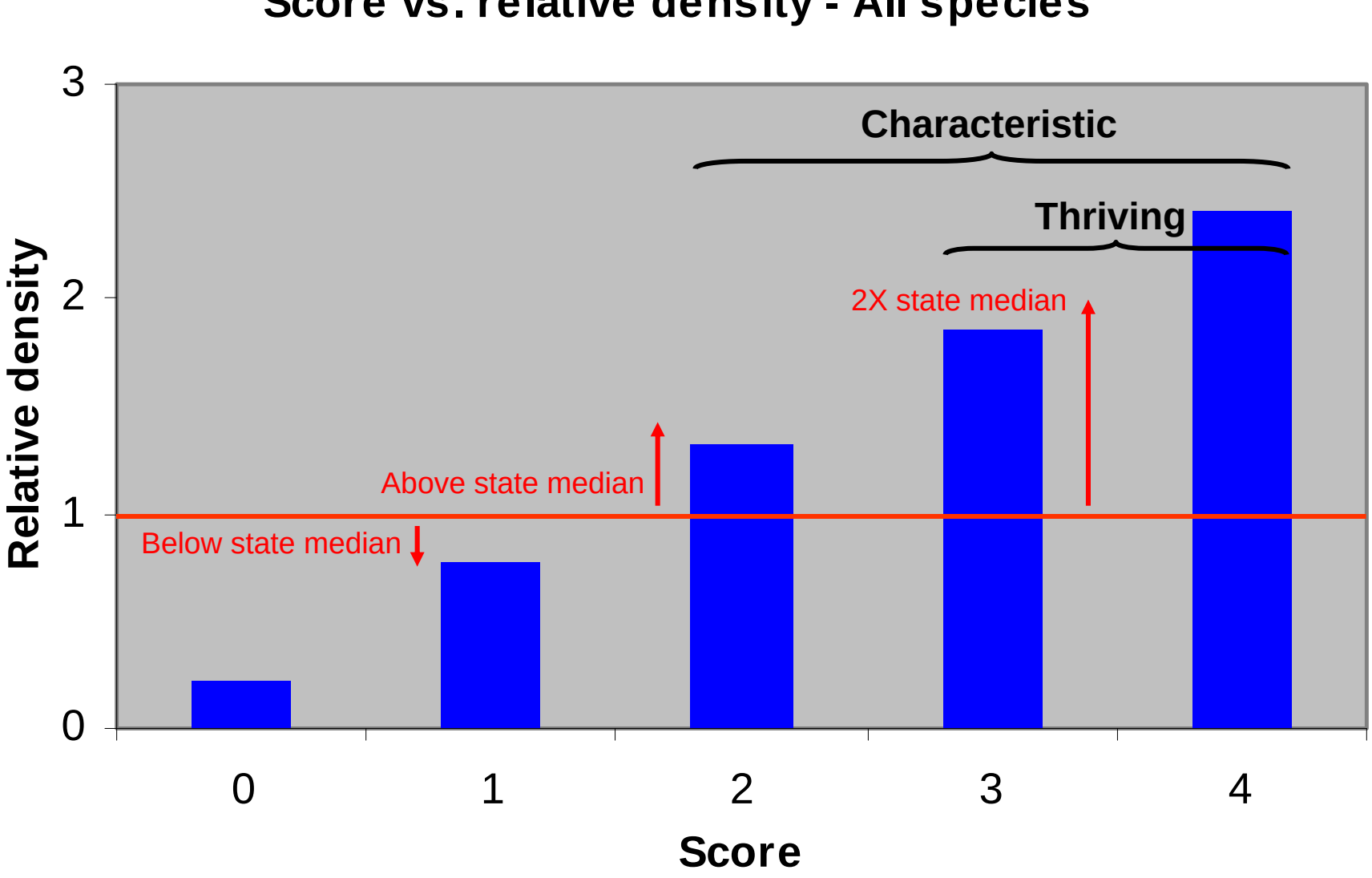
- What fish populations live where in the streams of the State and how do they respond to flow reductions in the summer (at low flow)
- Two Key Issues to Review
  - Defining Stream Types and "Characteristic Fish Populations"
  - Defining "Functional Impairment" to Characteristic Fish Populations due to water withdrawals

We grouped Michigan streams into types and developed response models using an average of ~ 20 specific segments per type



