Largemouth Bass in Northern Wisconsin: Factors Regulating Recruitment and Potential Dietary Interactions with Walleyes

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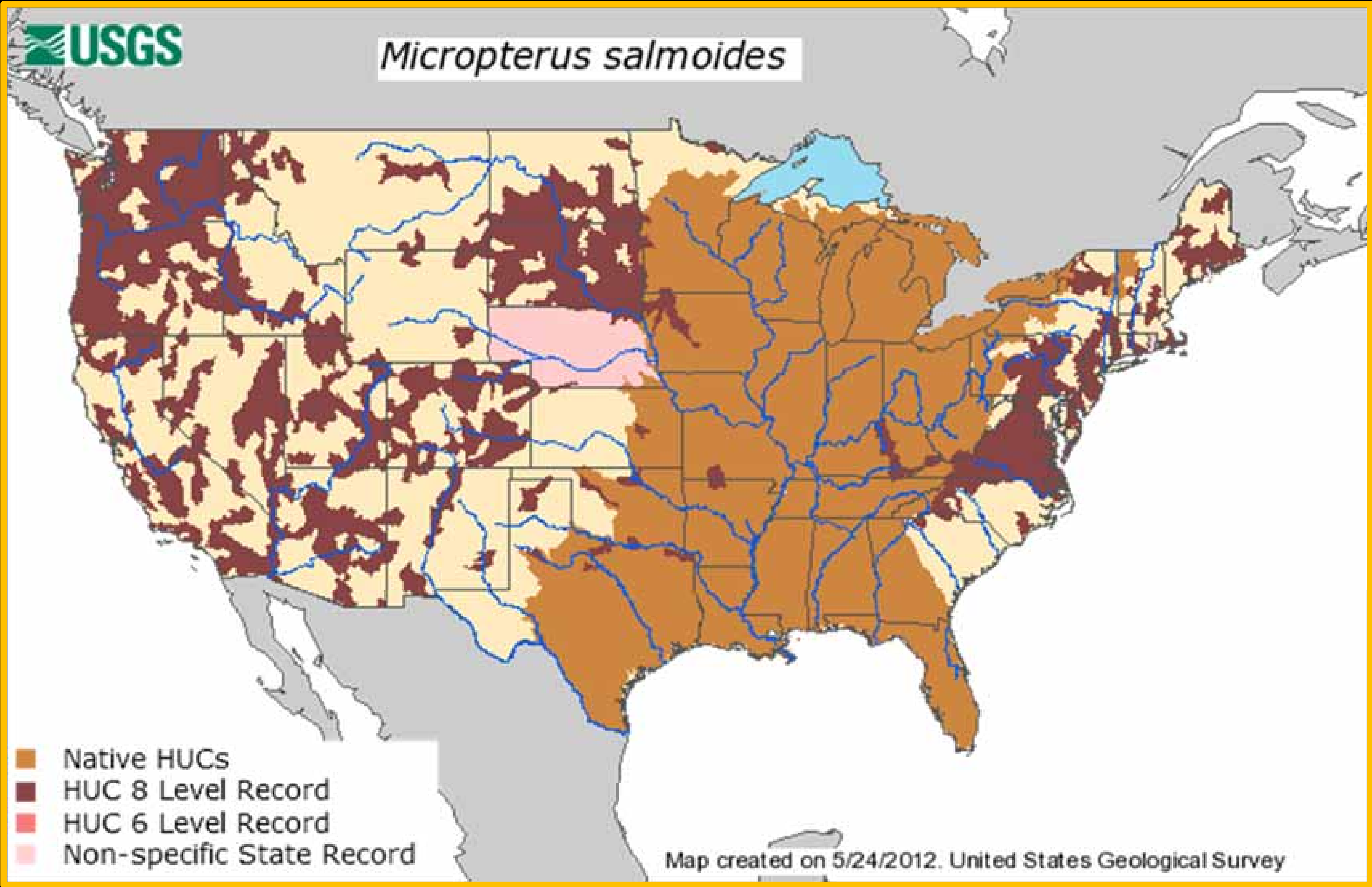
Largemouth Bass (LMB)

Range



Research Problem

- In some lakes, apparent increases in LMB abundance have coincided with perceived and documented declines in walleye (WAE) abundance.

- WDNR has changed harvest regulations and stocking strategies for WAE and LMB.

