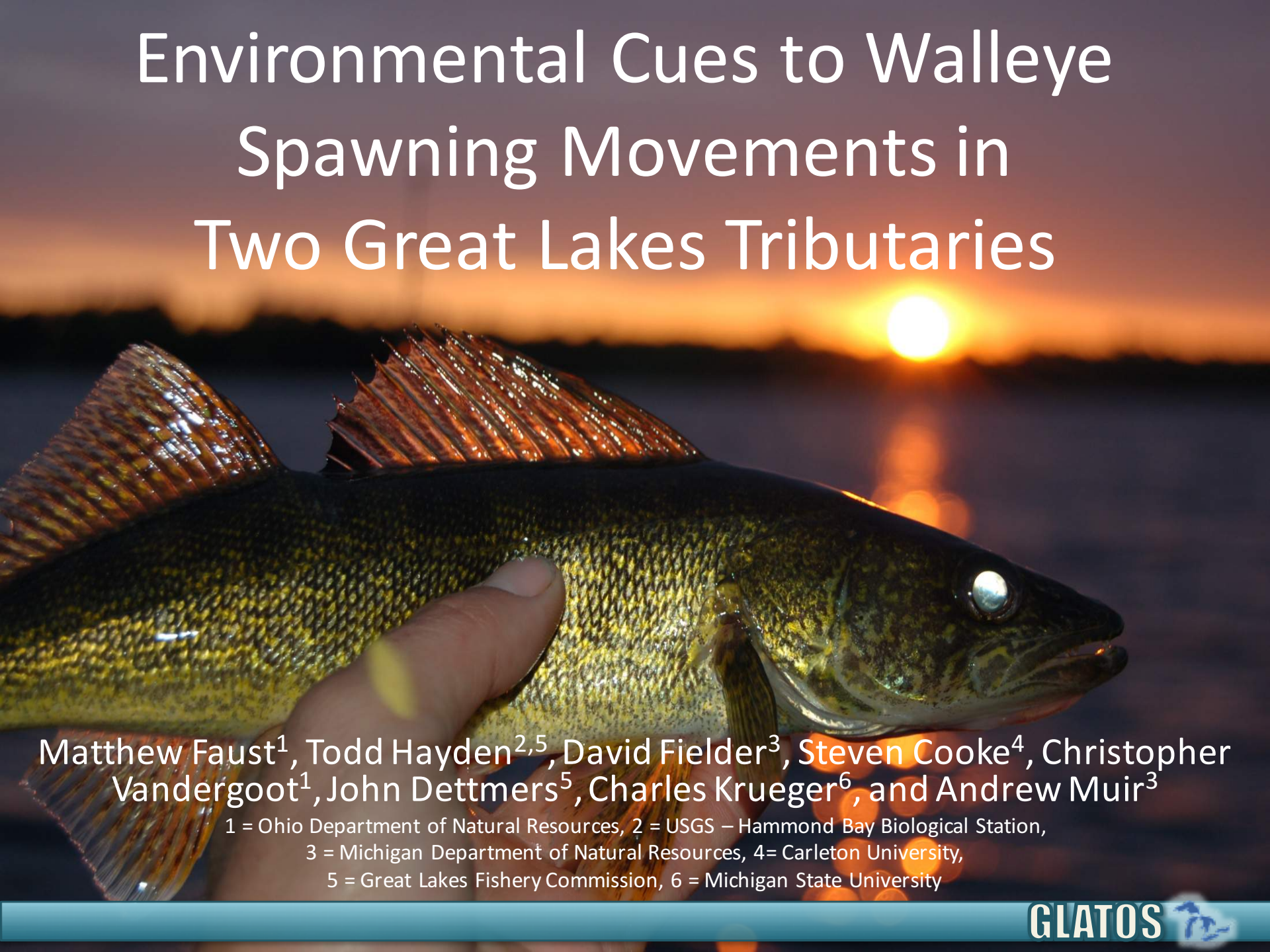
Environmental Cues to Walleye Spawning Movements in Two Great Lakes Tributaries



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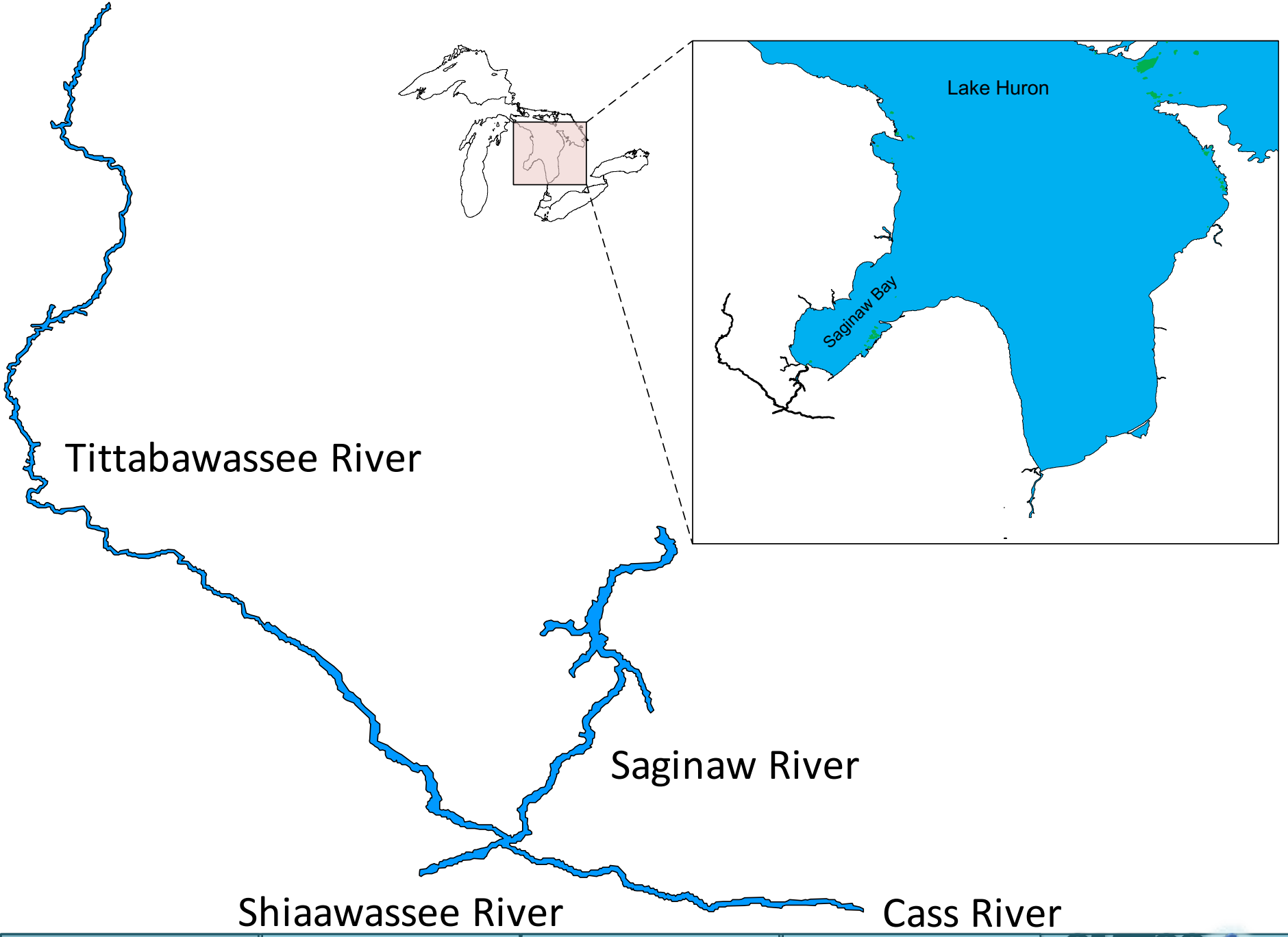
1 = Ohio Department of Natural Resources, 2 = USGS – Hammond Bay Biological Station,
3 = Michigan Department of Natural Resources, 4= Carleton University,
5 = Great Lakes Fishery Commission, 6 = Michigan State University