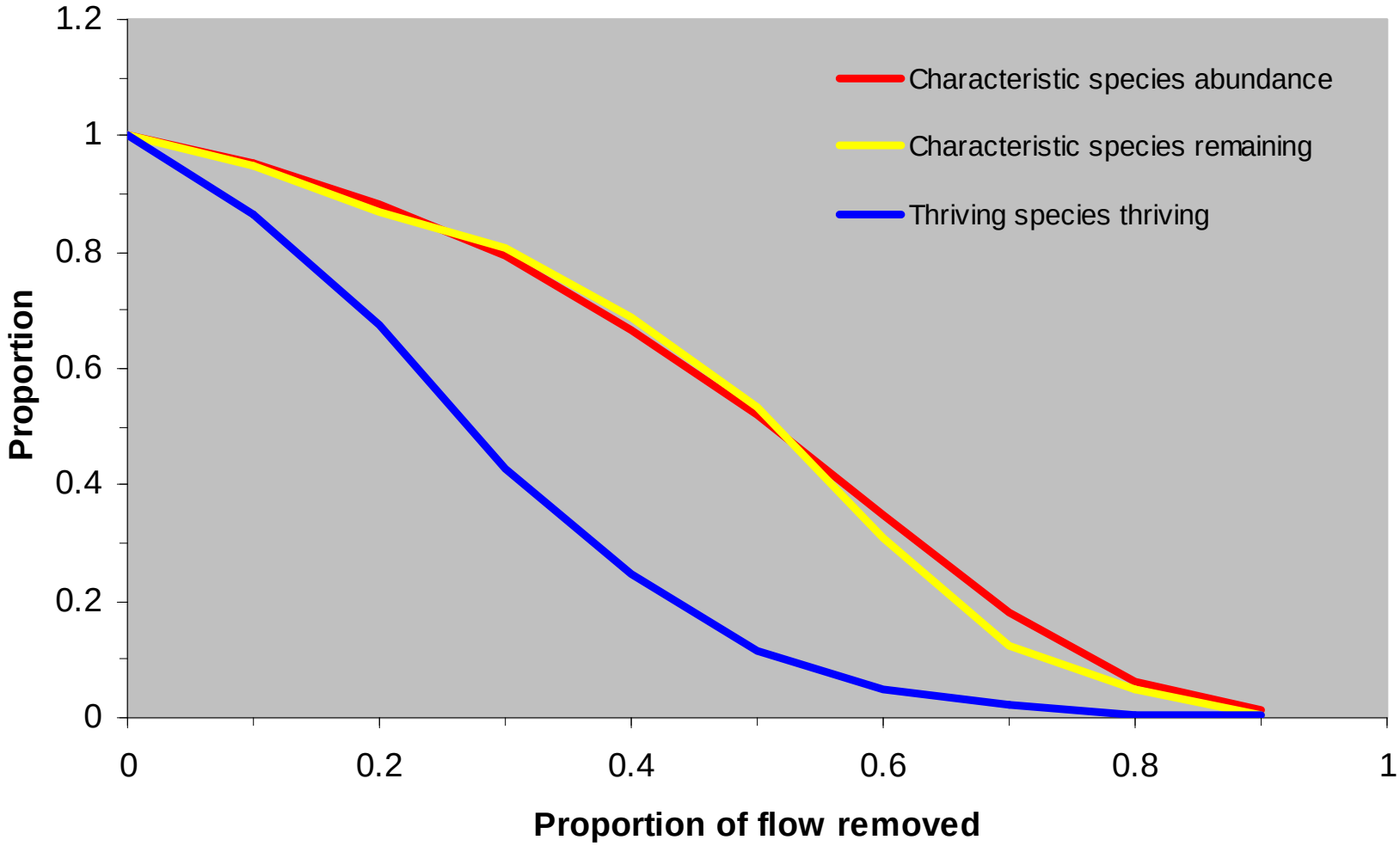

N/A
Cold stream
Cold small river
Cold transitional stream
Cold transitional small river
Cold transitional large river
Cool stream
Cool small river
Cool large river
Warm stream
Warm small river
Warm large river


brook trout
brown trout
Each Species has a range of flow that it prefers or thrives in
burbot
hornyhead chub
mottled sculpin
smallmouth bass
logperch
yellow perch
rock bass
freshwater drum
brook stickleback
black bullhead
silver redhorse
white sucker
northern pike
creek chub
walleye
Low-Flow Yield ($m^3.s^{-1}.km^{-2}$)
10
100
1000
10000
Catchment Area (km^2)



Relative density = site density / species' median density statewide
(7000 species predictions / 183 sites)

What Can the Fish Curves Tell Us About Functional Impairment?



