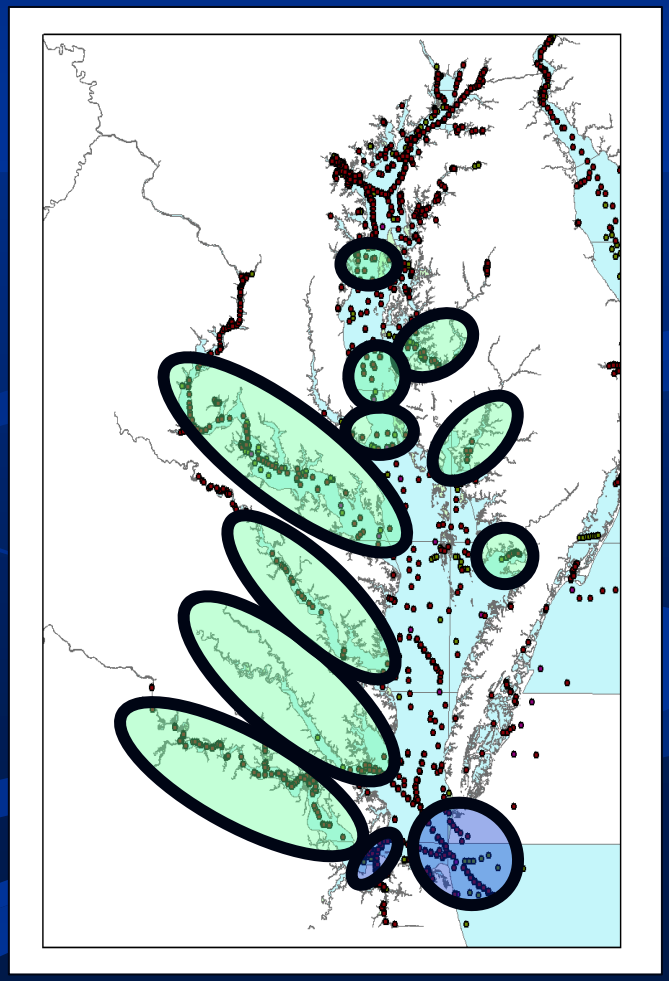
UNIVERSITY OF MARYLAND CENTER FOR ENVIRONMENTAL SCIENCE
CHESAPEAKE BIOLOGICAL LABORATORY
David H. Secor, Professor

Movement, Migration, and Management of Chesapeake Bay Fishes: Measuring traffic patterns, good and bad neighborhoods

(1) Fish and watermen spatially respond to environmental change.
(2) Most stock assessments and habitat recovery plans assume that fish stay put.
(3) Telemetry aids management by
- Testing critical assumptions and estimating key parameters in support of assessment and habitat recovery.
- Evaluating how fish and fisheries adapt to environmental change.



AJ's habitat models performed equally well, Chesapeake goes hypoxic: sturgeons go pell-mell.

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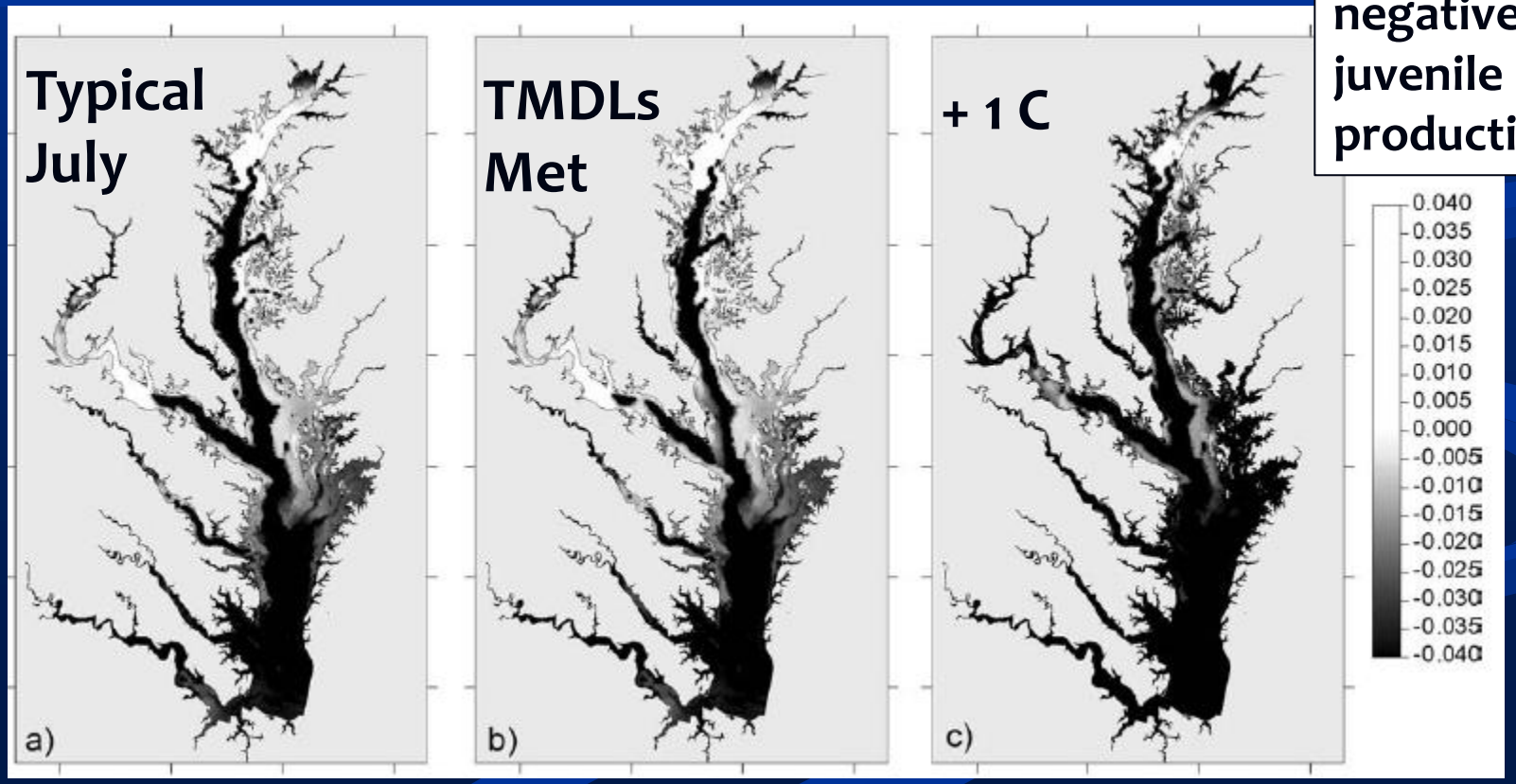
Modeling the influence of hypoxia on the potential habitat of Atlantic sturgeon *Acipenser oxyrinchus*: a comparison of two methods

