Fish Production Responses to Long-term Additions of Coarse Woody Habitat

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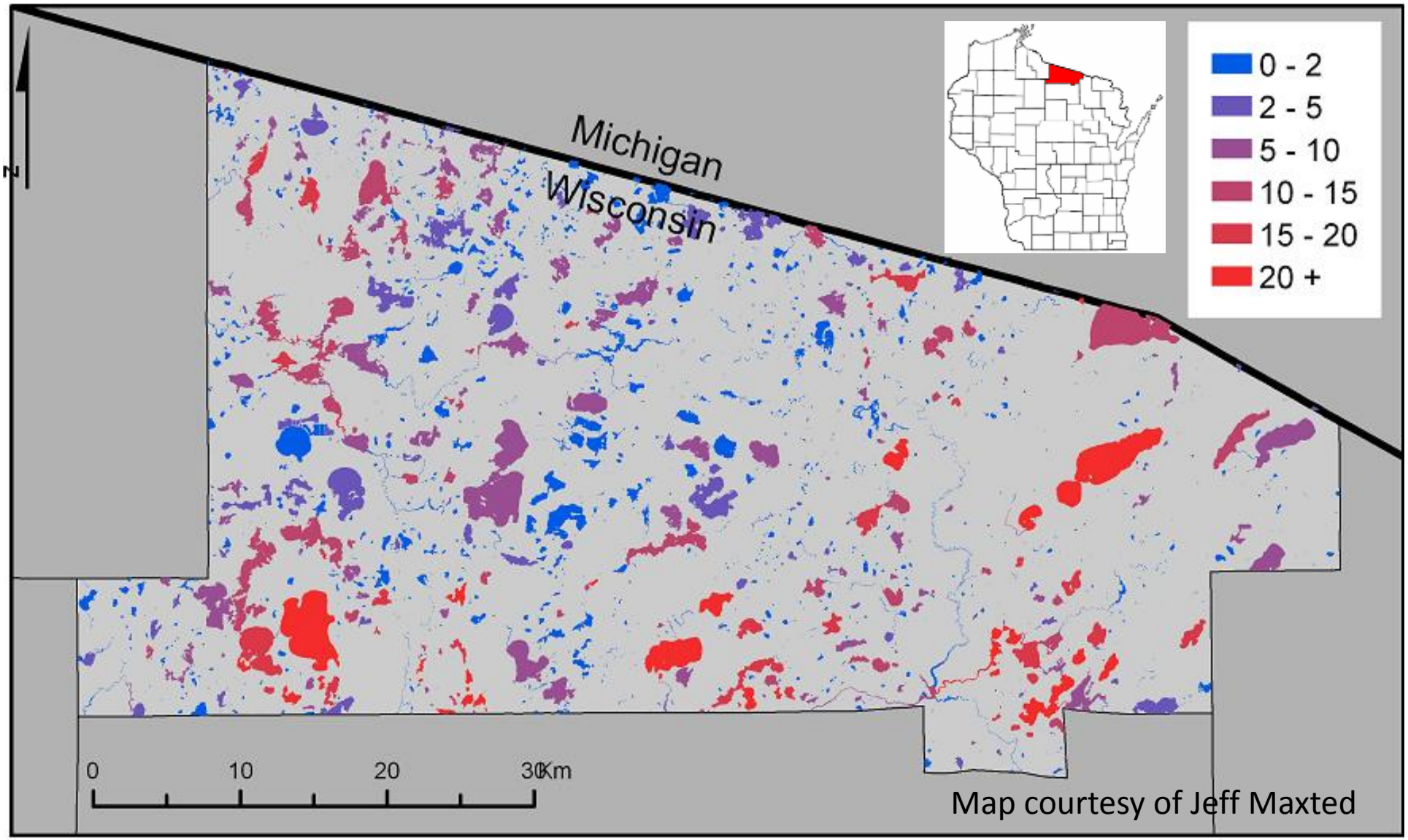
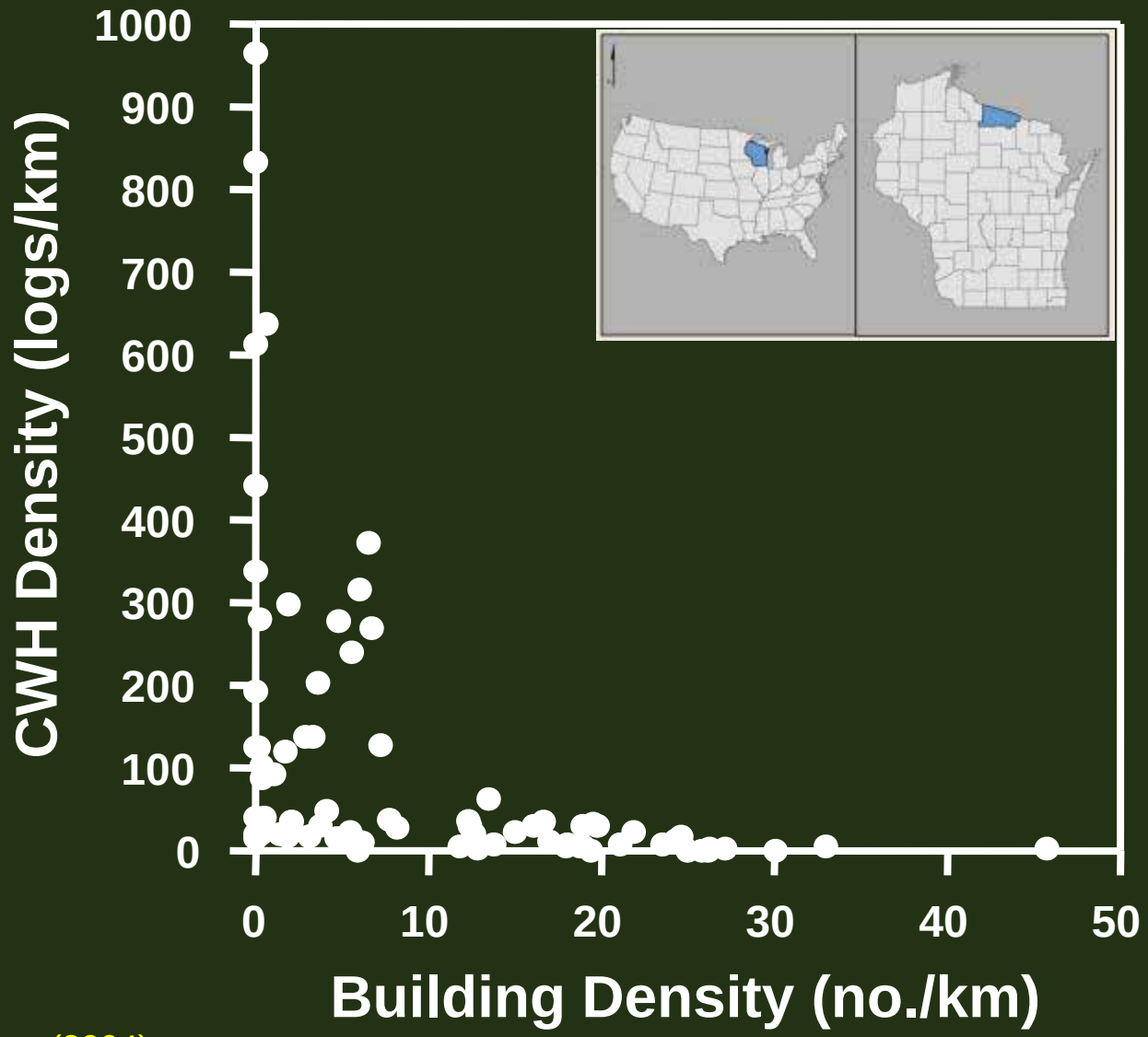
Lakeshore Residential Development



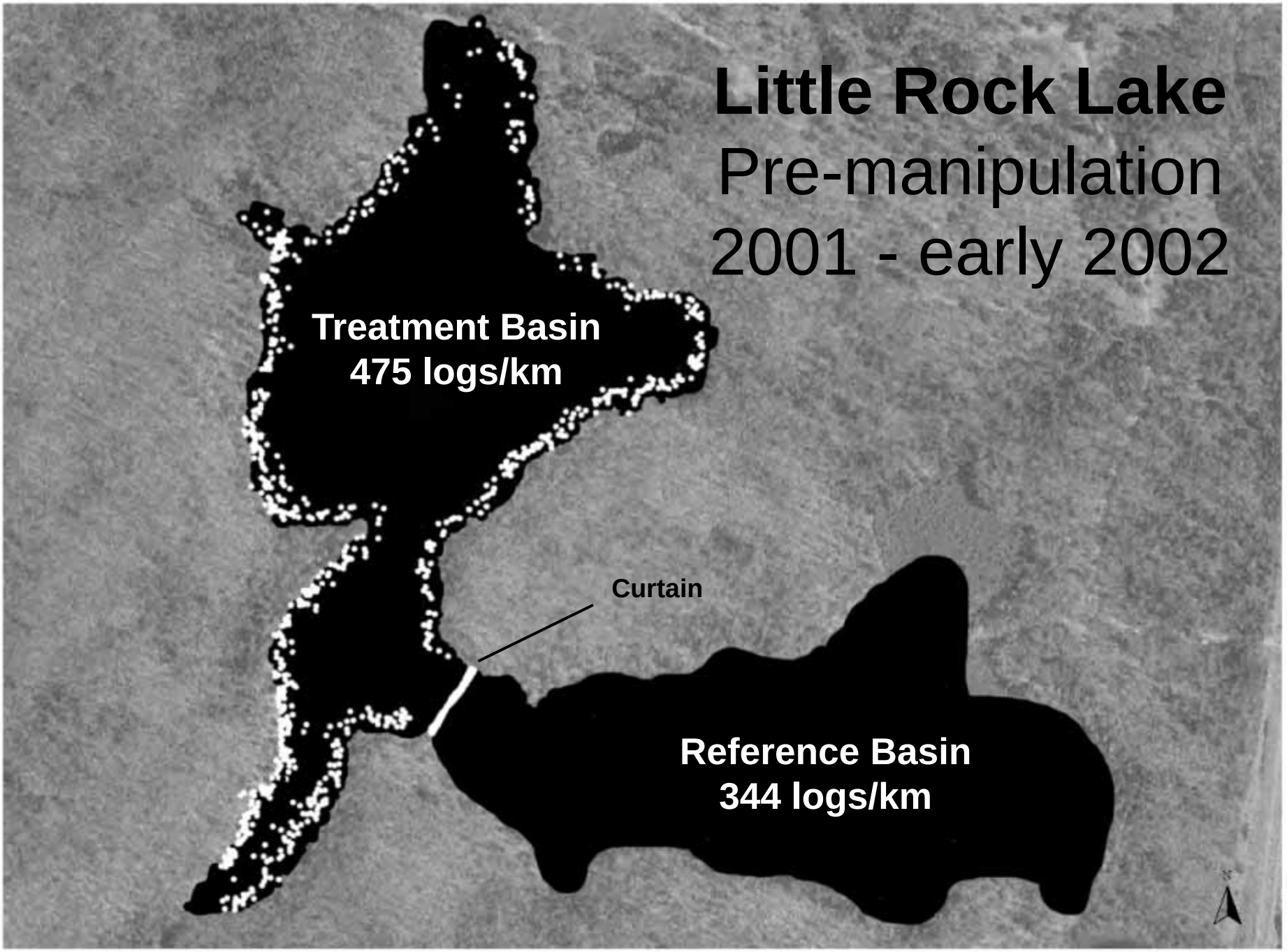
CWH and Lakeshore Residential Development



