How will Climate Change Impact Salmon Recruitment?

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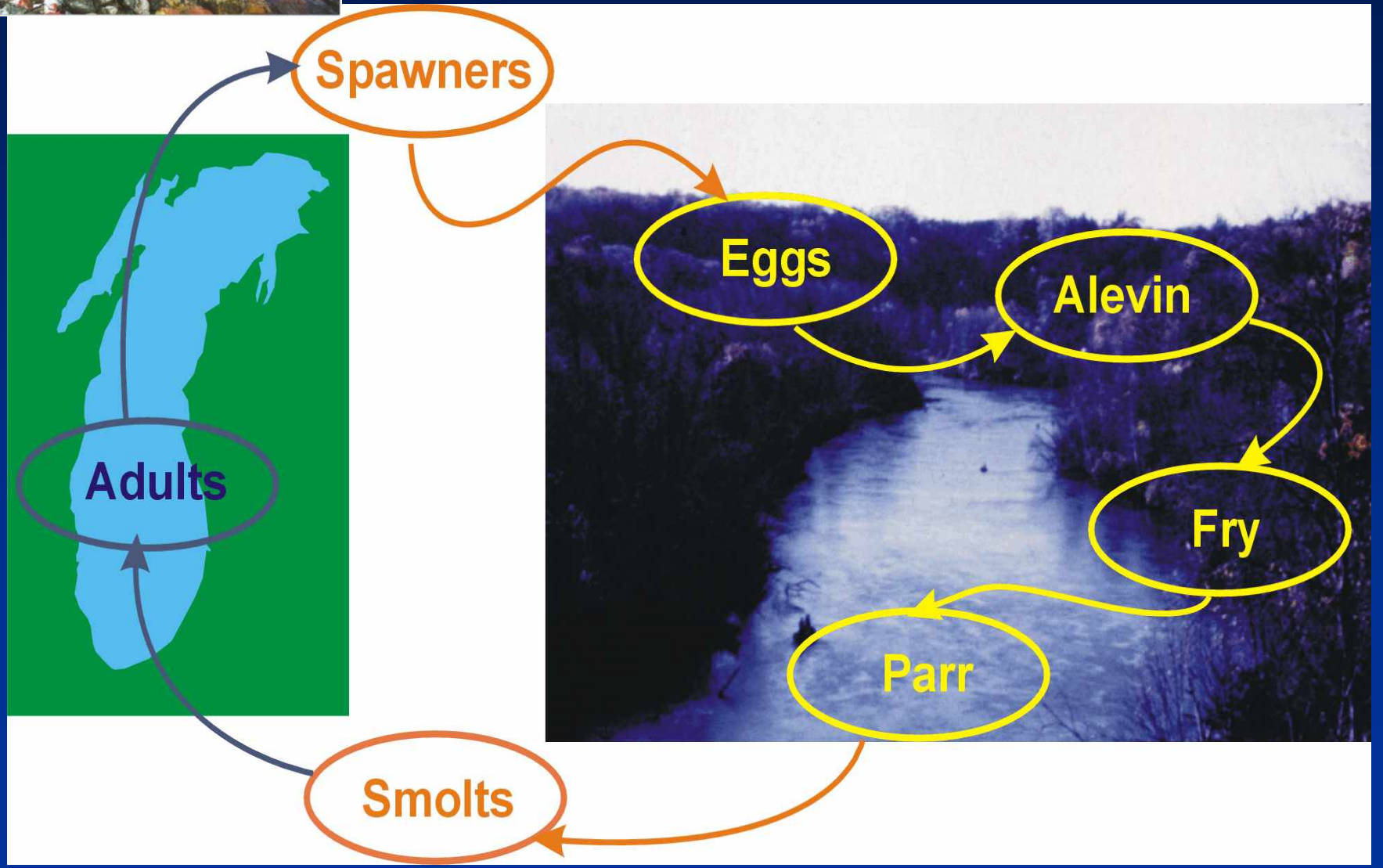
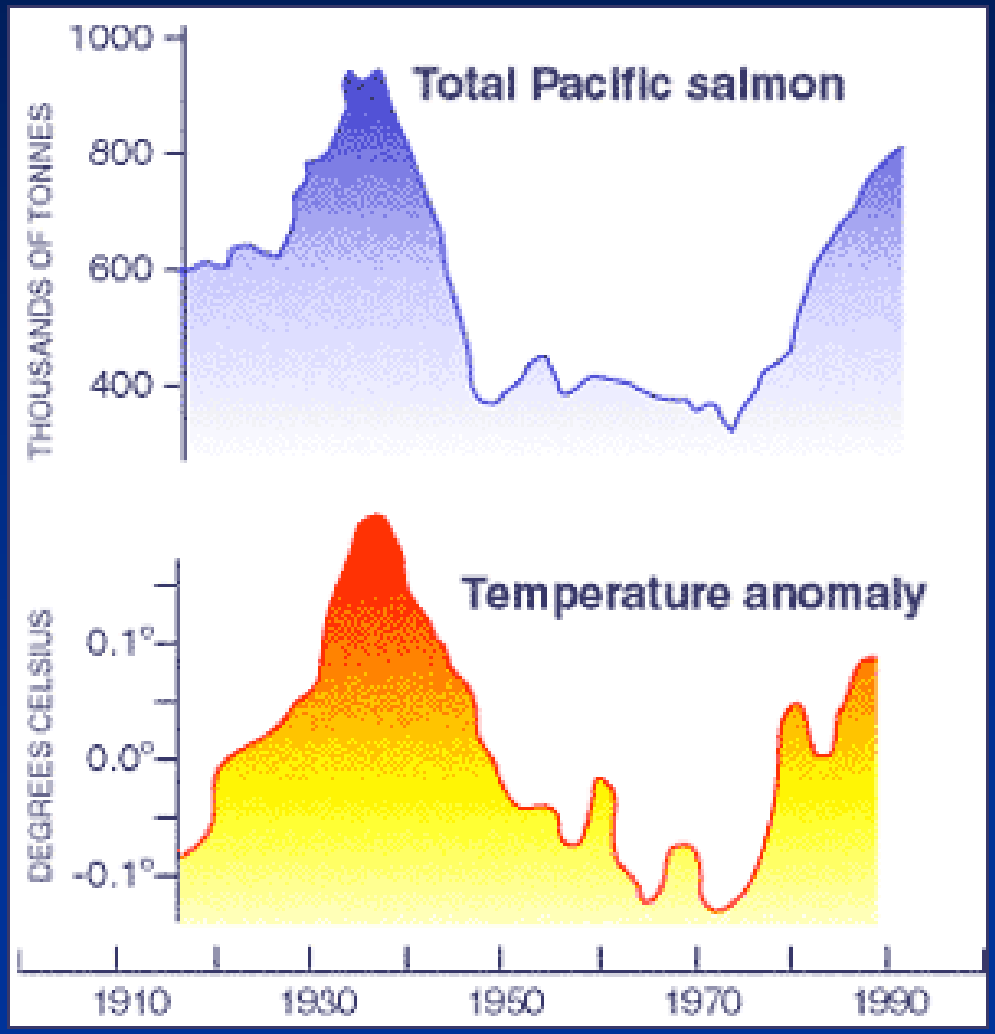
Outline