Management Program

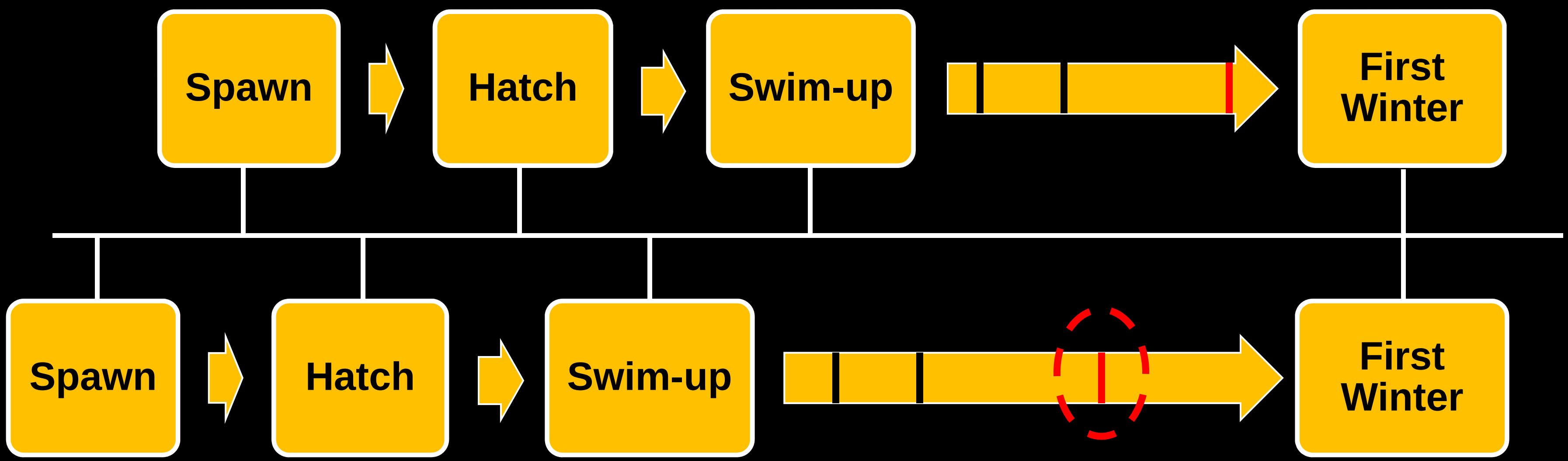
- Reduction in angler harvest of WAE:
  - 18” minimum length limit (up from 14”), daily bag reduction from 5 to 3 fish.
- Maintain adequate WAE spawning stock:
  - Monitor and stock WAE, subject to budget and hatchery capacity restrictions.
- Reduction in LMB populations:
  - Remove the current 14” minimum length limit.

Research Questions

- **Why the increase in LMB abundance?**
  - **Harvest regulations for LMB have generally become more stringent over the last several decades.**
  - **Most anglers voluntarily release LMB.**
  - **Climatic patterns may be more conducive to LMB recruitment (i.e., warmer summers, earlier hatch dates).**

Climate and Early Life History

- What if recent climatic trends allow LMB to hatch earlier and grow faster?



Research Questions

- Why the increase in LMB abundance?
  - Harvest regulations for LMB have generally become more stringent over the last several decades.
  - Most anglers voluntarily release LMB.
  - Climatic patterns may be more conducive to LMB recruitment (i.e., warmer summers, earlier hatch dates).
- What mechanisms could be contributing to interactions between largemouth bass and walleye?
  - Predation
  - Competition

