

# NAVPAT II

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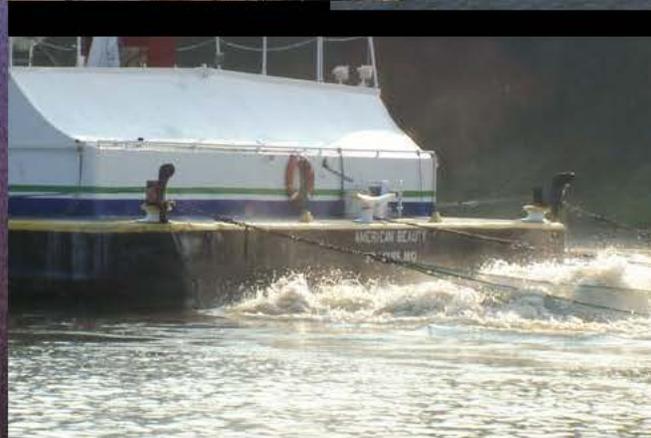
## Acknowledgements

NAVPAT I – Terry Siemsen, Louisville District

NAVPAT II – Janet Cote, Huntington District

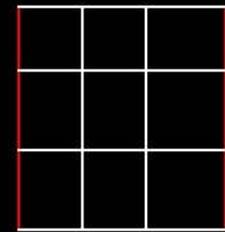
# Source of Impacts

- Main channel – entrainment of eggs and larvae
- Channel “border” – substratum scour
- Shallow littoral – wavewash, drawdown, stranding



# NAVPAT II

## Biological Modeling



- Breaks channel into cells
- Physical variables calculated by cell
- Tow movements modify cell variables
- Using the HEP concept, habitat impacts are calculated for each cell, and summed for baseline and each alternative:

$$\text{HSI} * \text{Area} = \text{HU}$$

# NAVPAT II

## PHYSICAL VARIABLES

### HABITAT SUITABILITY EXISTING CONDITIONS

- Depth
- Velocity
- Substrate

### TOWBOAT DISTURBANCE MODIFIERS

- Towboat-induced >velocity
- Substrate scour
- Shoreline water drawdown
- Entrainment



