EVALUATION OF GROWTH AND SURVIVAL OF DIFFERENT GENETIC STOCKS OF MUSKELLUNGE

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PRESENTATION OVERVIEW

- Background and Study Design
- Results of “Project Green Gene”
  - Job 1: Growth Comparison
  - Job 2: Survival Comparisons
  - Job 3: Muskellunge Diet and Lake Impacts

Muskellunge Stocking

- Muskellunge are a popular predatory sportfish that reach great size
- In Illinois all Muskellunge (Musky) are likely a product of stocking
- Stocking source is an important consideration to maximize size and survival
- Several studies have compared populations within a stock (Younk and Strand 1992, Margenau and Hanson 1997)

BACKGROUND
LATITUDINAL VARIATION

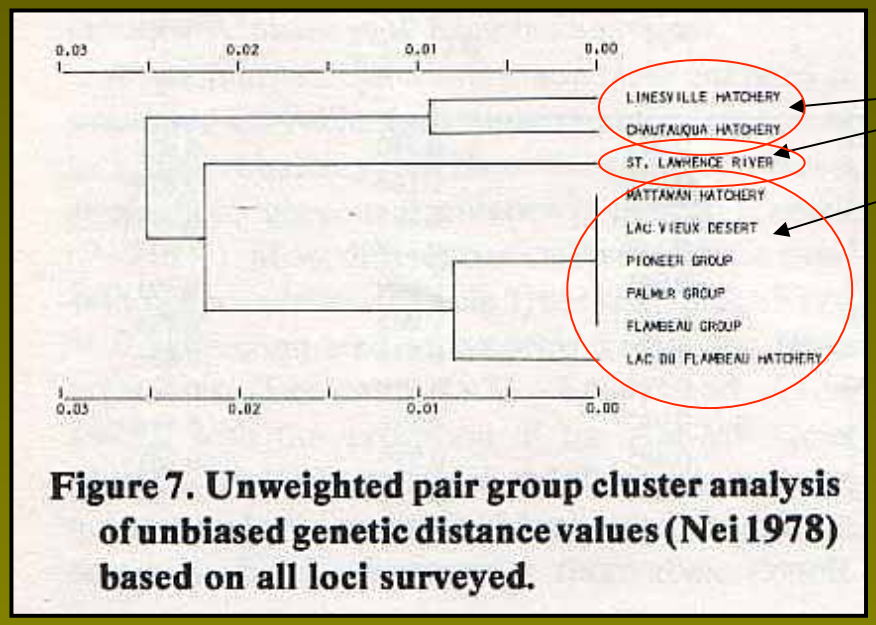
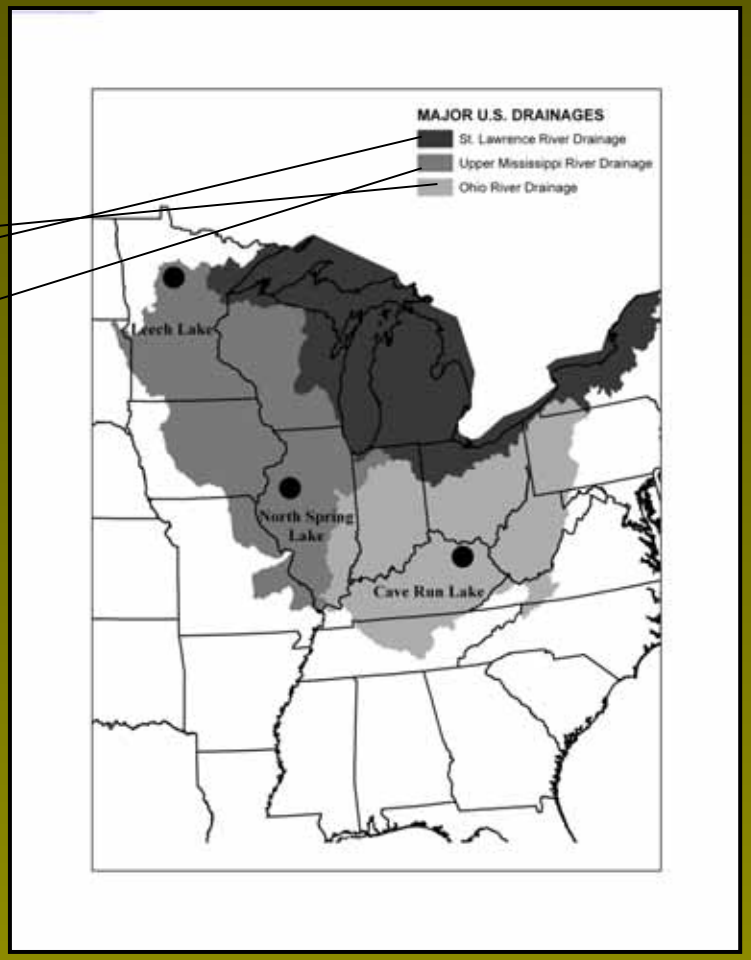


Figure 7. Unweighted pair group cluster analysis of unbiased genetic distance values (Nei 1978) based on all loci surveyed.