Objectives

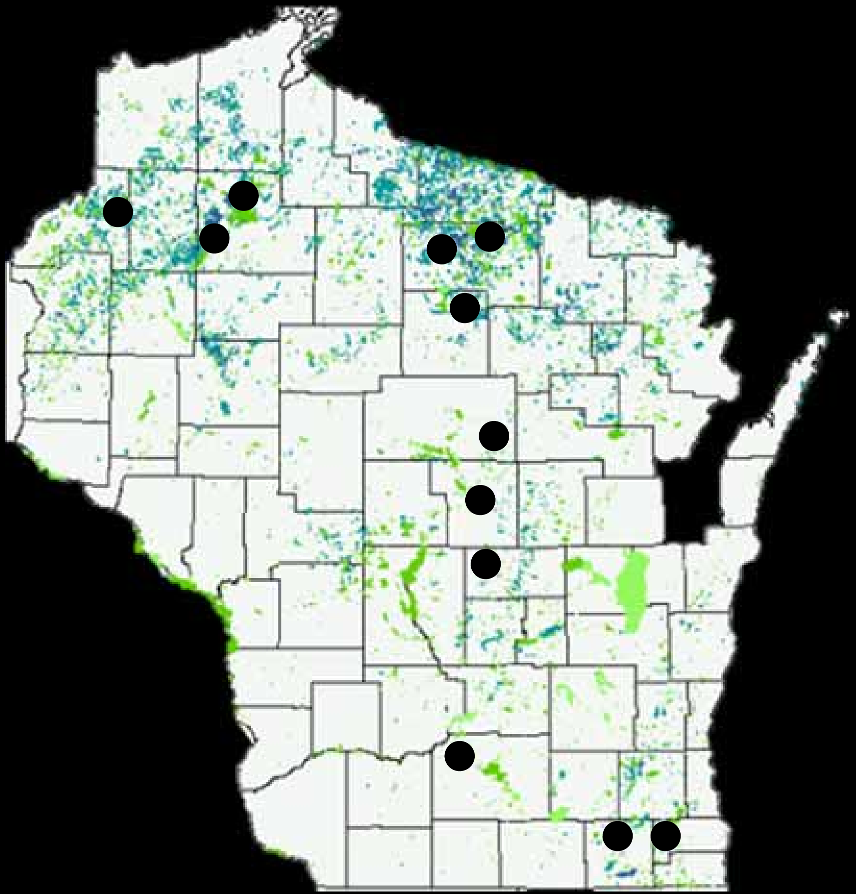
- Determine if hatch timing influences total length and daily growth rate of age-0 LMB.

- Determine if diet overlap and predation occurs between adult WAE and LMB in northern Wisconsin lakes.

Methods

Study Area

- Northern Wisconsin
  - Squaw Lake
  - Big McKenzie Lake
  - Big Sissabagama Lake
  - Muskellunge Lake
  - Minocqua Lake
  - Teal Lake
- Central Wisconsin
  - Pike Lake
  - Sunset Lake
  - Pleasant Lake
- Southern Wisconsin
  - Indian Lake
  - Browns Lake
  - Pleasant Lake