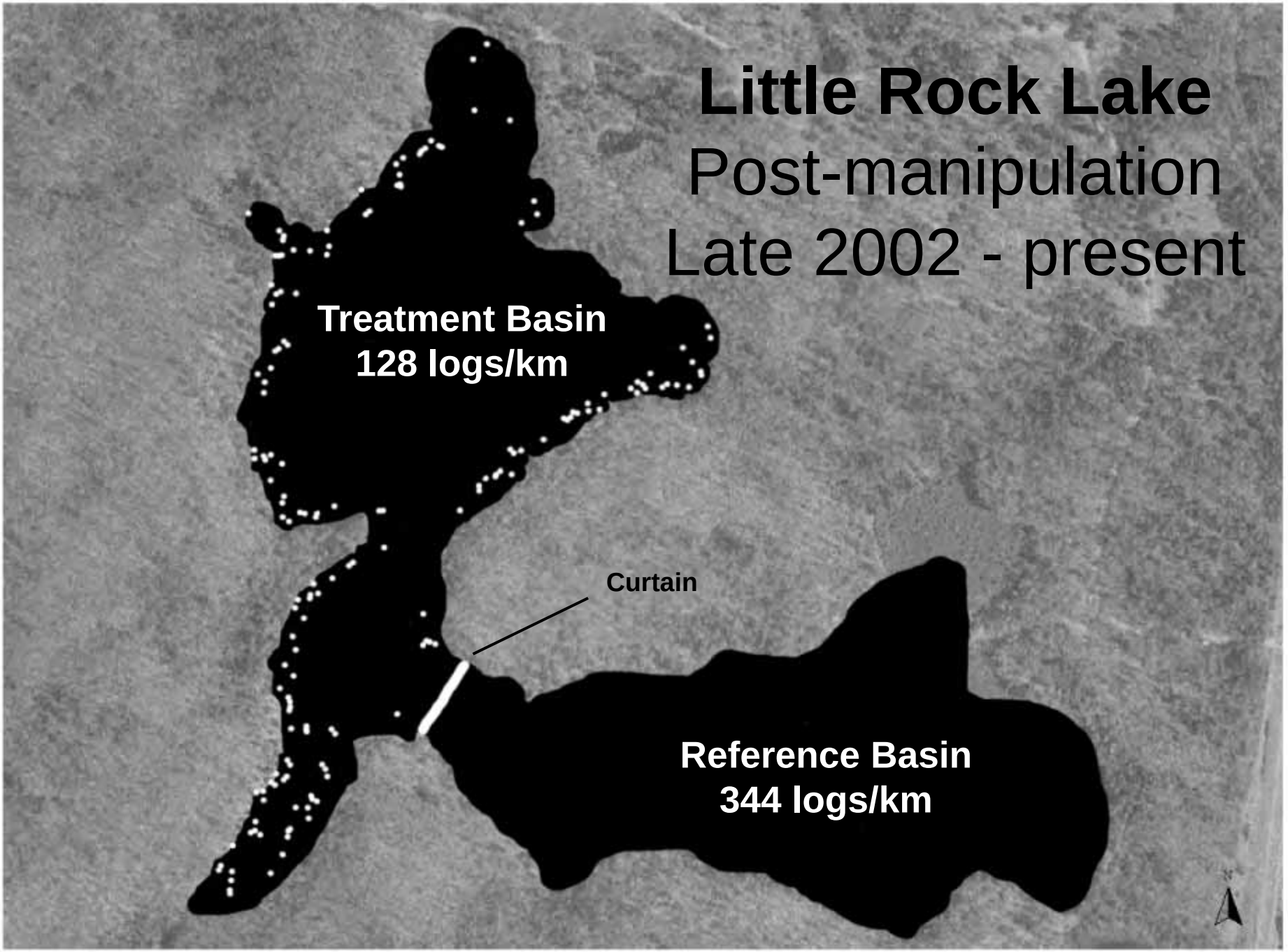
Sugden-Newbery (2004)

yellow perch
(*Perca flavescens)*
Benthivore

largemouth bass
(*Micropterus salmoides*)
Piscivore

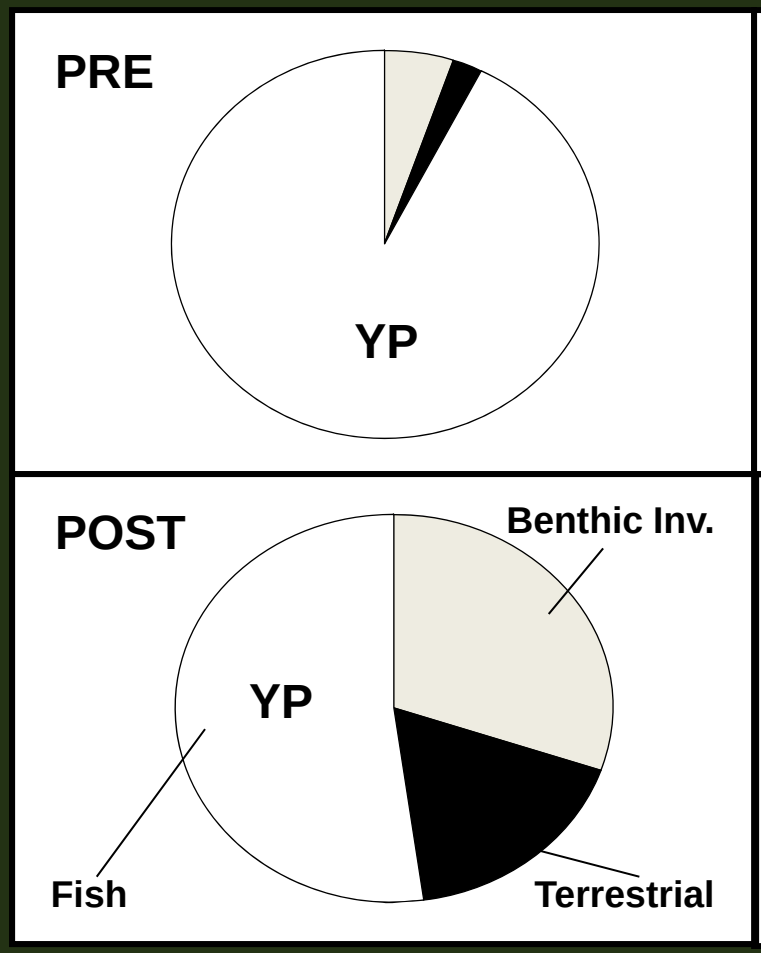

Little Rock Lake
Pre-manipulation
2001 - early 2002
Treatment Basin
475 logs/km
Curtain
Reference Basin
344 logs/km

CWH Removal – July, August 2002

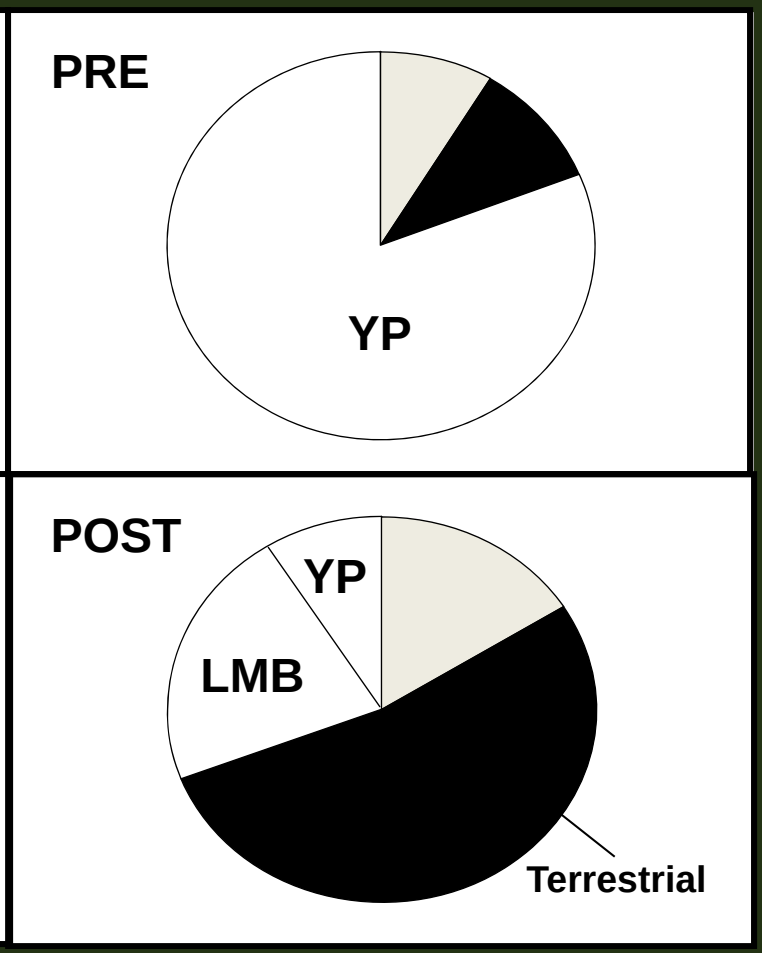

Little Rock Lake
Post-manipulation
Late 2002 - present
Treatment Basin
128 logs/km
Curtain
Reference Basin
344 logs/km

Largemouth Bass Diets

Little Rock (Reference)