Koppelman and Phillipp 1986



MUSKELLUNGE SOURCE POPULATIONS

Population (abbreviation)	Source Water	Drainage (stock)	Latitude (north)	Mean Annual Air Temp (F)
Kentucky (KY)	Cave Run Lake	Ohio River	37° 35'	55.2
Ohio (OH)	Clear Fork Lake	Ohio River	39° 30'	49.6
Pennsylvania (PA)	Pymatuning Reservoir	Ohio River	41° 30'	47.4
New York (NY)	Lake Chautauqua	Ohio River	42° 07'	49.4
Wisconsin (WI)	Minocqua Chain	Upper Miss. River	45° 30'	39.3
Minnesota (MN)	Leech Lake	Upper Miss. River	46° 35'	39.9
Illinois (IL)	North Spring Lake	*	40° 40'	50.7

THEORETICAL PREDICTIONS

Thermal Adaptation

- Growth rates are adapted to the local thermal regime.
- Physiological processes tuned to this regime
- Supported by studies of inverts, crustaceans and fish (including walleye)

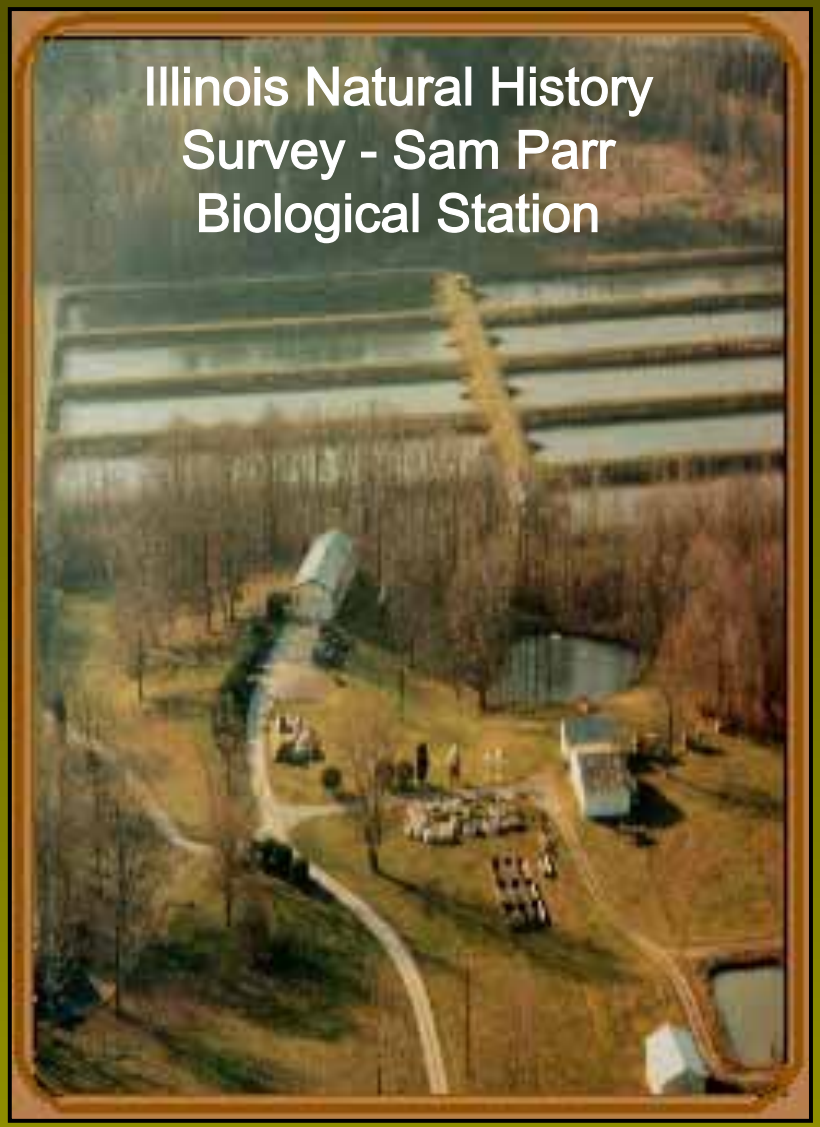
(Galarowicz and Wahl 2003)

Countergradient Variation

- High growth rates selected for by short growing season.
- Higher energetic reserves lead to higher overwinter survival.
- Supported by numerous studies in fish.

(Conover and Present 1990, Shulze et al. 1996 and others)

POND EXPERIMENT



POND #1	POND #2	POND #3
MISS = 33	MISS = 33	MISS = 33
OH = 33	OH = 33	OH = 33
IL = 33	IL = 33	IL = 33

- Initiated in the fall, three trials
- Drained subsequent spring and fall
- Forage provided