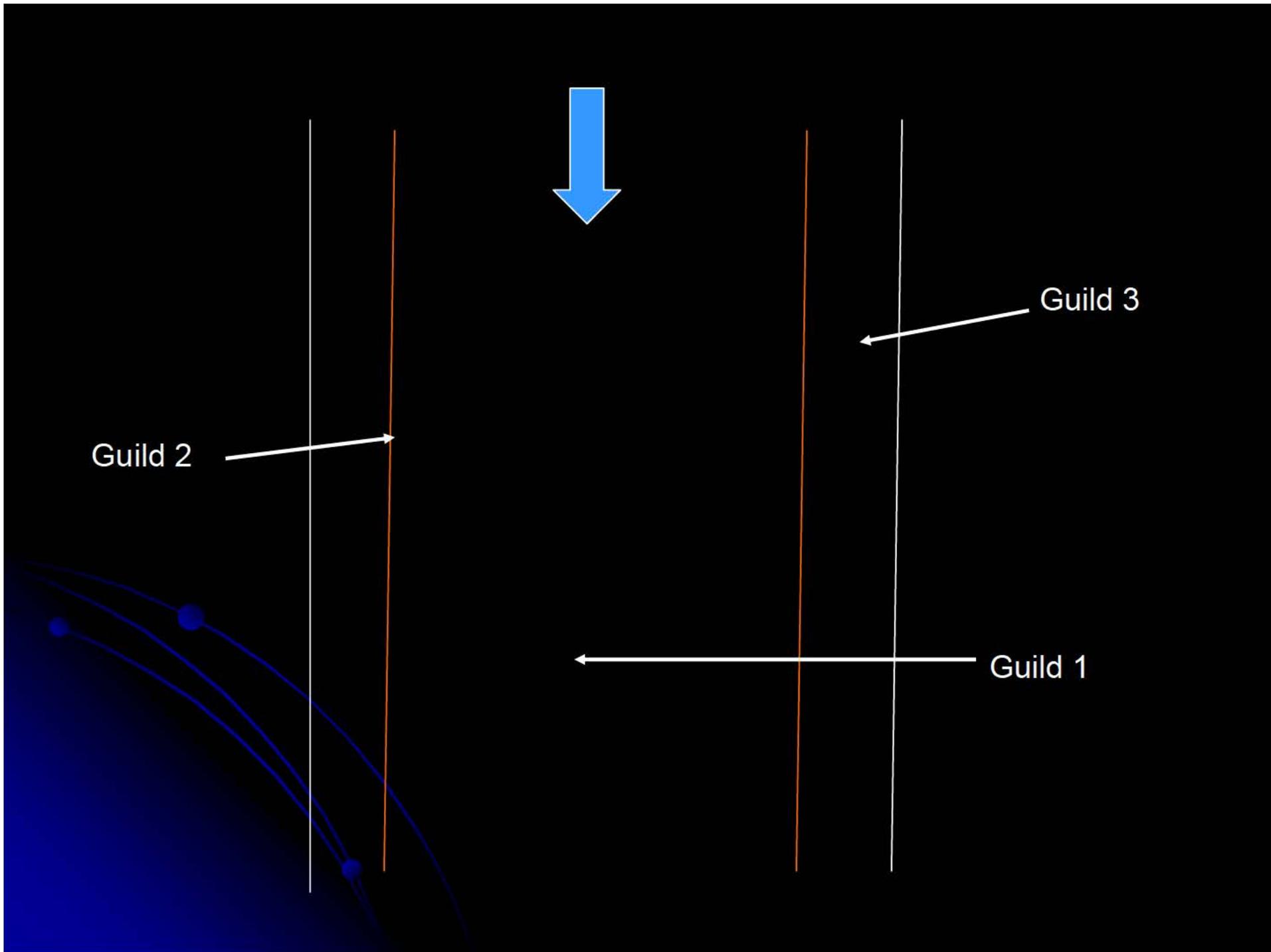
- Sailing line (cells)
- Recovery rate



# Guilds

- Nine guilds accounting for 120 fish in the Ohio River Drainage
- Emphasized habitat preference and modes of reproductive
- Utilize spawning chronology to define seasonal applicability – early, mid, late season spawners





Navigation  
Traffic  
Scenario

```
graph TD; A[Navigation Traffic Scenario] --- B[Main channel entrainment]; A --- C[Channel border scour]; A --- D[Nearshore drawdown];
```

Main channel  
entrainment

Channel border  
scour

Nearshore  
drawdown

## MAIN CHANNEL ENTRAINMENT

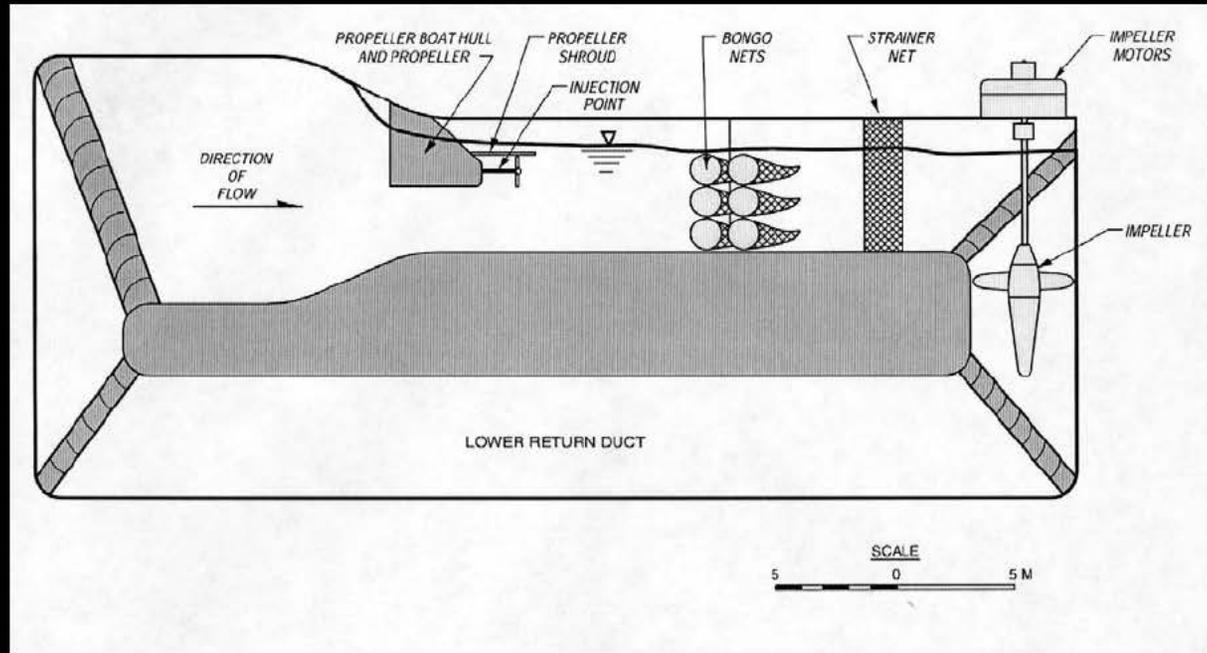
Guild: pelagic eggs/larvae  
Seasonal concerns: stage/spawning chronology  
Spatial concerns: sailing lines/decay of effects