GLATOS

- Saginaw Bay walleye
  - Largest source stock in Lake Huron
  - Collapse ---> stocking ---> recovery
- Lake Erie walleye
  - Largest commercial and recreational fisheries
  - Wide fluctuations in abundance
- Spawn during March – May
- Spawning migrations
  - Adfluvial (lake resident » river spawner)

- Conceptual framework for walleye spawning movements:
  - Priming and releasing factors
    - Priming factors bring about behavioral readiness
    - Releasing factors initiate behavior
- Environmental cues (i.e., releasing factors)
  - Water temperature
    - Entering = water temps below optimal levels (< 5 – 10 °C)
    - Spawning = increasing water temps to optimal levels
    - Leaving = sustained high temps or sharp drop
  - River discharge
  - Others (e.g., water temperature x discharge)

- Objectives were to determine what environmental conditions are associated with:
  - pre-spawning movement of walleye into tributaries and onto spawning habitat,
  - post-spawning movement of walleye off of spawning habitat and out of the tributaries back into the lake, and
  - if walleye pre- and post-spawning movements differ by sex.

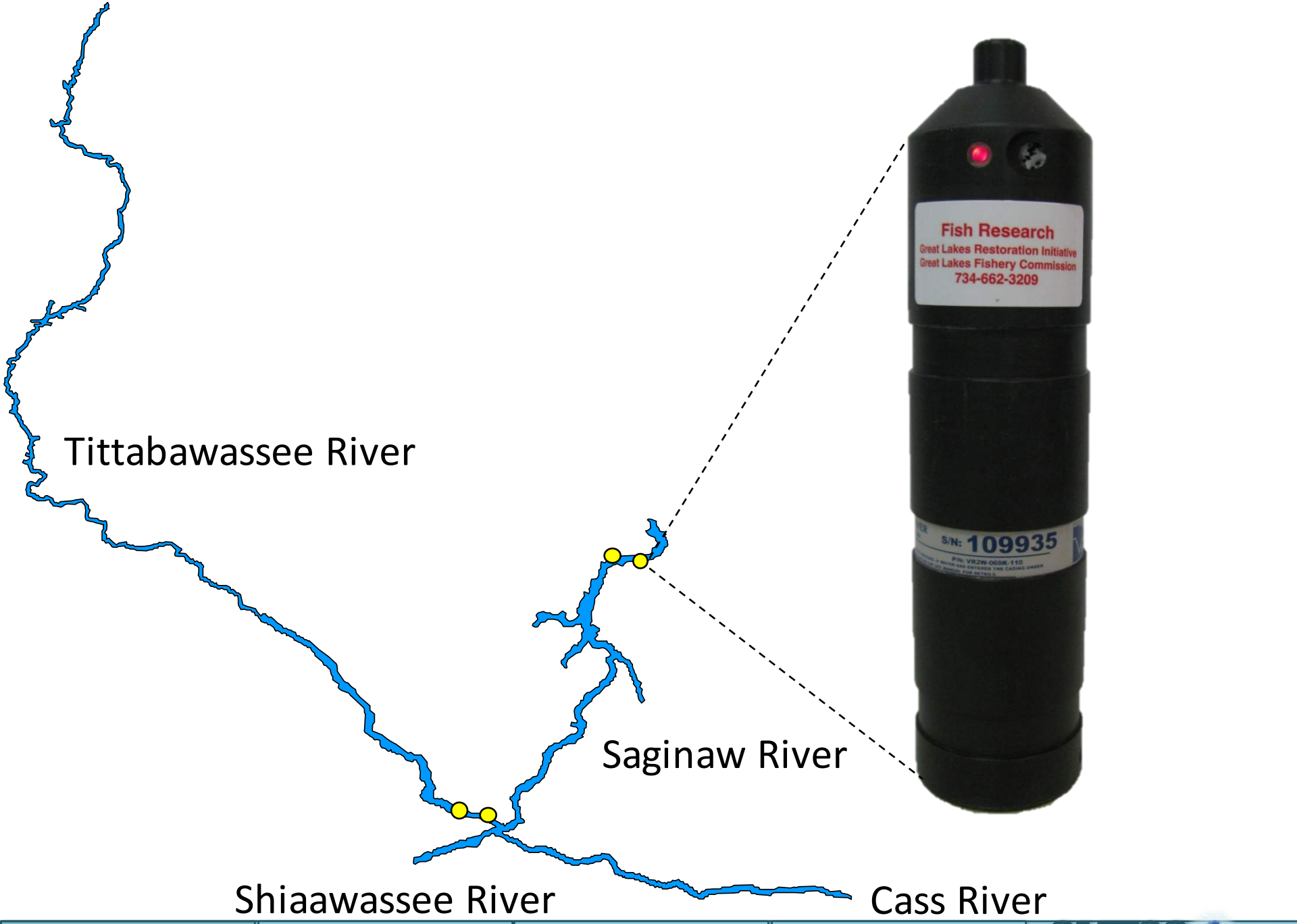

Lake Huron
Saginaw Bay
Tittabawassee River
Saginaw River
Shiaawassee River
Cass River