Adam J. Schlenger[1,*], Elizabeth W. North[1], Zachary Schlag[1], Yun Li[1,5], David H. Secor[2], Katharine A. Smith[3], Edwin J. Niklitschek[4]

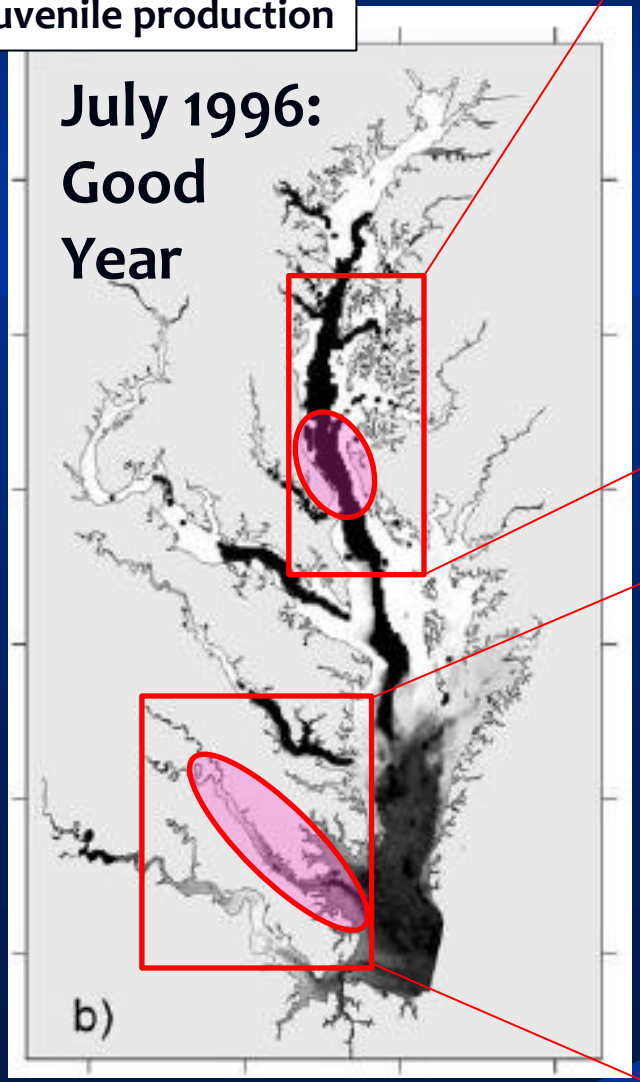
Dire sturgeon predictions?

- Chesapeake is a bad neighborhood in summer
- TMDL Regulations make trivial improvements to sturgeon habitat
- Climate warming (+ 1 C) nearly wipes out sturgeon habitat
- Are sturgeon destined for extirpation?

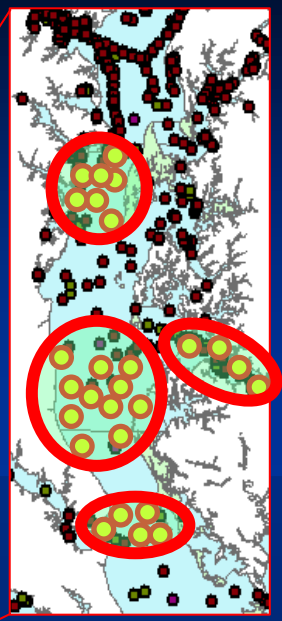


Section 6 Award: Assessment of Critical Habitats for Recovering the Chesapeake Bay Atlantic Sturgeon

