

# Spawning stock characteristics, egg deposition and post emergent survival in the lake sturgeon (*Acipenser fulvescens*): The relative importance of potential barriers to recruitment

Patrick S. Forsythe, Kim T. Scribner, Kristin Bott, Kregg Smith and Ed Baker



# Lake Sturgeon: Population Decline

## Two Facts:

Populations have declined  
No Recovery

## One Potential Reason:

Recruitment may be too low to  
rebuild existing populations

Year	Larvae Captured
2000	780
2001	2975
2002	1691
2003	16,417
2004	437

## Basic Research Needs

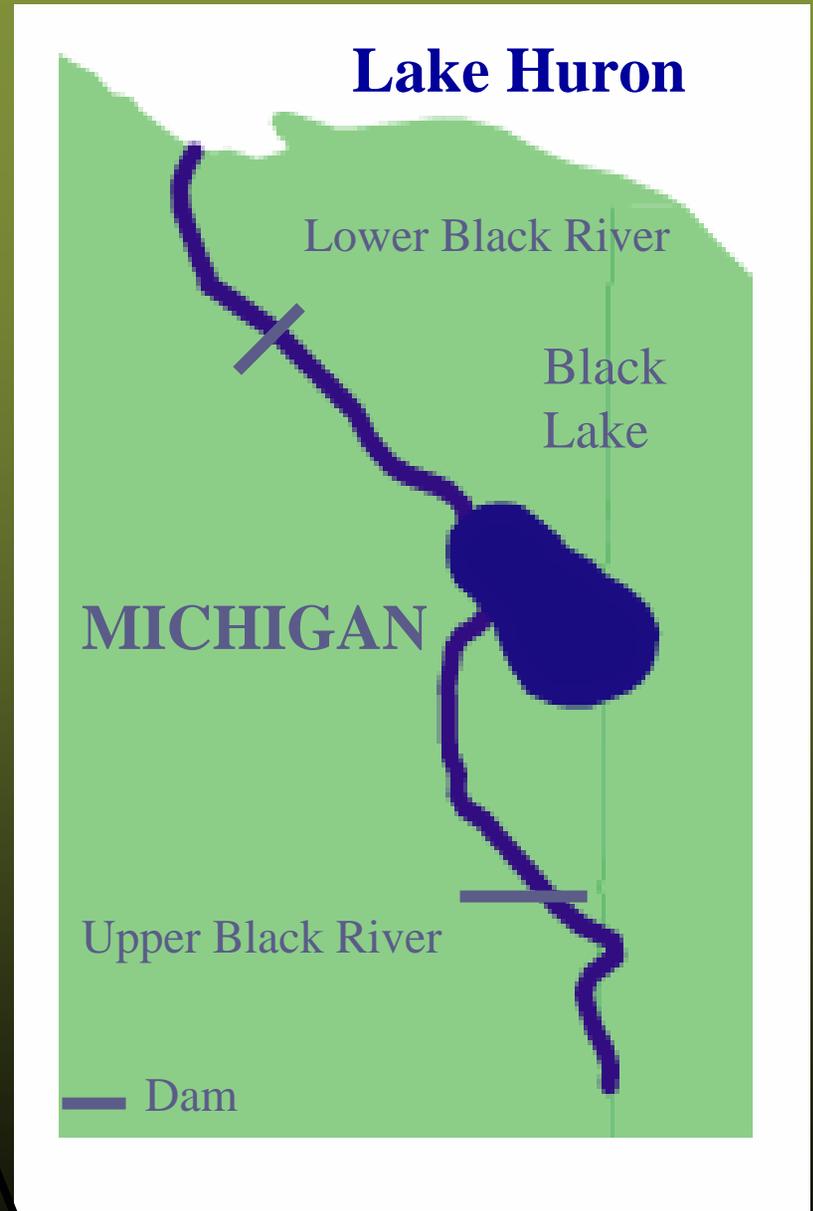
1. Need information about the aspects of the species' early life history and reproductive ecology
2. Need information on factors that are potential barriers to lake sturgeon reproductive success