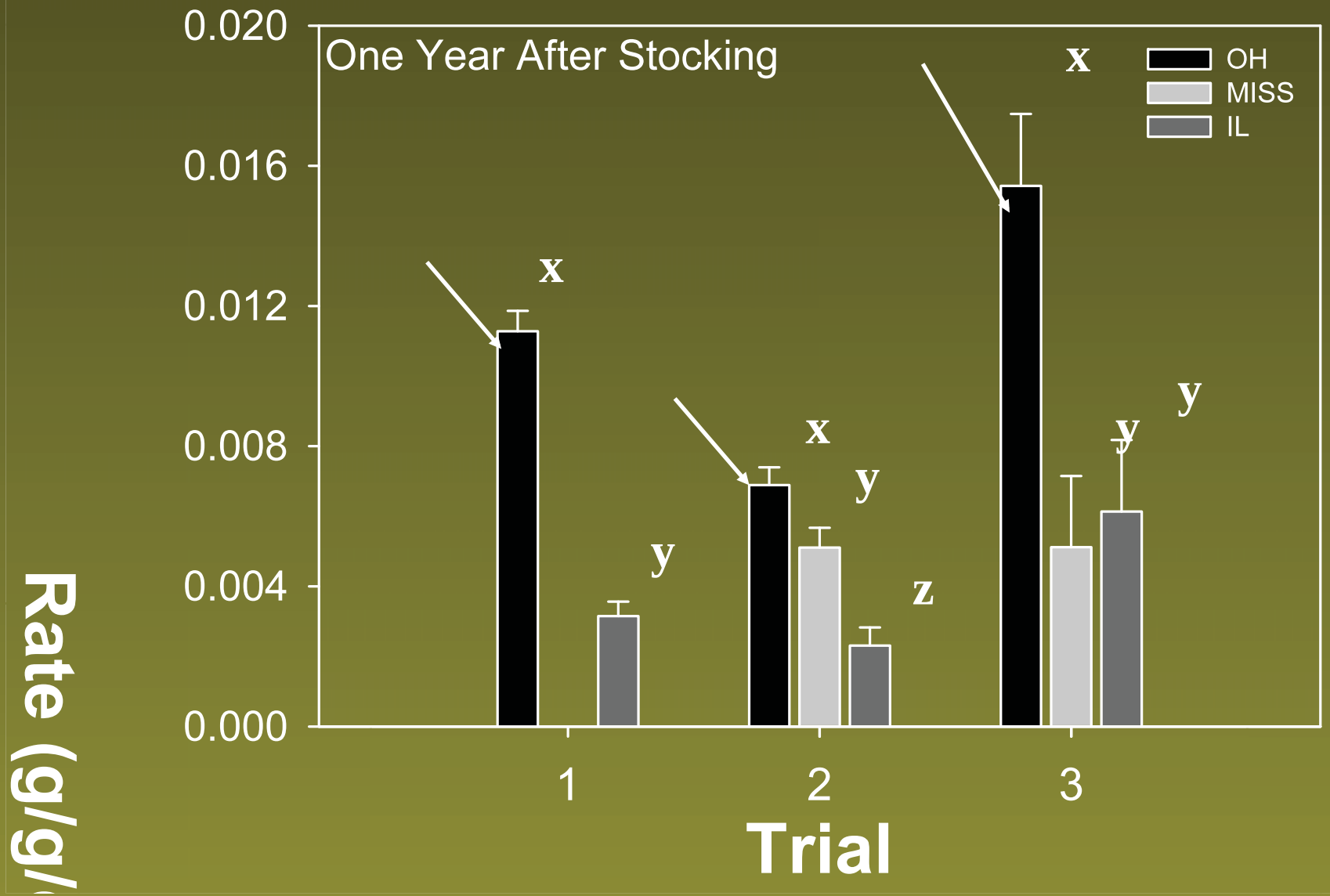
RESERVOIR EXPERIMENT

- **Pierce Lake**
  - Mean Annual Air Temperature = 48 F
  - 147 Acres
- **Mingo Lake**
  - Mean Annual Air Temperature = 52 F
  - 176 Acres
- **Sam Dale Lake**
  - Mean Annual Air Temperature = 55 F
  - 194 Acres

RESERVOIR EXPERIMENT

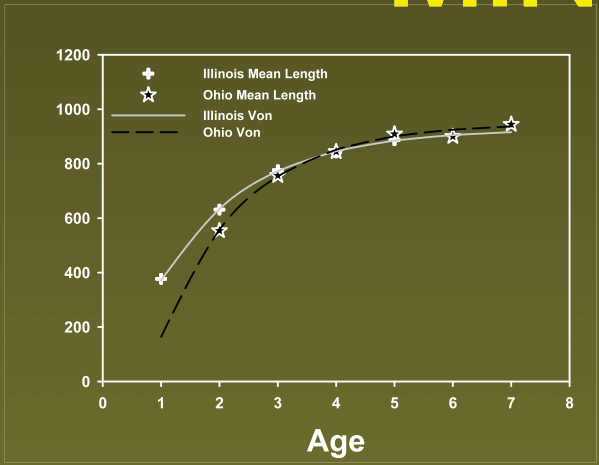
GROWTH COMPARISON (JOB 1)