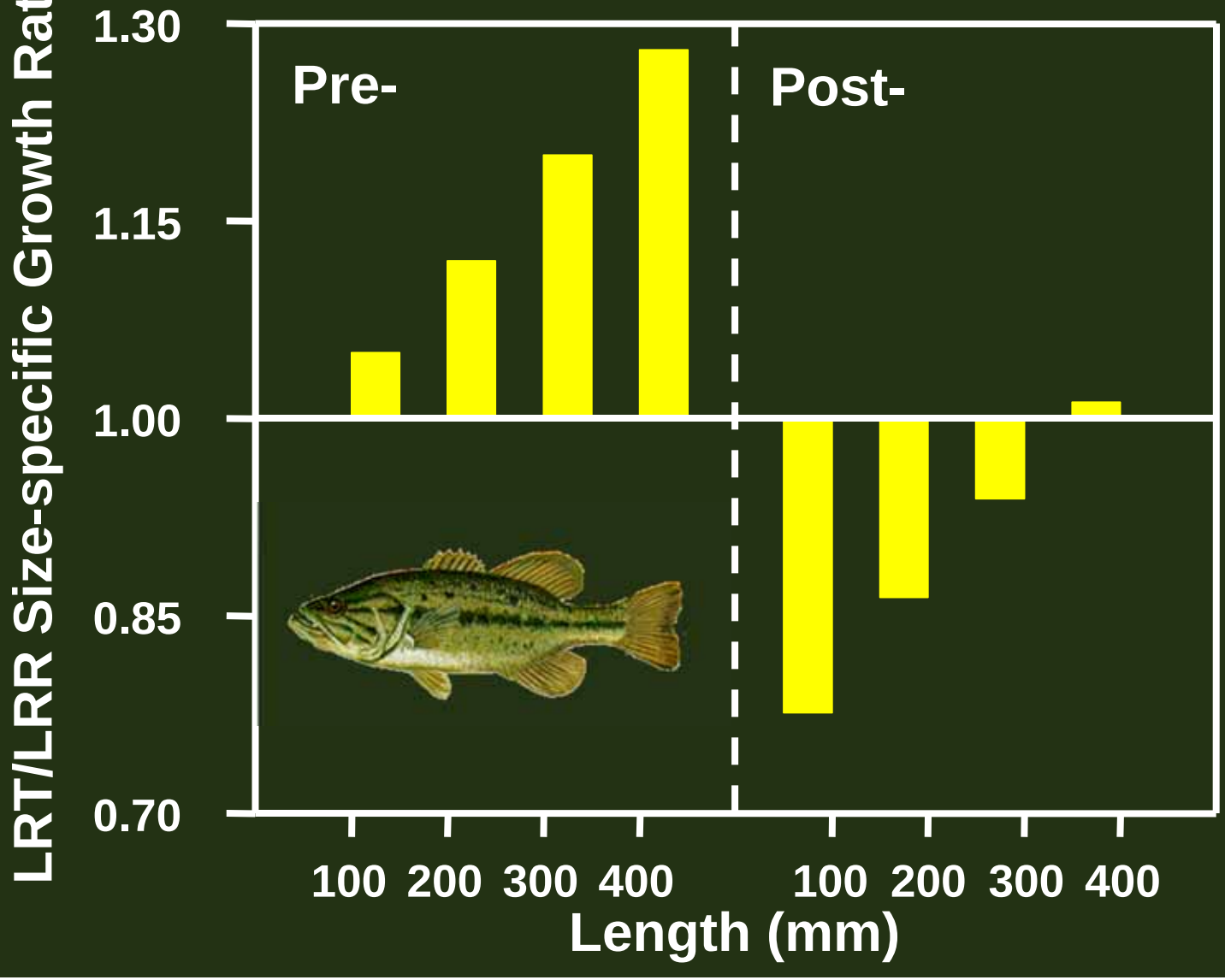


Little Rock (Treatment)

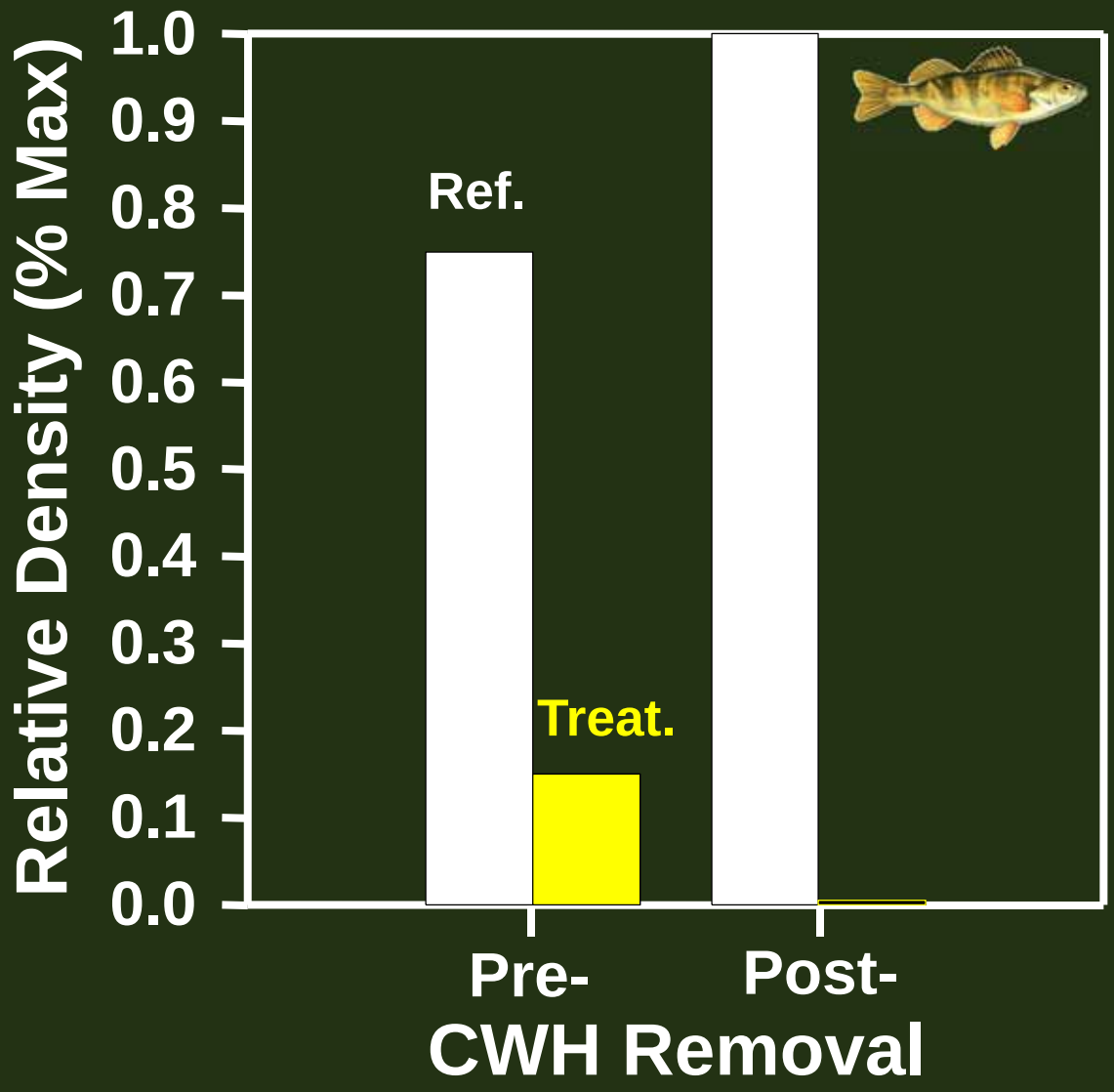


***No diet changes observed in yellow perch**

Largemouth Bass Growth Rates



Yellow Perch Abundance
(Population Estimate)