Methods

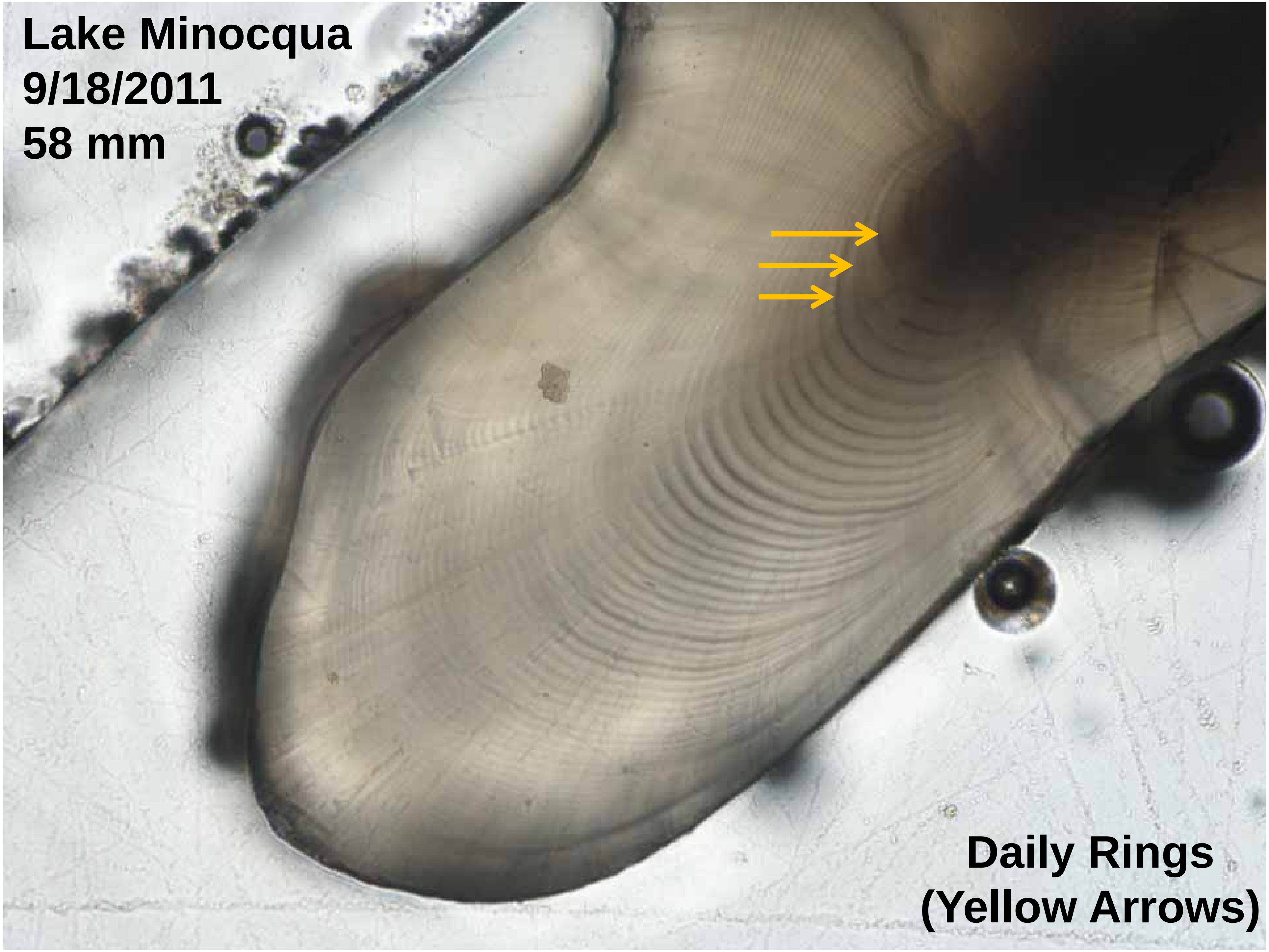
Objective 1 Data Collection

- Age-0 LMB were collected periodically during May-October 2012-2013.
- Age-0 LMB were collected with 40-ft mesh beach seine at randomly selected sites.
- Age-0 LMB are measured (mm) and weighed (0.01g).

Methods

Objective 1 Data Collection

- Sagittal otoliths were removed and secured to a glass slide
- Each otolith was polished using wetted 2,000-grit sandpaper.
- Digital images of otoliths were projected onto a monitor using a compound microscope equipped with a digital camera.


Lake Minocqua
9/18/2011
58 mm
Daily Rings
(Yellow Arrows)

Methods

Hatch Date

- **Hatch Date**
  - **Daily rings of LMB are generally not discernible until swim-up, which occurs approximately 7 days after hatching.**

$$Hatch\ date = d_c - (DRC + 7d)$$

  - d_c **= Day of capture**
  - DRC **= Average daily ring count**

Methods

Growth Rate

- **Daily Growth Rate**
  - **The total length of LMB is approximately 6 mm at swim-up.**

$$DGR = \frac{TL_c - 6\,mm}{DRC}$$

  - DGR **= Daily growth rate**
  - TL_c **= Total length at capture**
  - DRC **= Average daily ring count**