Tittabawassee River

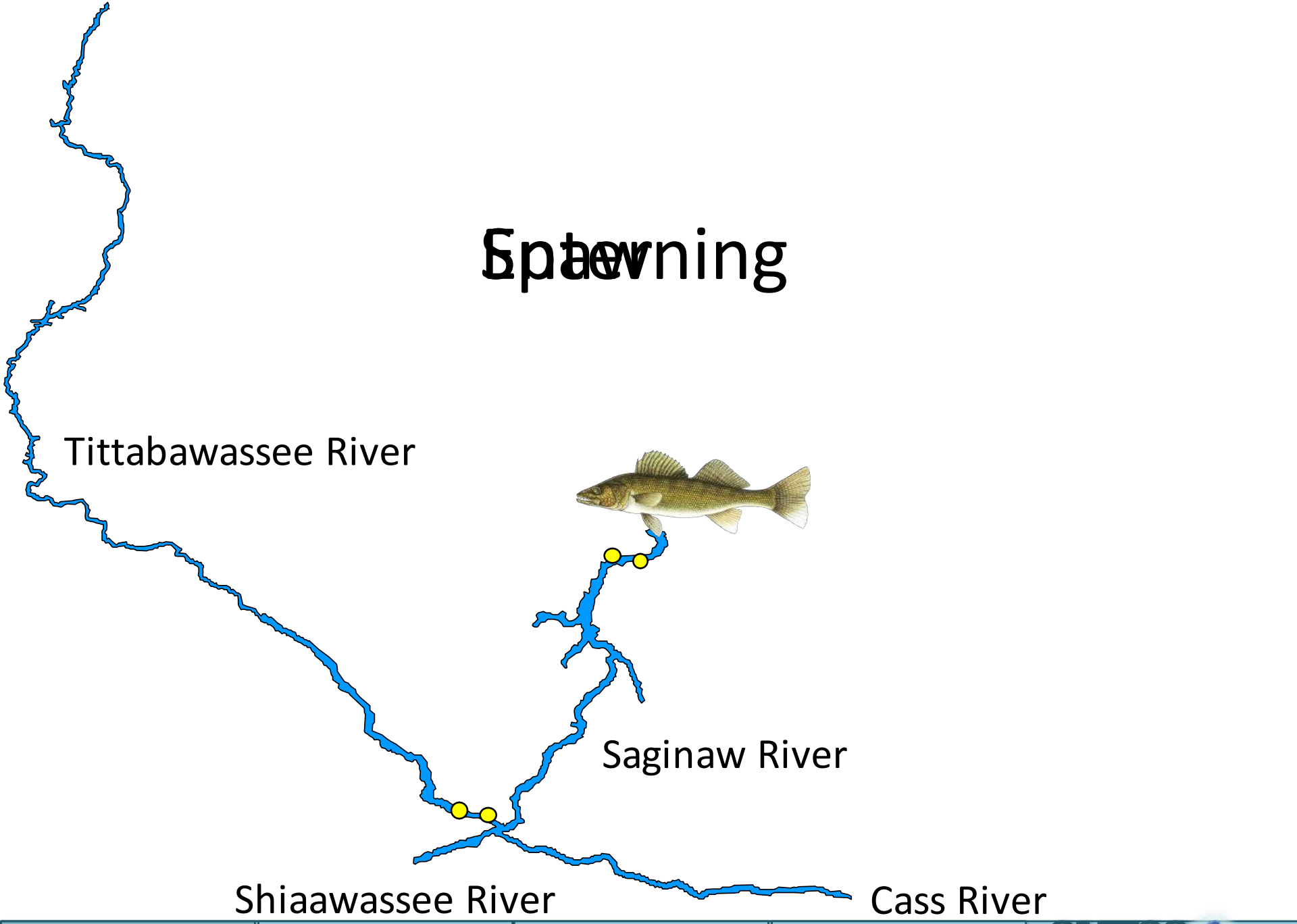
Saginaw River

Shiaawassee River

Cass River


Tittabawassee River
Saginaw River
Shiaawassee River
Cass River
Fish Research
Great Lakes Restoration Initiative
Great Lakes Fishery Commission
734-662-3209
S/N: 109935