During the 2000's, a prolonged drought provided a replicate study

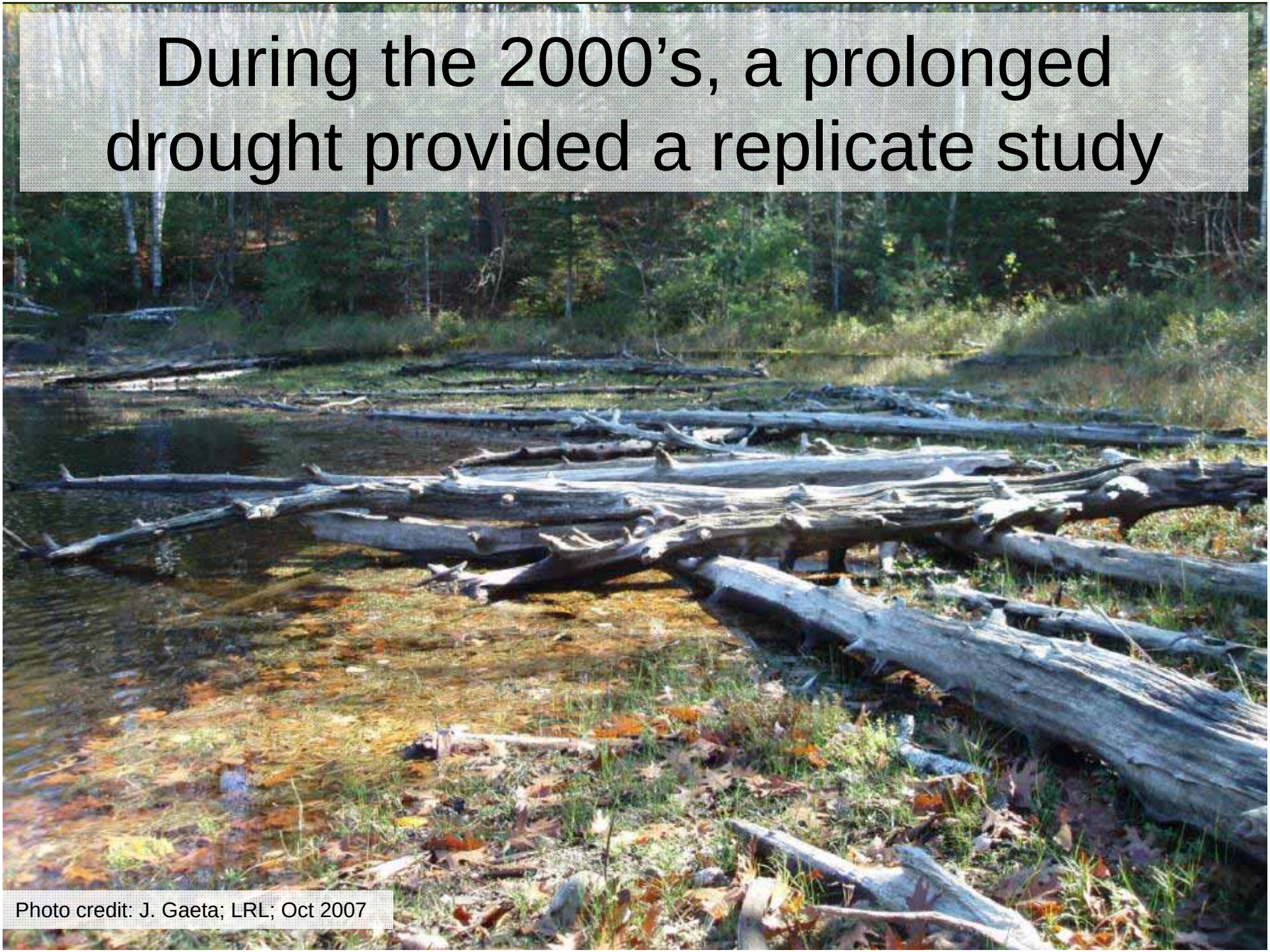
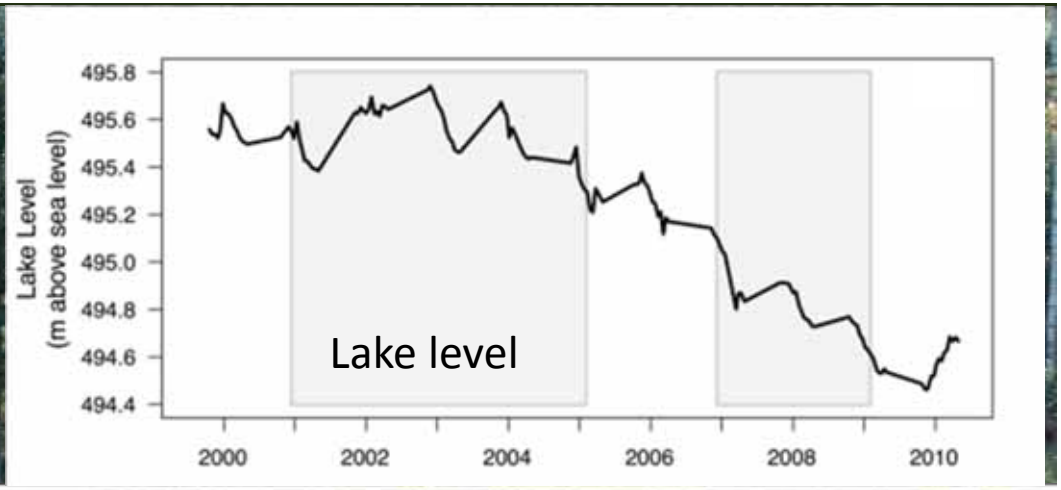
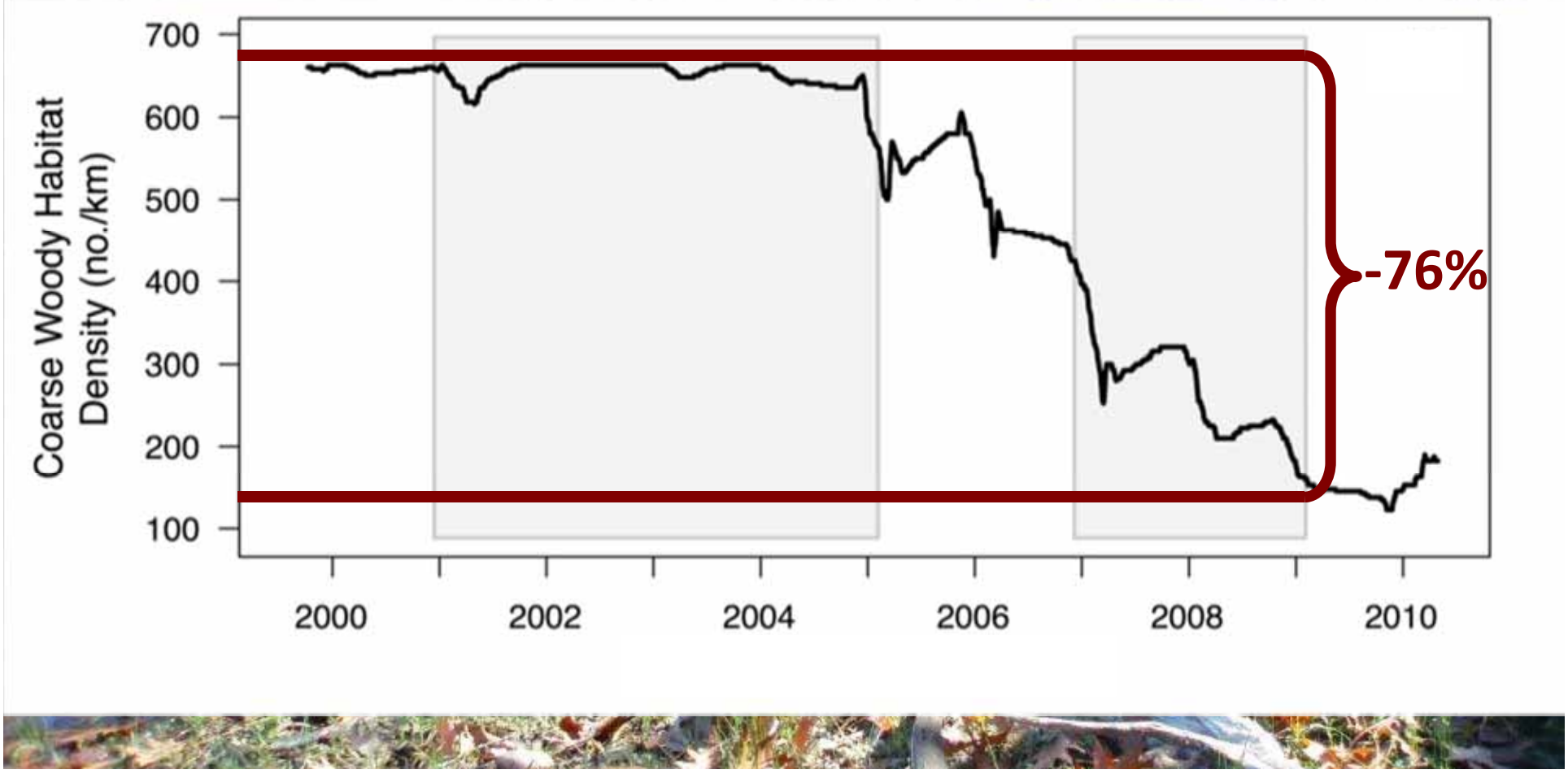
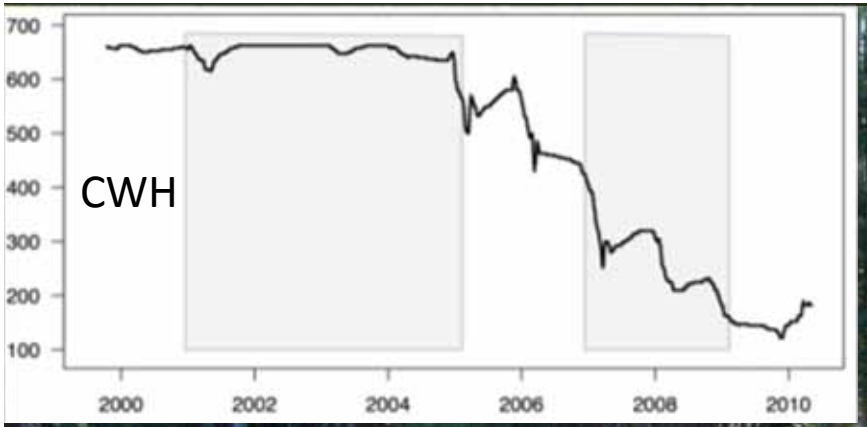