- How does Climate affect salmon???
- Climate change predictions
- Identify knowledge gaps and science tools
- How can we adapt to change???

Salmonid Life Cycle

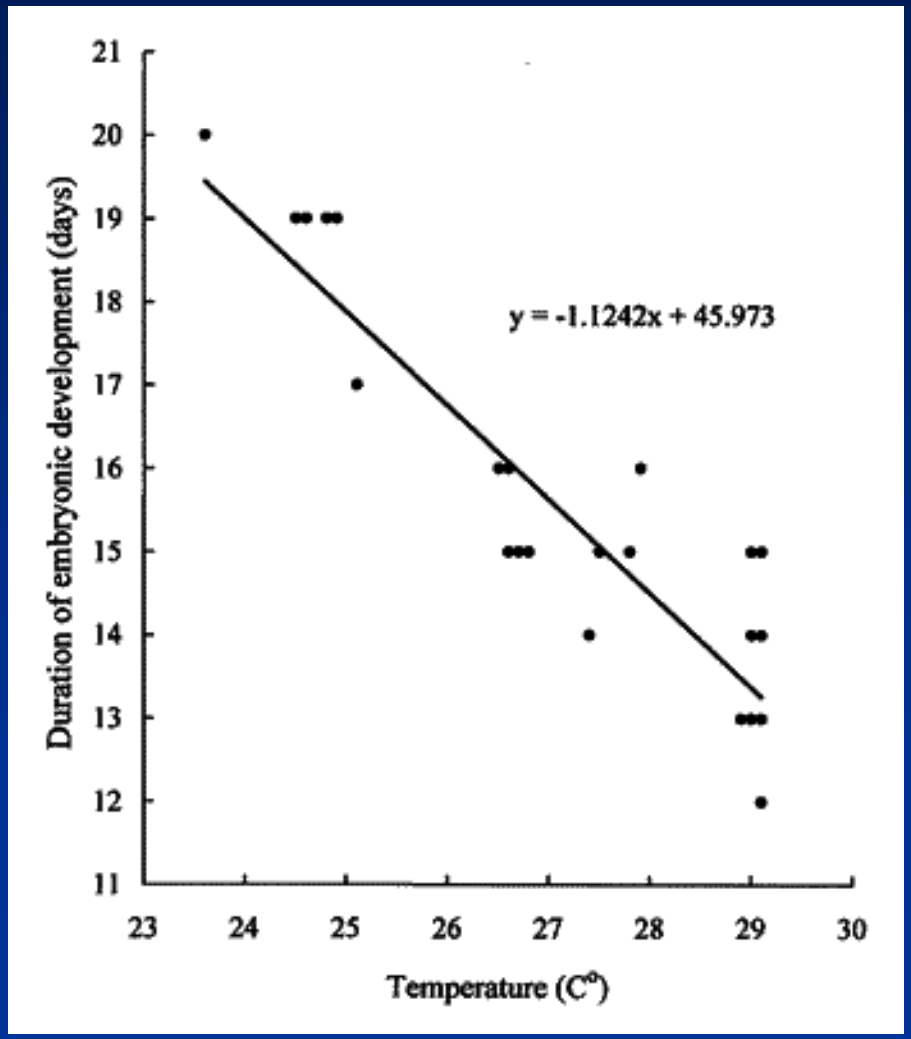