POND EXPERIMENT

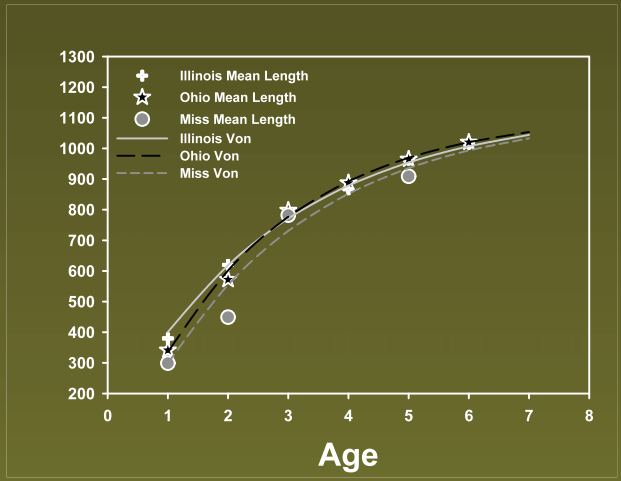


ANOVA, p ≤ 0.05

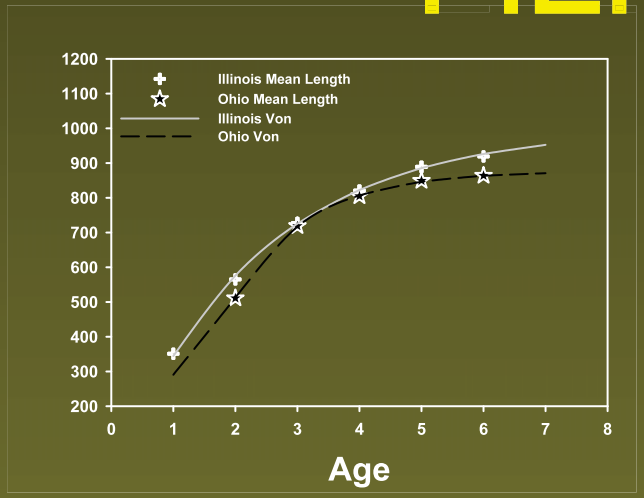
MINGO MALES


1200
1000
800
600
400
200
0
0
1
2
3
4
5
6
7
8
Illinois Mean Length
Ohio Mean Length
Illinois Von
Ohio Von
Age