# Research Objectives

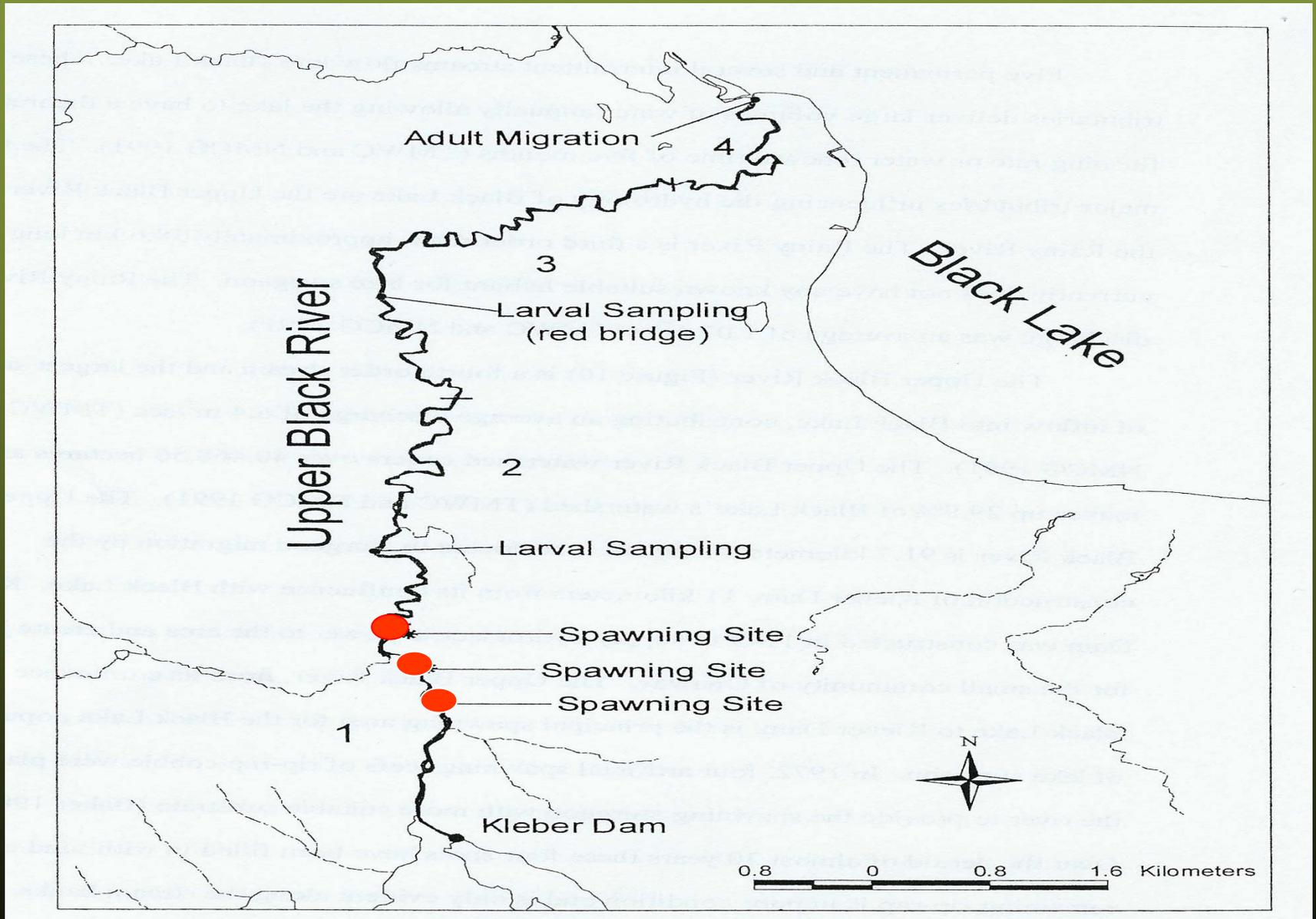
1. Determine the importance of annual spawning stock abundance, size and age structure, and sex ratios to reproductive success
2. Estimate fertilization rates as a function of spawner number and sex ratios
3. Determine sources and magnitude of egg predation
4. Determine factors that influence larval survival during drift