## ENTRAINMENT MORTALITY

HSI values related to volume entrained  
Recent lab and field data  
Species and size differences

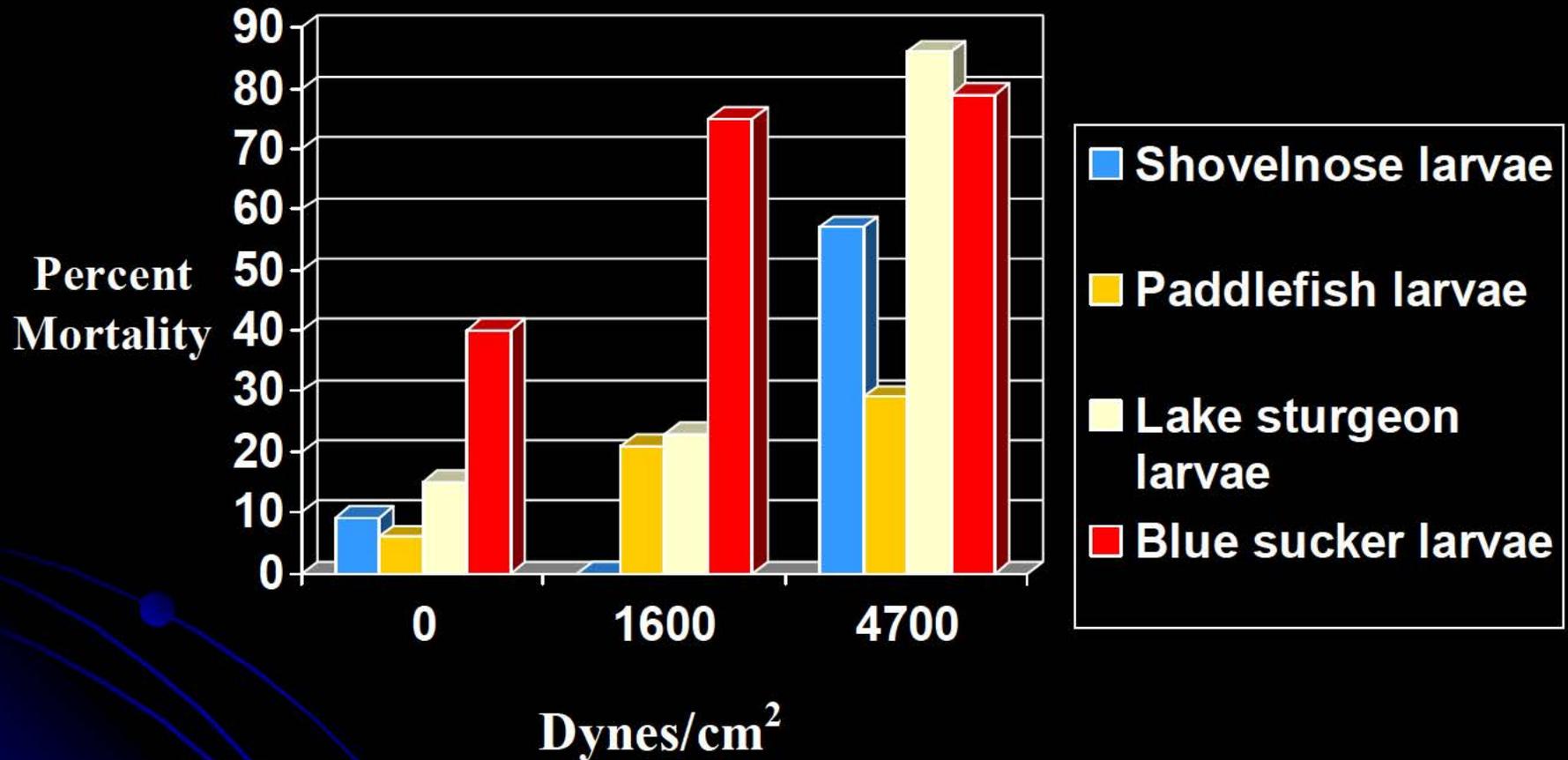
## NAVPAT UNITS

# Propeller Entrainment of Larval Fish



- Shovelnose sturgeon larvae – 14 mm
- Lake sturgeon larvae – 11 mm
- Paddlefish eggs and larvae – 14 mm
- Blue sucker larvae – 8 mm
- Common carp juvenile – 22 mm