Methods

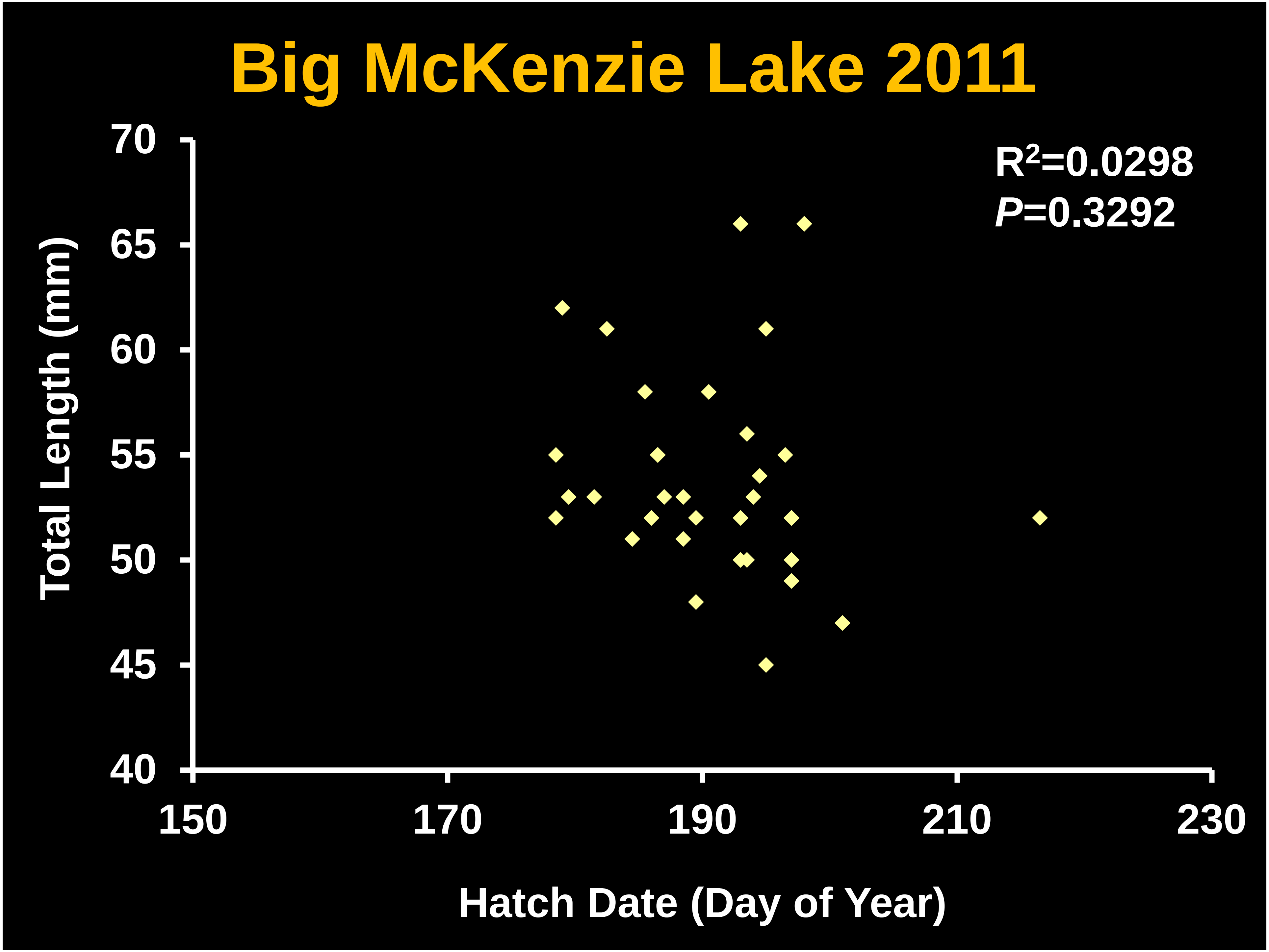
Objective 1 Data Analysis

- Influence of hatch timing on total length and growth rate of age-0 LMB.