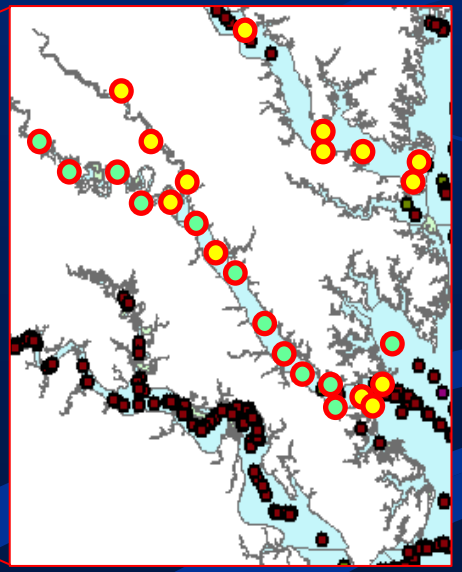
Black is negative Juvenile production



Corridor



Nursery/Forage



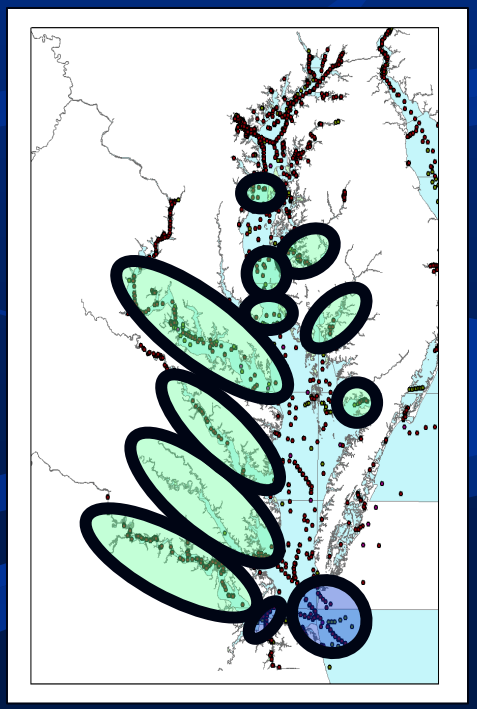
Neighborhoods & Traffic Jams

(1) Intensive Telemetry:

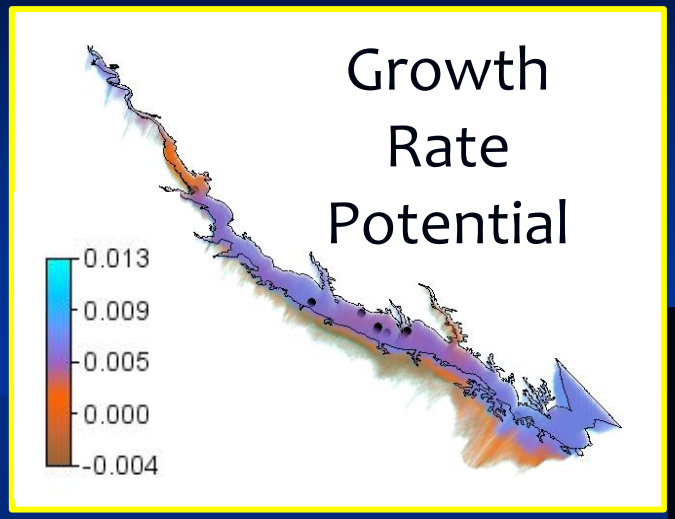
- High receiver coverage
- Summer WQ surveys
- Test model predictions against sturgeon incidence

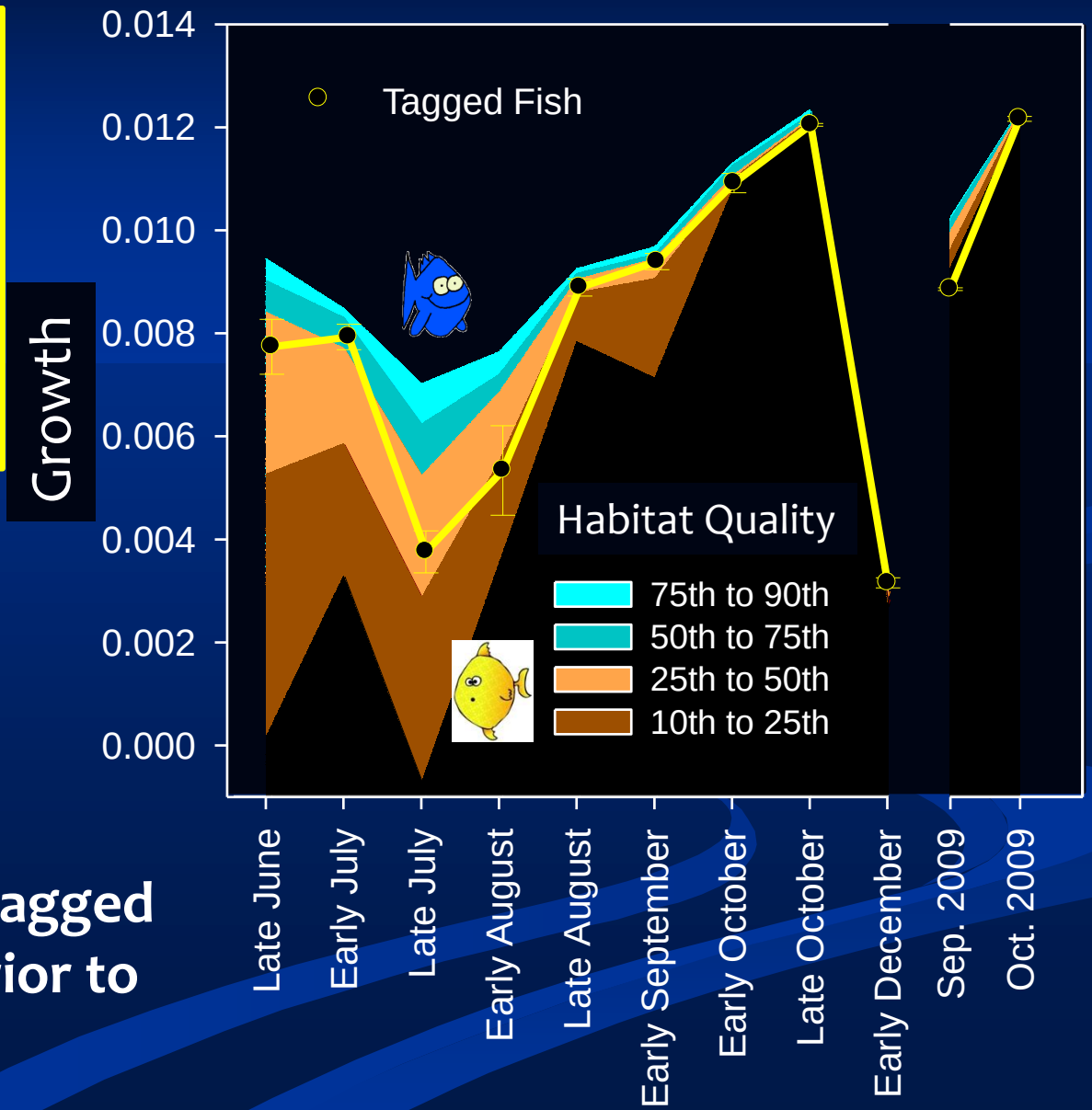
(2) Broad-scale Telemetry:

- Test incidence in tributaries and Bay region against predictions



Telemetry Foiling Expectations:
Predicted Habitat ≠ Preferred Habitat, but….