# Propeller-Induced Larval Fish Mortality

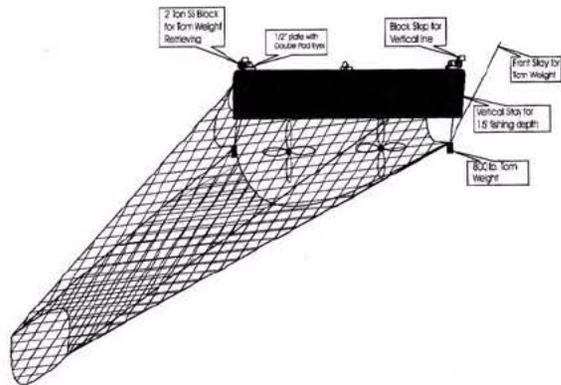


- No significant effect on eggs and juveniles
- Maximum shear stress: 6,300 dynes/cm<sup>2</sup>

# Adult Entrainment Study - ERDC



Tow Boat Trawl Rigging





# Retrieving Fish From Codend



# Propeller Induced Mortality



## CHANNEL BORDER SCOUR

Swiftwater demerals eggs: lithophilic, adhesive, nests  
Seasonal considerations: stage/spawning chronology  
Spatial considerations: sailing lines/decay of physical effects

## TYPES of NEGATIVE EFFECTS

Behavioral disruption (nests)  
Suspension of deposited eggs  
Abrasion of egg chorion