MINGO FEMALES

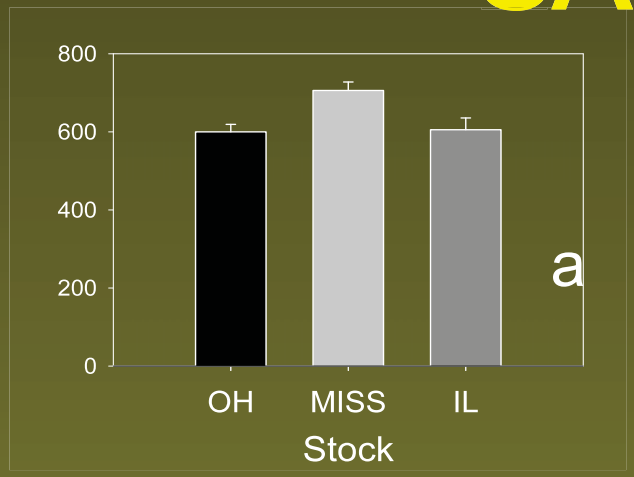


PIERCE MALES



PIERCE FEMALES

SAM DALE

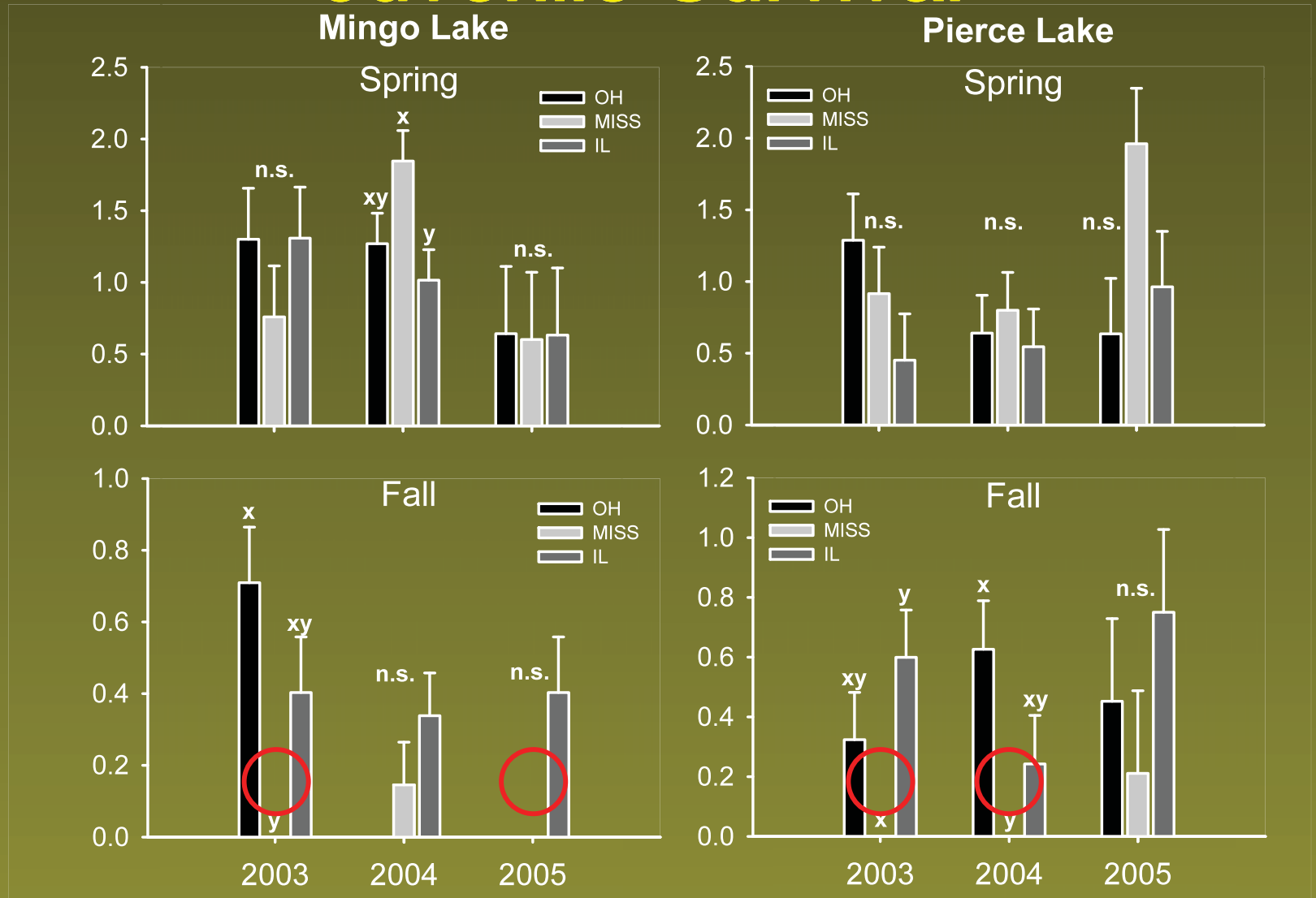


SURVIVAL (JOB 2)

POND EXPERIMENT

Logistic ANOVA, p ≤ 0.05

RESERVOIR EXPERIMENT- Juvenile Survival



ANOVA, $p \leq 0.05$

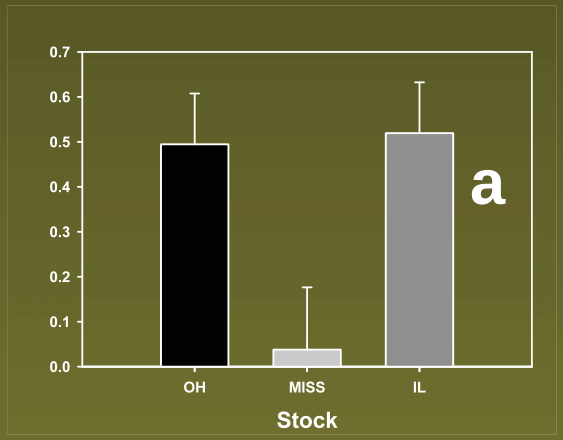
ADULT SURVIVAL

- Trap Net Data (Mingo/Pierce)
  - Spring
  - 2007-2009
- Electrofishing Data (Sam Dale)
  - Spring/Fall 2009

SPRING 2009 NETTING

- Mingo Lake
  - 63 fish, 84 net nights = 0.83 fish/net/night
  - 52 IL, 11 OH, 0 MISS
- Pierce Lake
  - 74 fish, 44 net nights = 1.7 fish/net/night
  - 53 IL, 21 OH, 0 MISS

MINGO LAKE SURVIVAL TO ADULTHOOD (Age-3)