# Unique Study Site -Black Lake, MI



# Unique Study Site – Upper Black River



# Decomposing a Complicated Life History



## Stage 5 : Adults

Recruitment

Growth rates

Population estimates

Survivorship

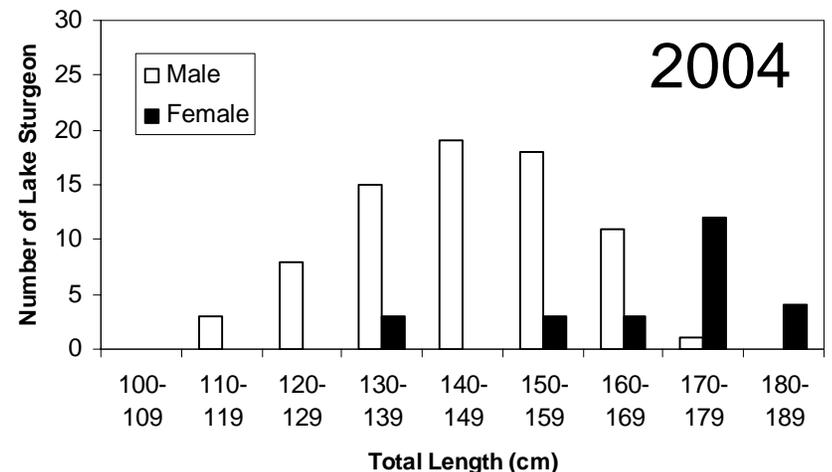
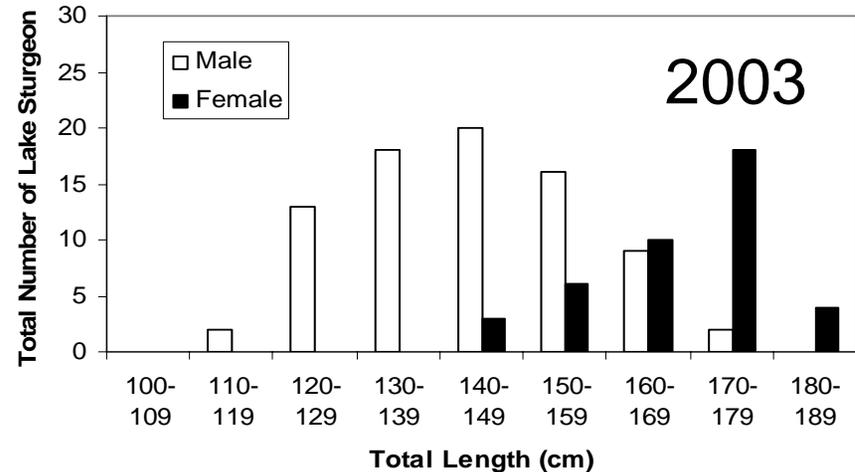
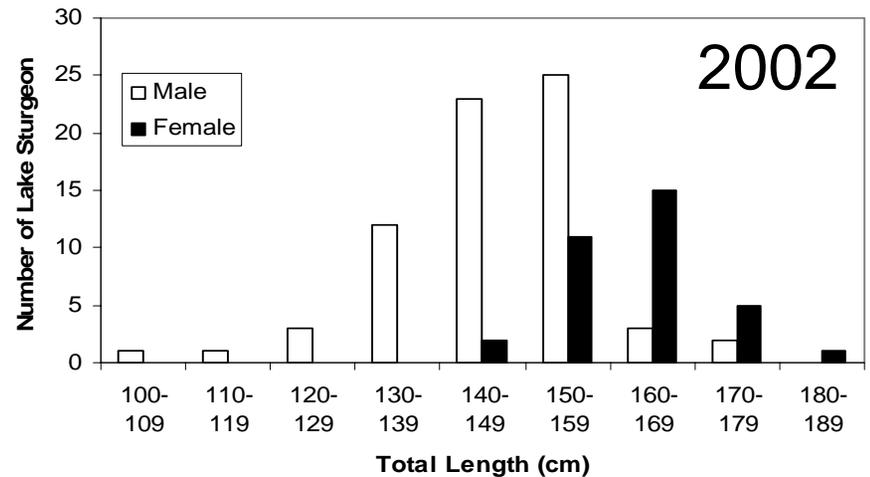
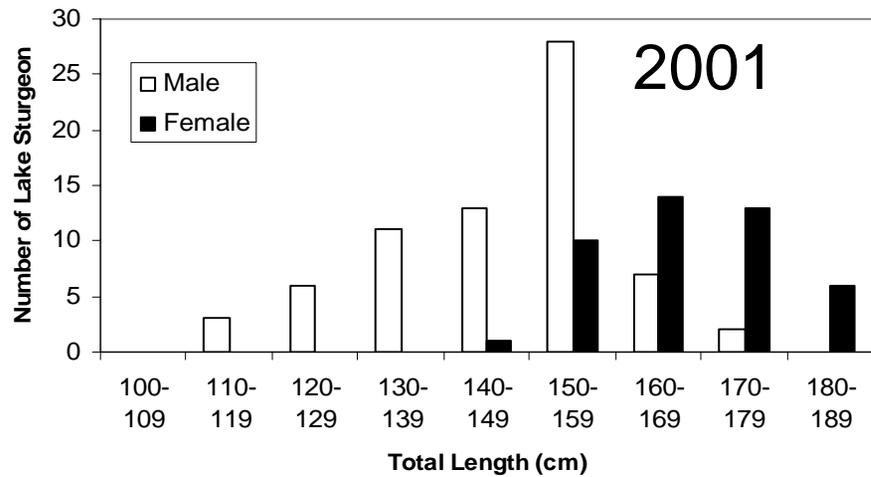
# Stage 1: Spawning Adult Sturgeon