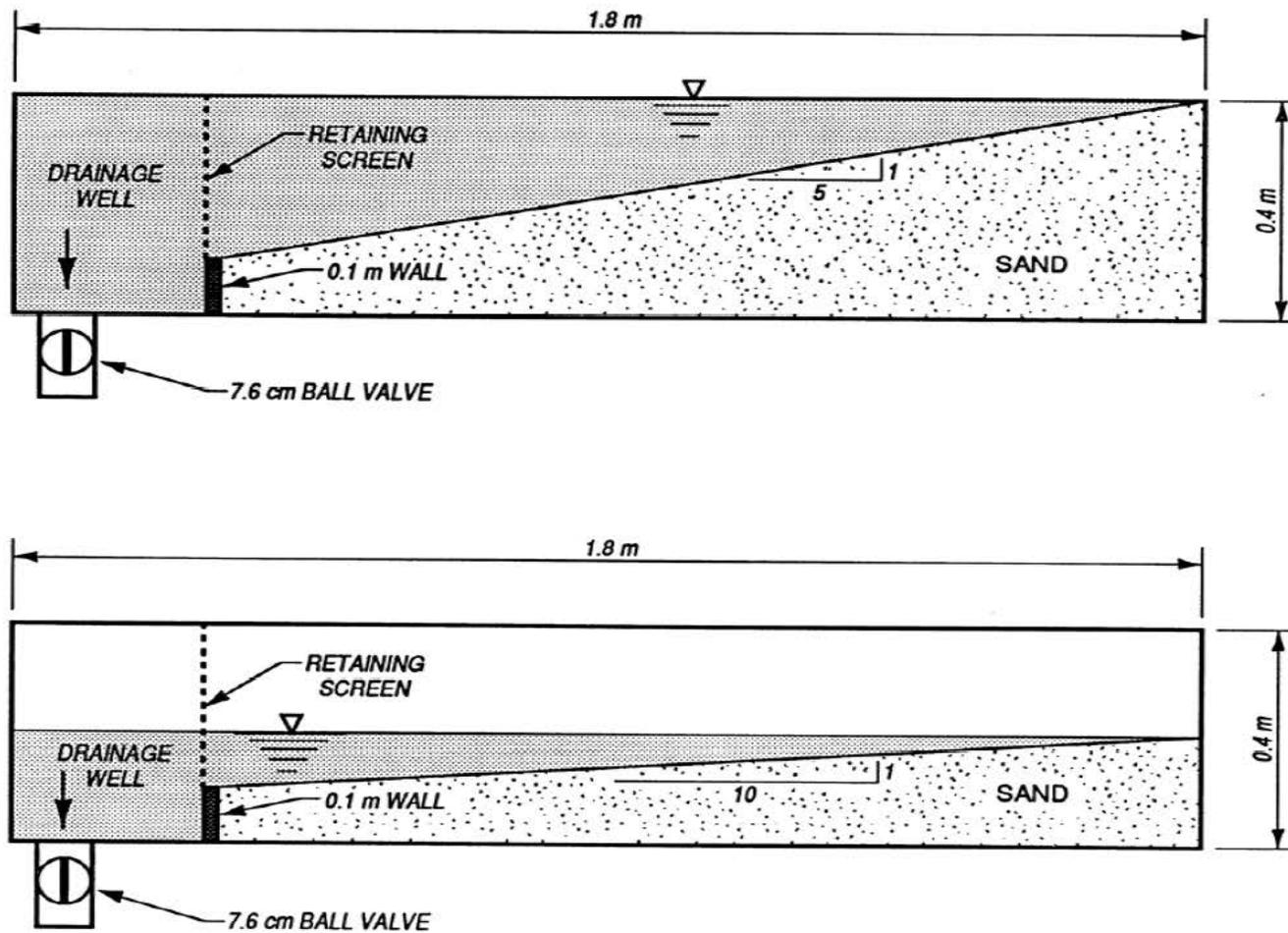
## NAVPAT UNITS

**NEARSHORE DRAWDOWN and WAVES**  
Slackwater eggs and larvae  
Seasonal concerns: stage, spawning chronology  
Spatial considerations: narrow impact zone

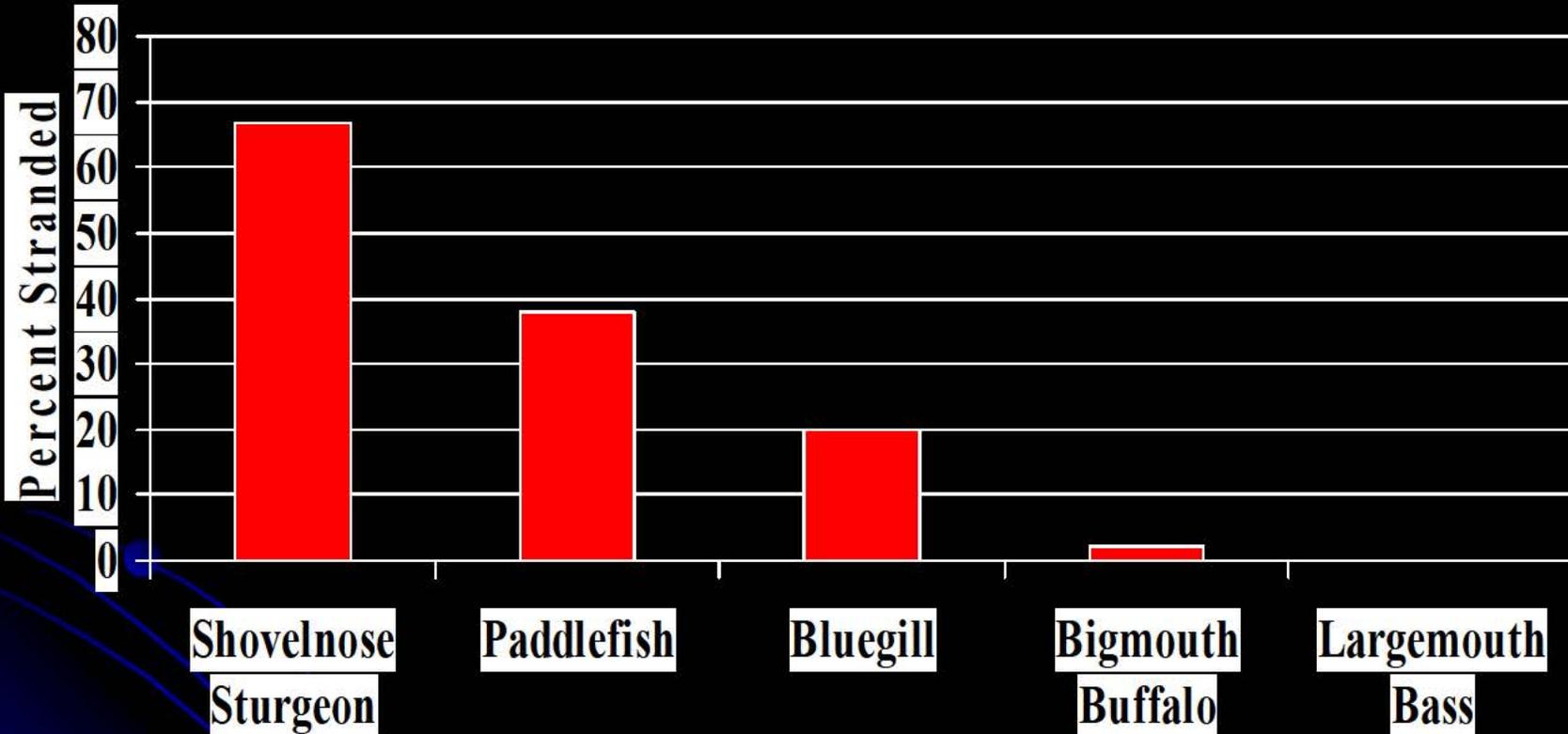
**TYPES OF EFFECTS**  
Wave disturbance of nest-builders  
Drawdown stranding of larvae