Climate affects Ocean Conditions which affect Salmon Production

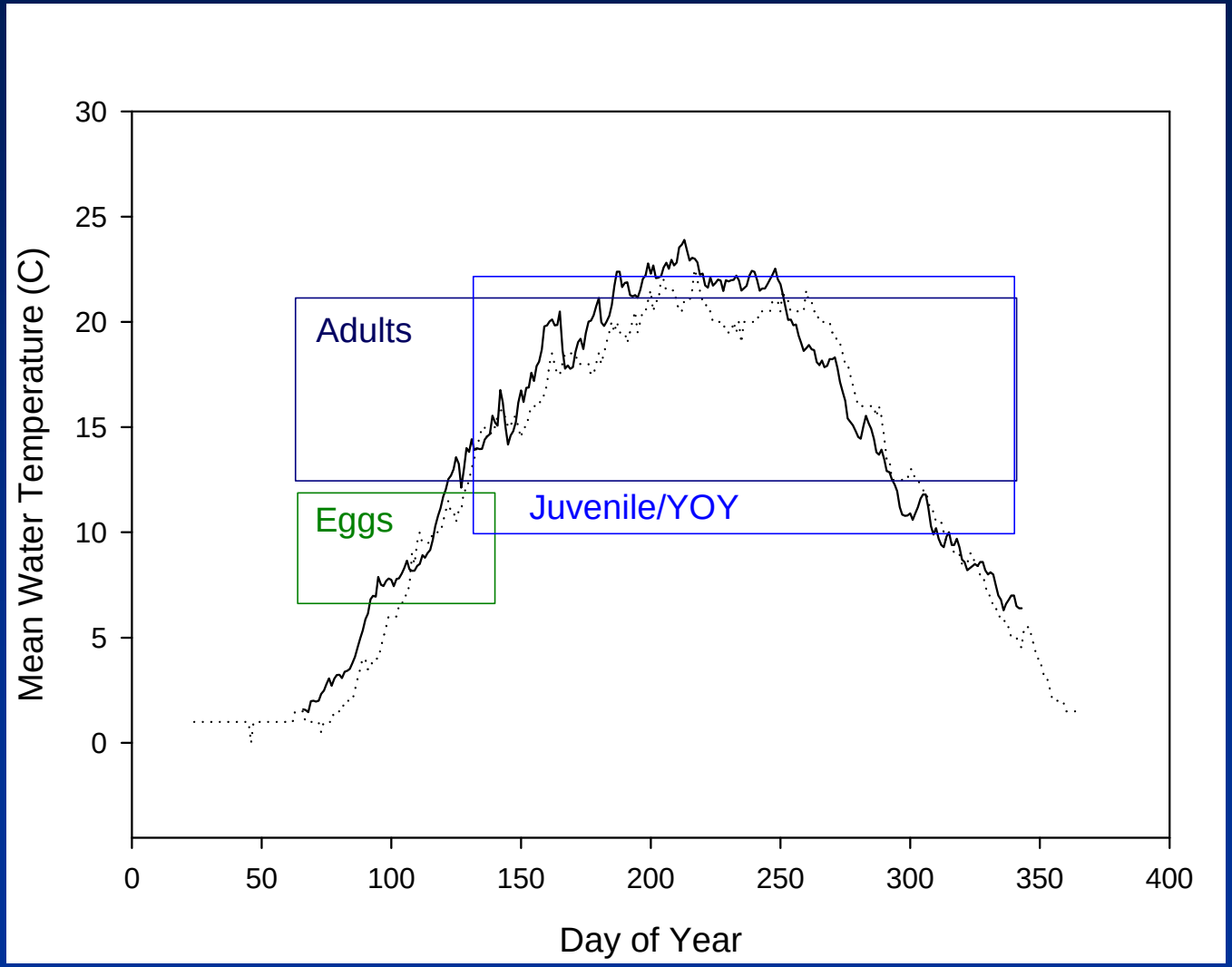


Temperature, Flow Affect Spawning Run Timing

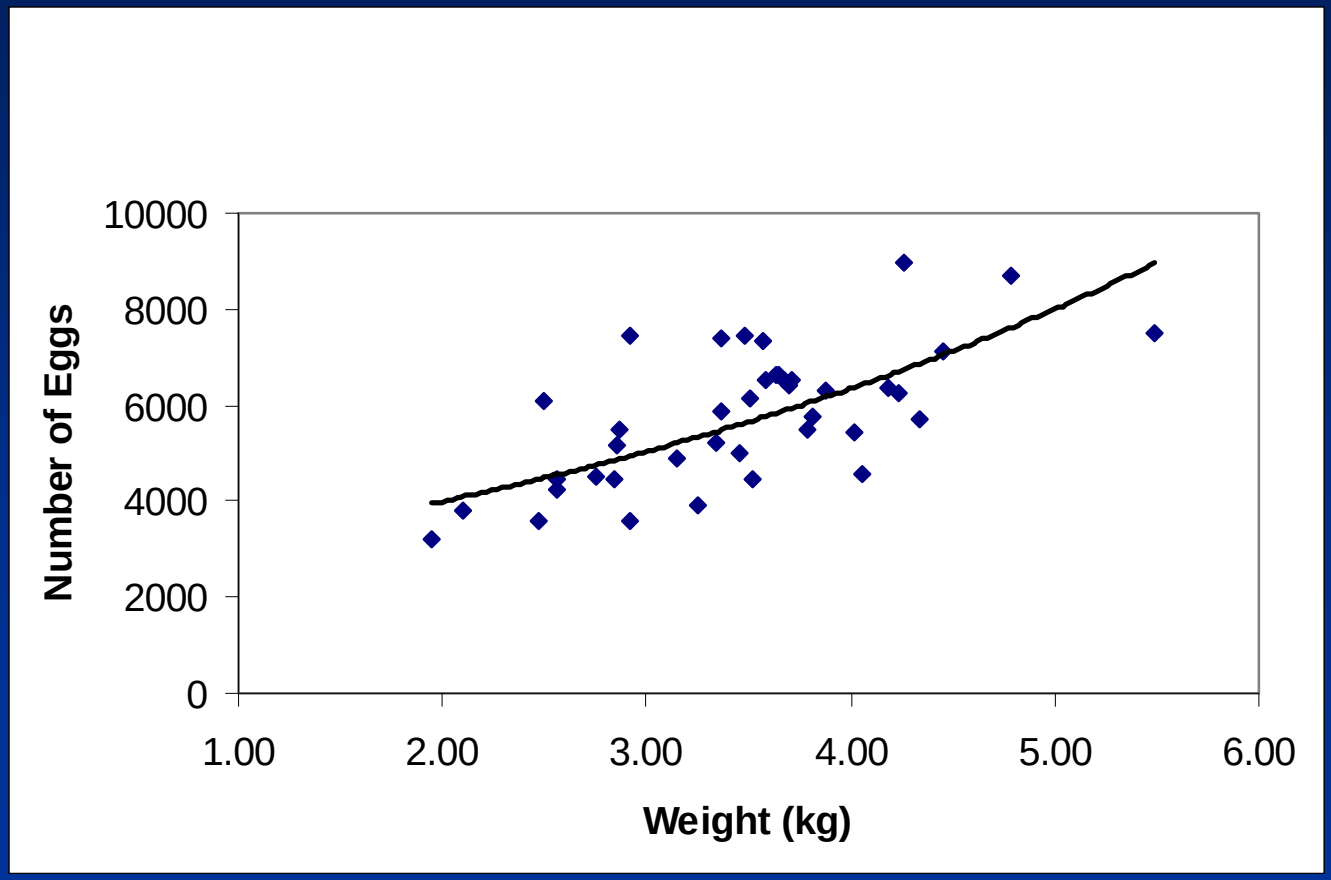
…and Egg survival, development and hatch time