Photo credit: J. Gaeta; LRL; Oct 2007

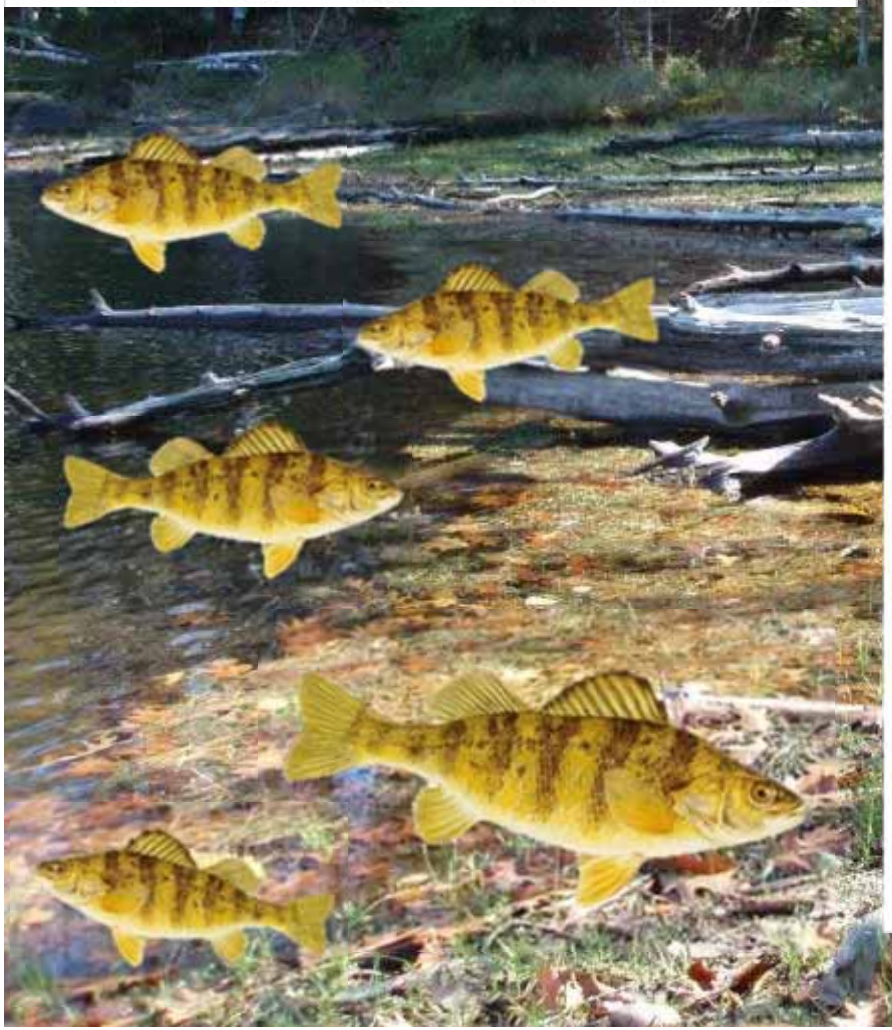
Corresponding change in CWH

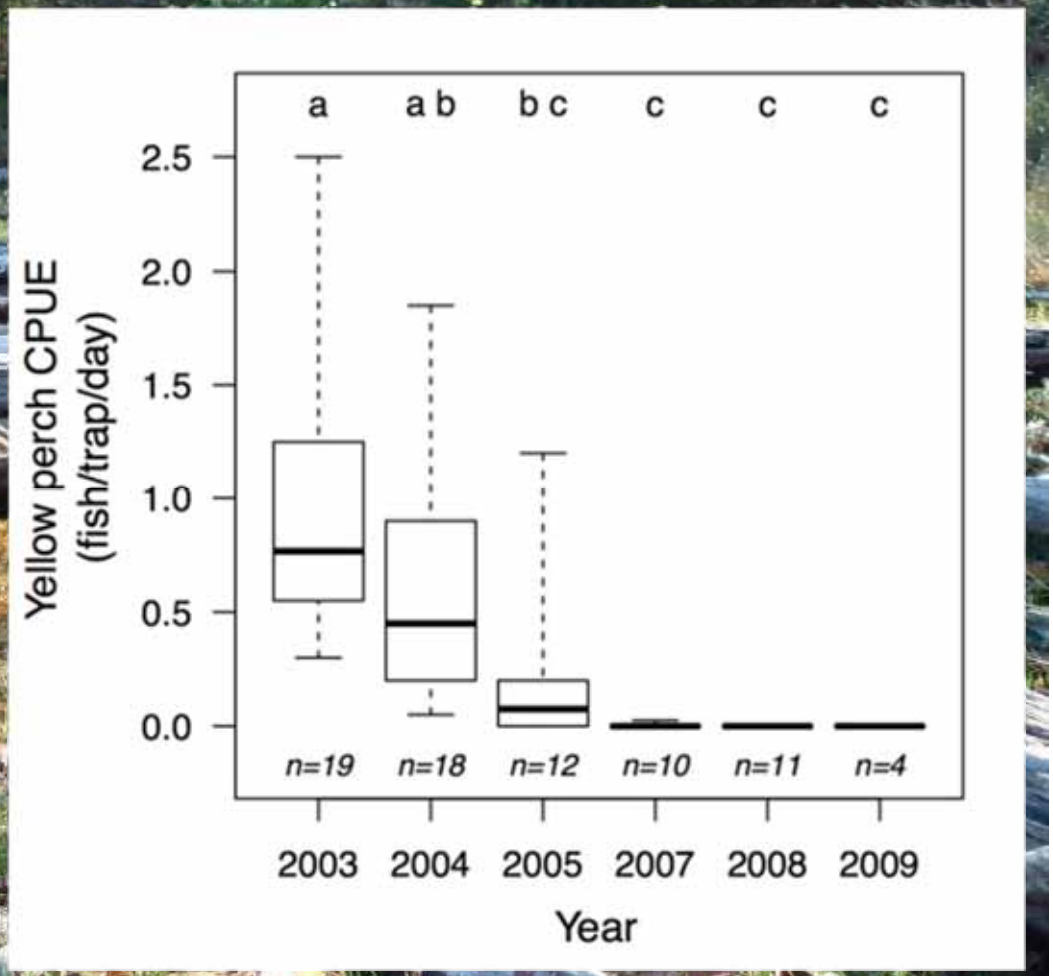


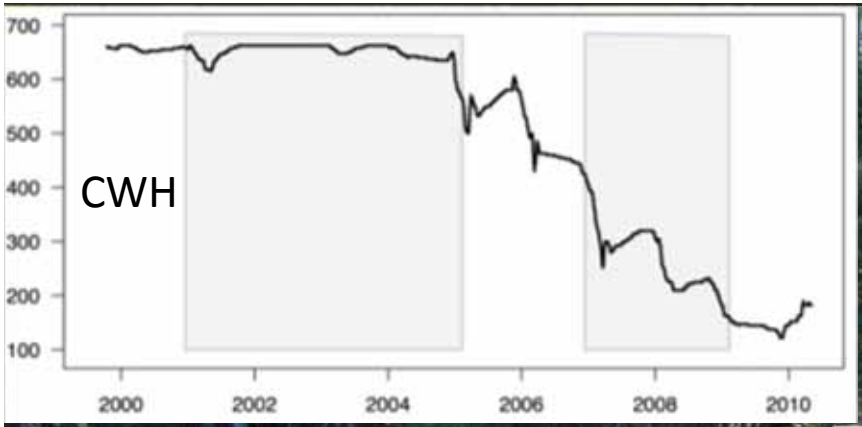




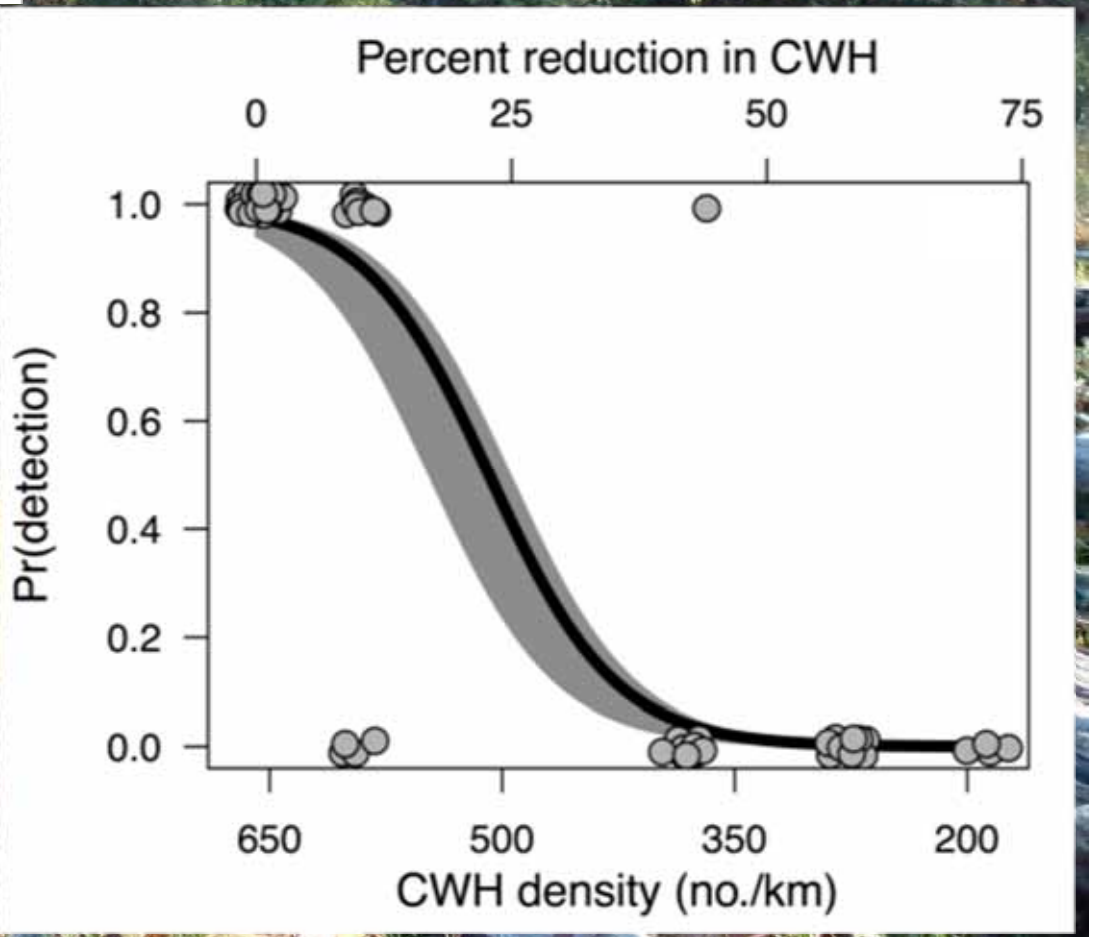
Corresponding change in perch (prey fish)