## -Methods-

- Migration was restricted at the mouth of the river
- Movement was monitored using a video camera
- Adult sturgeon were netted at the spawning grounds
- Fish were tagged using both external and internal methods
- Biological information was collected
- Fin clips were taken for genetic analysis



# Differences in size structure?

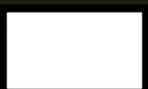


**\*\*Males**

Chi-square= 340.8

DF= 279

P= 0.0067



**Female**

Chi-square= 213.5

DF=189

P= 0.1066



# Number of Spawners and Sex Ratios

2001

N=115

Sex Ratio = 1.50 :1

2002

N=104

Sex Ratio = 2.06 :1

2003

N=121

Sex Ratio = 1.95 :1

2004

N=100

Sex Ratio = 3.00 :1

- Recruiting males into the spawning population
- Spawning frequencies of males and females

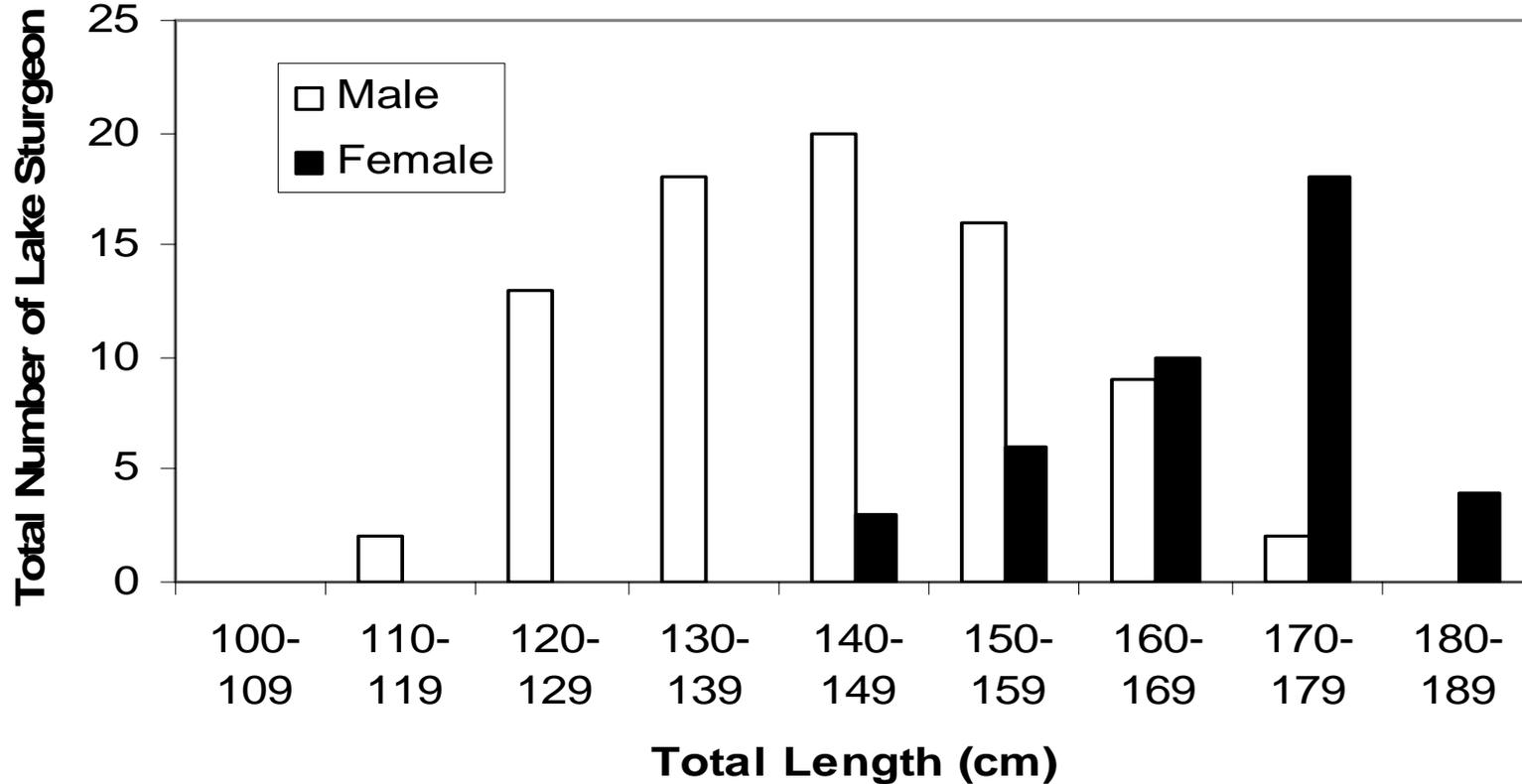
2003

N=121

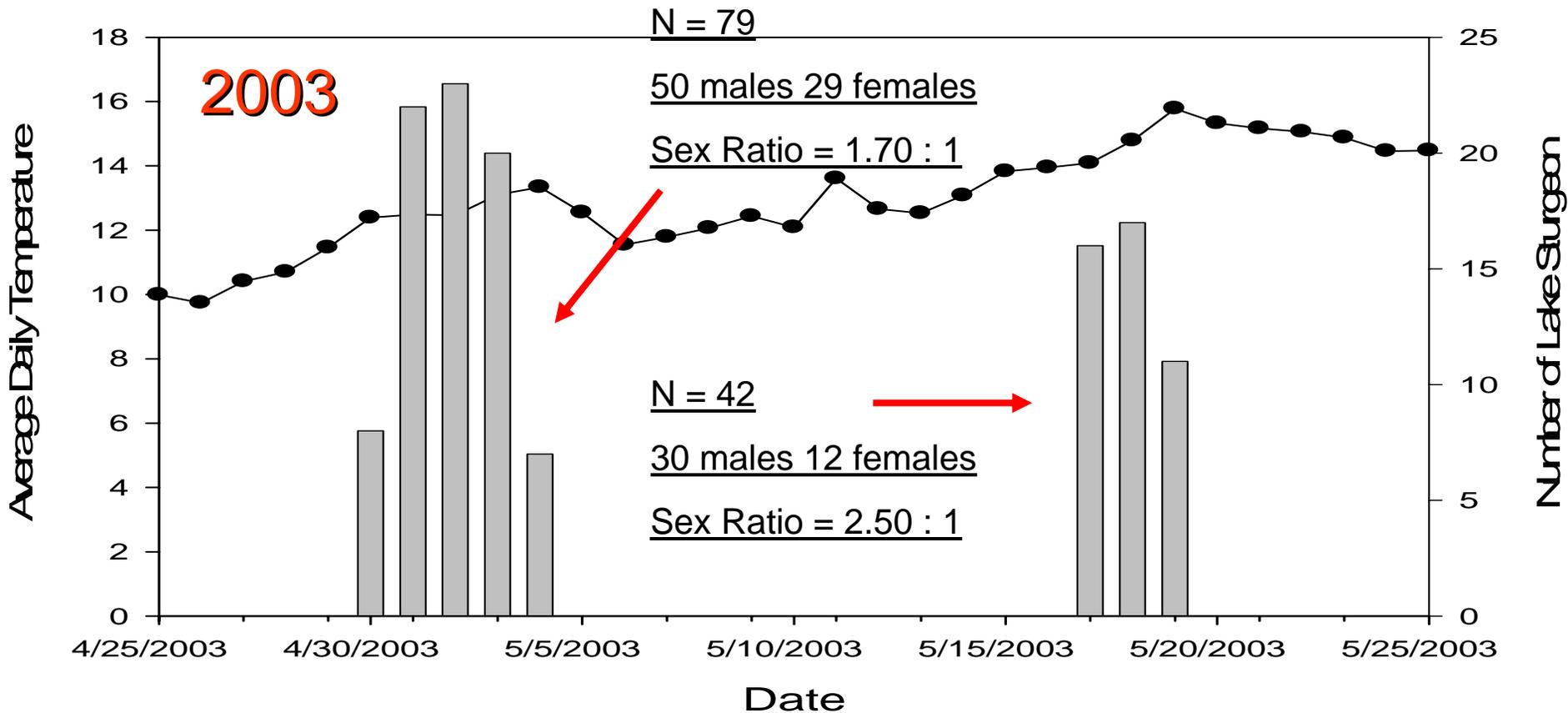
Sex Ratio = 1.95 :1

# 2003 Field Season

-Stage-Based Approach-



# Adult Migration and Spawning



\*\*Females in the first group were larger than females in the second

ANOVA: Girth:  $P = 0.033$

\*\*Males in the first group were smaller than males in the second

ANOVA: Length:  $P = 0.001$   
ANOVA: Weight:  $P = 0.003$

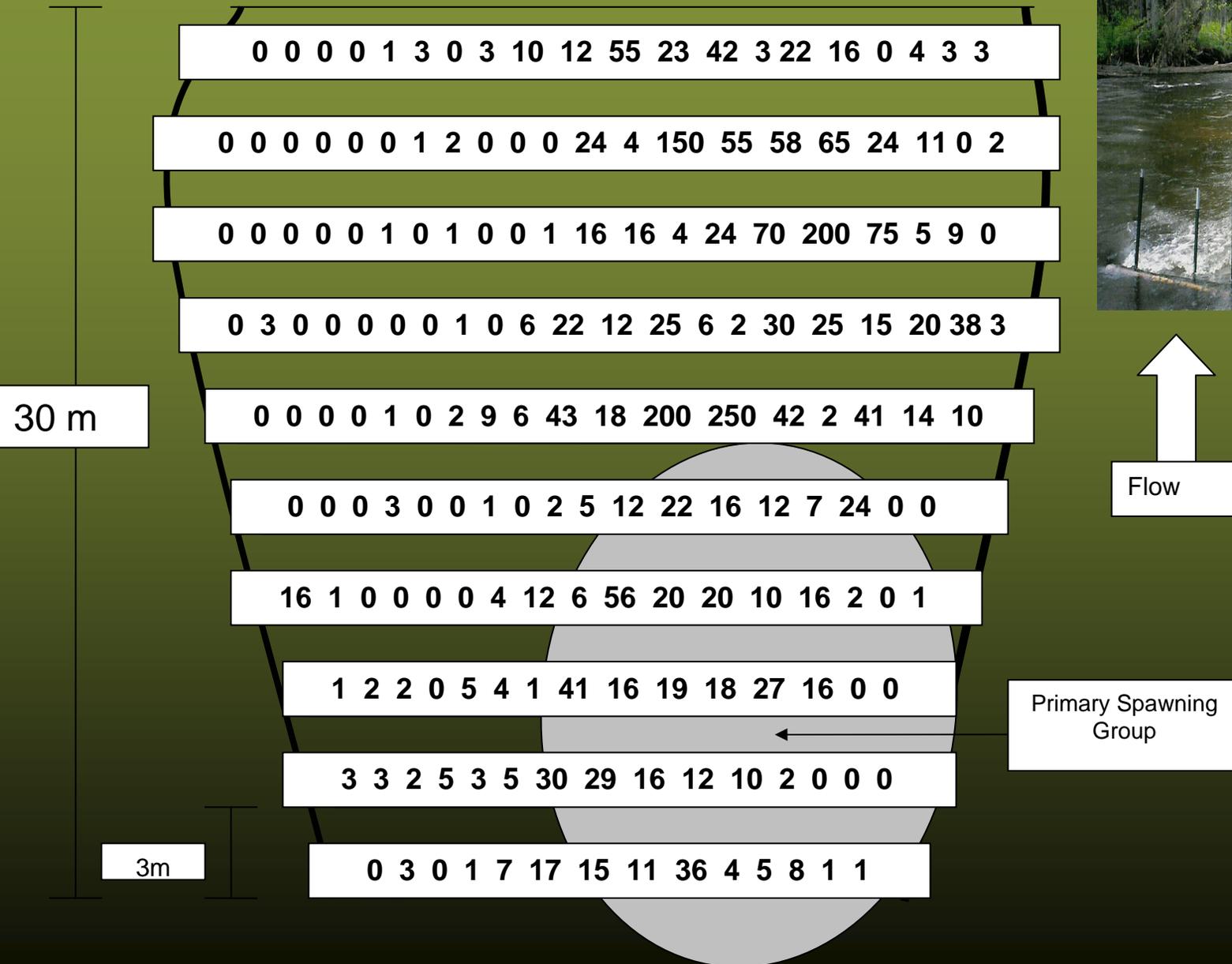
# Stage 2: Egg Deposition

-Methods-

- Stream transects were run starting above the spawning group
- Kick nets were conducted every meter
- Transects were continued down stream every three meters
- Flow, stream discharge and substrate size at each location



# Egg Deposition



# Egg Deposition

- Stepwise Multiple Regression
- Dependent variable: Egg Abundance
- Independent variables:
  - Stream depth
  - Stream flow
  - Average substrate size
  - Downstream distance from the spawning group
  - Stream channel position

Step	Model Variables	F	P	R <sup>2</sup> (adjusted)
1	Average Substrate Size	104.989	<0.001	0.343
2	Ave. Substrate Size Stream Channel Position	73.738	<0.001	0.428

# Stage 3: Larval Sturgeon

## -Methods-

- D-frame drift nets were used to sample larval sturgeon
- Deployed two meters apart across the stream channel
- Sampling was conducted during a five hour time period
- Collection cups are emptied every hour
- The number of larval sturgeon in each net are counted