Temperature regulates fish metabolism, consumption and preferred temperature



…which affects Egg production and Potential for Successful Recruitment



Predicted GL Climate Changes

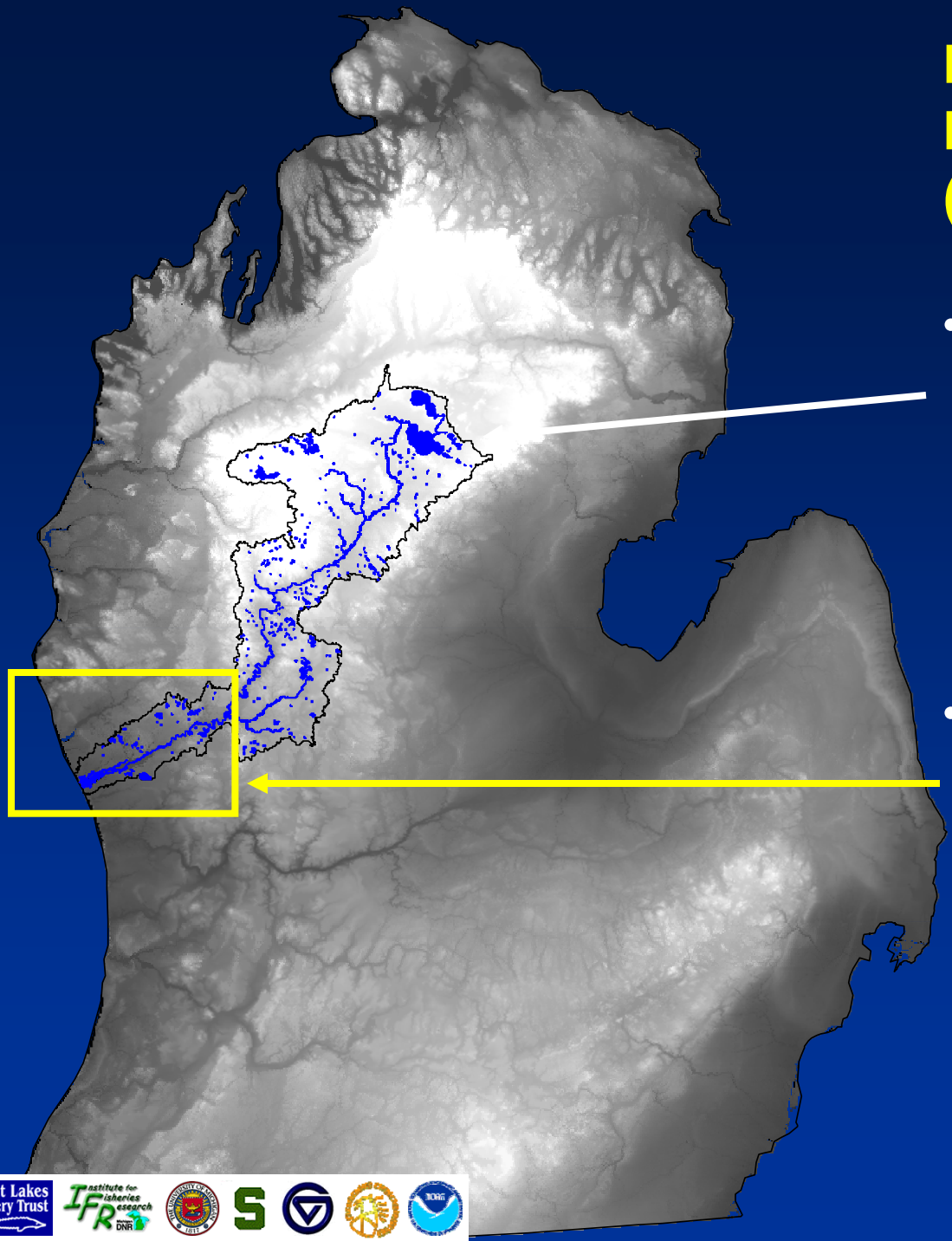
- Warmer temperatures, especially in Winter
- Wetter winters, drier summers, more extreme storm events
- Lower lake levels

Knowledge Gaps

- How will Climate Change affect stream and lake habitats supporting salmon?