**NAVPAT UNITS**

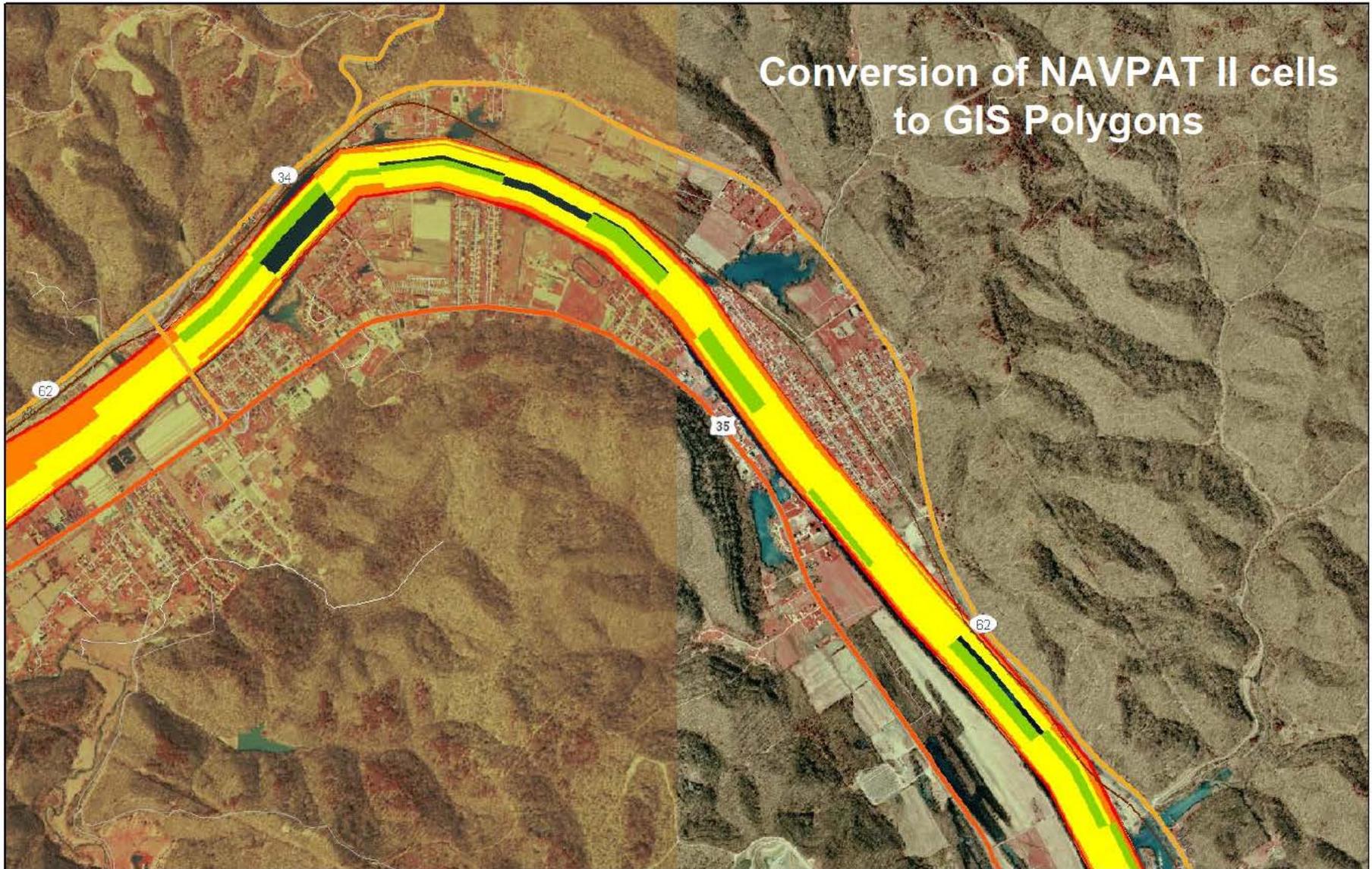
Adams, S. R., T. M. Keevin, K. J. Killgore, and J. J. Hoover. 1999. Stranding potential of young fishes subjected to simulated vessel-induced drawdown. Transactions of the American Fisheries Society 128:1230-1234.