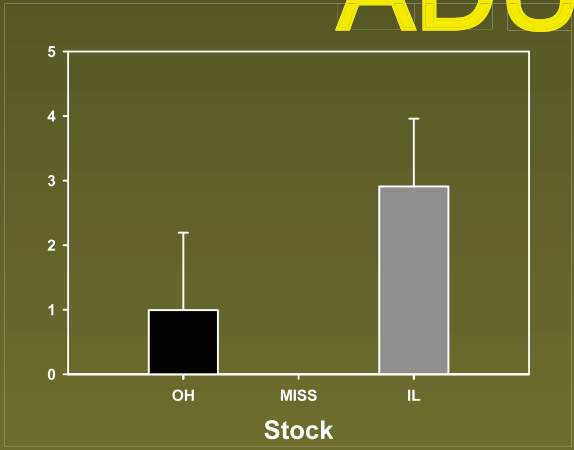


a

b

ANOVA, $p \leq 0.05$

PIERCE LAKE SURVIVAL TO ADULTHOOD



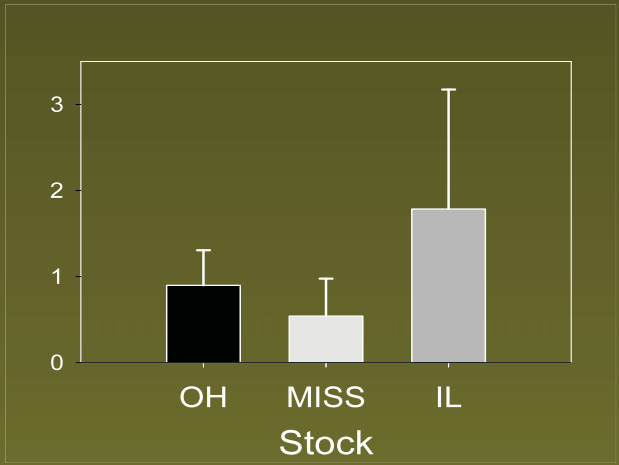
a

a

0

ANOVA, p ≤ 0.05

Sam Dale Lake- Age 1+

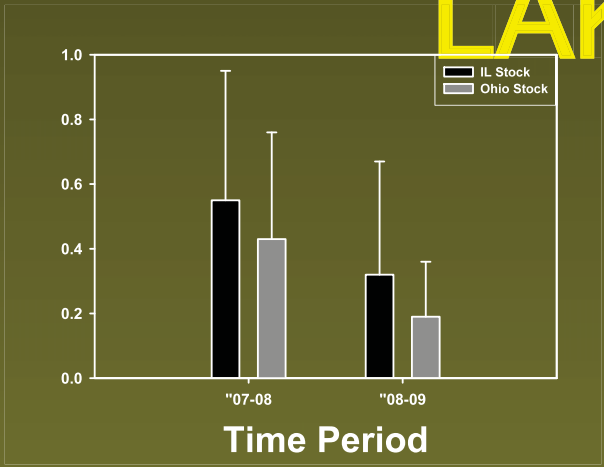


a

a

a

ADULT ANNUAL SURVIVAL LAKE MINGO



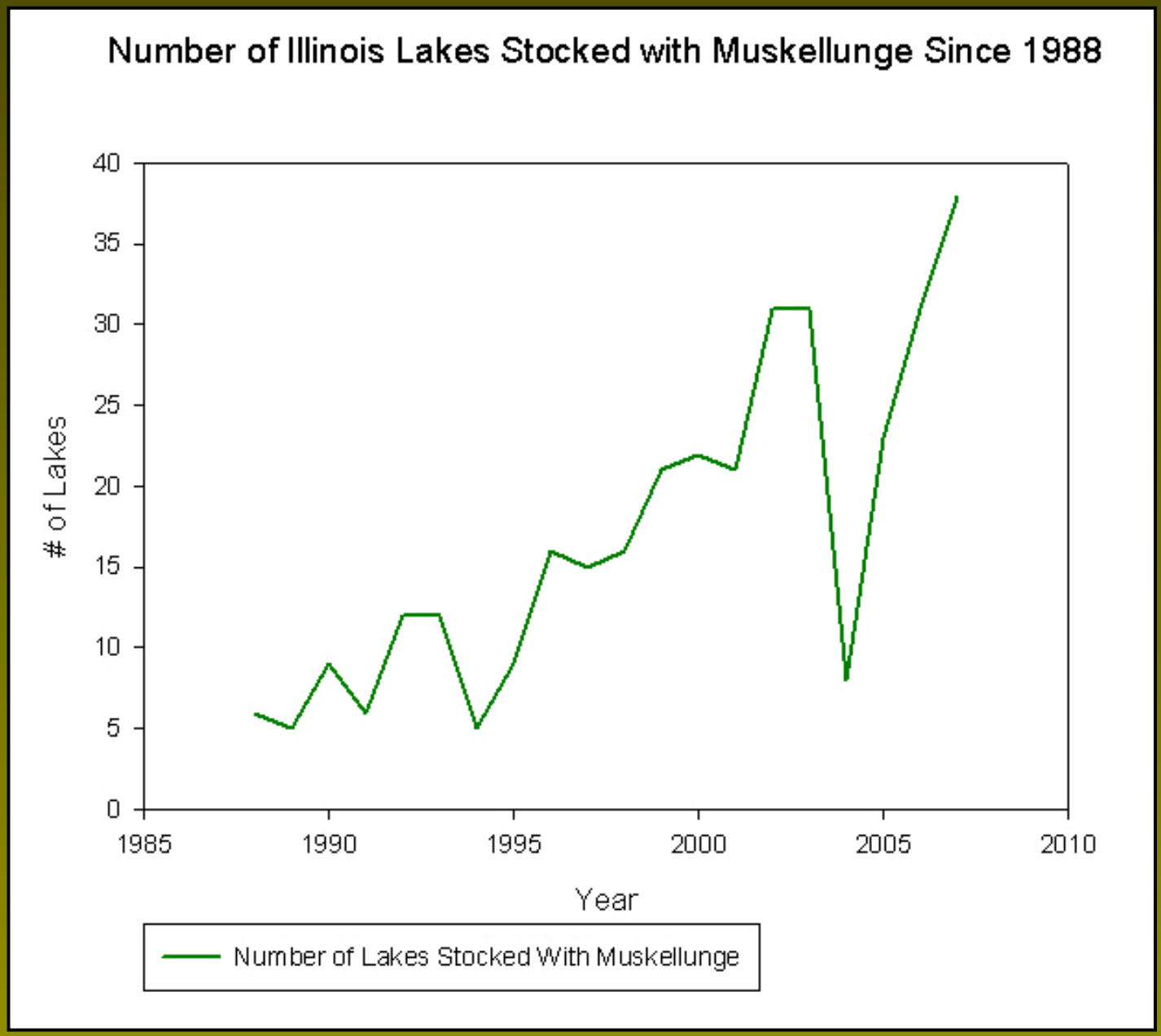
GROWTH AND SURVIVAL SUMMARY

- GROWTH
  - POND
    - OH>IL=MISS
  - RESERVOIR
    - Mingo OH=IL MISS?
    - Pierce IL>OH MISS?
    - Sam Dale MISS>OH=IL (tentatively)
- SURVIVAL
  - POND
    OH=IL>MISS
  - RESERVOIR
    OH=IL>MISS

MUSKIE IMPACTS (JOB 3)

- Groups of concerned anglers
  - "MUSKIE ARE EATING ALL THE BASS!"
  - "I KNOW THEY EAT THE CRAPPIE!"
- Limited prior research
  - Single lakes
  - Anecdotal evidence
    - No controls

