DOER Environmental Resource Protection Focus Area

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Purpose

- **Situation**: USACE Districts are confronted by complex T&E Species issues that extend across District/Division boundaries, involving a very large number of target species. Many management practices intended to protect T&E and other sensitive species remain untested. Protecting the environment occurs against a backdrop of fewer acceptable dredged material placement options.
- **Barriers**: Opportunities to evaluate alternative management practices are constrained by both funding and logistics. Regulatory restrictions often prevent timely conduct of collaborative studies that address species with protected status.
- **Solution**: Provide tools for both proactive and retrospective evaluation of protection measures. Examine positive attributes of the dredging process (e.g., beneficial uses) that lead to increased flexibility and more options for environmental resource protection.

Structure

- Focus Area consists of three “work unit” topic areas
  - T&E Species protection
  - Beneficial use of dredged material for habitat restoration, creation, and enhancement
  - Environmental windows and other management practices related to resource protection

Ongoing Research Projects

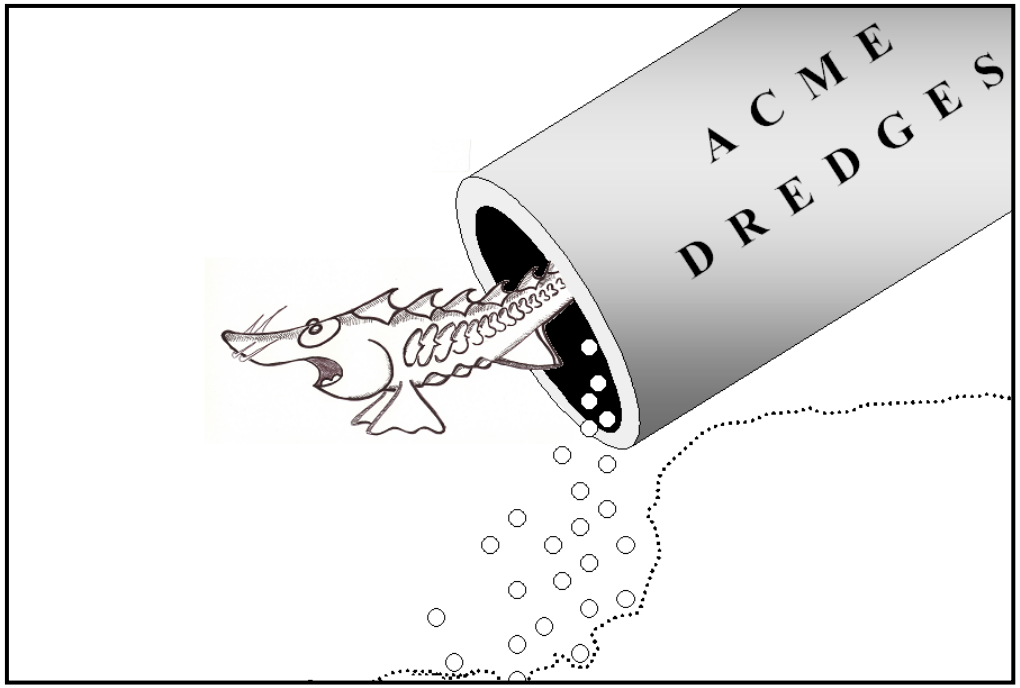
- **T&E Species protection**
  - **Assessing effectiveness of rescue trawling in reducing incidental take of sea turtles (Dickerson)**
  - **Evaluate improved sea turtle deflector and bed leveler designs (Dickerson/Welp)**
  - **Improving management of avian habitat during coastal and inland during navigation project construction, operation, and maintenance (Fischer)**
  - **Develop improved technologies for sturgeon detection (Reine/Clarke)**
  - **Determine factors that govern risk of sturgeon entrainment (Hoover/Killgore)**

Ongoing Research Projects

- **Beneficial uses of dredged material**
  - **Documentation of EFH attributes of coastal open-water BU projects (Reine/Clarke)**
- **Environmental windows**
  - **Develop risk-informed decision tools specifically for non-contaminant stressors (Suedel/Lutz)**
  - **Document effectiveness of alternative management practices (Clarke)**

Entrainment Risk for Sturgeon

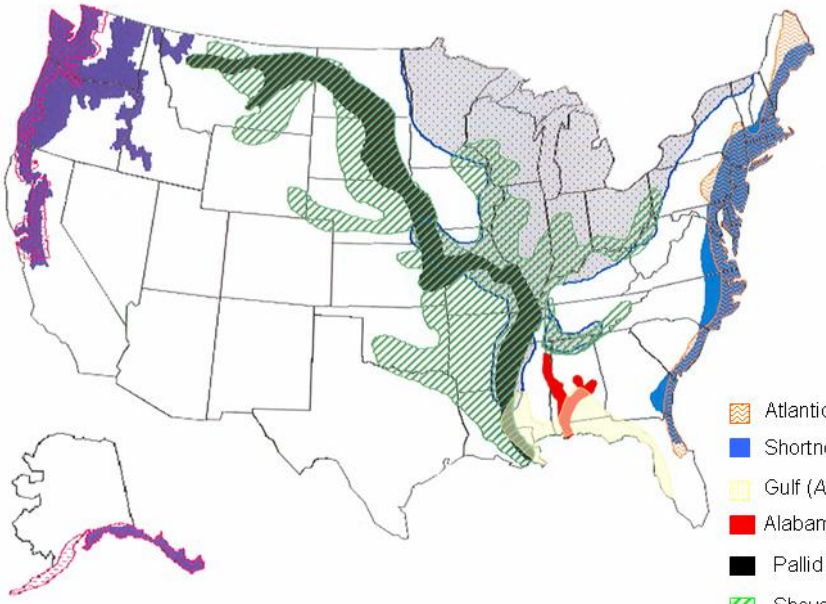
- **Problem: Determine the likelihood of entrainment of juvenile sturgeon in a flow field created by a hydraulic dredge**



Entrainment Risk for Sturgeon

Major Waterways of the U.S.