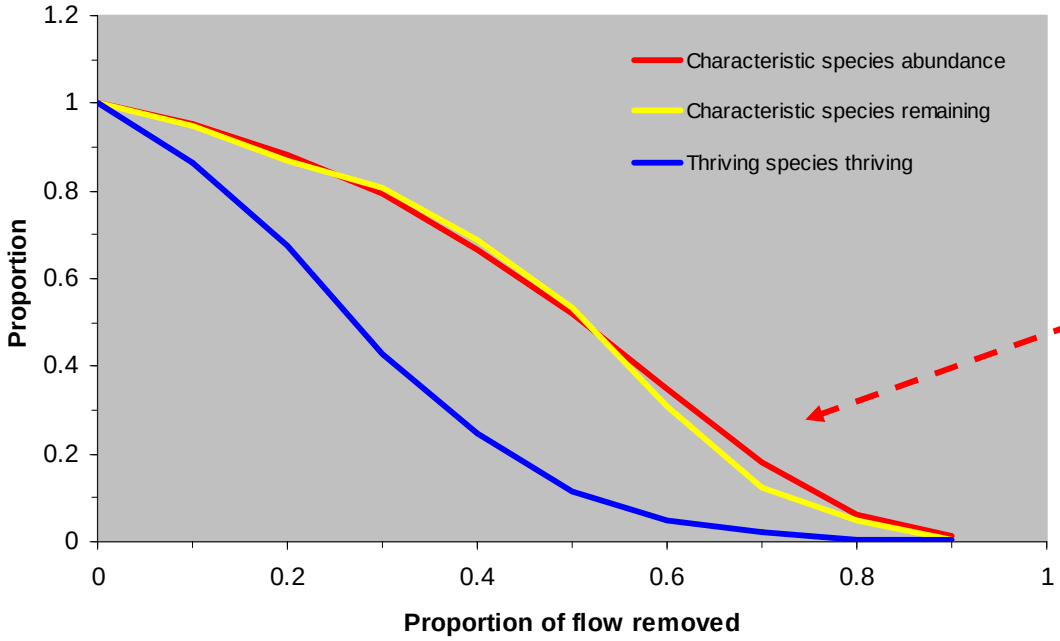
Interpretive criteria from Davies and Jackson 2006