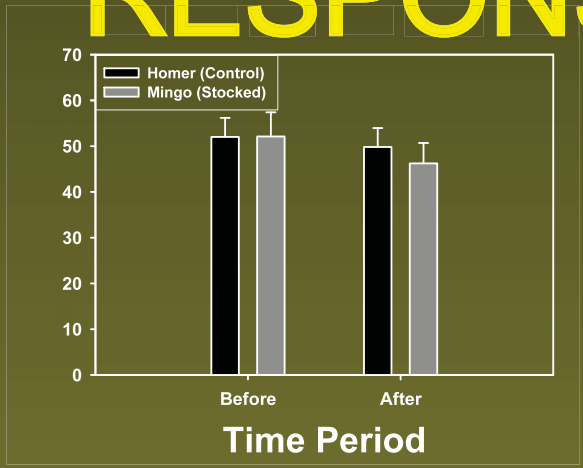
http://www.fishingfury.com/wp-content/uploads/2009/06/muskie_jaw.jpg


Number of Illinois Lakes Stocked with Muskellunge Since 1988
# of Lakes
0
5
10
15
20
25
30
35
40
1985
1990
1995
2000
2005
2010
Year
Number of Lakes Stocked With Muskellunge

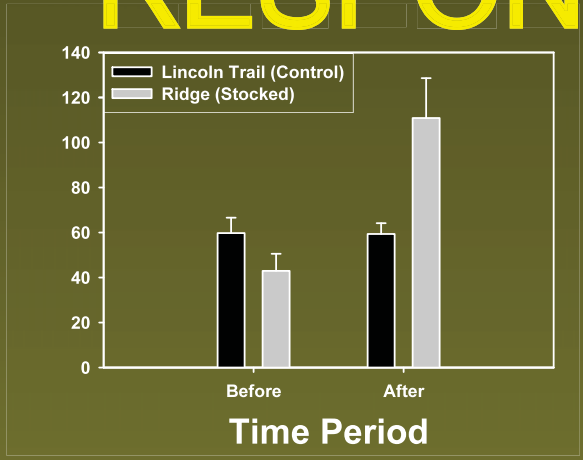
EFFECTS OF MUSKIE STOCKING

- Long term community data
  - Muskie Introductions
    - Lake Mingo
    - Ridge Lake
    - FAS Lakes
  - Control lakes
- Look for changes in stocked lakes
  - Largemouth bass, panfish – CPUE, Size
- Look at diet composition

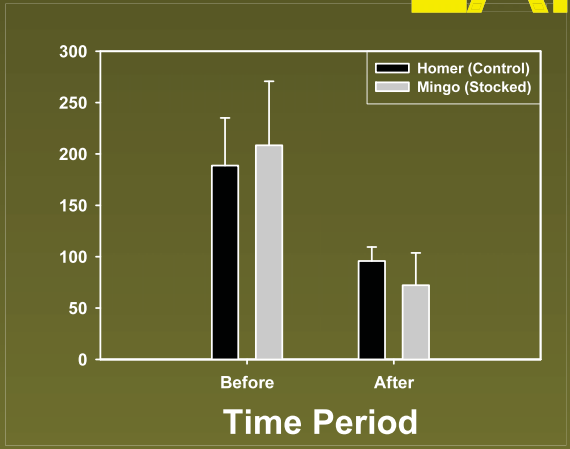
LARGEMOUTH BASS RESPONSE LAKE MINGO



LARGEMOUTH BASS RESPONSE RIDGE LAKE



BLUEGILL RESPONSE LAKE MINGO

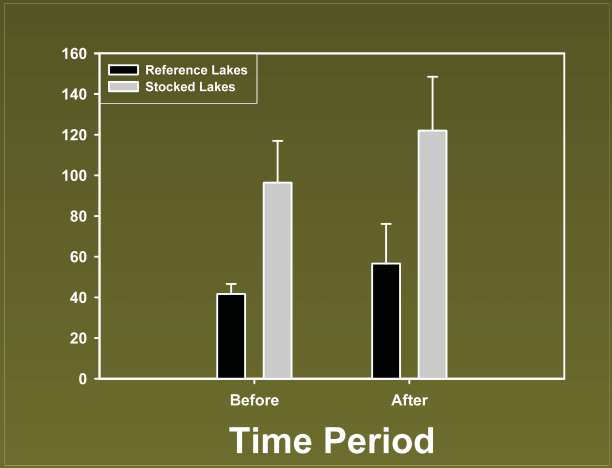


BLUEGILL RESPONSE RIDGE LAKE

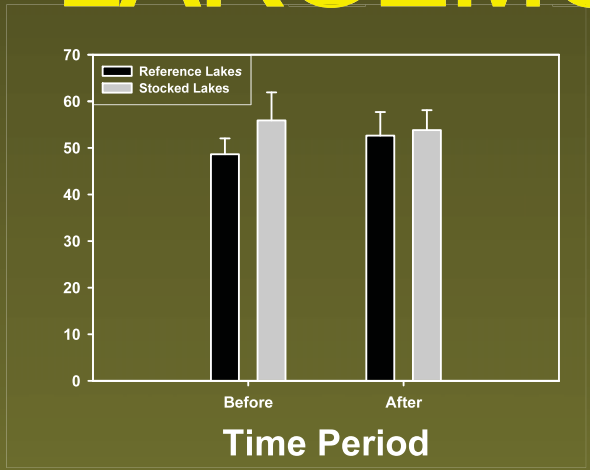
FAS (Fishery Analysis System)

- Stocked lakes
  - Mill Creek
  - Shovel Lake (Banner)
  - Staunton city
- Control lakes
  - Bloomington
  - Leaquana
- 8 years
  - 4 before
  - 4 after
- Largemouth bass