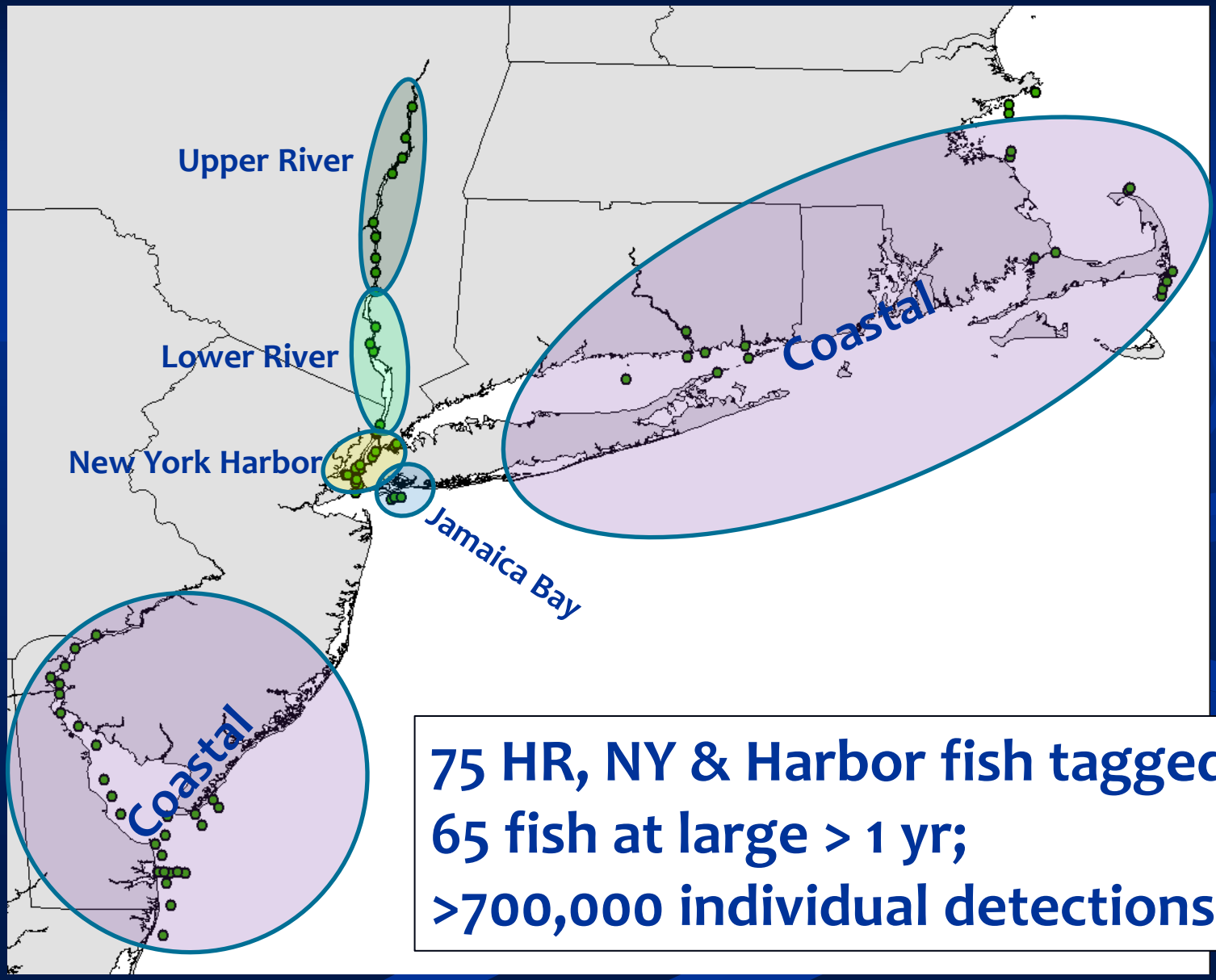




….most striped bass tagged in the Patuxent left prior to summer hypoxia

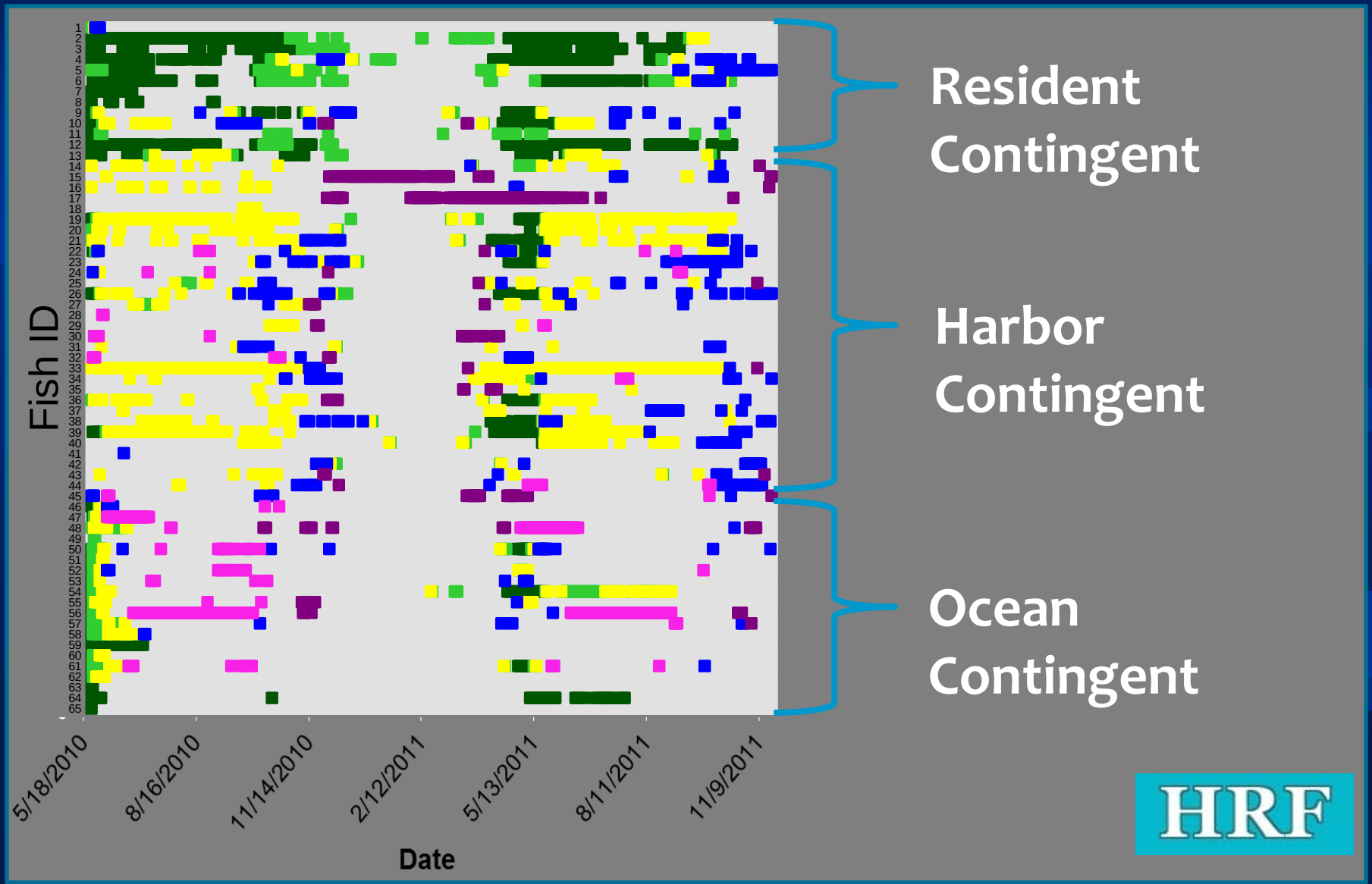
How many Hudson River Striped Bass Leave?

HRF



75 HR, NY & Harbor fish tagged;
65 fish at large > 1 yr;