Distribution of Sturgeon Species in the U.S.



The Atlantic Sturgeon is Presumed Extirpated in DC.

The Shortnose Sturgeon is Presumed Extirpated in DC and VA.

The Lake Sturgeon is Presumed Extirpated in AL, LA, MS, NC, ND, WV.

The Shovelnose Sturgeon is Presumed Extirpated in AL, NM, OH, PA, WV.

- Atlantic (*Acipenser oxyrinchus oxyrinchus*)
- Shortnose (*Acipenser brevirostrum*)
- Gulf (*Acipenser oxyrinchus desotoi*)
- Alabama (*Scaphirhynchus suttkusi*)
- Pallid (*Scaphirhynchus albus*)
- Shovelnose (*Scaphirhynchus platorynchus*)
- Lake (*Acipenser fulvescens*)
- White (*Acipenser transmontanus*)
- Green (*Acipenser medirostris*)

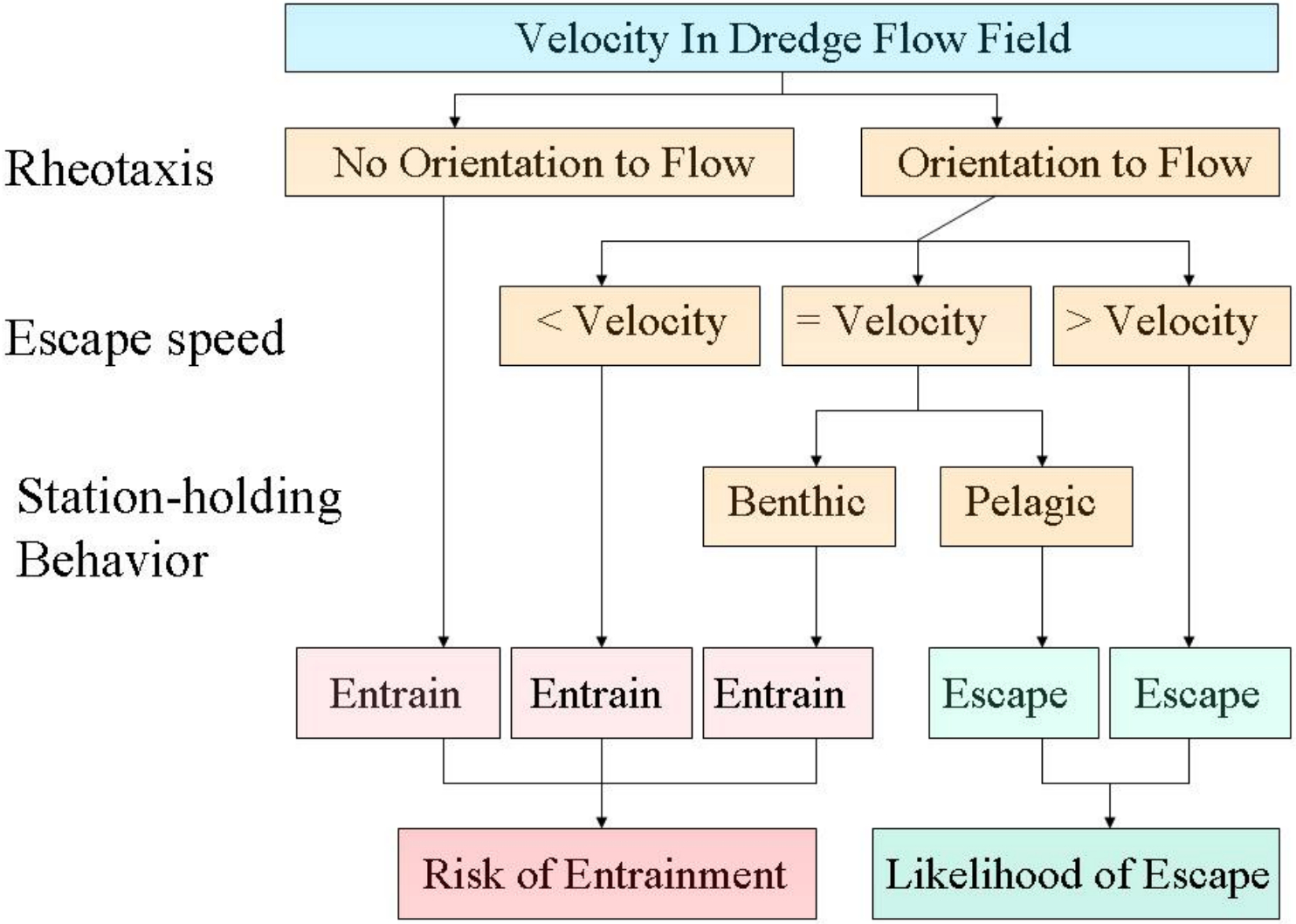
Sources:
Atlas of North American Freshwater Fishes (1980)
Fishes of Alabama and The Mobile Basin (1996)
Natureserve.org (Feb. 2005)
Peterson Field Guides: Reptiles and Amphibians (1998)

Entrainment Risk for Sturgeon

Approach

- Laboratory studies of swimming performance
- Risk assessment for specific water velocities based on performance measures
  - Rheotaxis
  - Endurance
  - Station-holding behavior
- Evaluation of dredge flow fields