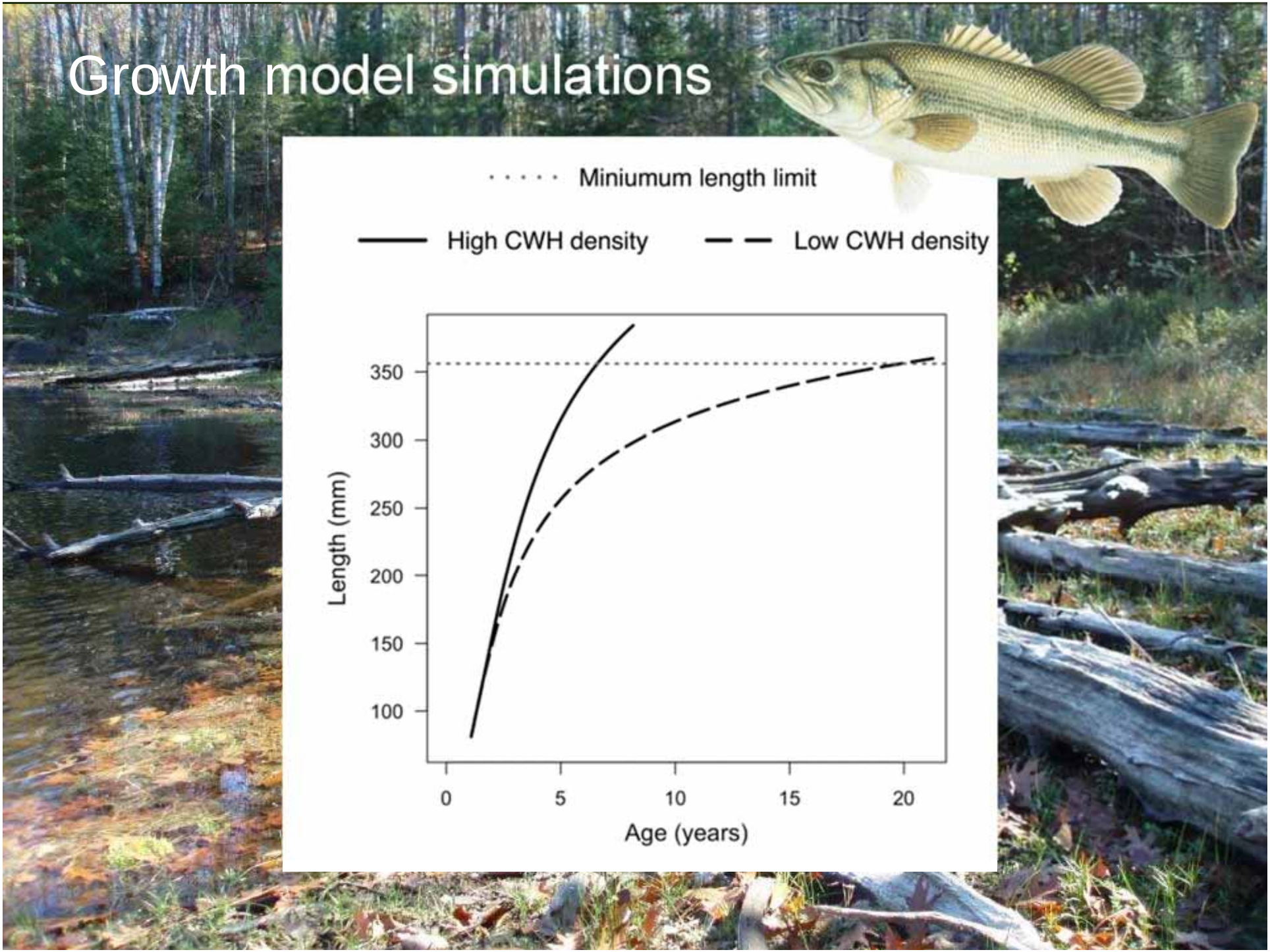




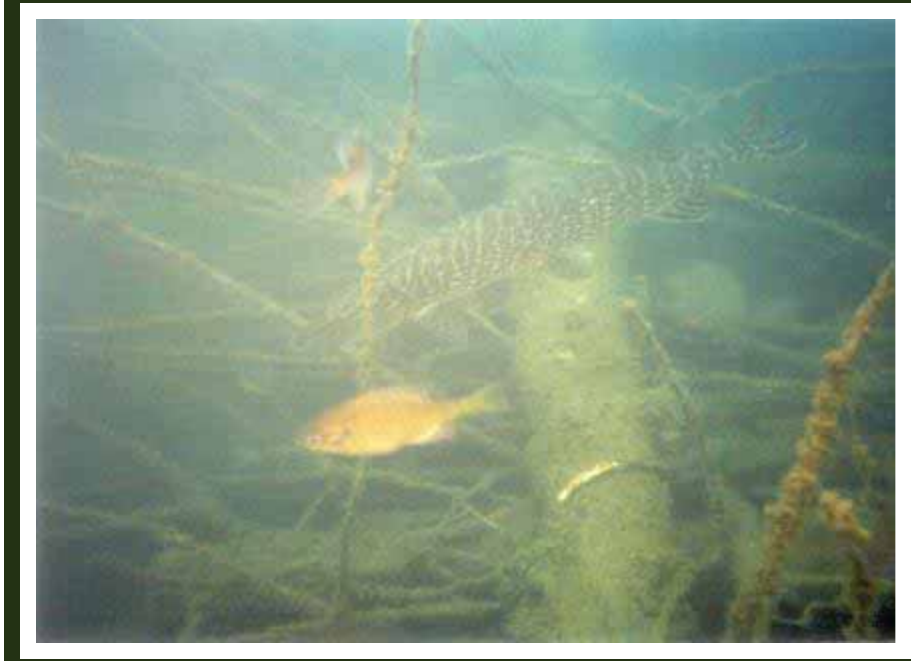
Corresponding change in perch (prey fish)