>700,000 individual detections

How many Hudson River Striped Bass Leave?
Partial Migration; Contingents vary in neighborhoods, traffic corridors

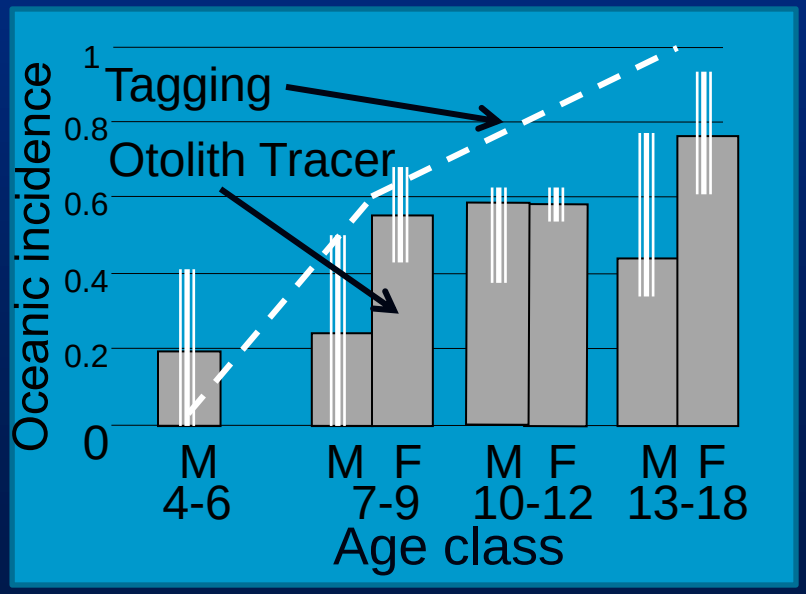


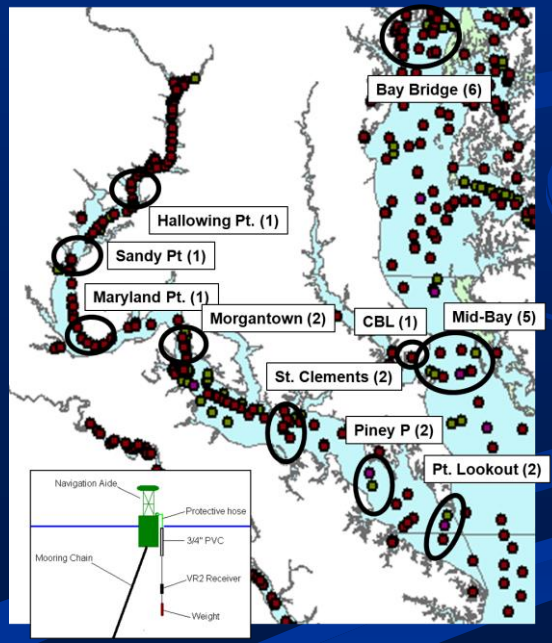
How many Chesapeake Bay Striped Bass Leave?