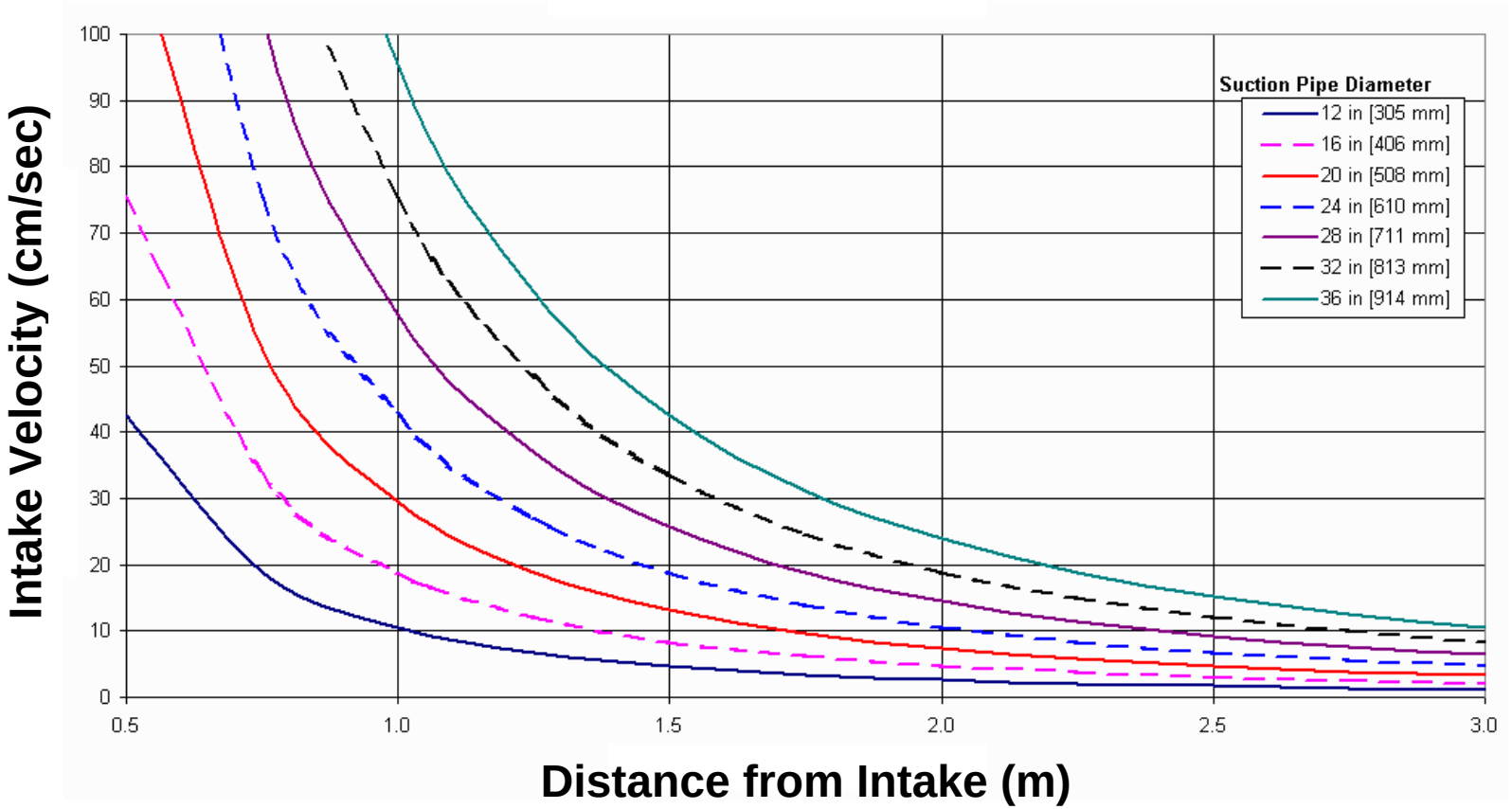
Entrainment Risk for Sturgeon



Entrainment Risk for Sturgeon

Predictions of Flow Fields Near the Intakes of Hydraulic Dredges

http://el.erdc.usace.army.mil/dots/doer/flowfields/dtb350.html