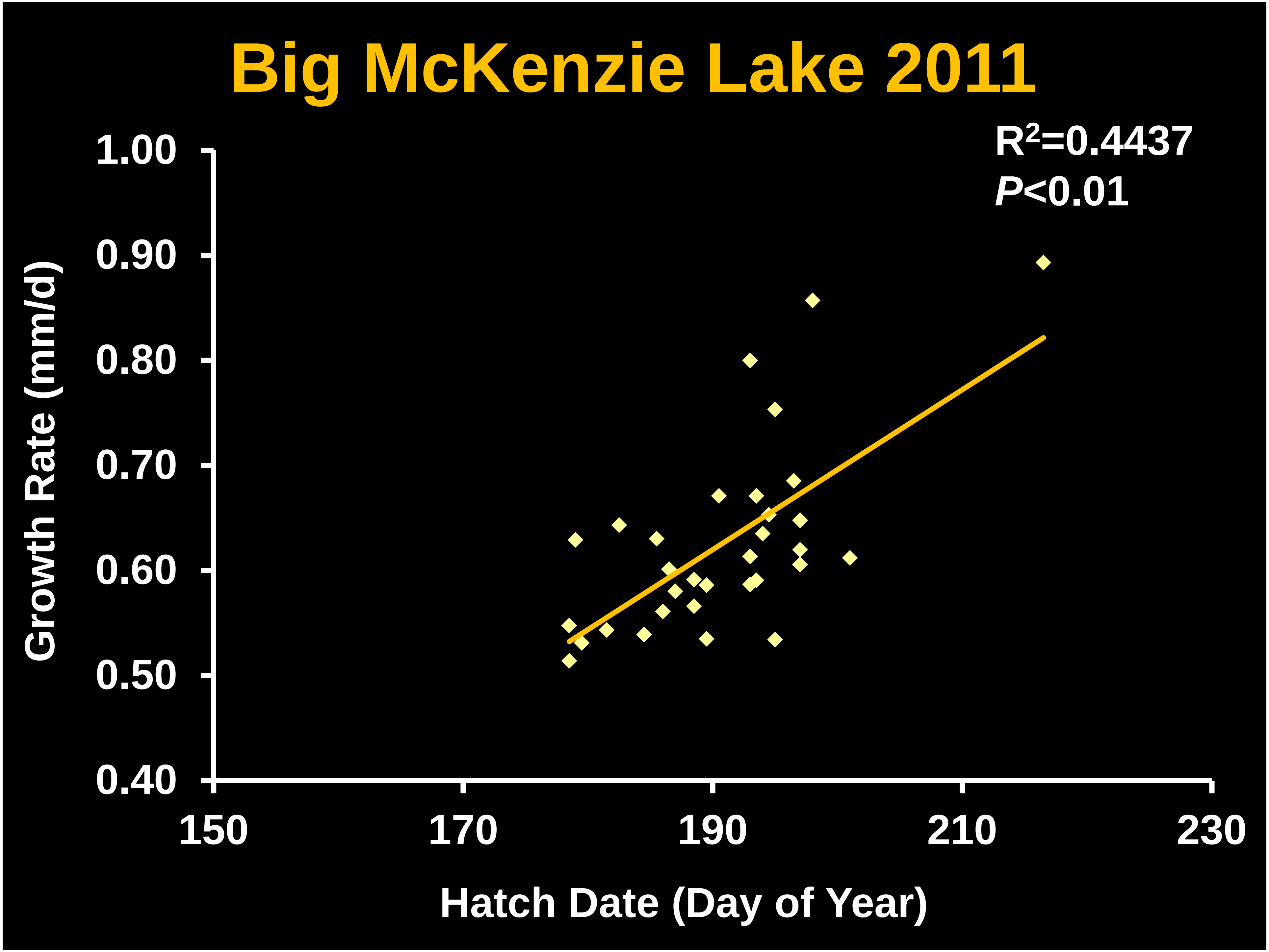
- Linear regression in the form of:

$$Total\ Length = a + b(Hatch\ Date)$$

$$Growth\ Rate = a + b(Hatch\ Date)$$



Big McKenzie Lake 2011
R2=0.0298
P=0.3292
Total Length (mm)
70
65
60
55
50
45
40
150
170
190
210
230
Hatch Date (Day of Year)


Big McKenzie Lake 2011
R2=0.4437
P<0.01
Growth Rate (mm/d)
1.00
0.90
0.80
0.70
0.60
0.50
0.40
150
170
190
210
230
Hatch Date (Day of Year)

Methods

Objective 2 Data Collection

- Adult LMB and WAE were collected at two week intervals during May-October 2012.

- AC boat electrofishing was used at randomly selected sites.

- Diet items were removed by gastric lavage.

  - Big Sissabagama Lake
    - LMB (n=289) WAE (n=76)

  - Teal Lake
    - LMB (n=120) WAE (n=153)

Methods

Objective 2 Data Collection

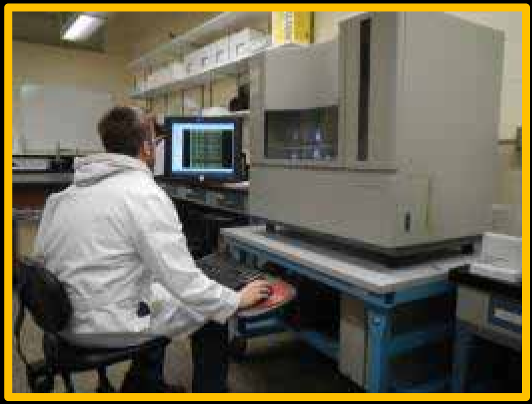
- All diet items were identified to order for invertebrates and to genus for identifiable fish.

- Prey items in each sample were separated into individual taxonomic groups, enumerated, and wet weighed to the nearest 0.01 g.