- How will CC affect timing and development of stream and lake food webs supporting salmon?
- How will climate AND land use change affect salmon reproduction?

Models and Data Needed

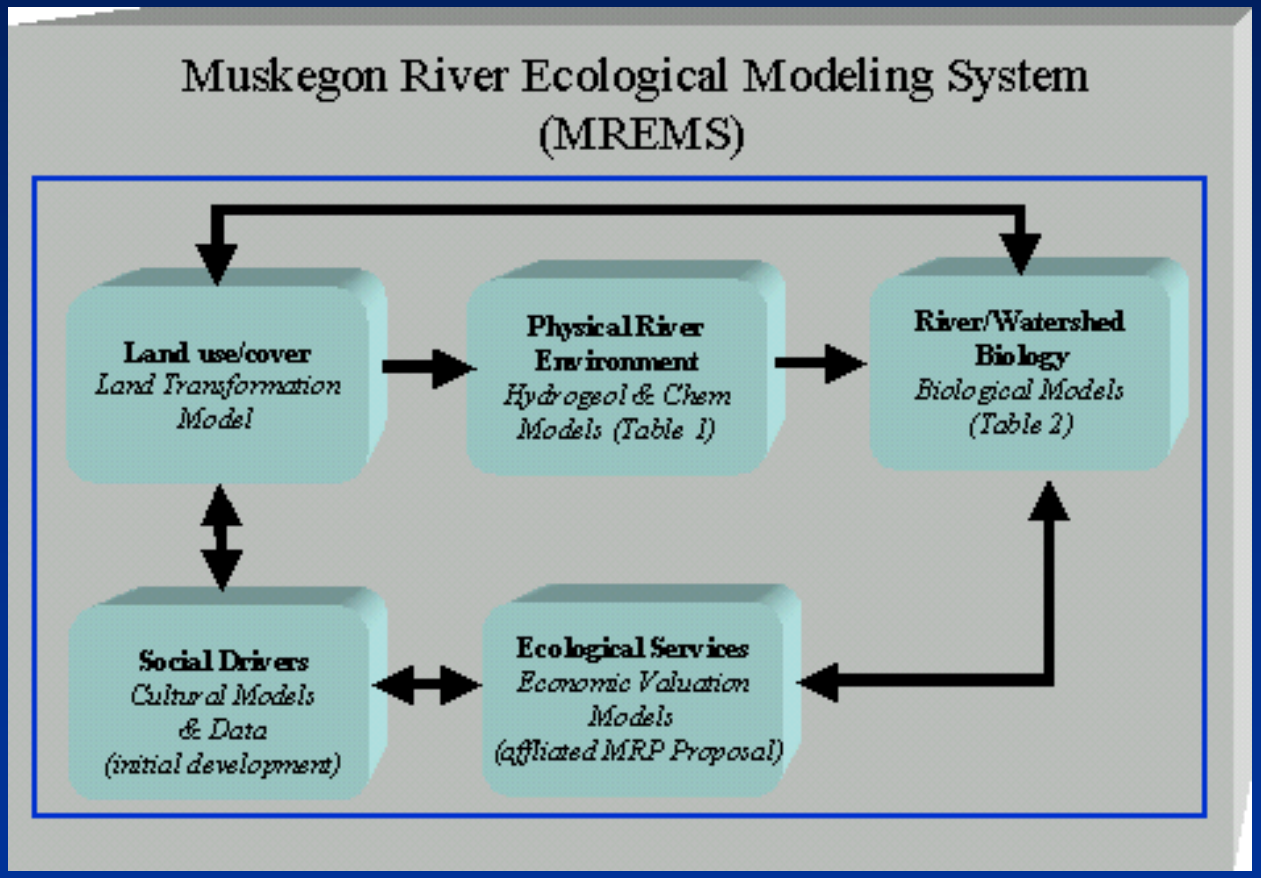
- Models of Stream and Lake physical habitats
- Models of nutrient loadings and food web dynamics, in response to climate
- Basic monitoring data needed to detect changes in physical habitats, and salmon life stages, growth and reproduction