Cutterhead (1/4 cylinder intake) with suction velocity = 4.6 m/sec

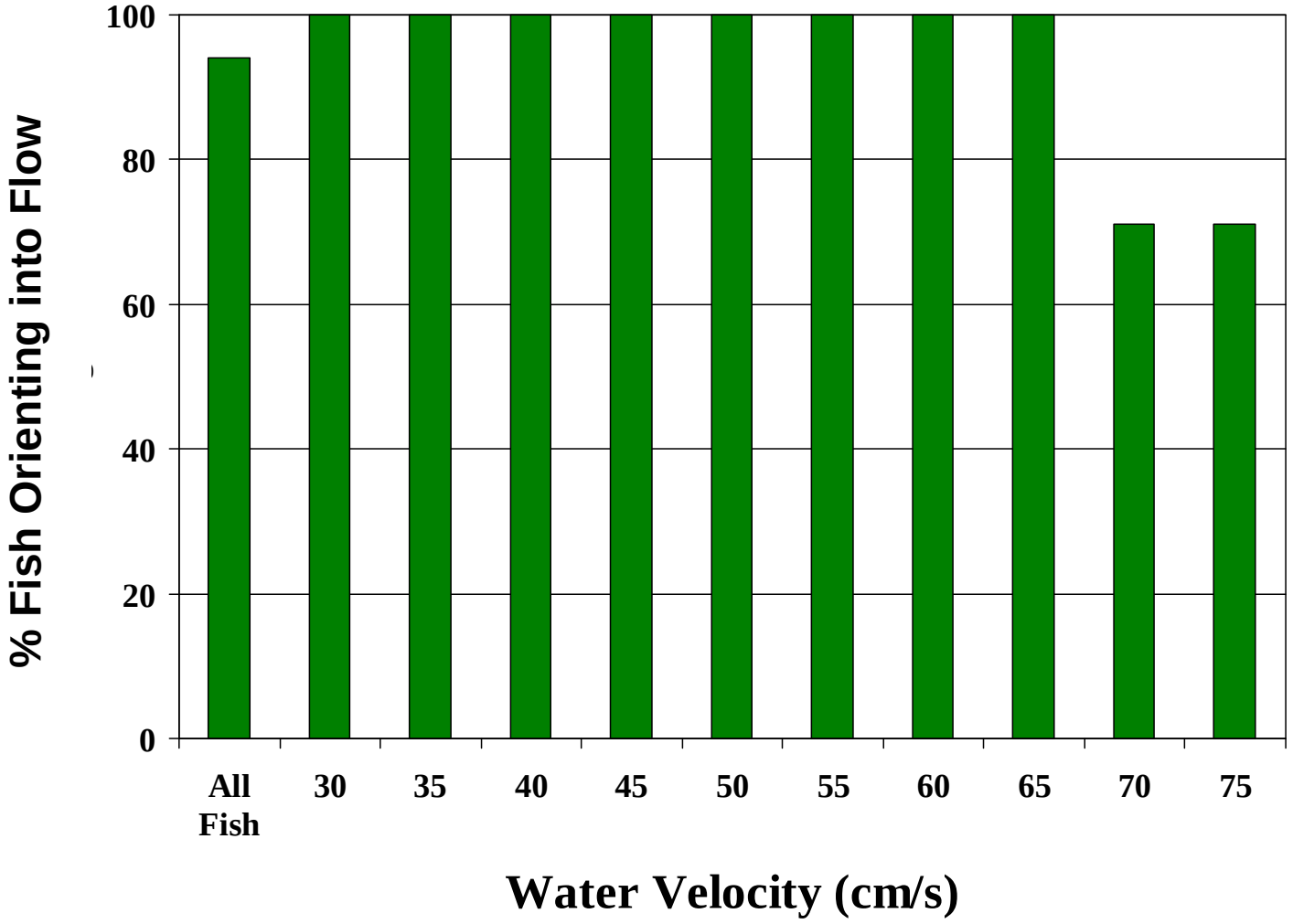
Entrainment Risk for Sturgeon

SWIM TUNNEL PERFORMANCE TESTS

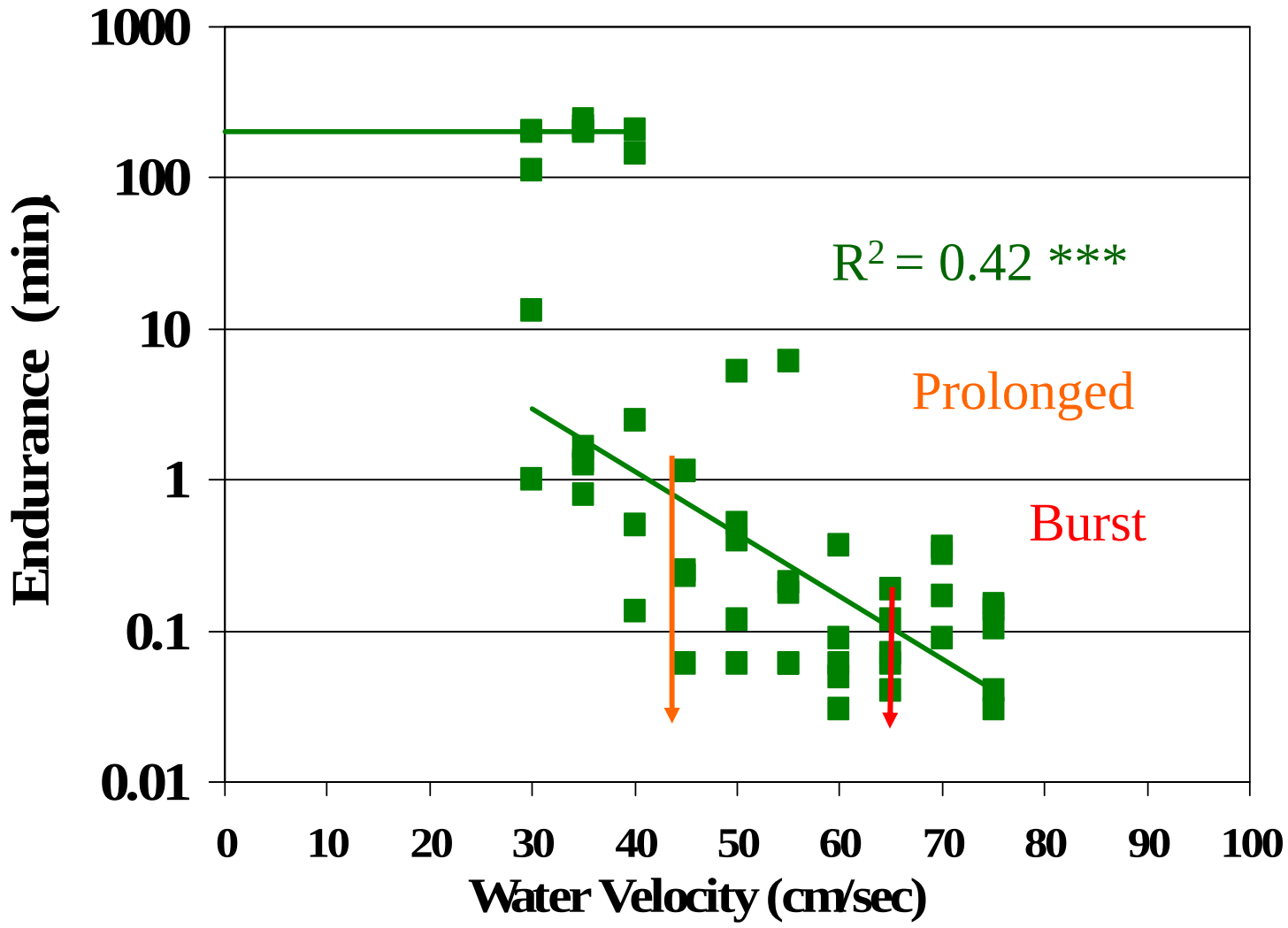
- **Atlantic sturgeon**
- **White sturgeon**
- **Lake sturgeon**