Methods

Objective 2 Data Collection

- **DNA Barcoding:**
  - **Whole genomic DNA extracted.**
  - **Cytochrome oxidase I gene amplified and sequenced.**
  - **Query national database (NCBI nr database) to determine the likely source species.**



Methods

Diet Overlap

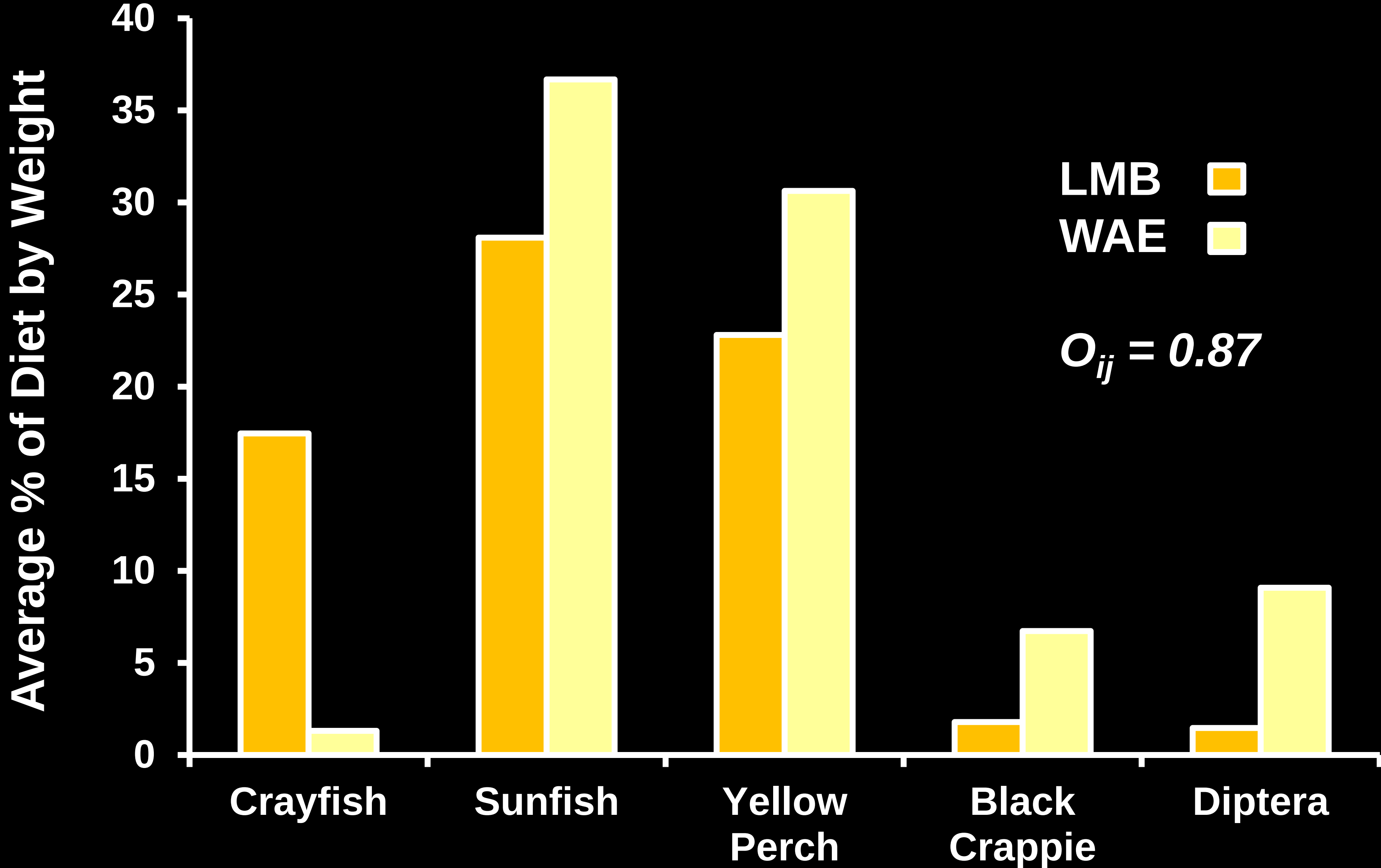
- **Diet overlap:**
  - **Diets of LMB and WAE were summarized as an average proportion by wet weight.**
  - **Pianka's index of niche overlap.**

$$O_{ij} = \frac{\sum_i^n p_{ij} p_{ik}}{\sqrt{\sum_i^n (p_{ij})^2 \sum_i^n (p_{ik})^2}}$$

  - p_{ij}**= Proportion of diet item** i **in LMB**
  - p_{ik}**= Proportion of diet item** i **in WAE**