## Simulated Stranding of Larval Fish



# Conversion of NAVPAT II cells to GIS Polygons

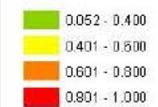


## Area of Interest

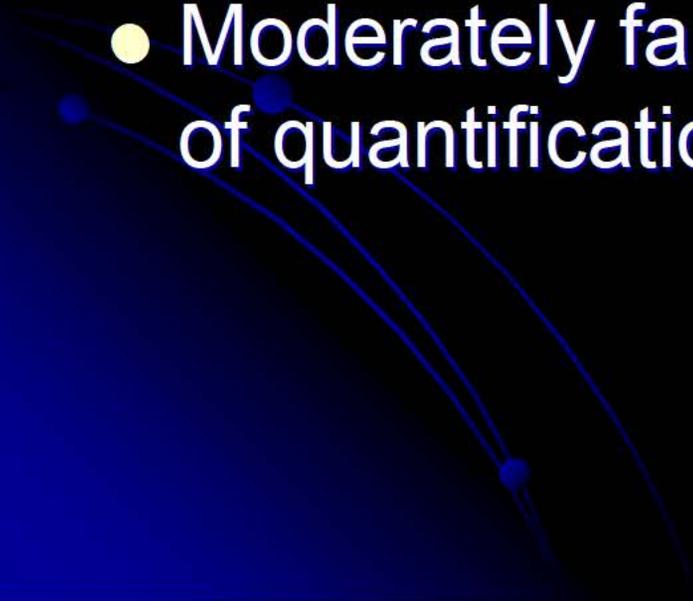


## Legend

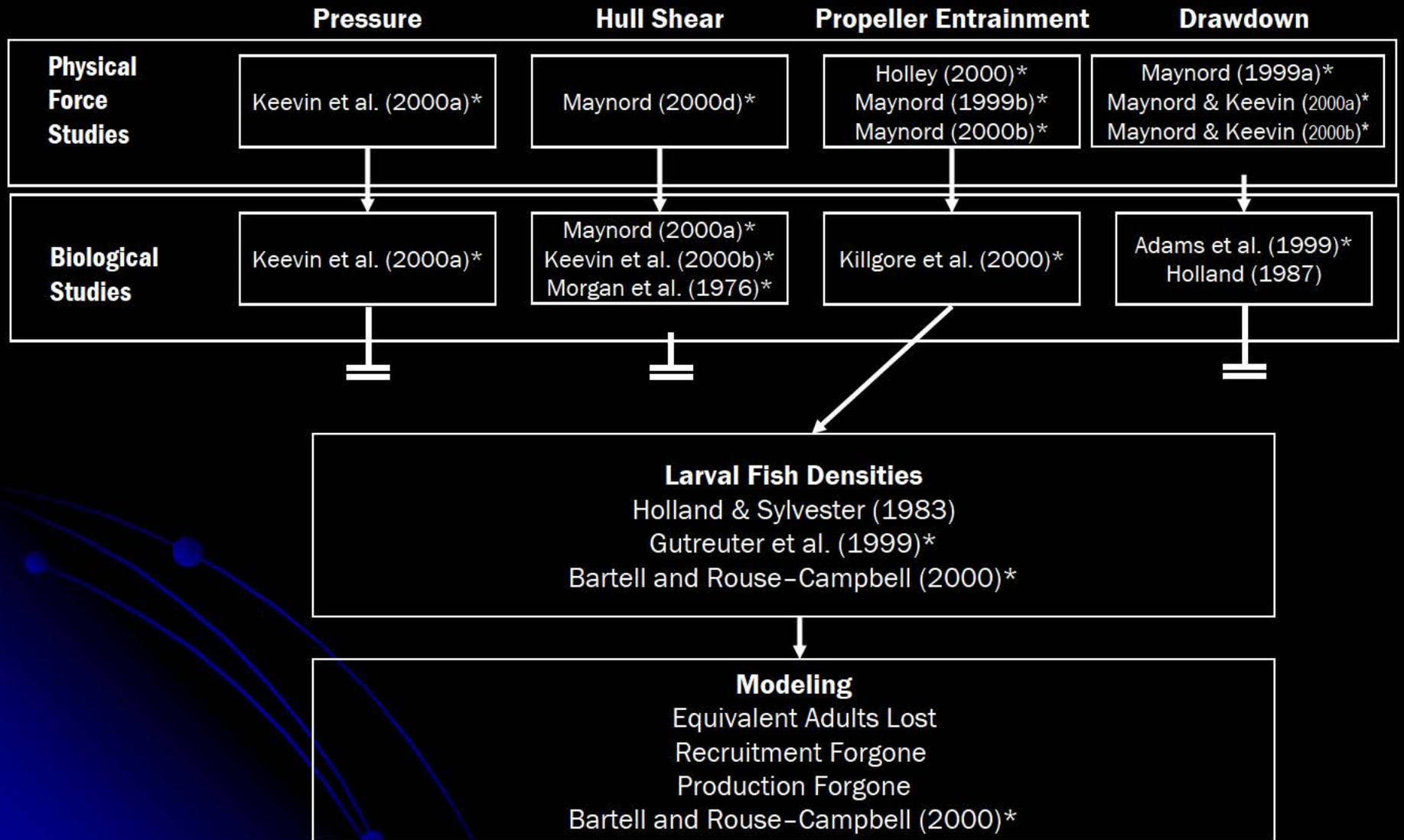
Habitat Suitability Index



# NAVPAT Strengths

- Spatially explicit
  - Can guide system-level mapping and restoration strategies
  - Tailors HSI models to traffic stresses
  - Moderately familiar and accepted method of quantification
- 

# Population-level Evaluation



\*Indicates studies conducted for the Navigation Study

# Comparison of Methods

Attribute	NAVPAT II	Population