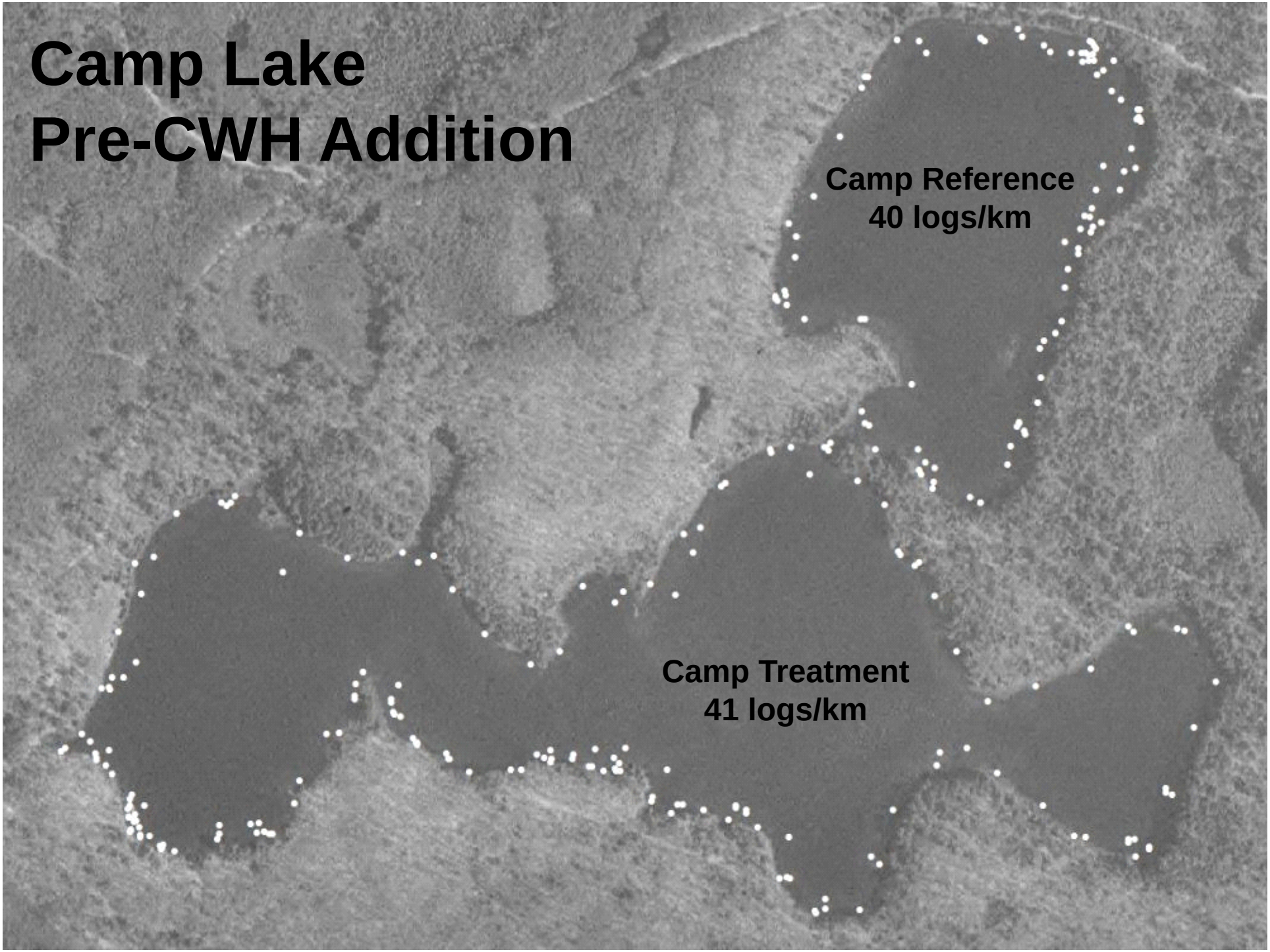


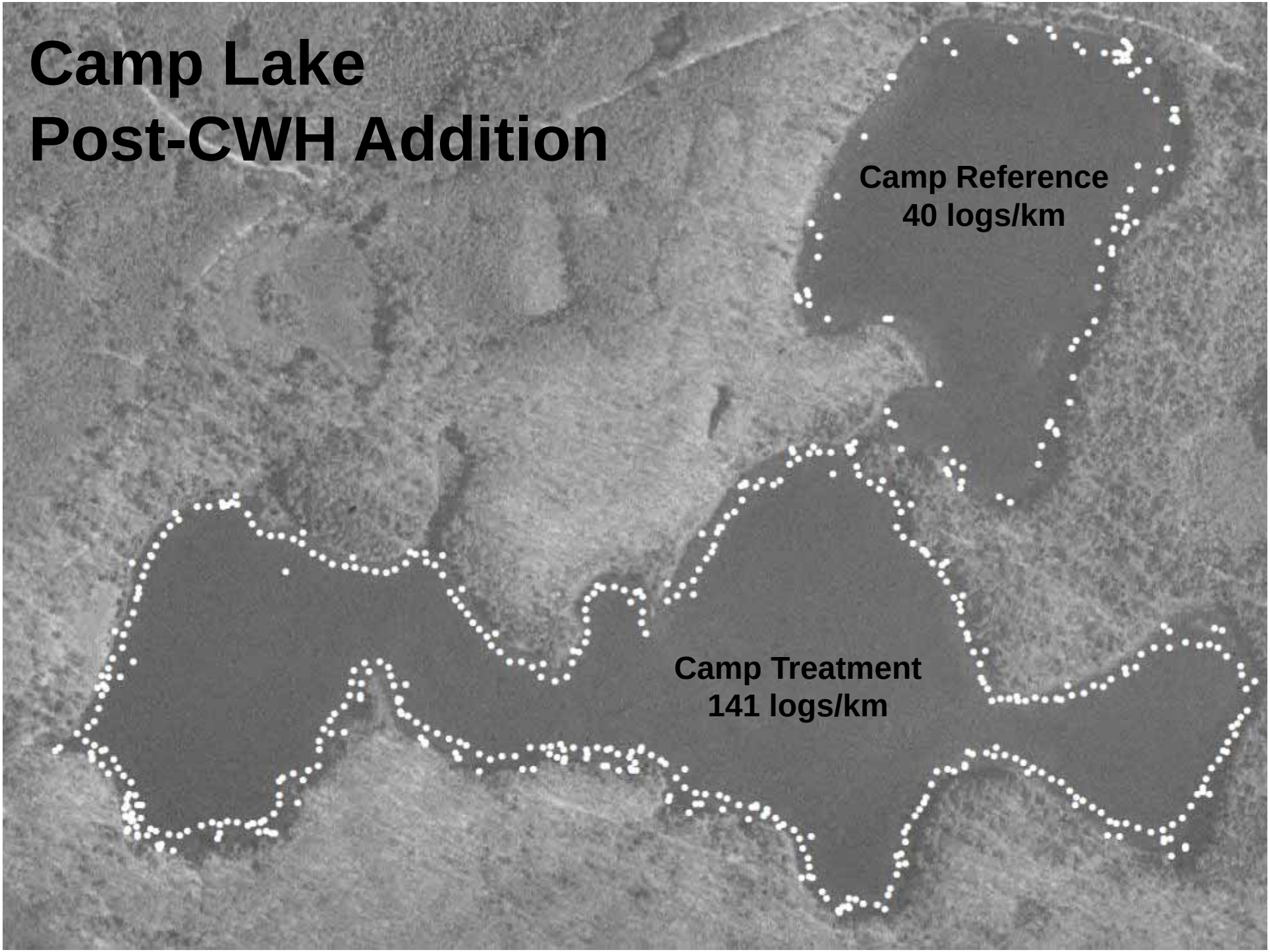
Growth model simulations



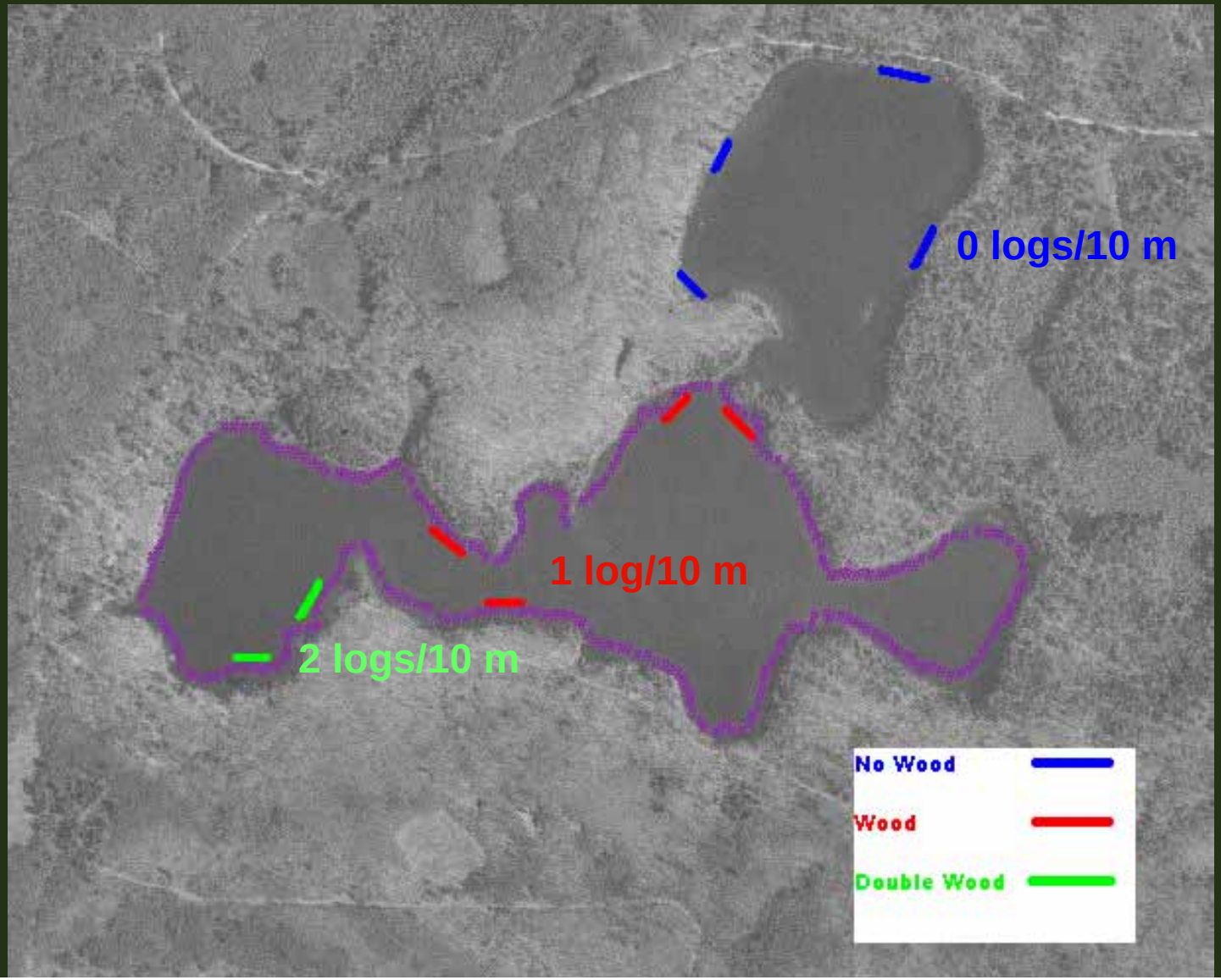
Can CWH addition reverse the negative effects of CWH loss on fish populations?