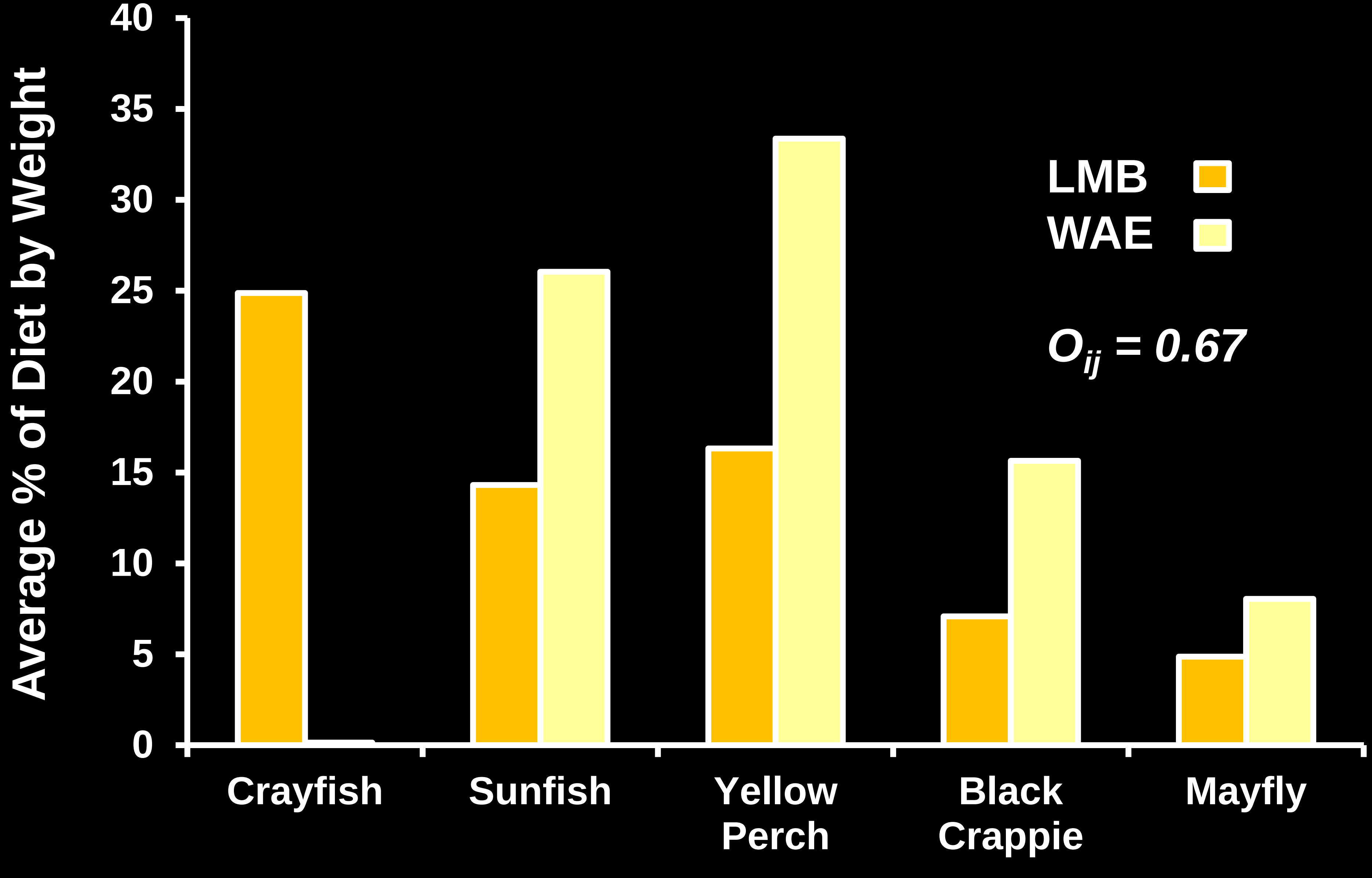
Results

Diet Overlap Big Sissabagama Lake



Results

Diet Overlap Teal Lake



Management Implications

- If LMB abundance is largely determined by environmental variables:
  - Changes to harvest regulations and stocking strategies may not reduce LMB abundance.

- If LMB negatively interact with WAE:
  - Walleye stocking strategies may need adjustment in order to reflect their relationship with LMB.

- New options for management would be available:
  - – Removal of bass may be a viable option.