Baseline or existing condition

Some density changes in fish

Some replacement of sensitive species

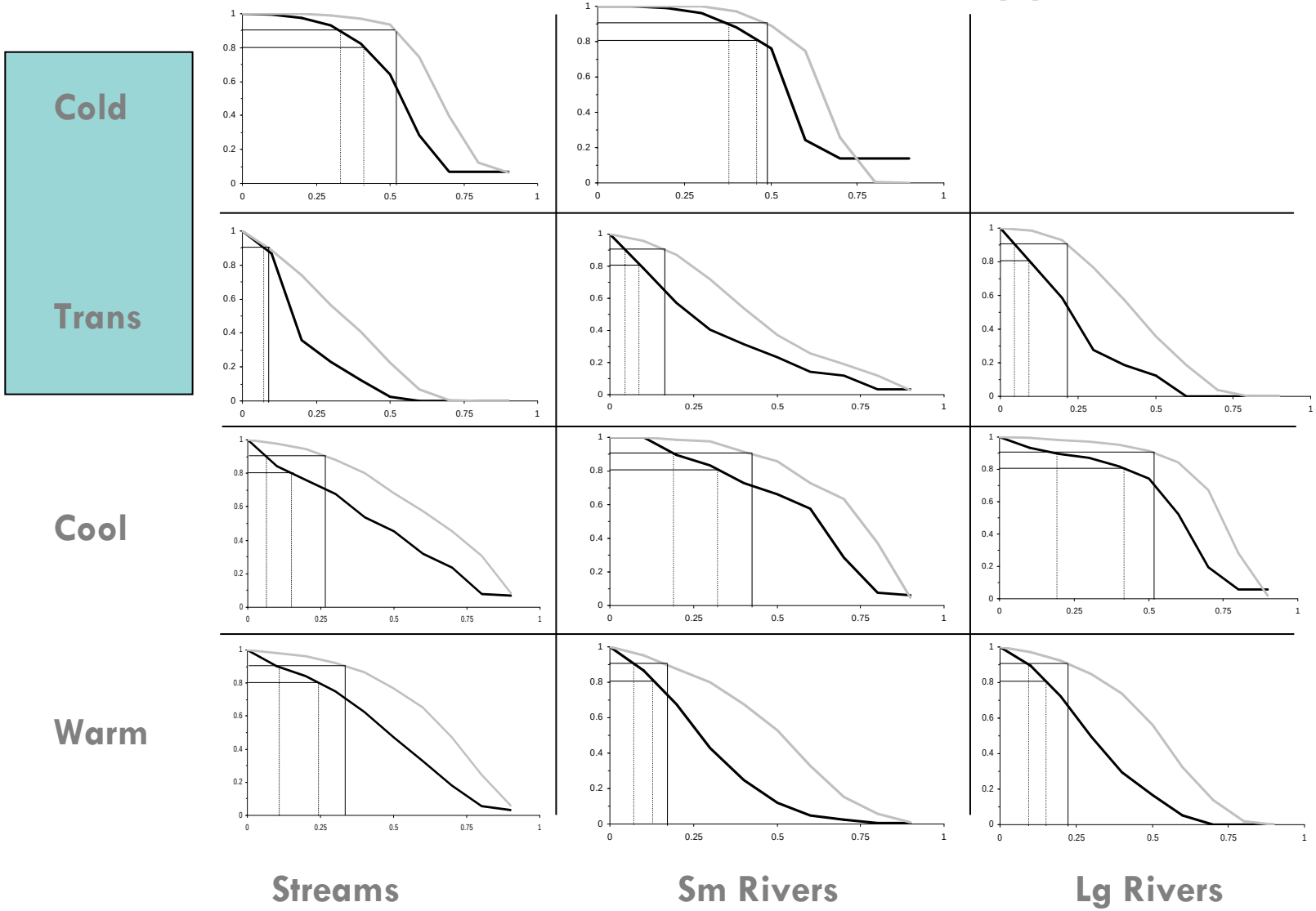
Notable replacement by tolerant species



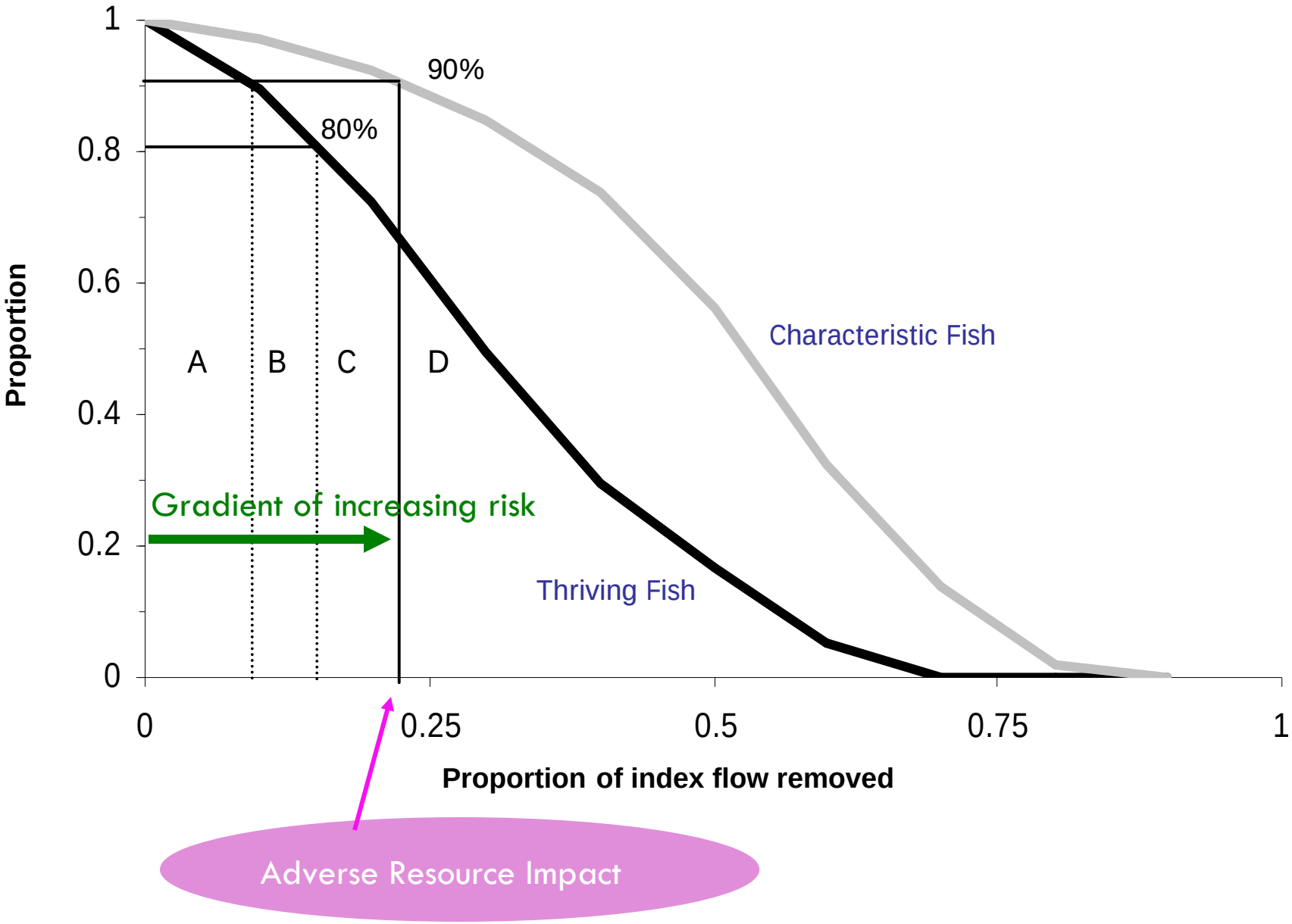
Tolerant species dominant; ecological functions altered