Juveniles and sub-adults

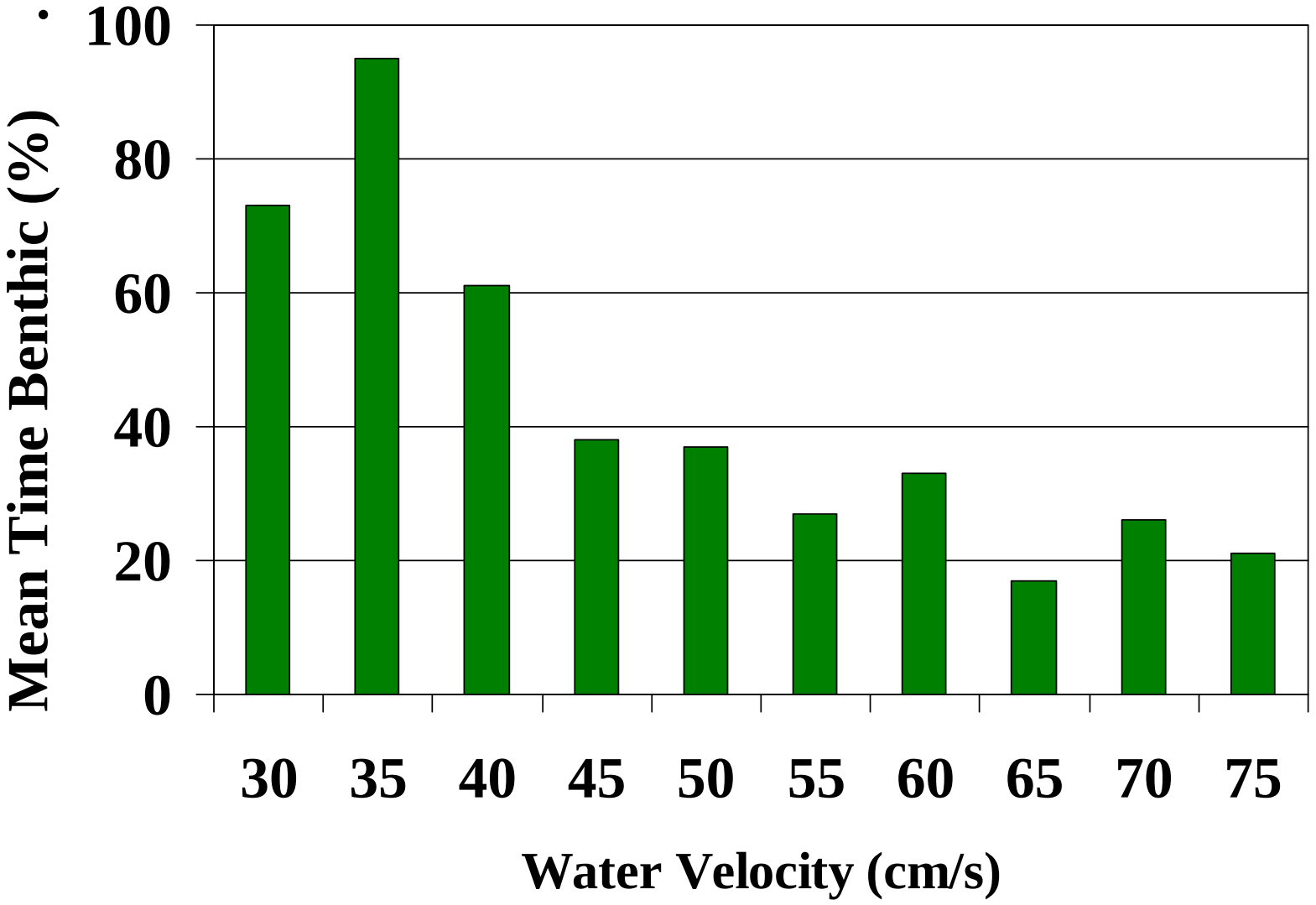
Entrainment Risk for Sturgeon

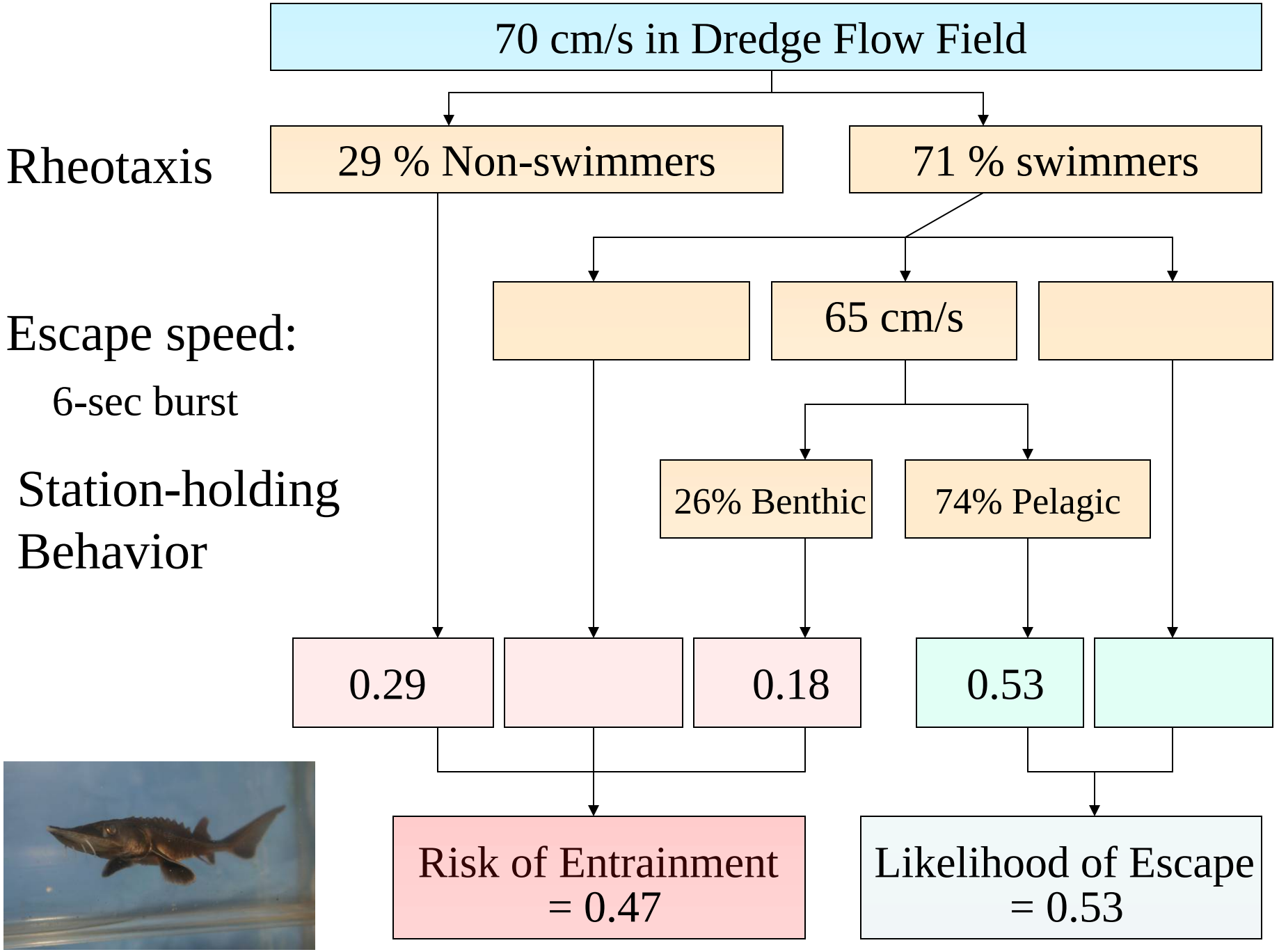


Entrainment Risk for Sturgeon



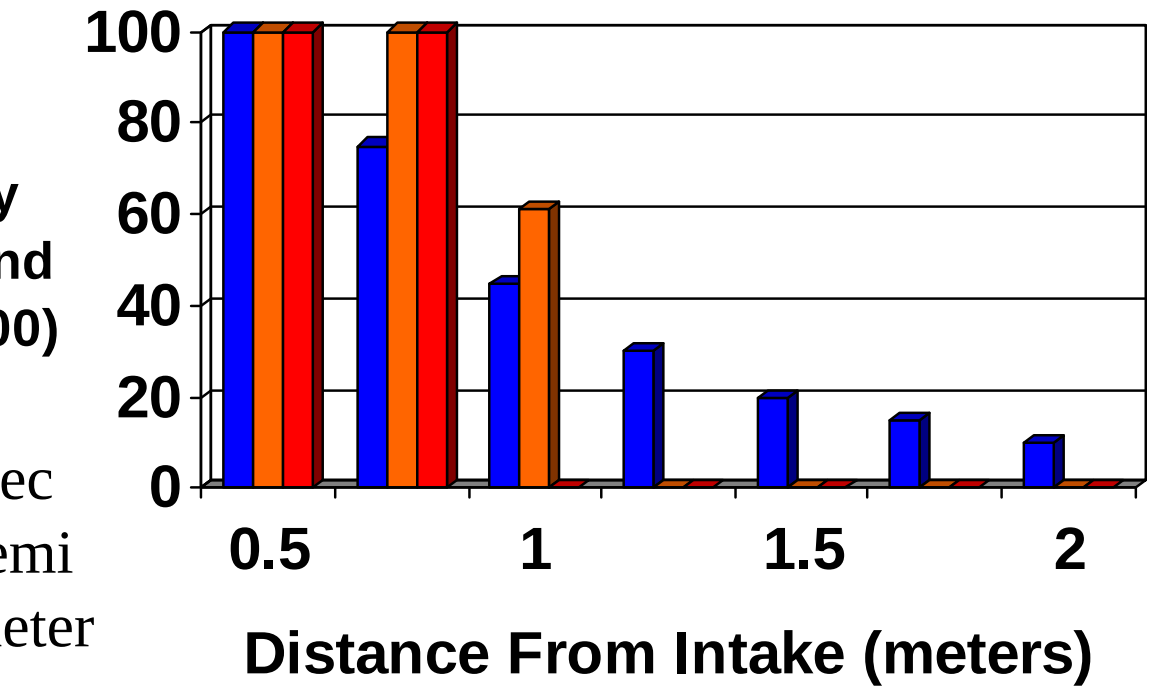
Entrainment Risk for Sturgeon



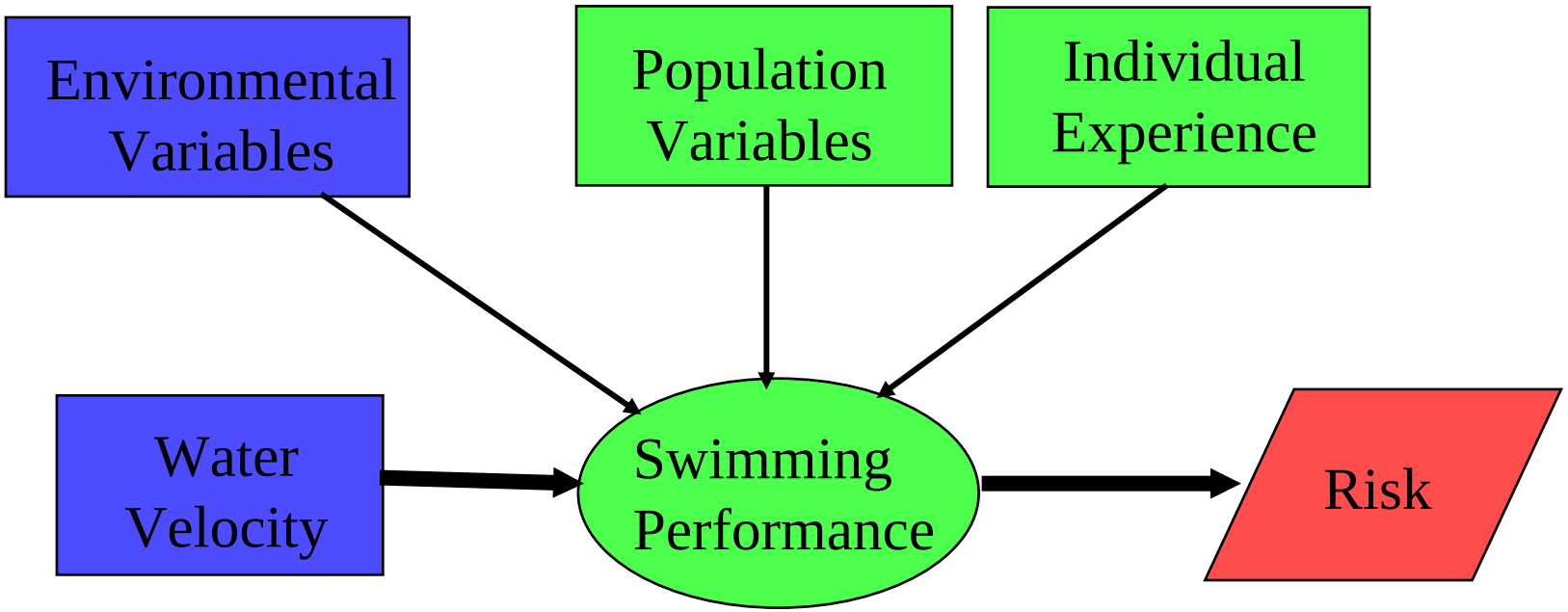

70 cm/s in Dredge Flow Field
Rheotaxis
29 % Non-swimmers
71 % swimmers
Escape speed:
6-sec burst
65 cm/s
Station-holding Behavior
26% Benthic
74% Pelagic
0.29
0.18
0.53