Scope	Site Specific - System level	System-level
Approach	Habitat-based (more assumptions)	Demographic – based (fewer assumptions)
Requirements	Cross-sectional Data	Population statistics
Cost	Moderate	Moderate to Expensive depending on data availability

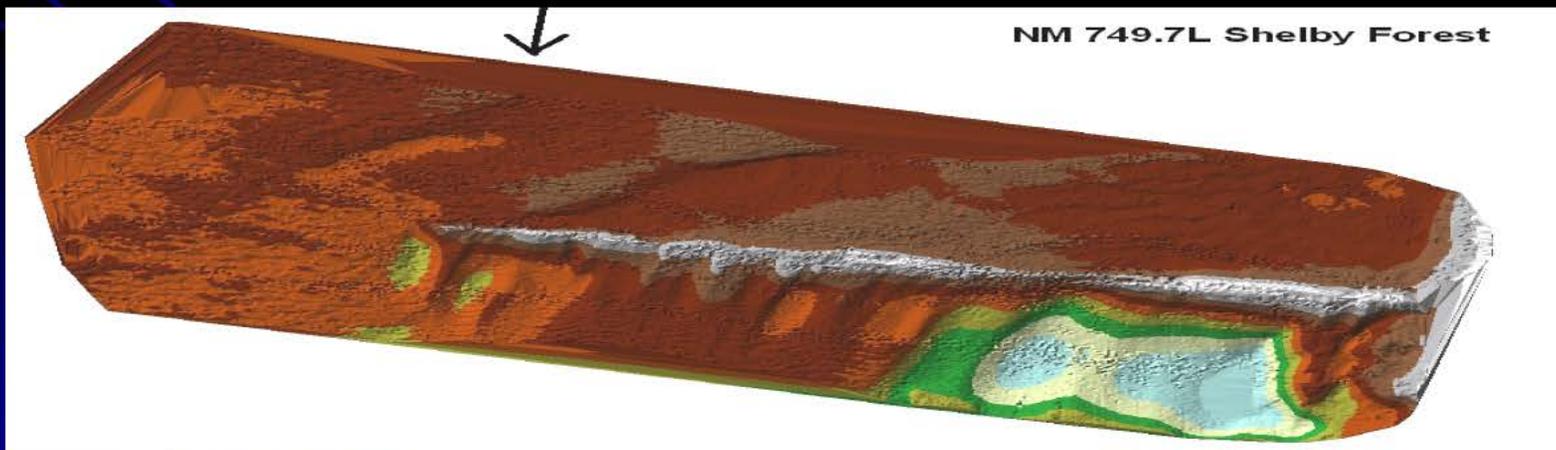
# Mitigation???



# Dikes



**Goal:** Develop environmental guidelines for dike notching that considers the placement and geometry of the notch to maximize benefits for fishes and macroinvertebrates



# Gravel Bars



# Secondary Channels



# Borrow Pits



# Floodplain Pools



**Questions???**