# Larval Drift Profile

● A total of 16,314 larval sturgeon were captured

N = 79

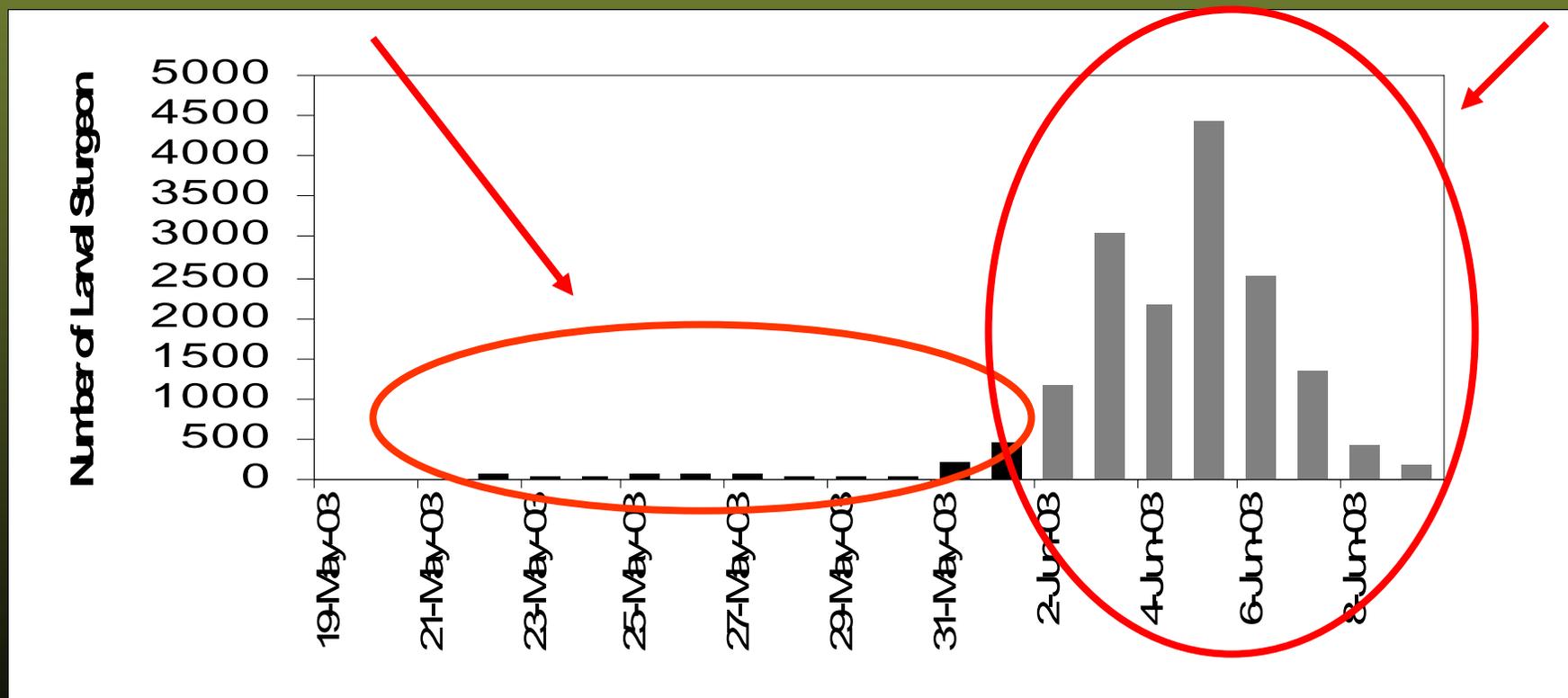
Sex Ratio = 1.70 : 1

351 larval sturgeon

N = 42

Sex Ratio = 2.50 : 1

15,963 larval sturgeon



# What was different?



## Site B vs Site C



Large Substrate Sizes

Deep

Slower Water Velocity

Smaller Substrate Sizes

Shallow

Faster Water Velocity

# Discussion and Conclusions

## Power of the stage based approach

- The potential barriers to lake sturgeon recruitment can be decomposed into several different stages
- One or more of these stages may have a large impact on lake sturgeon survival and recruitment
- The impact of each stage may change from year to year
- Knowledge of all these factors will be critical to designs of reintroduction programs

# Acknowledgements

- Michigan Department of Natural Resources
- MDNR Fisheries Division, Gaylord MI
- Sturgeon For Tomorrow Inc.
- Wolf Lake Fish Hatchery

# Questions?