Risk of Entrainment = 0.47
Likelihood of Escape = 0.53

Entrainment Risk for Sturgeon

Suction = 4.6 m/sec
Field = quarter-hemi
Pipe = 36 in diameter

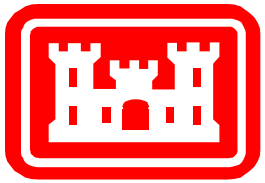


Entrainment Risk for Sturgeon



Sturgeon Detection and Biotelemetry

- **Determine Atlantic sturgeon habitat use patterns**
  - **– Seasonality**
  - **– Time budget in channels and shoals**
  - **– Examine behavior in proximity to active dredging operations**
- **In partnership with:**



USACE Norfolk District

Virginia Sea Grant

Virginia Commonwealth University

US Fish & Wildlife Service

Active Tracking

- **Refined movement patterns**
- **Diel movement patterns**
- **Influence of tidal phase on movements**
- **Time budgeting: Navigation channel vs. shoal utilization**
- **Behavioral response to encounter with dredge**

Passive Telemetry

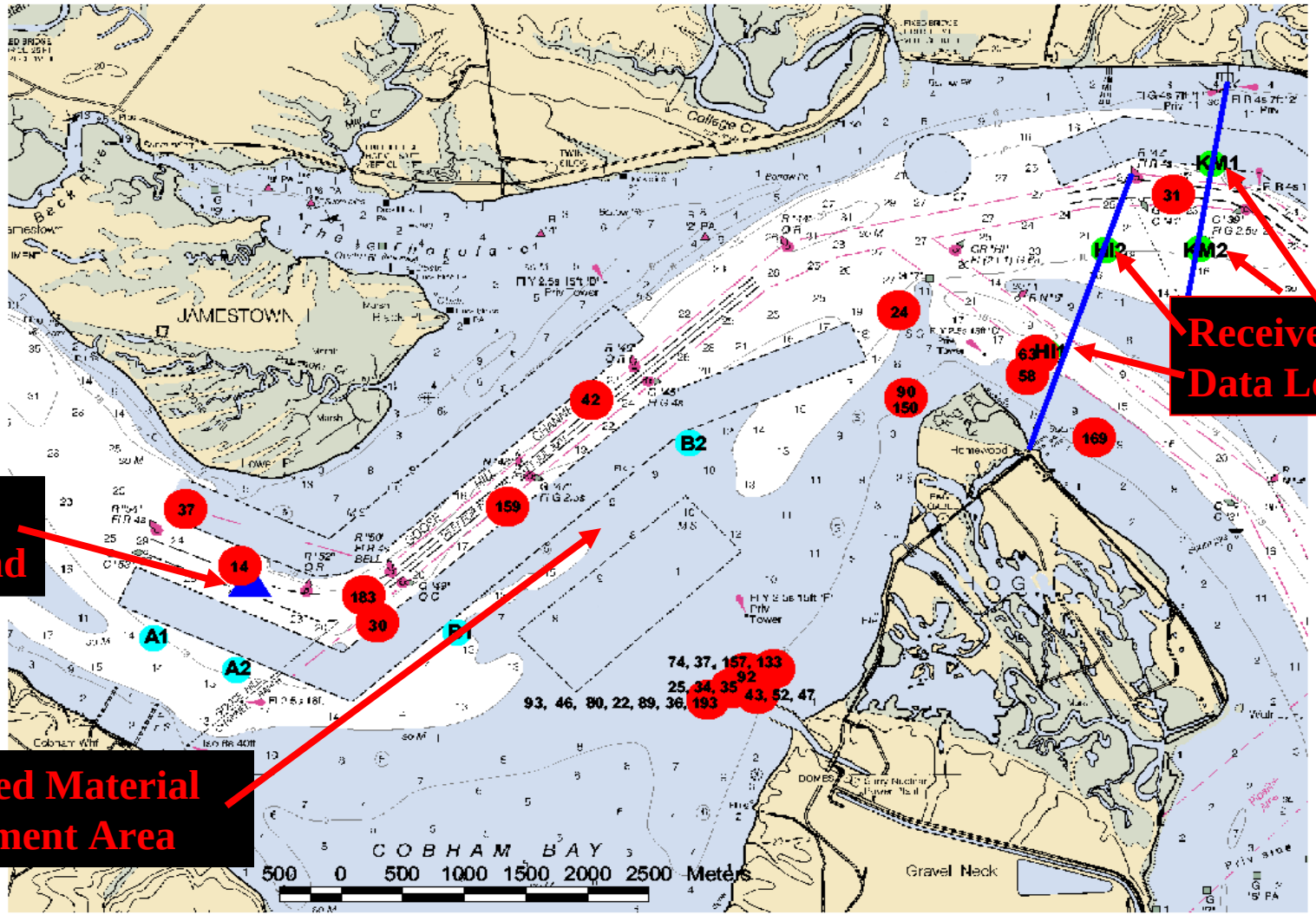
Acoustic array deployed to identify essential sturgeon habitat