Spawning


Tittabawassee River
Saginaw River
Shiaawassee River
Cass River

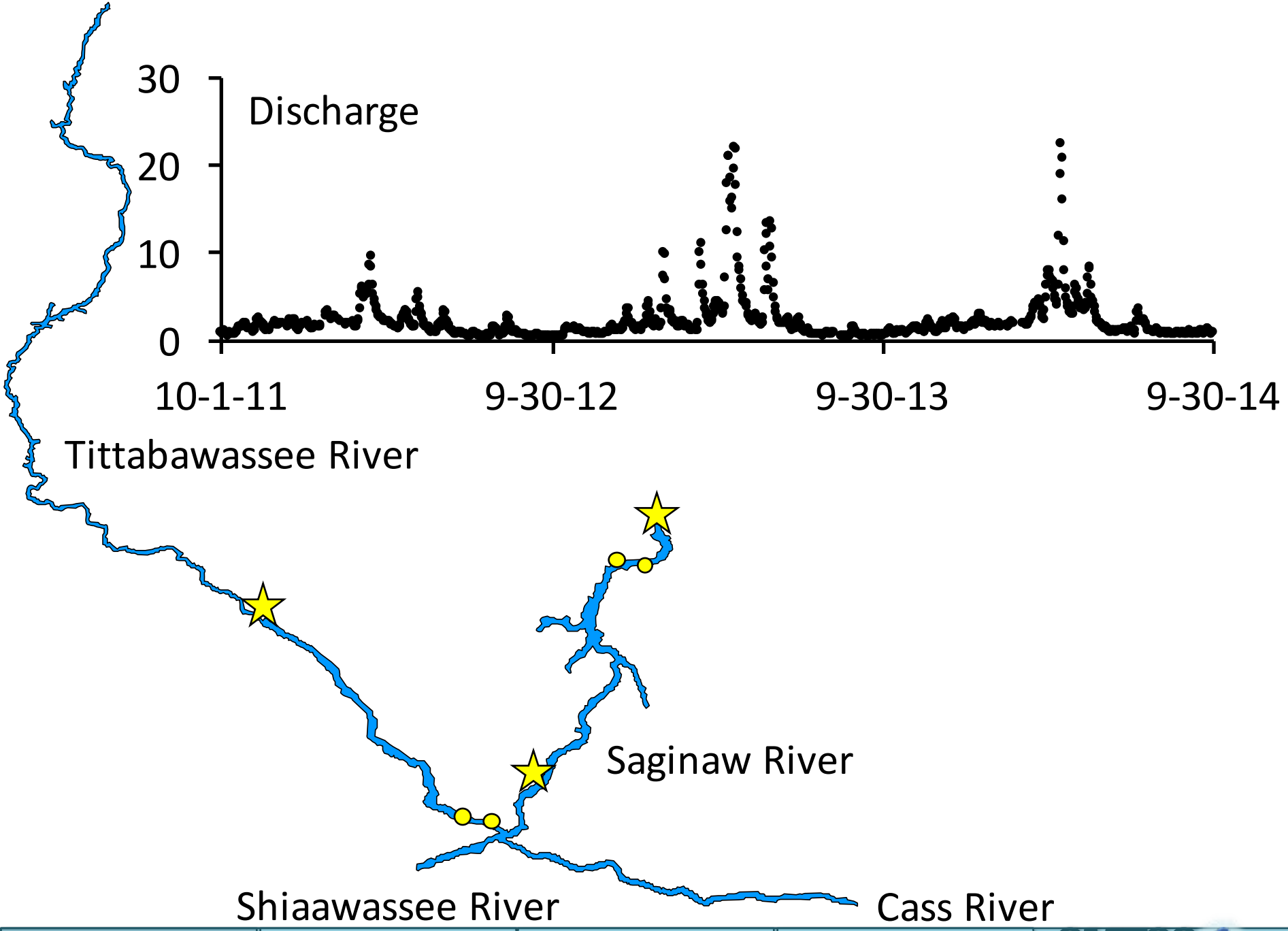
Detroit River Walleye

Tittabawassee River

Saginaw River

Shiaawassee River

Cass River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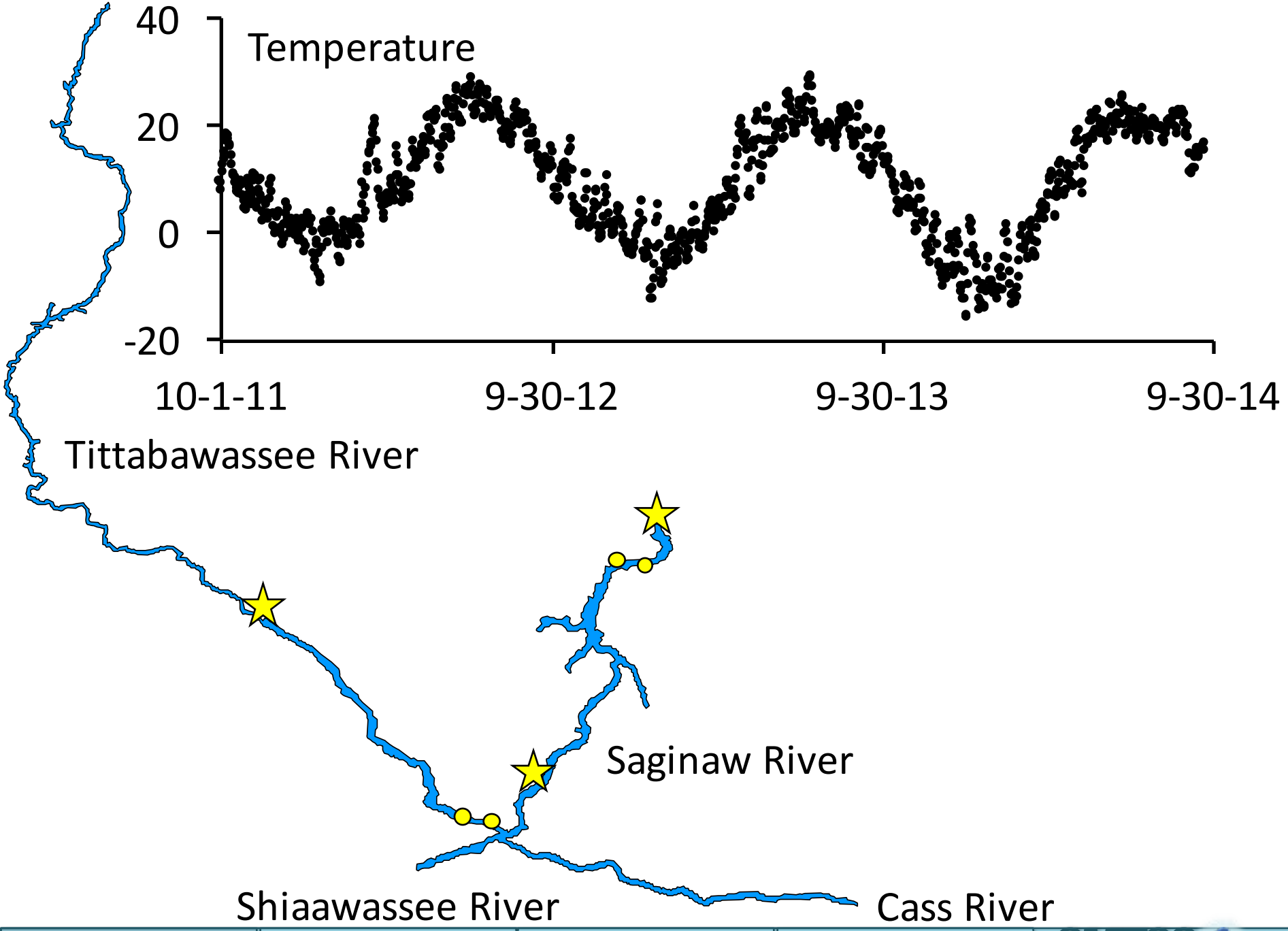
Tittabawassee River
Saginaw River
Shiaawassee River
Cass River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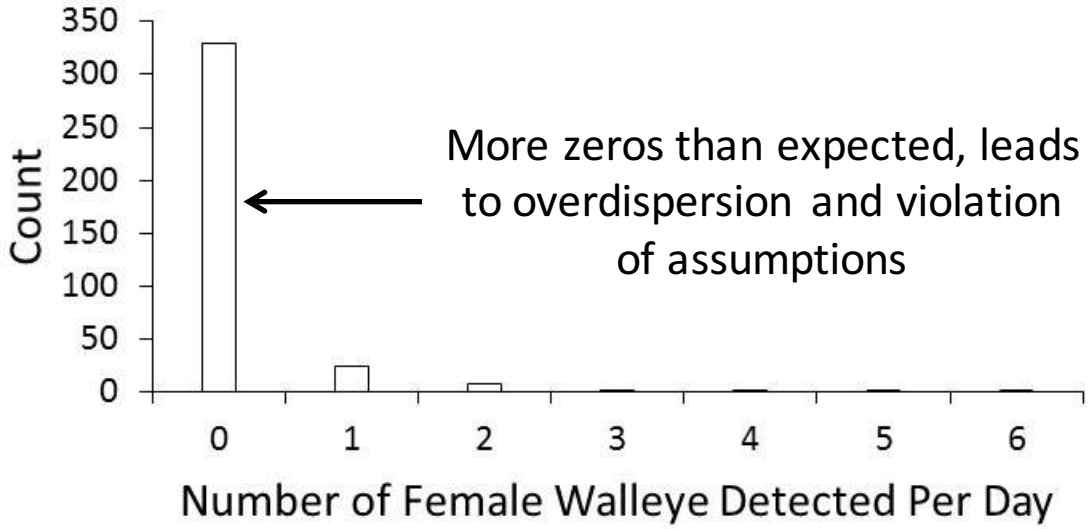
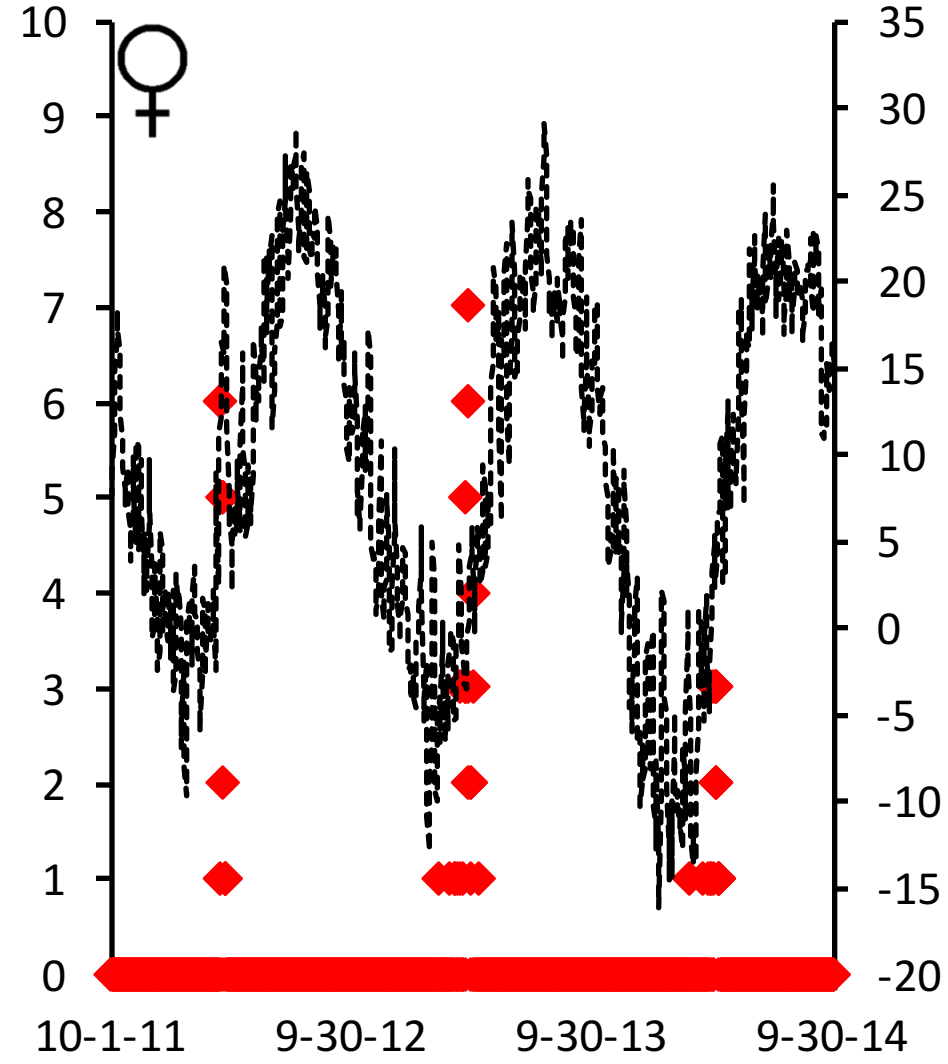
Tittabawassee River
Saginaw River
Shiaawassee River
Cass River

- Response variable = # fish @ given receiver location per day
  - Count data - - - > GLM with Poisson or negative binomial error distribution
  - Also considered zero-inflated models…



- Response variable = # fish @ given receiver location per day
  - Count data - - - > GLM with Poisson or negative binomial error distribution
  - Also considered zero-inflated models…
    - Zero-inflated Poisson most appropriate
- Developed *a priori* list of candidate models
  - Hypothesized influence of environmental variables
  - AIC to evaluate hypotheses (i.e., models)
  - Results today limited to spawning and leaving
- R using lme4 and pscl packages