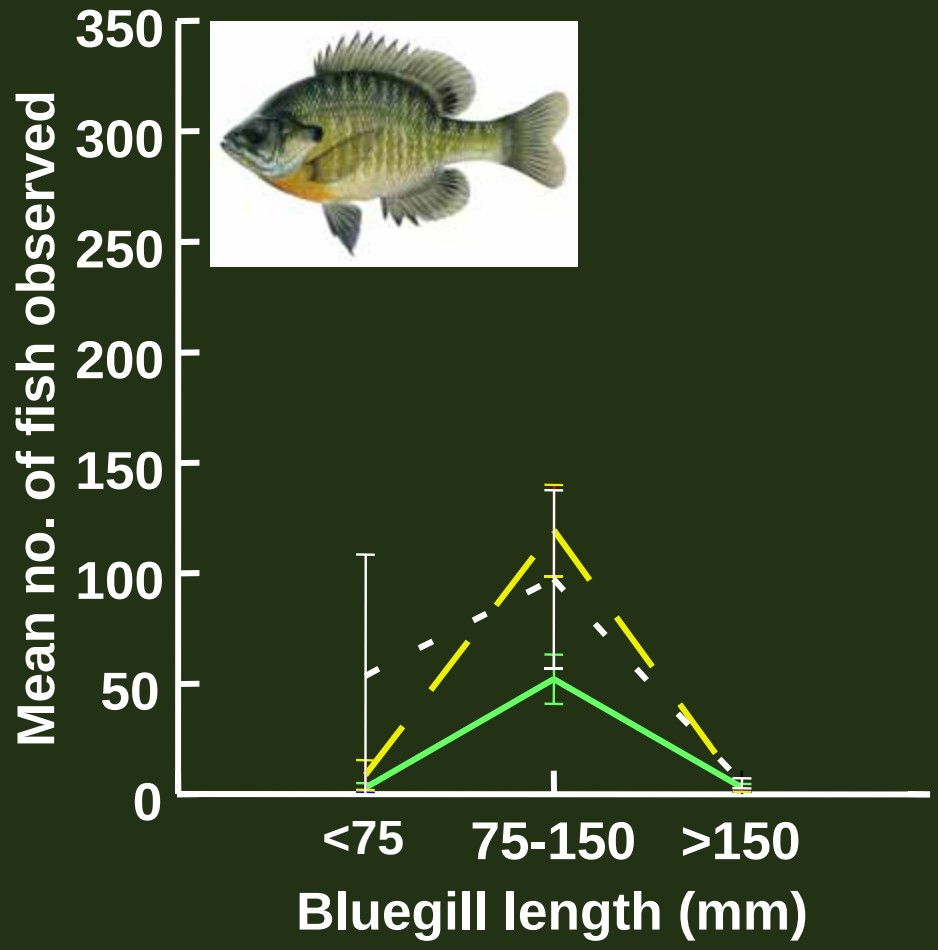

Camp Lake
Pre-CWH Addition
Camp Reference
40 logs/km
Camp Treatment
41 logs/km

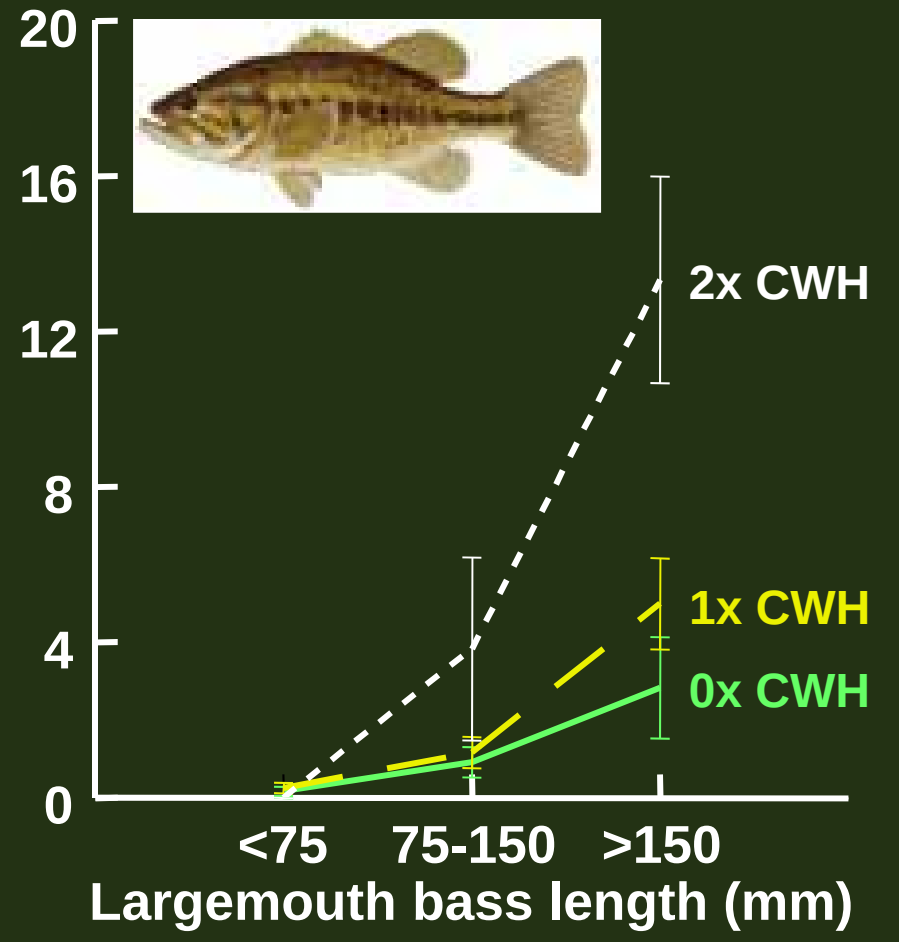

Camp Lake
Post-CWH Addition
Camp Reference
40 logs/km
Camp Treatment
141 logs/km

Camp Lake CWH Fish Usage

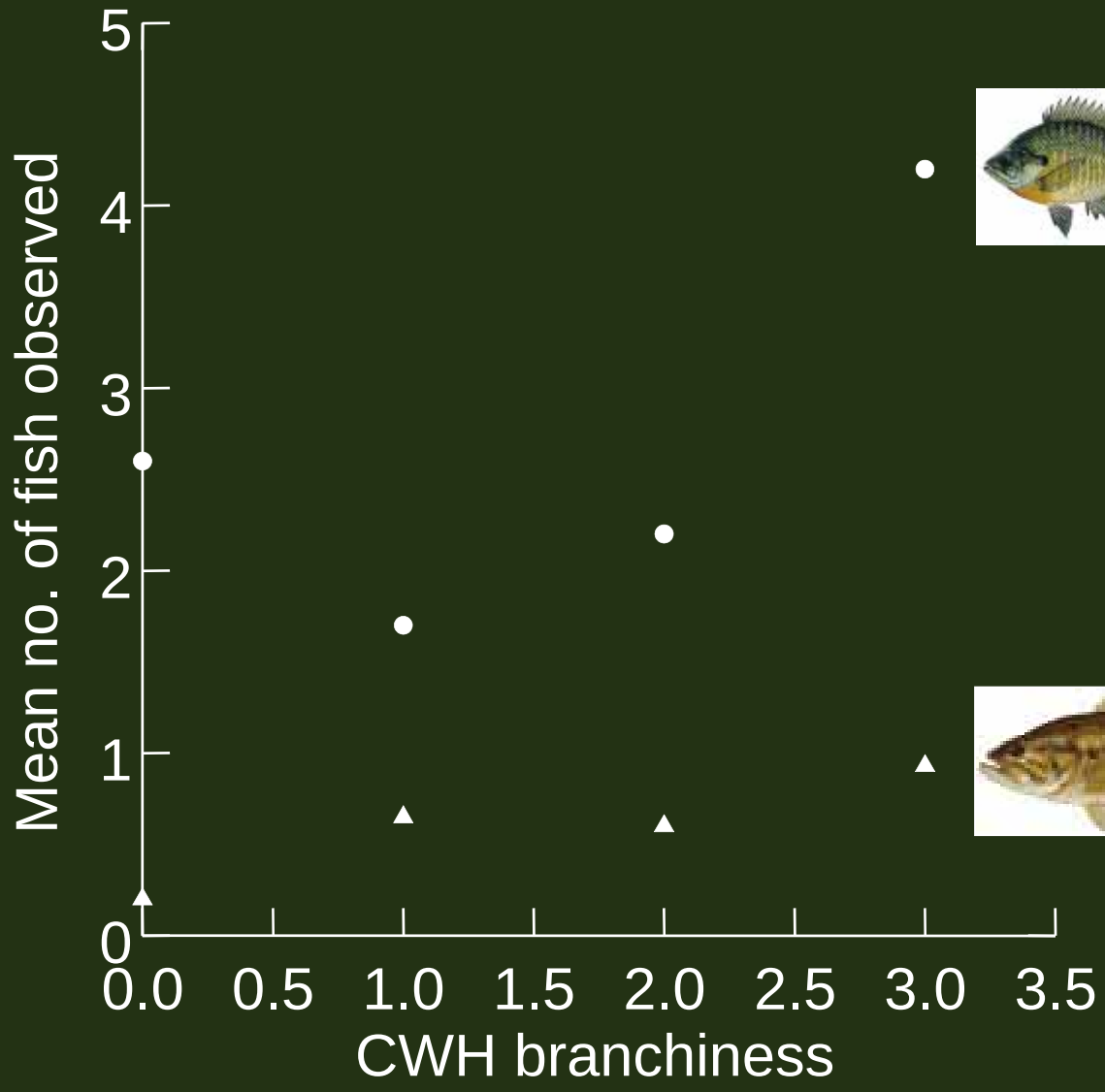


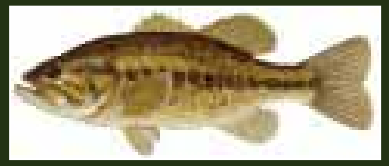
Camp Lake CWH Fish Usage





Camp Lake CWH Fish Usage



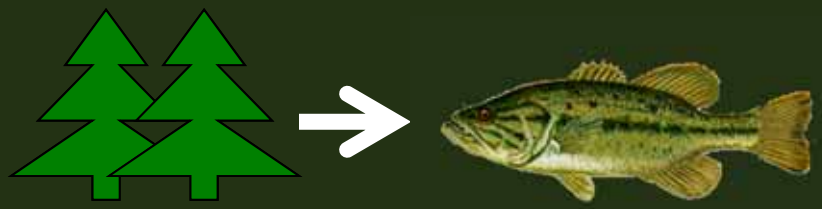


-Greater CWH complexity = greater fish usage

Coarse Woody Habitat and Fishes

KNOWN:

- Many fishes are attracted to CWH (Newbrey et al. 2005, Sass et al. 2012)
- CWH loss can severely deplete forage fishes and depress largemouth bass growth rates (Sass et al. 2006, Gaeta et al. 2014)
- Fish behavioral responses are evident with CWH addition (Sass et al. 2012)
- Lakeshore residential development is negatively correlated with CWH (Christensen et al. 1996)
- A substantial proportion of fish production can derive from terrestrial sources of carbon (Pace et al. 2004)



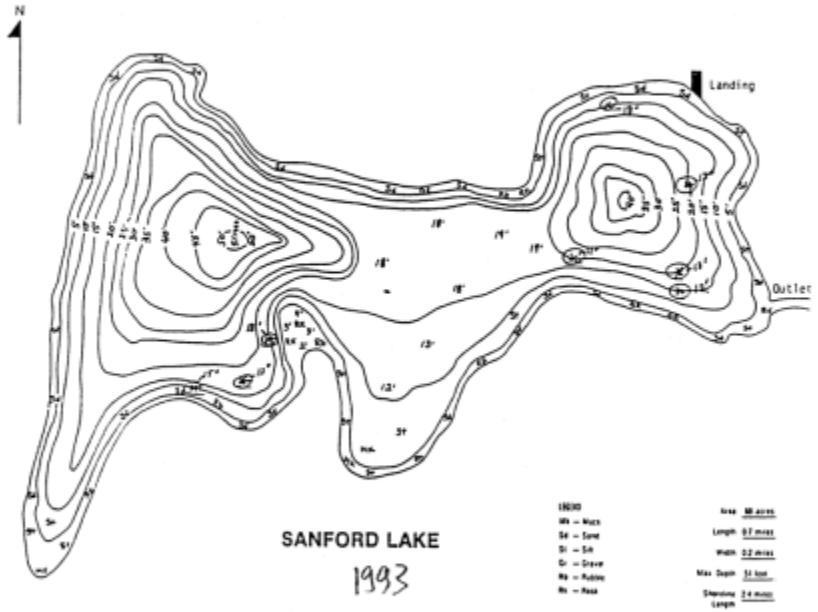
UNKNOWN:

- Does CWH addition simply attract fishes?
- Does CWH addition increase fish production?
- How do fishes respond to CWH addition….

➢ in a more complex fish community
➢ in larger lakes
➢ over extended periods of time (20-25 years)

Sanford Lake - Dairymen's, Inc.

- 88 acres
- Maximum depth of 51 feet
- Undeveloped shoreline



Reference System = Escanaba Lake

Sanford Lake Fish Community

Sanford Lake Study Timeline

Phase I

Pre-manipulation monitoring

Phase II Post-manipulation monitoring

Phase III Post-manipulation monitoring

Post-study monitoring

2015 2018 2023 2028 2033

Phase I Post-manipulation monitoring

Phase II

Phase III

Response Variables

- Fish PE's, growth, condition, diet, production
- Food web structure (stable isotopes)
- Fish nutritional physiology and stress
- CWH habitat use
- Benthic macroinvertebrates
- Zooplankton
- Fish behavior and movements
- Temperature/dissolved oxygen profiles
- Periphyton
- CWH abundances
- Riparian forest characteristics
- Chlorophyll *a*, nutrients
- Submersed aquatic vegetation
- Leaf litter
- Angler harvest/catch rates
- ECOTONE RESPONSES

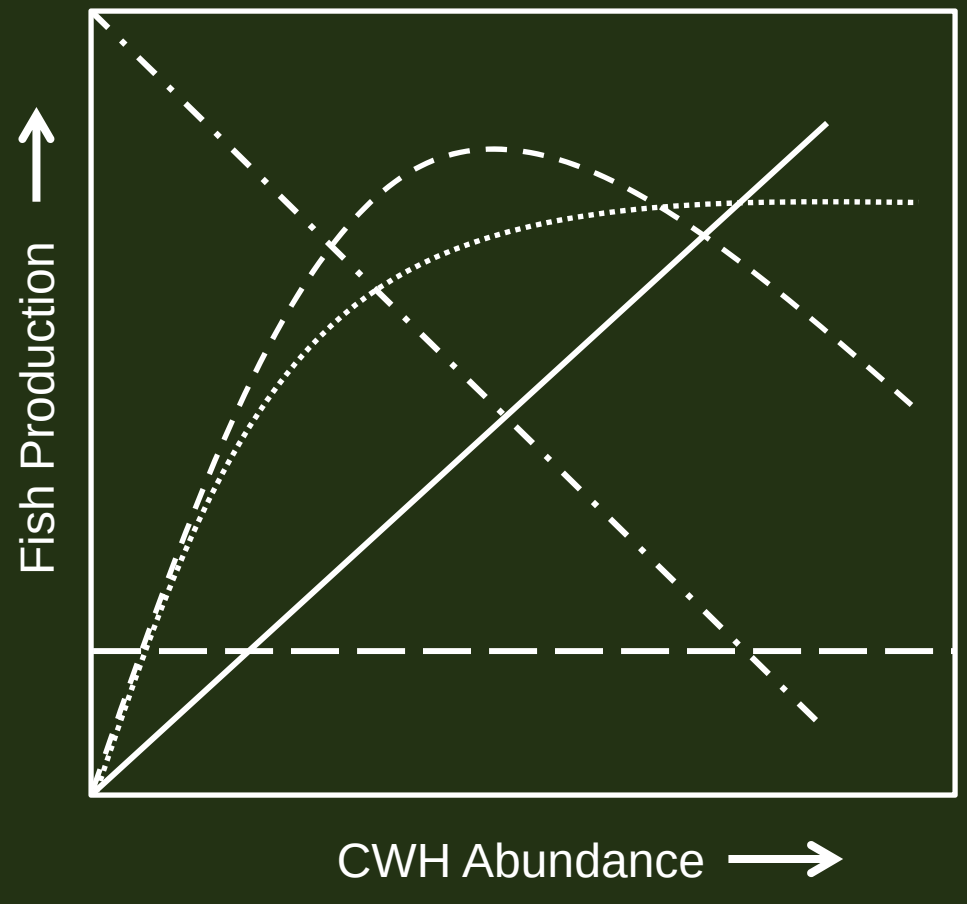
Ecotone Responses

Is energy transferred to terrestial ecosystem?

Tree drops input energy to aquatic ecosystem

Hypotheses

- Tree drops will increase fish production and energy transferred to the adjacent riparian ecosystem



Surprises?


Questions?
Photo by Matt Helmus