- **Assess migratory behavior**
- **Estimate residence time**
- **Identify patterns of river segment occupation by various size classes and document emigration from the system**
- **Determine areas of limited abundance or avoidance**
- **Assess the influence of physical factors (temp., time of day, currents) on migration**
- **Evaluate effects of tagging and handling**

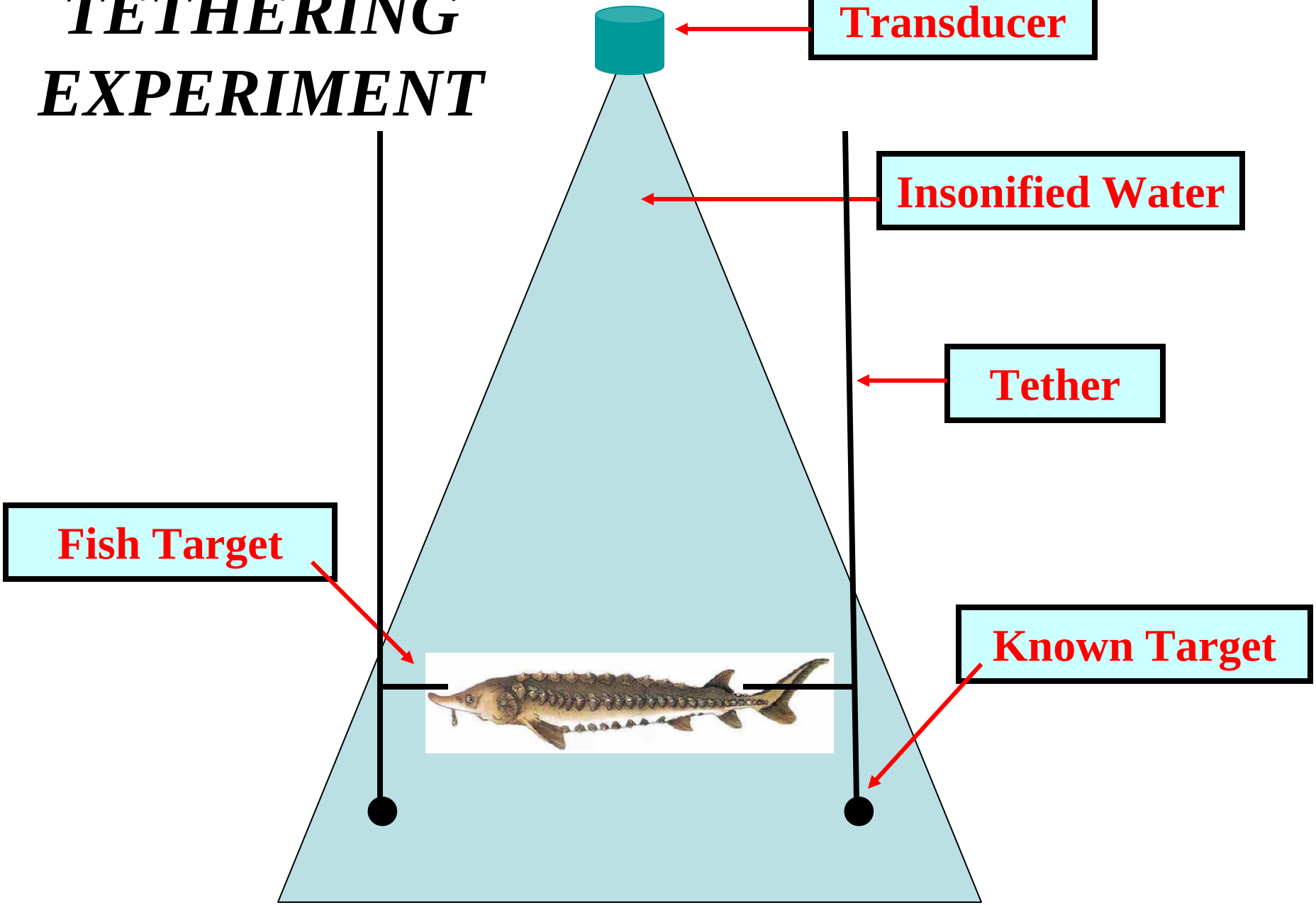
Receiver

Length = 98 mm
Weight (H20) 16 g
Tag Life = 4.5 yrs (min)
Depth Tag

Active and Passive Tracking of American Shad in the Lower James River



TETHERING EXPERIMENT



Future Research Projects

- **T&E Species protection**
  - Apply advanced sensor technologies to detection of sea turtle and other T&E species
  - Document behavioral responses of target species that influence risk during encounters with dredging operations
  - Expand tools for evaluating potential impacts on T&E Species in a system wide/regional sediment management context
  - Fill knowledge gaps on high priority species (e.g., noise effects)
- **Beneficial uses of dredged material**
  - Improved project planning tools and monitoring methodologies
- **Environmental windows**
  - Customize comparative risk assessment approaches
  - Fully Integrate advanced modeling capabilities into evaluation of risks associated with dredging projects and management practices
  - Expand knowledge base concerning dose-response relationships of problematic species and life history stages

Your Input

- **What needs do you see in these areas:**
  - Knowledge gaps related to conflicts with T&E Species?
  - Technical aspects of habitat-related benefits of beneficial uses?
  - Effective tools and technologies for setting and evaluating environmental windows?