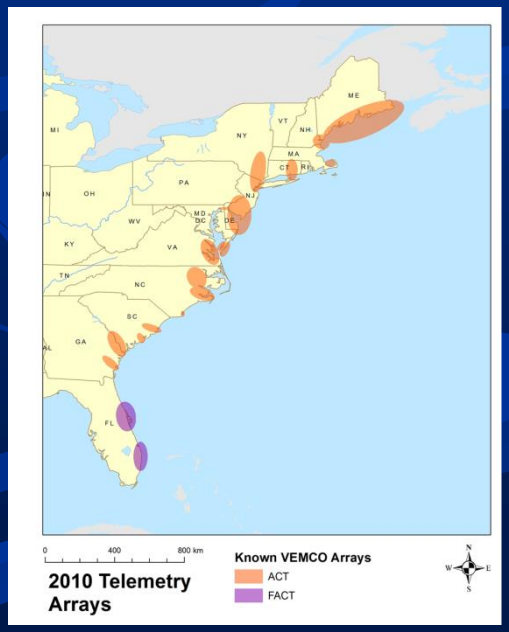
Size-specific and Seasonal Patterns of Emigration, and Chesapeake Bay and Coastal Habitat-use by Potomac River Striped Bass (Proposal to ASMFC)

Release 100 spawning aggregation striped bass, in size-stratified design. Test:

- **expected size and sex-specific patterns of emigration**
- **seasonal timing of emigration and spawning run: influence of temp and flow**
- **segregation of resident striped bass within the Potomac River, and among Chesapeake Bay regions and other tributaries**
- **emigration to non-natal estuaries (e.g., Delaware, Hudson) and coastal regions**
- **incidence of straying and skipped spawning**







Careful for what you wish for….

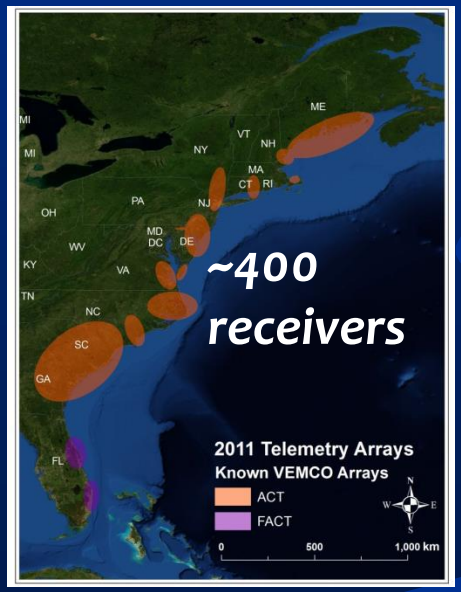
Data Sharing: Who's data? How to collaborate? How to gain access to data? Long-term data access?

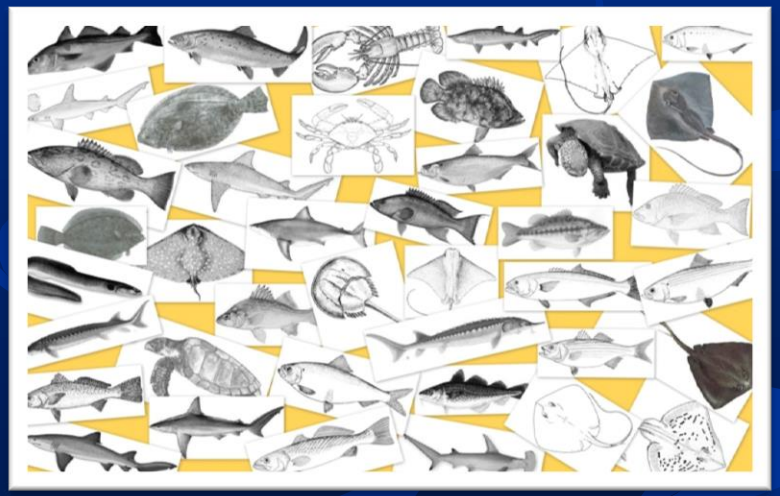
- Data Sharing Agreements (Section 6 MD-VA Award)
- Web-based database tools

Data Analysis:

- Observing systems
- Hypothesis driven
- Tag-recapture designs
- Longitudinal statistics
- Movement ecology