Muskegon Watershed Research Partnership (MWRP)

- Watershed assessment
  - Fish
  - Invertebrates
  - Algae
  - Water chemistry
  - Habitat
- Lower river detailed study
  - Invertebrate productivity
  - Fish bioenergetics
  - Hydrologic model (HEC)
  - Hydraulic model (HEC-RAS & HEC-GIS)
  - Channel habitat model

A Coupled Modeling System



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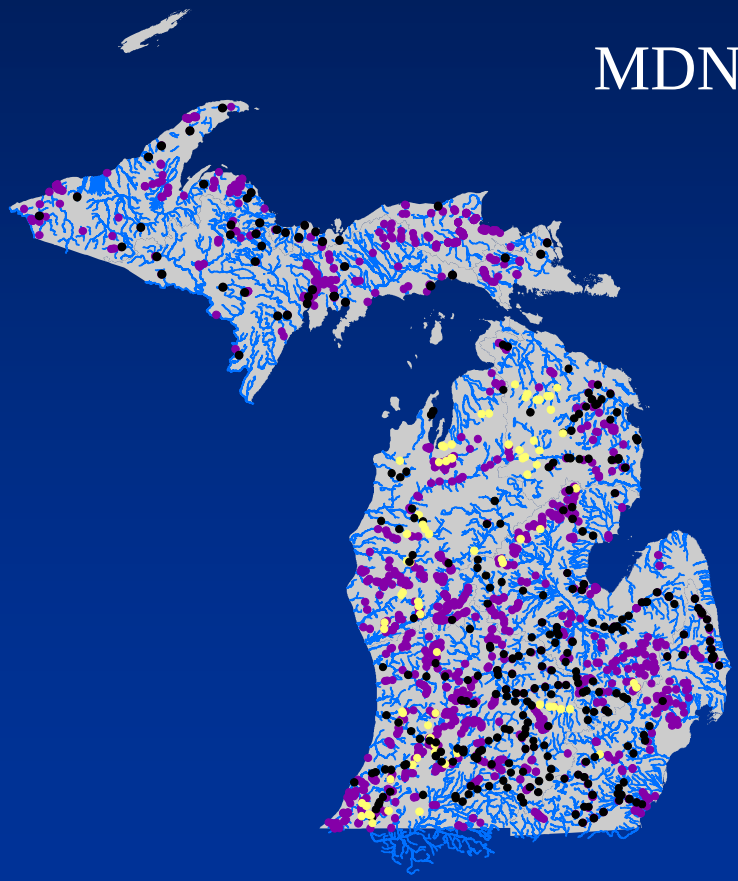
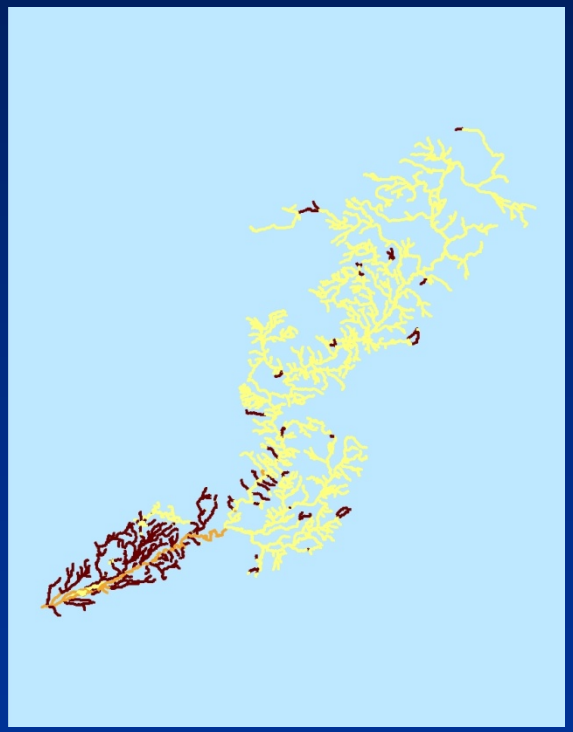
Use Existing Data on Fish and Habitat to extend predictions