Severe alteration of ecological structure and function

Developed Fish Curves (Response Models) for Each Major Stream Type

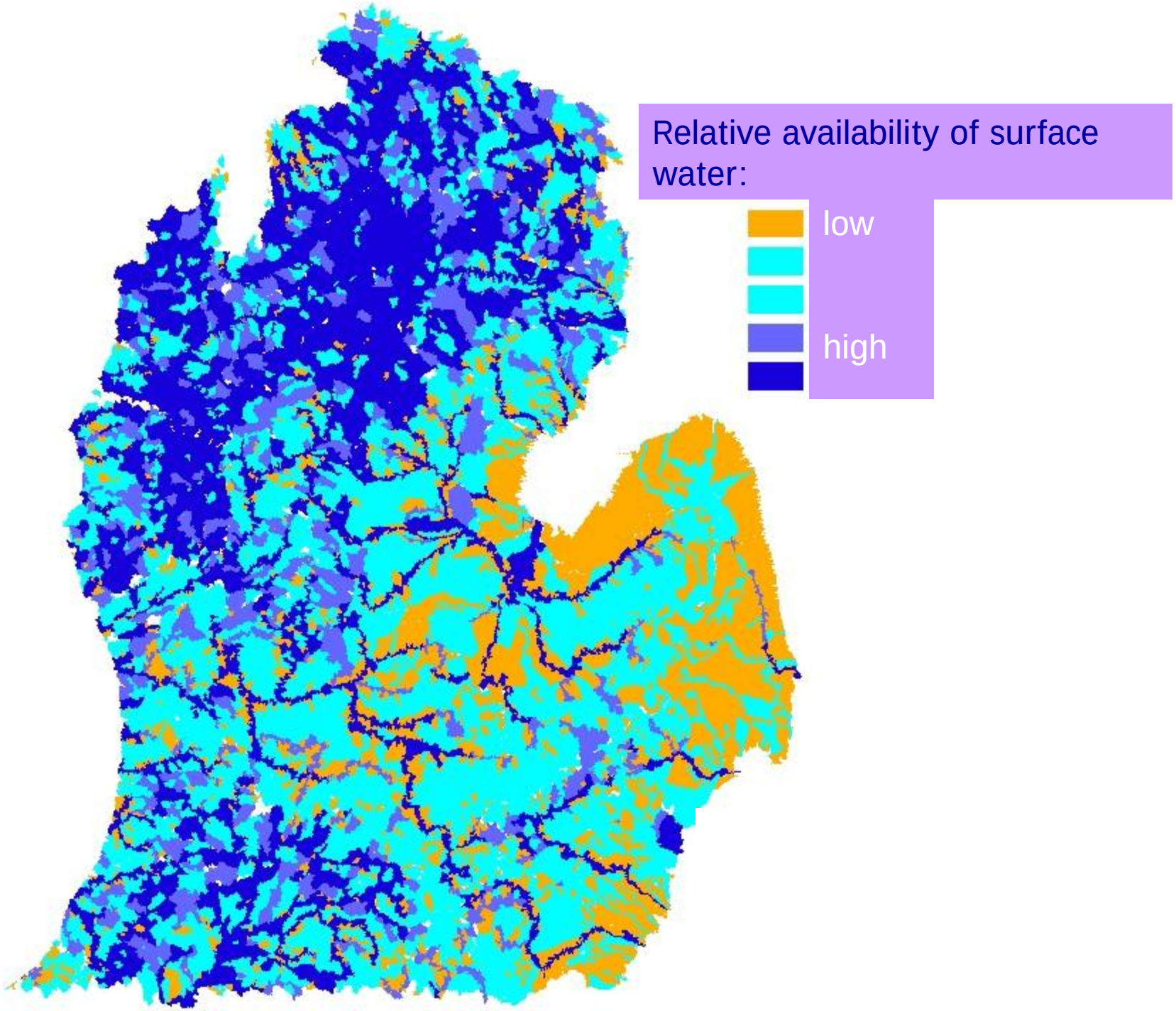


Interpreting the Fish Curves

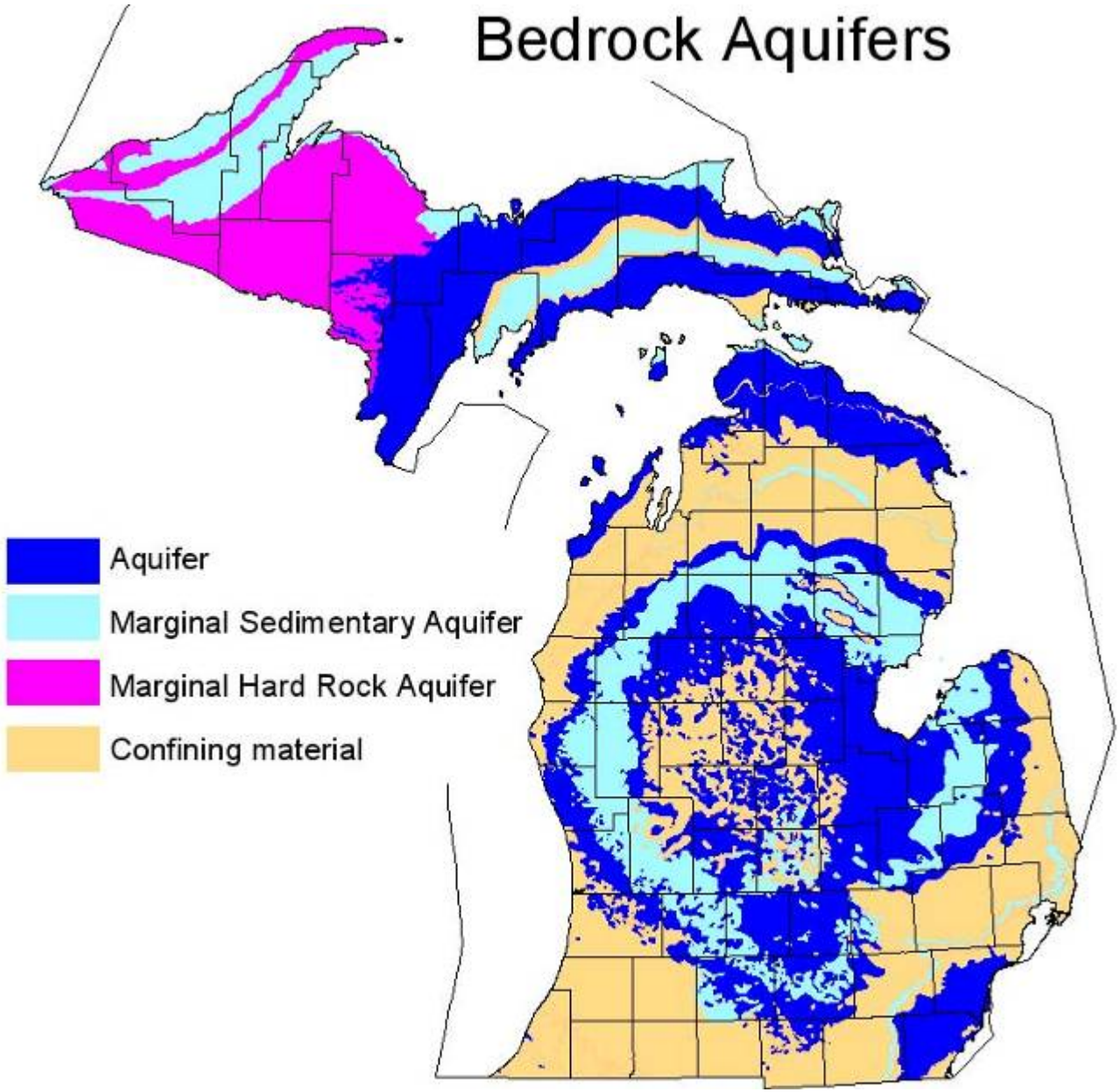


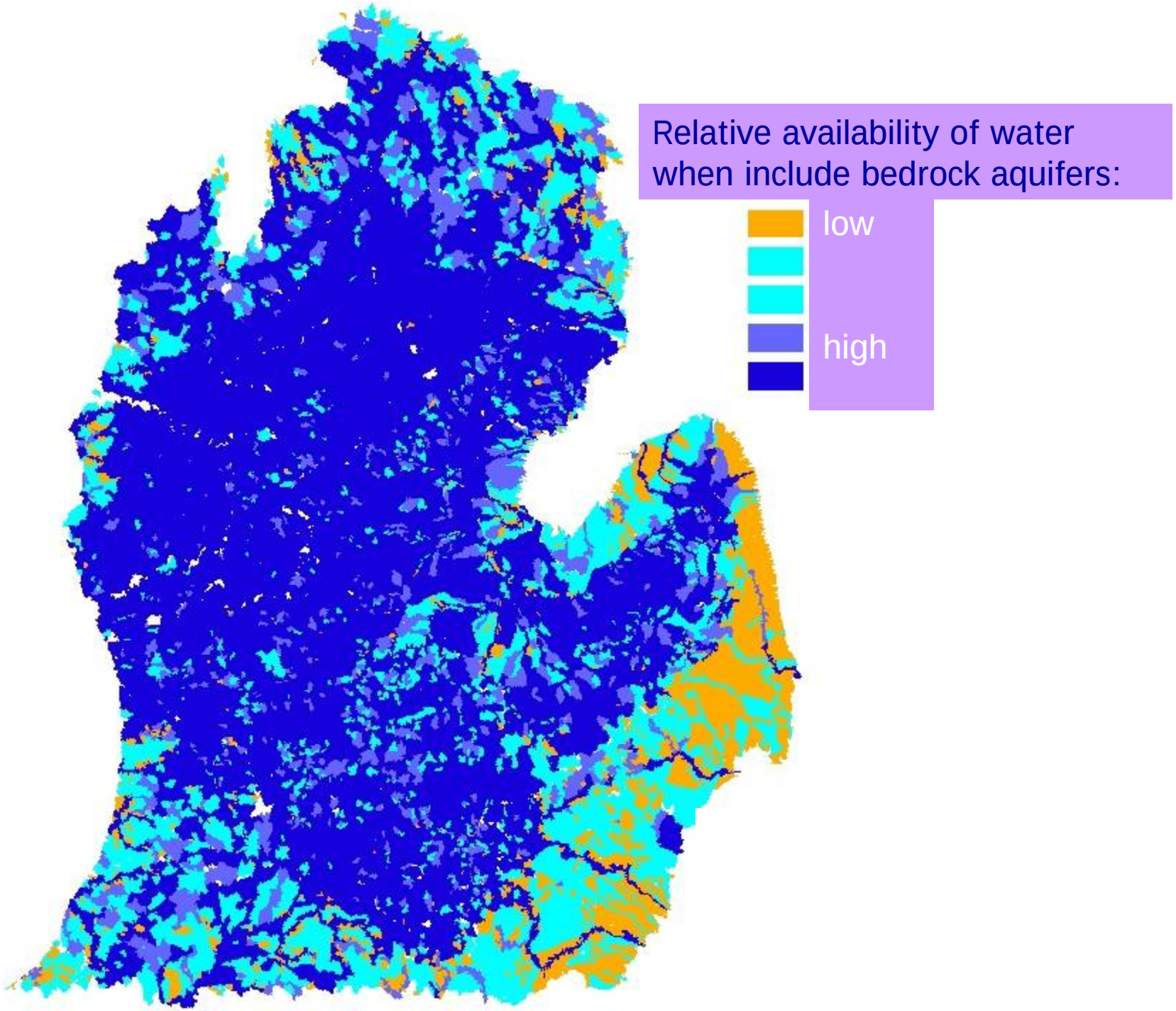
Water Withdrawal

- Surface Water
  - 100% removed from stream
- Ground Water
  - Impact on stream can be less than 100%
  - Impact can include nearby streams
  - Impact can be spread over a relatively large area


Relative availability of surface water:
low
high

Bedrock Aquifers




Relative availability of water when include bedrock aquifers:
low
high

The Water Withdrawal Assessment Process

This is the process that the user goes though to see whether the proposed withdrawal is OK or is likely to cause an adverse effect on fish populations

- **Screening Tool** – The Automated Analysis within the model based on general, state-wide data for a given withdrawal
- **Site Specific Analysis** – Same process as above but using site-specific data on flow, geology or fish

Implementation

Date	2/28/2006
ARI standard:	narrative
Presumed no ARI:	1320 feet away from Trout Stream > 150 feet deep
Applies to:	Trout Streams

Narrative: Shall not functionally impair a stream's ability to support characteristic fish populations.