Spawning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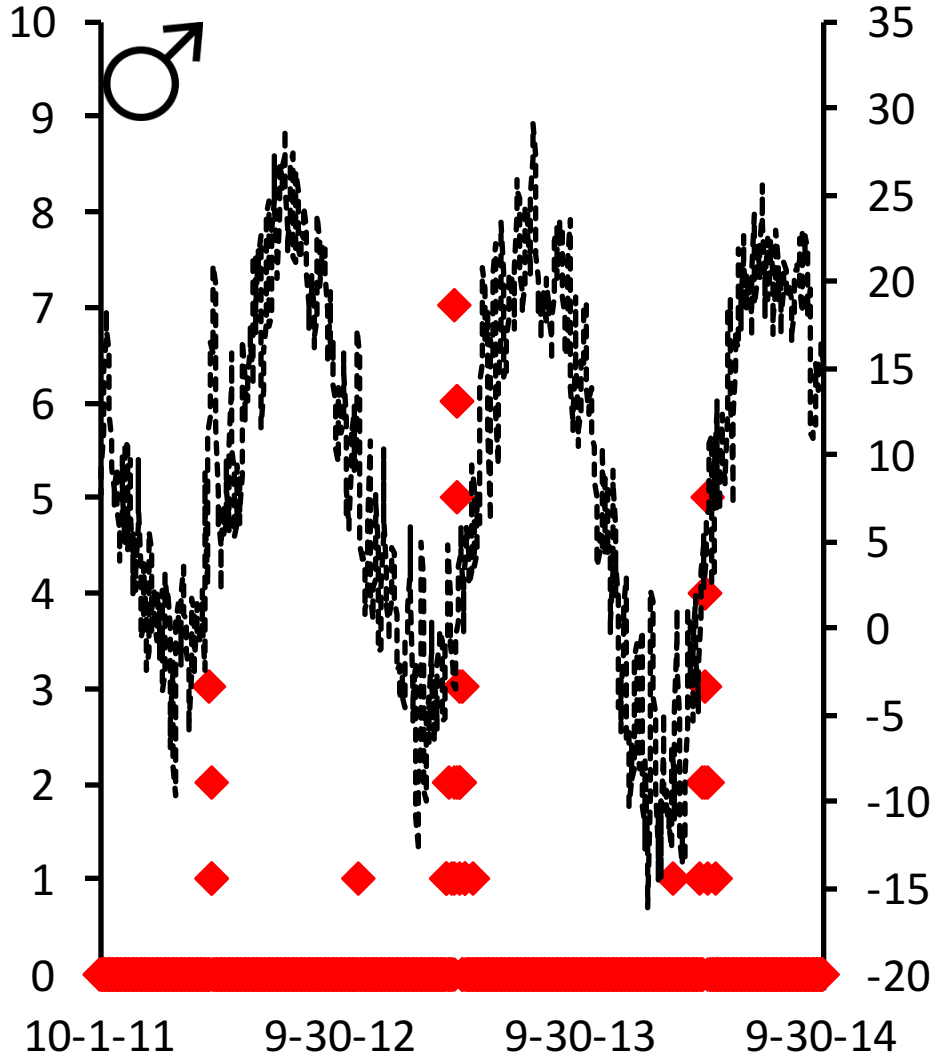
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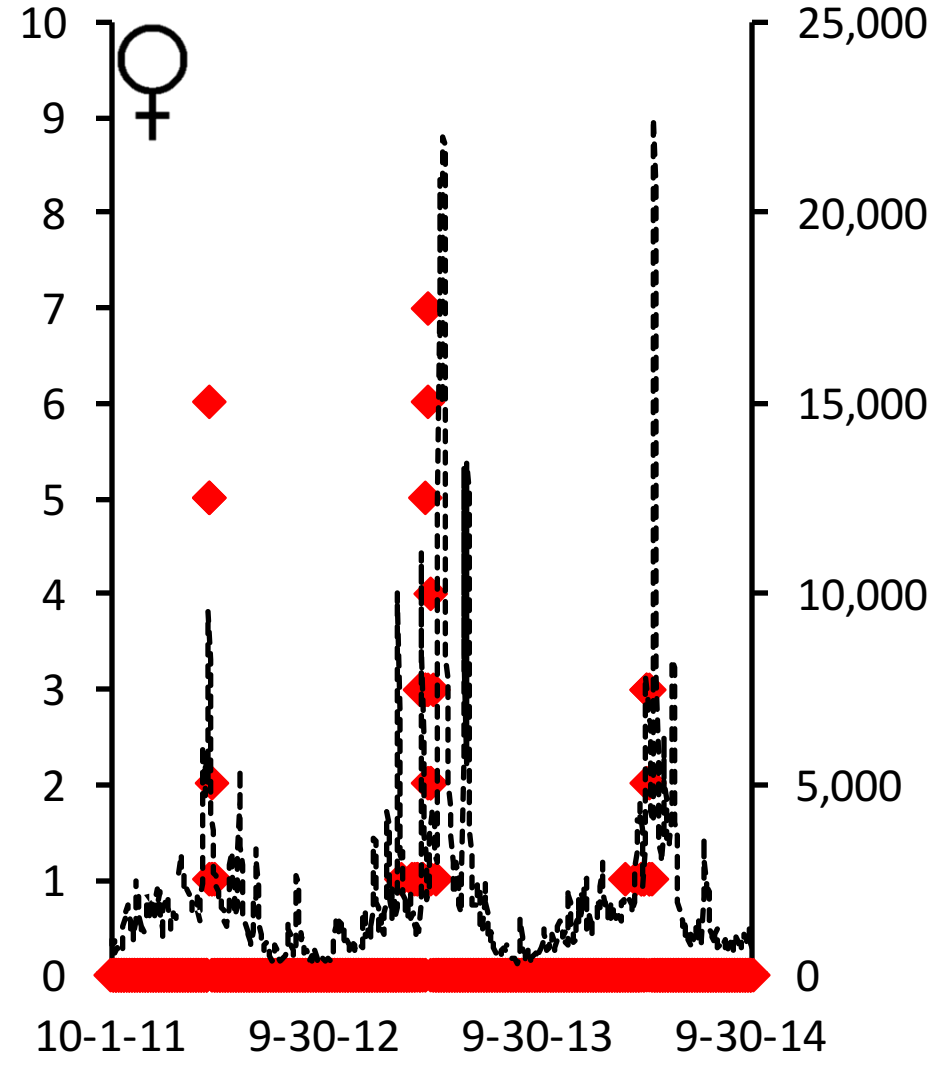
Spawning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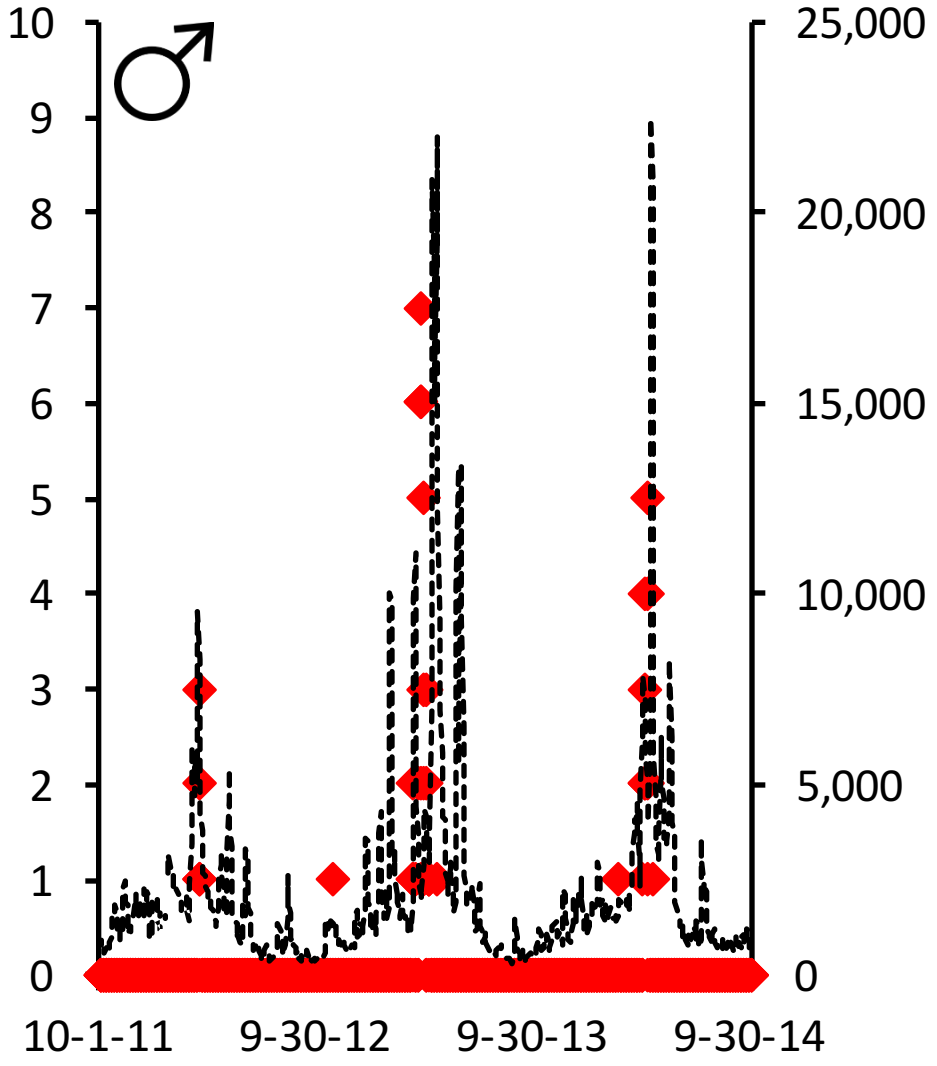
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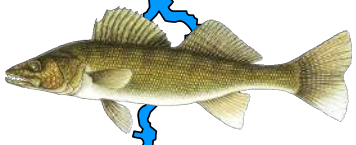
♂