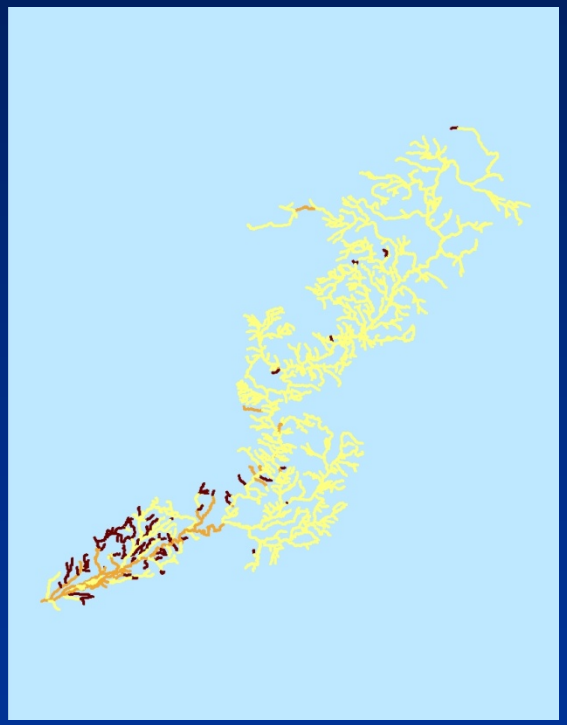
MDNR Fish Survey Sites



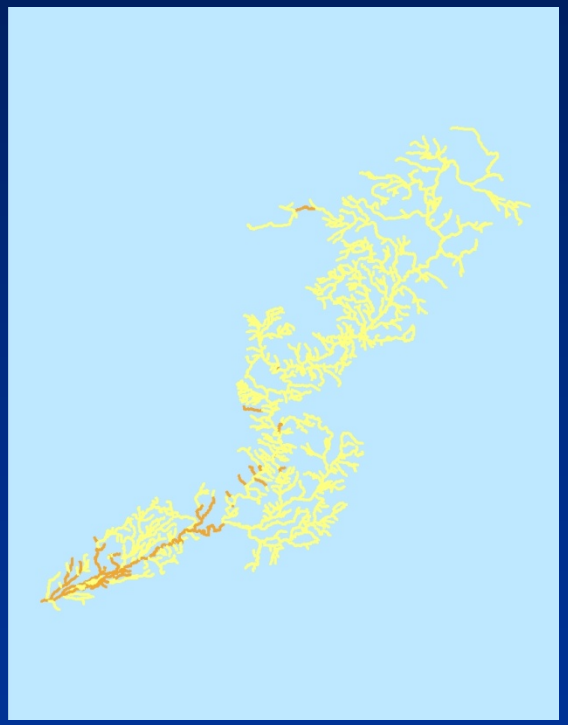
Steelhead Disappears in Muskegon River With Climate Change



1998 July Temp



+ 5.4 °F (3 °C)

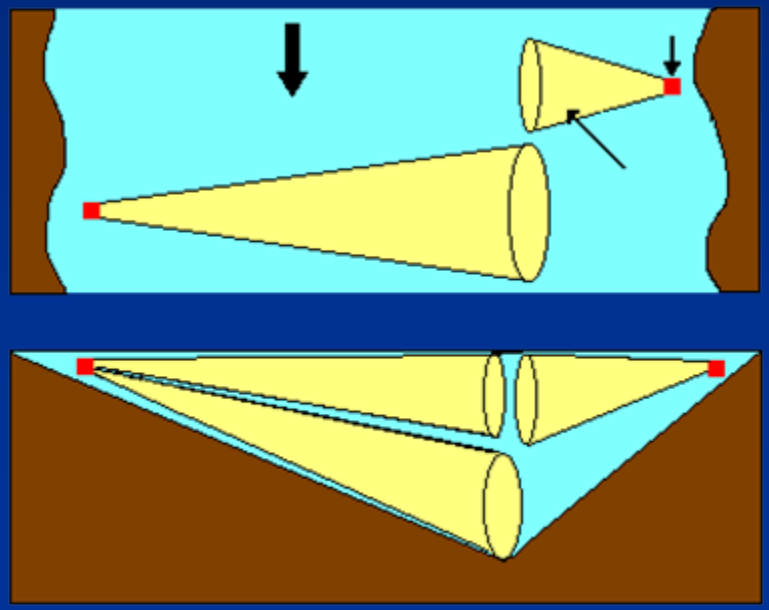


+ 9 °F (5 °C)

% Change in Species Occurrence in Muskegon Watershed With Summer Temperature Increase of +5 °F

	Winners	Losers
Steelhead		- 40%
Chinook salmon	No change	
Stream Trouts		- 45%
Smallmouth	+ 20%	
Northern Pike	+ 65%	
Walleye	No change	