LARGEMOUTH BASS CPUE



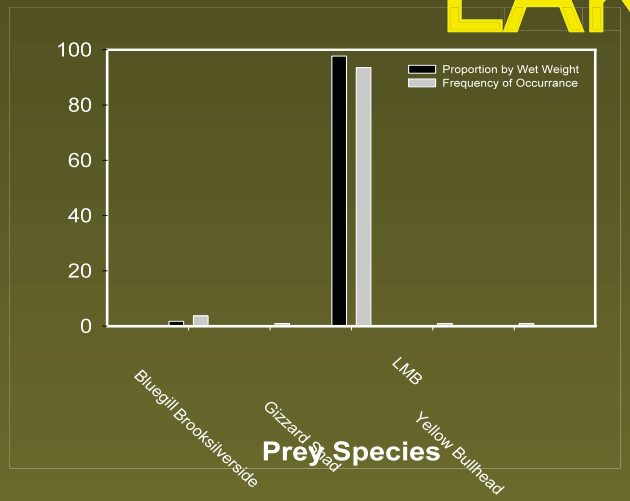
LARGEMOUTH BASS SIZE



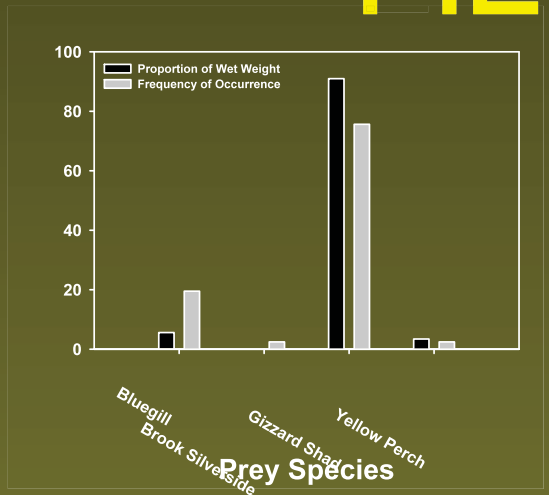
DIET COLLECTION

- Collecting diet data from age 0+ fish
- 5 lakes with diverse prey assemblages
- Nonlethal gastric lavage technique

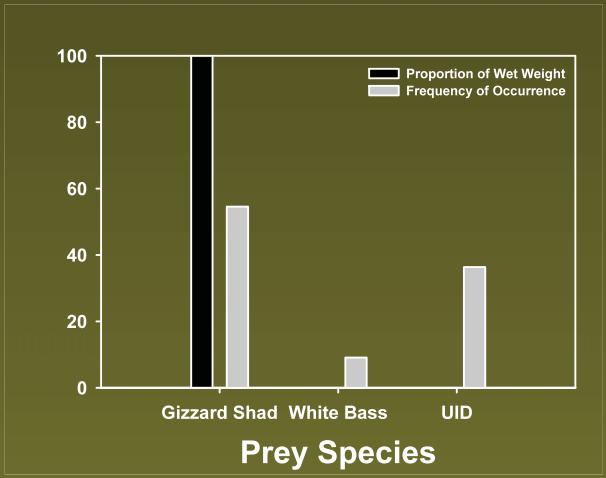
LAKE MINGO


100
80
60
40
20
0
Proportion by Wet Weight
Frequency of Occurrance
Bluegill
Brooksilverside
Gizzard Shad
LMB
Yellow Bullhead
Prey Species

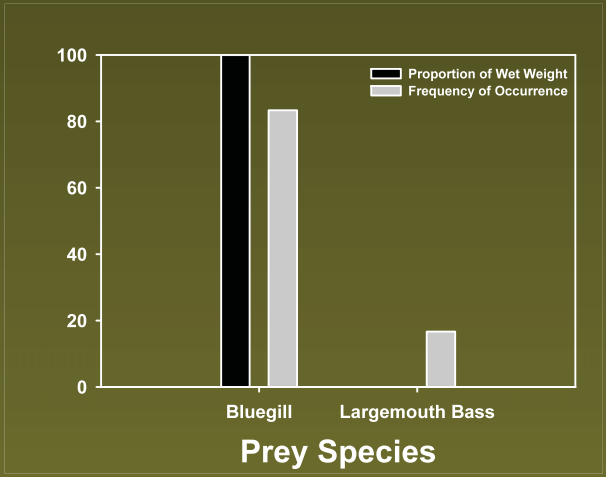
PIERCE LAKE


100
80
60
40
20
0
Proportion of Wet Weight
Frequency of Occurrence
Bluegill
Brook Silverside
Gizzard Shad
Yellow Perch
Prey Species

LAKE SHELBYVILLE



RIDGE LAKE


100
80
60
40
20
0
Proportion of Wet Weight
Frequency of Occurrence
Bluegill
Largemouth Bass
Prey Species

MUSKIE IMPACTS SUMMARY

- Fishery Effects
  - No impacts on LMB
    - Mingo, Ridge, Mill Creek, Shovel, Staunton City
  - No impacts on BLG
    - Mingo , Ridge
  - Further Analysis Needed
- Diet Composition
  - Shad dominate when available > 85%
  - Bluegill dominate when shad unavailable
  - Very little predation on game species
    - LMB
    - BLG
    - YEP
    - BK/WH CRAPPIE

Future Directions

- Chronic thermal maxima between stocks
- Physiological response to heat shock
- Stock-specific bioenergetic model

QUESTIONS?