Global Model
- Temperature ($\bar{x}$ and Δ)
- Discharge ($\bar{x}$ and Δ)

Temperature x Discharge Model
- Temperature ($\bar{x}$)
- Discharge ($\bar{x}$)

Tittabawassee River



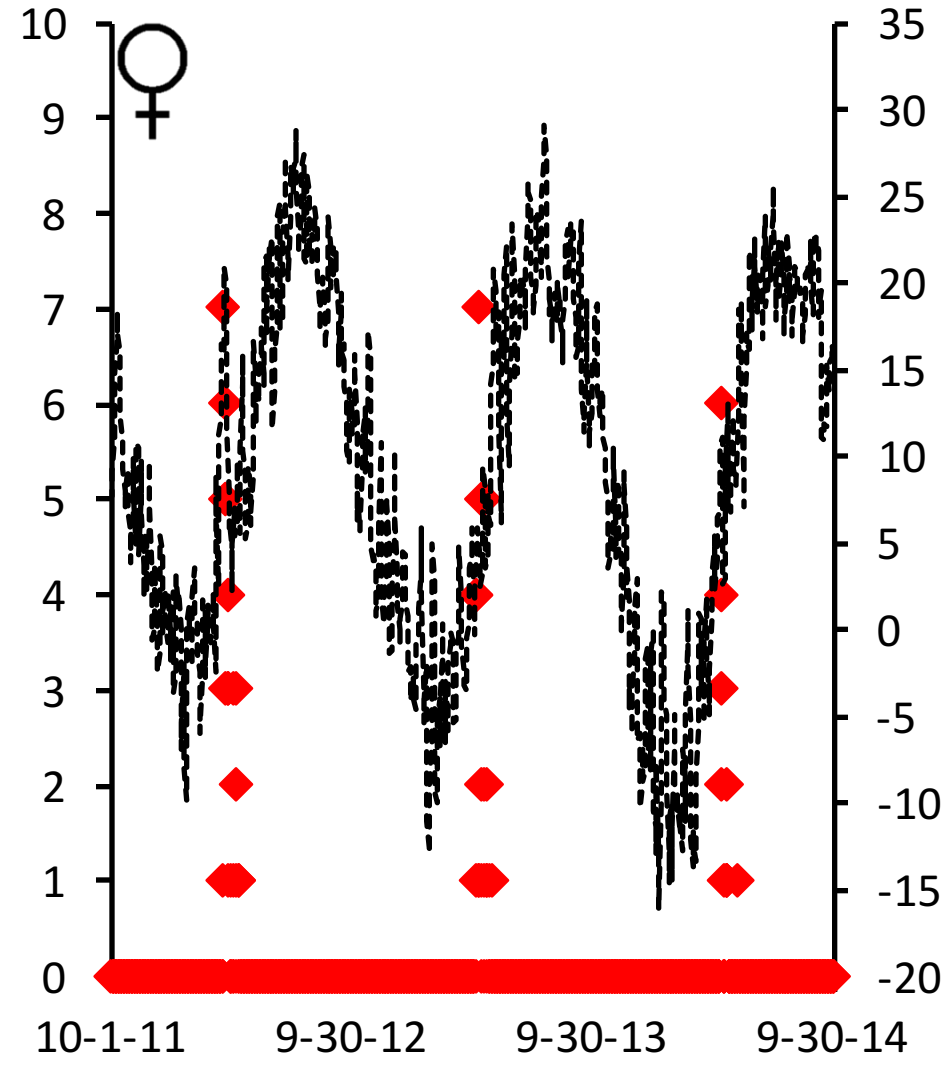
Saginaw River

Spawning

Shiaawassee River

Cass River

Leave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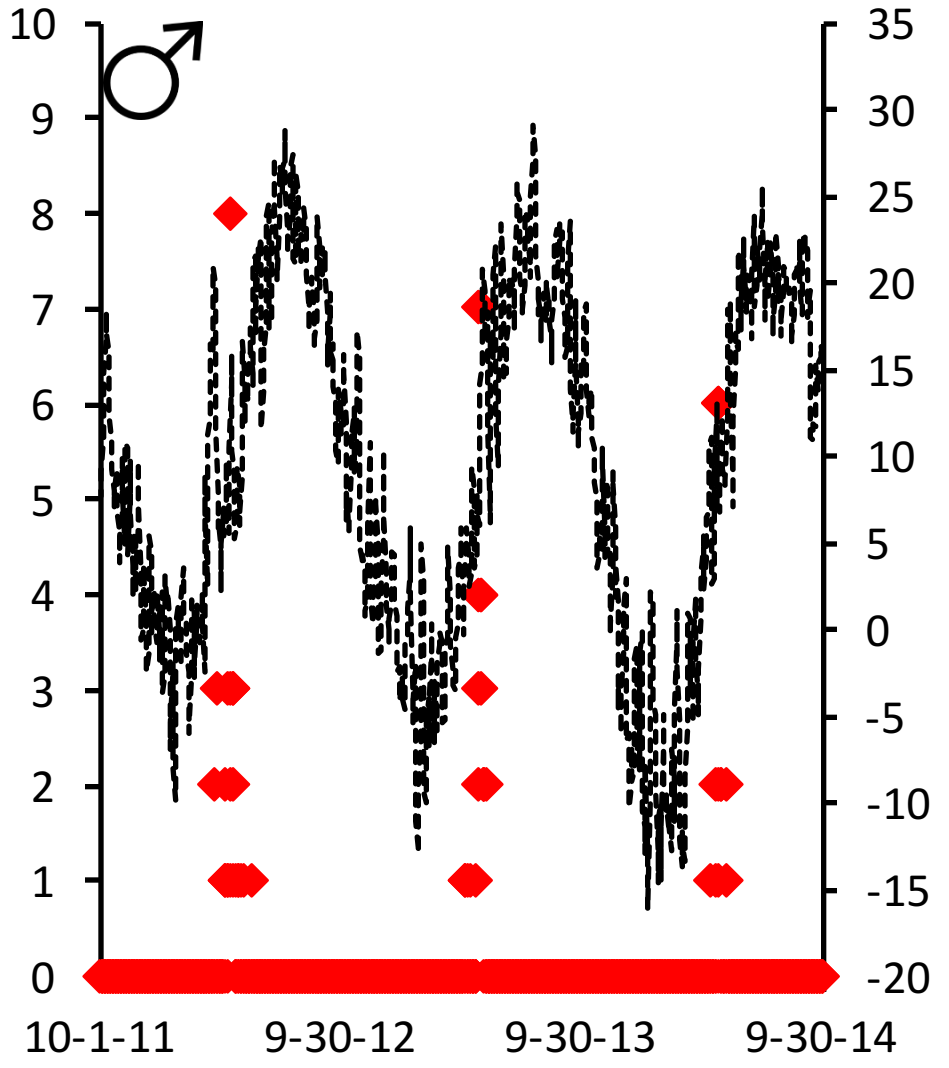
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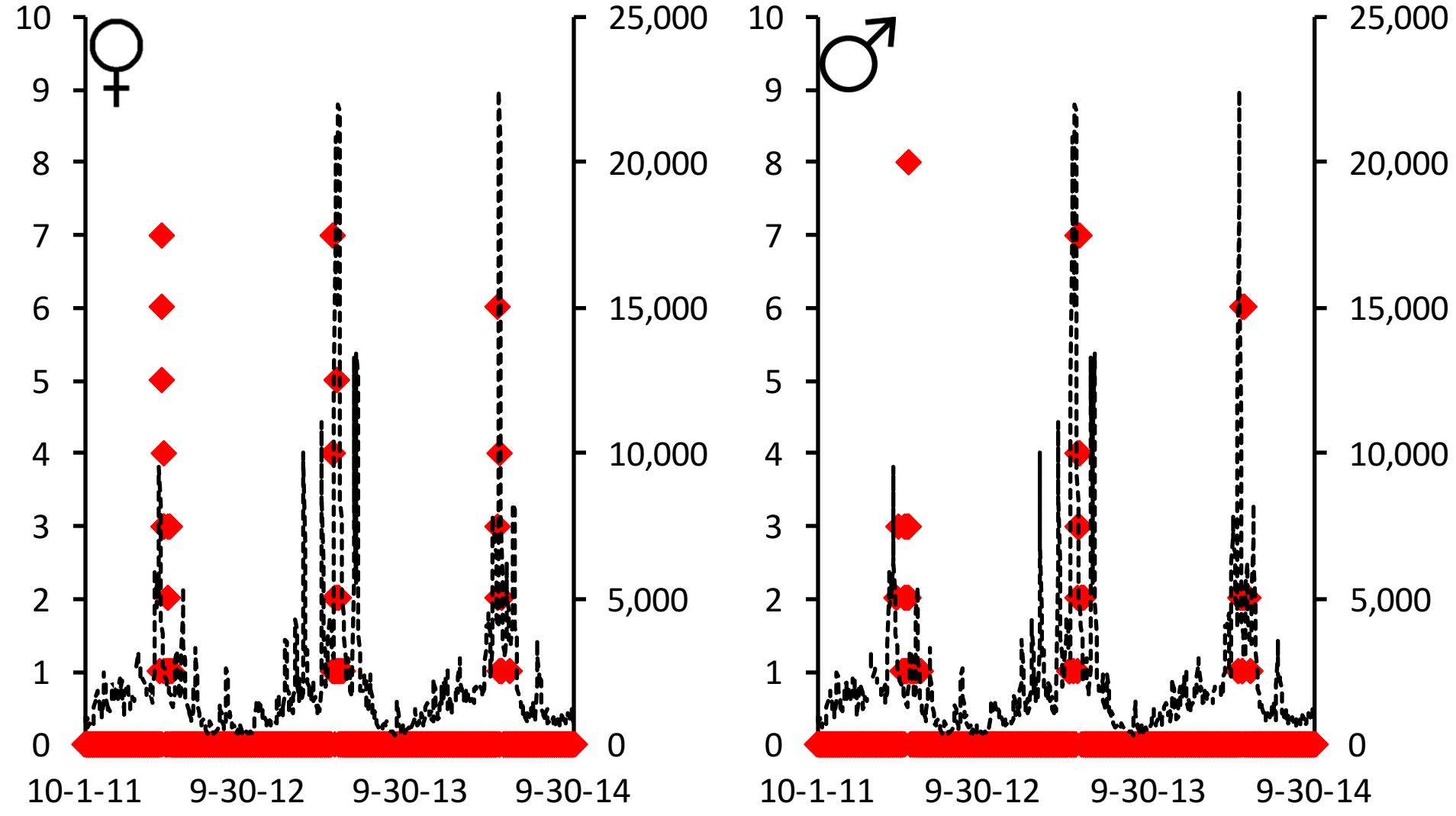
Leave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♂

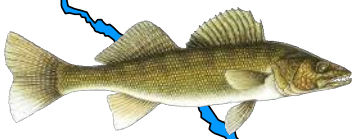
Temperature x Discharge Model

- Temperature ($\bar{x}$)
- Discharge ($\bar{x}$)

Global Model

- Temperature ($\bar{x}$ and Δ)
- Discharge ($\bar{x}$ and Δ)