The Atlantic Cooperative Telemetry Network





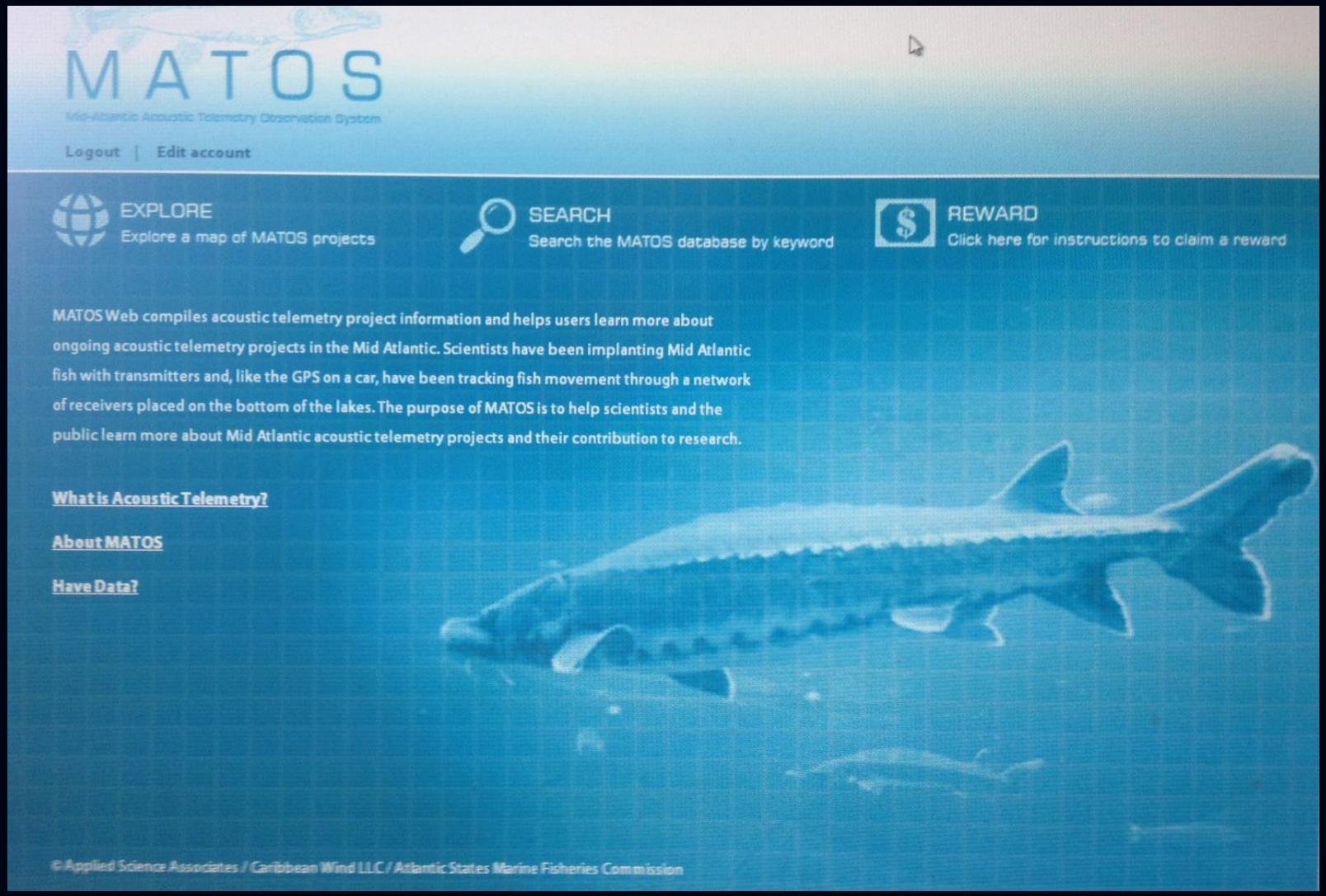
http://www.theactnetwork.com/

Dewayne Fox

Currently there are over 5000 known transmitters deployed since 2004, with over 1000 deployed in 2010 alone. This corresponds to 82 investigators and 49 identified species currently being studied along the east coast.

http://matos.asascience.com/

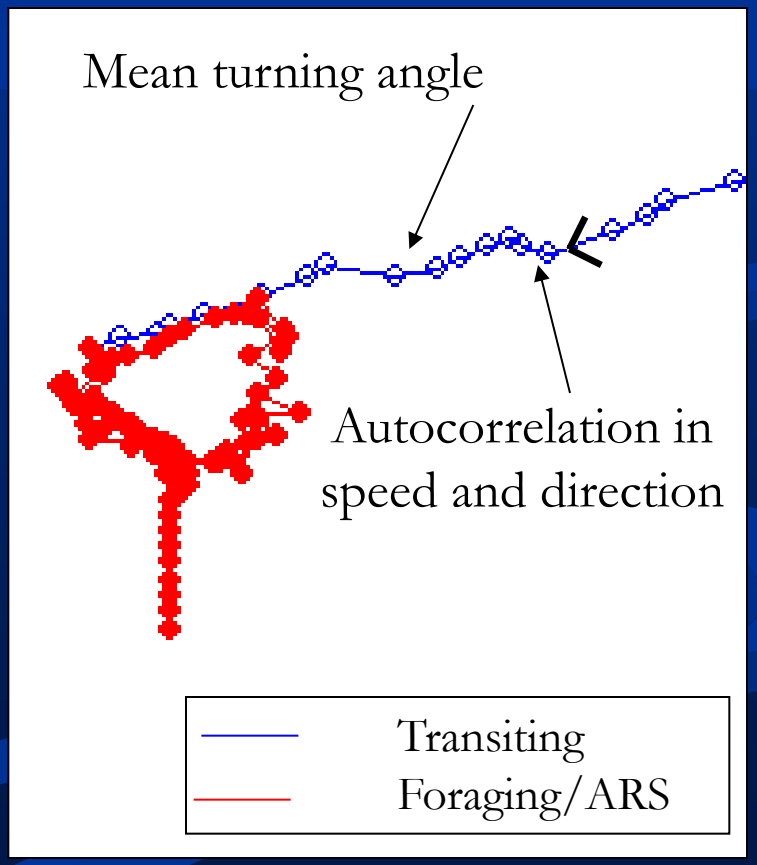
Mid-Atlantic Acoustic Telemetry Observation System (Doug Williams, NCBO), ASMFC-support



Bio-informatic Challenge: Inferences on individual movement behaviors

State-spaced modeling: time series model that predicts the future state of a system from its previous states probabilisitically.