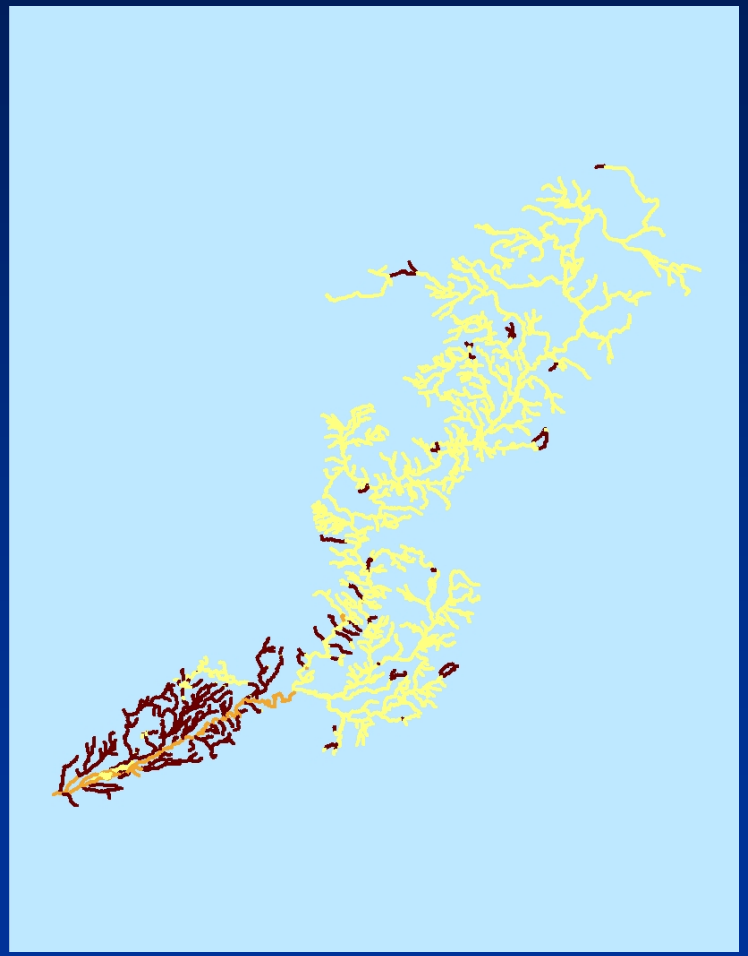
Needs: Continue monitoring salmon life stages



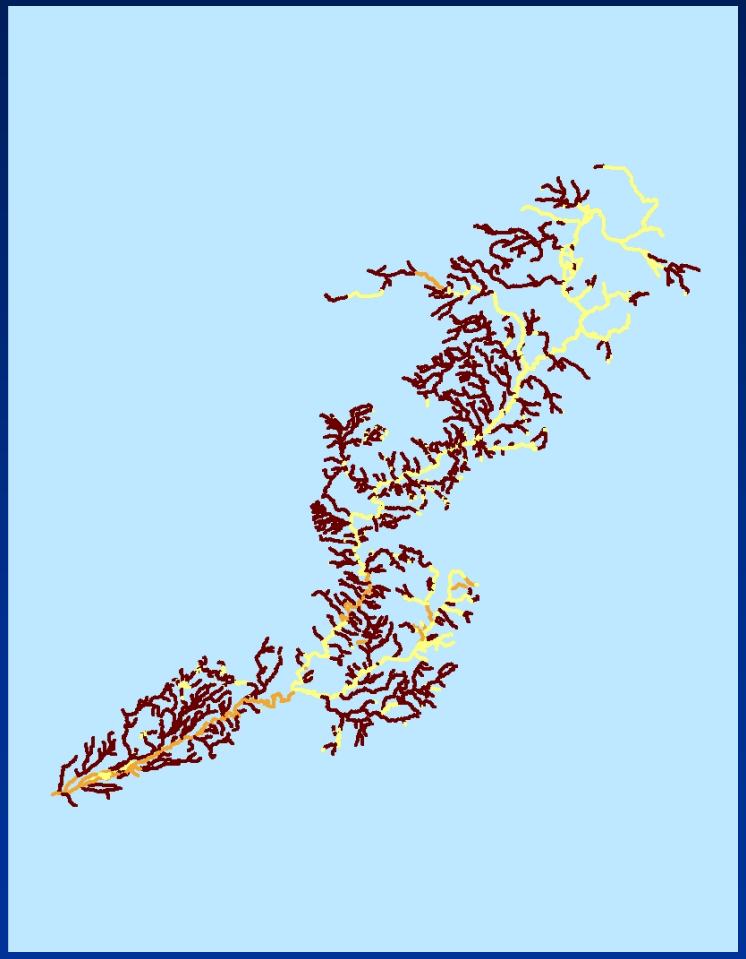
What can we do? Adapt…

- Above All, Protect or increase spawning and nursery habitat and Groundwater Sources
- Stock coldwater species
- Learn to like Warmwater Species (Smallmouth, Northern Pike)

Steelhead, Salmon will increase if dams are removed



1998 - Dams



1998 No Dams

Questions?