Tittabawassee River



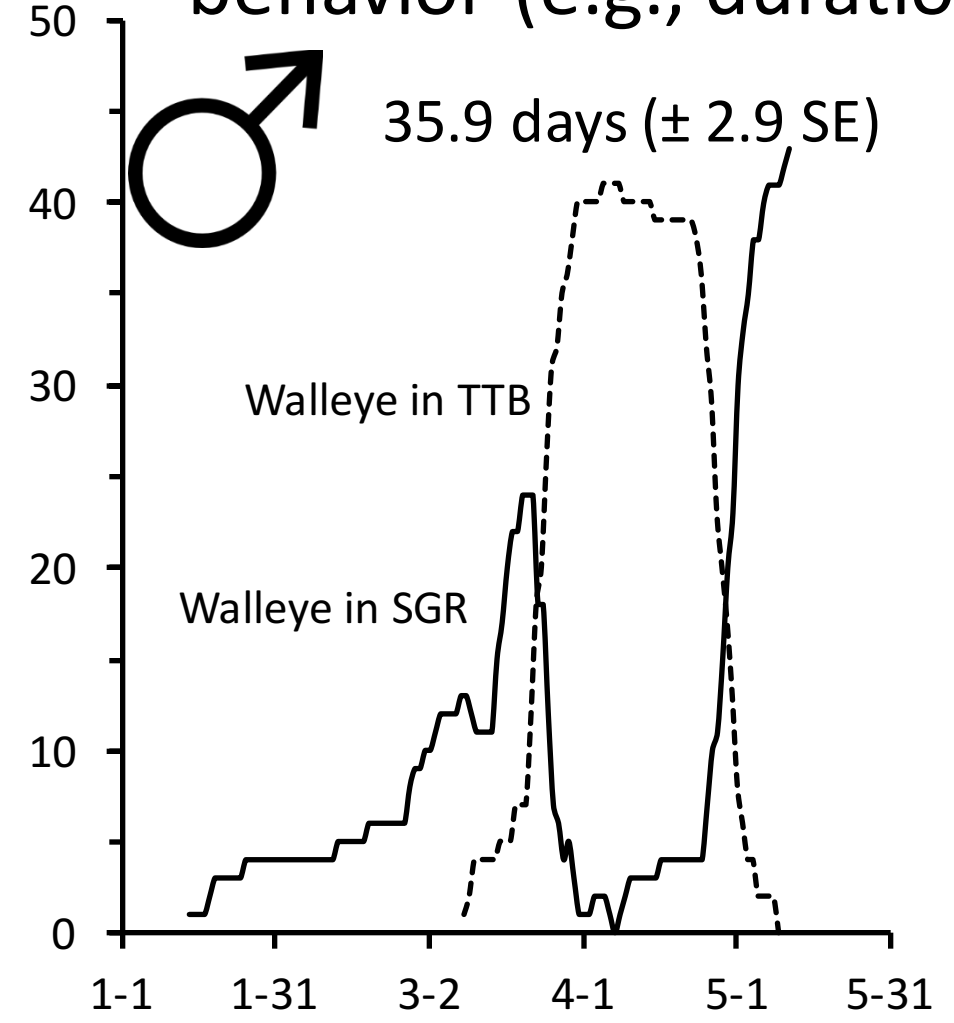
Saginaw River

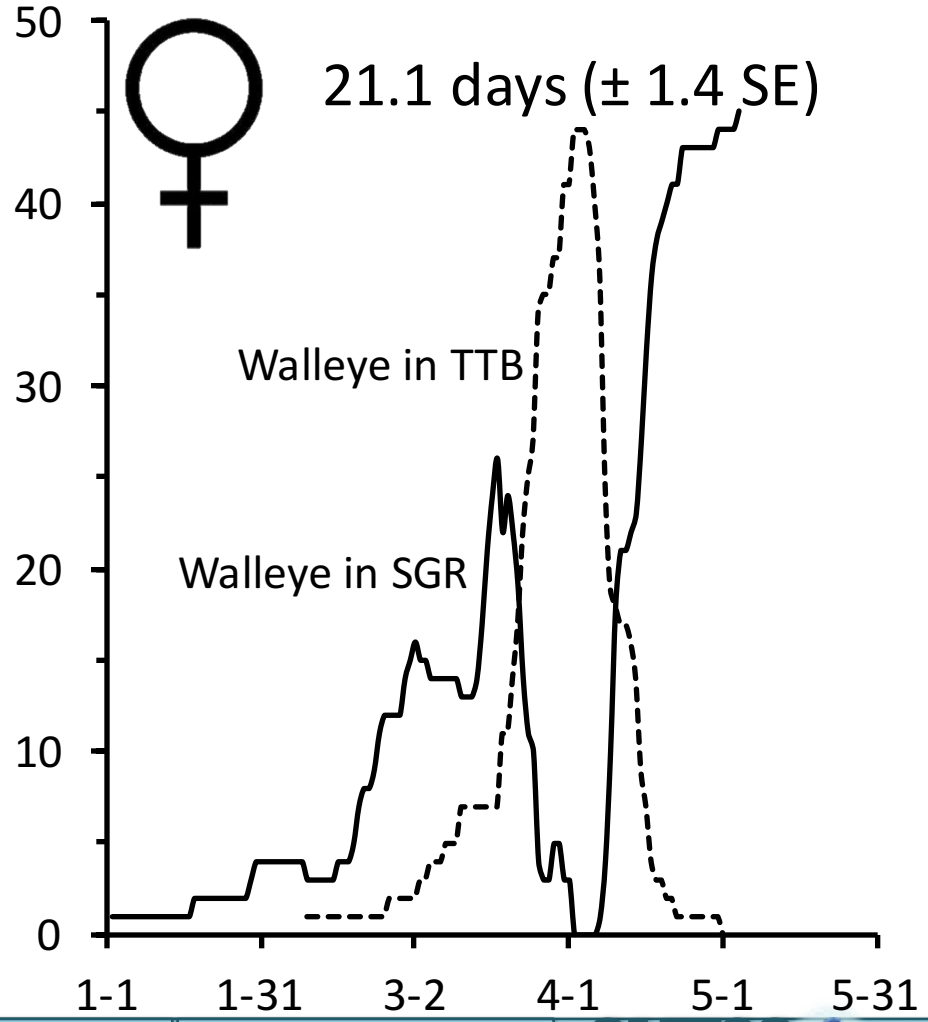
Shiaawassee River

Cass River

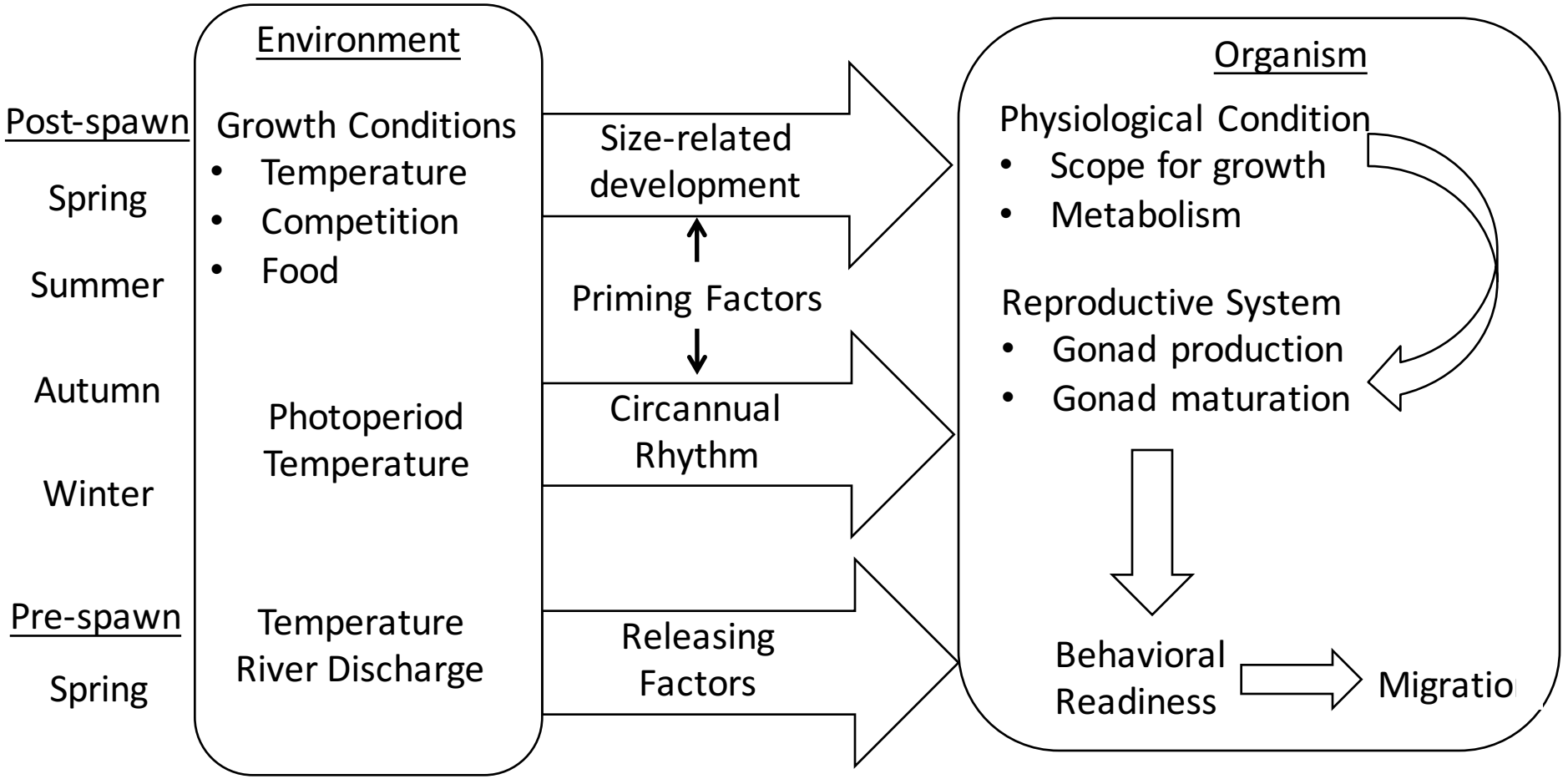
Leave

- Sexes responding to similar releasing factors…
- What about other aspects of spawning behavior (e.g., duration on spawning grounds)?





- Revisiting conceptual framework for spawning walleye movements



Adapted from McCormick et al. 1998

Thank you for your attention!

Questions?