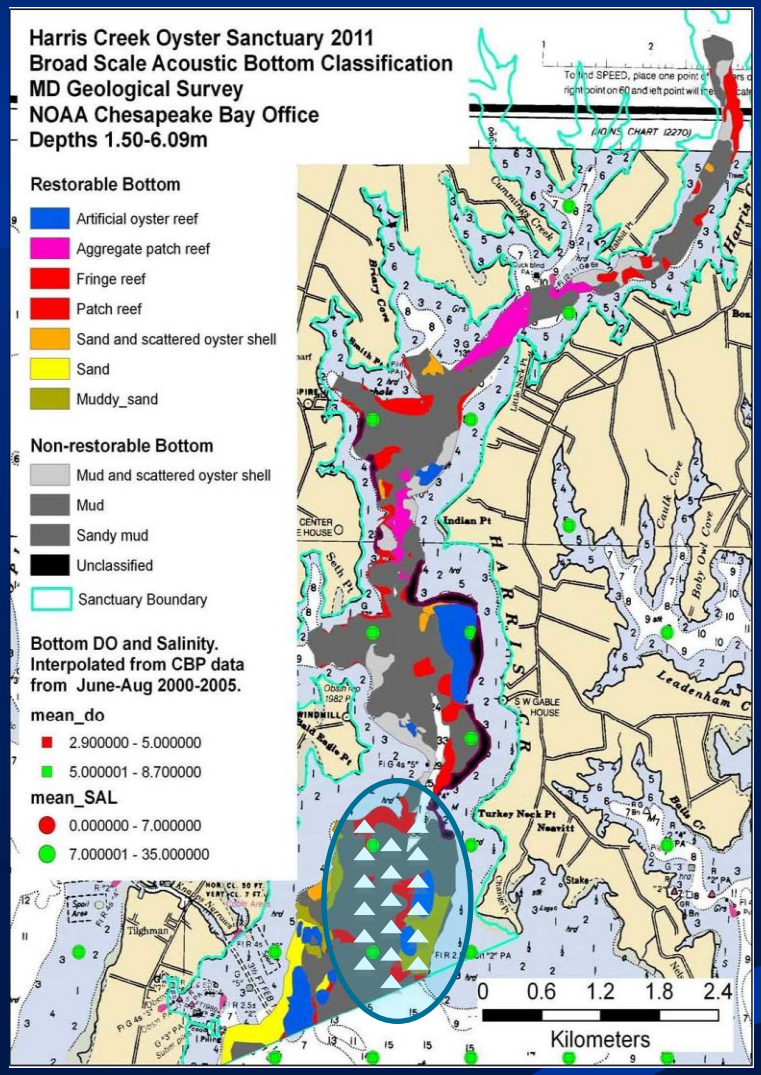
Helen Bailey



From Jonsen et al. (2007)

Down-scaled Telemetry: using fine-scale movements to infer habitat function

White perch utilization of a restored oyster reef in Harris Creek in comparison with unrestored habitat (Proposal to NCBO; Bailey and Secor)

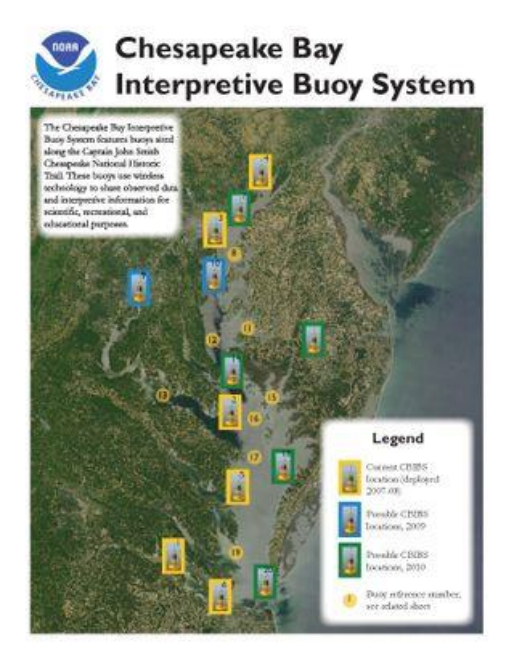


- Deploy an 18 receiver positioning system across classes of habitat type in Harris Creek
- Release white perch into receiver array
- Determine if there is an association between white perch foraging behavior and the benthic habitat, and whether foraging behavior is more prevalent at restored than unrestored oyster reefs.

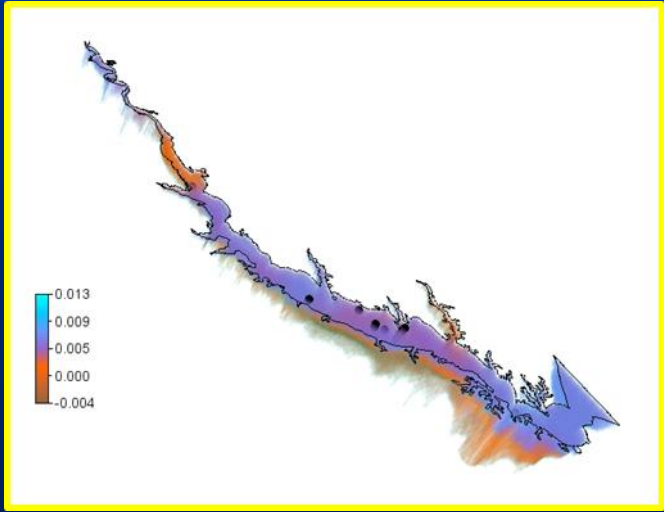
The Big Picture: Mapping Fish Migrations onto Seascapes

Seascape Ecology: Now-casting fish distributions by integrating oceanographic and fish observing systems, telecommunications, and modeling.

Coastal Observing Perspective



Habitat/Movement Modeling Perspective



Fish Observing Perspective

Why? Improved surveys and assessments, models of TMDL effectiveness and climate adaptation, management around protected species, scale-dependent habitat recovery, etc. etc.