Date	2/28/2008
ARI standard:	narrative
Presumed no ARI:	1320 feet away from Trout Stream > 150 feet deep
Applies to:	all streams

Narrative: Shall not functionally impair a stream's ability to support characteristic fish populations.

Date	7/9/2008
ARI standard:	narrative
Presumed no ARI:	1320 feet away from all streams > 150 feet deep
Applies to:	all streams

Narrative: Shall not functionally impair a stream's ability to support characteristic fish populations.

Date	2/1/2009
ARI standard:	quantitative
Presumed no ARI:	1320 feet away from all streams > 150 feet deep
Applies to:	all streams

Quantitative: Withdrawal limited to percent reduction of Index Flow as specified in legislation (max 25%).

Date	7/9/2009
ARI standard:	**quantitative**
Presumed no ARI:	Zone A or B in WWAT DEQ site specific review
Applies to:	**all streams**

Quantitative: Withdrawal limited to percent reduction of Index Flow as specified in legislation (max 25%).

Requirements that Large Capacity Withdrawals (LCW) not cause an Adverse Resource Impact (ARI)

Date	2/28/2006	2/28/2008	7/9/2008	2/1/2009	7/9/2009
ARI standard:	narrative	narrative	narrative	quantitative	quantitative
Presumed no ARI:	1320 feet away from Trout Stream > 150 feet deep	1320 feet away from Trout Stream > 150 feet deep	1320 feet away from all streams > 150 feet deep	1320 feet away from all streams > 150 feet deep	Zone A or B in WWAT DEQ site specific review
Applies to:	Trout Streams	all streams	all streams	all streams	all streams

Narrative: Shall not functionally impair a stream's ability to support characteristic fish populations.

Quantitative: Withdrawal limited to percent reduction of Index Flow as specified in legislation (max 25%).

Registration Requirement

- New or increased > 100,000 gpd capacity
  Same as 2006 legislation
- New requirement: Demonstrate no ARI
- Screening tool or site-specific review
- 18 months to begin withdrawal

Zone A

Zone B

Zone C

Zone D

- Zones are set by law
- Numerical values are different for each stream type

Zone A Withdrawal

- Register and proceed

Zone B Withdrawal

- Register and proceed
- Cold-transition system: site-specific review required
- DEQ notification: groups that have requested notification, such as: conservation district, regional planning agency

Zone C

- Site-specific review required
- Certify use of environmentally sound and economically feasible conservation measures
- DEQ notifies: large quantity users (of the same water source); and local governments and groups that have requested notification.

Zone D

- Site-specific review required
- Cannot proceed if confirmed in Zone D
- Potential for “preventative measures”

Permitting

- Triggers:
  - > 2 million gpd capacity
  - > 1 million gpd capacity in Zone C
  - Use of “preventative measure”
  - Transfer of > 100,000 gpd from watershed of one Great Lake to another
- Exemption: Less than 2 million gpd use over 90 day average
- Public involvement process

Permitting Standard

- No ARI
- Returned, less consumptive use, to source watershed
- In compliance with local, state and federal laws
- Reasonable under Michigan common law
- Certified compliance with conservation measures
- Will not violate public or private rights of Michigan water law

Annual Reporting Requirement

- Volume withdrawn on annual and monthly basis
- Source and location
- Consumptive use
- Beginning 2010: Acknowledge review of conservation measures

Transition

- Tool available for testing: 10/1/08
- Begin accounting of withdrawals: 10/1/08
- Effective date of new ARI standard: 2/1/09
- Account for cumulative impacts: 2/1/09
- Required use of tool for registration: 7/9/09

Specific Uses

- Municipal community system: ARI if no feasible and prudent alternative location

- Bottled Water: Permit threshold dropped to 200,000 gpd.
  - No ARI
  - Reasonable use
  - Protect riparian rights
  - Address hydrologic impacts
  - Public involvement process

Future Directions

- Water User Committees
- Develop protective model for lakes
- Assessment of impacts to other ecological features