Nursery origins of the adult Atlantic menhaden stock

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Outline

- Importance
  - Link between 1^0 and 2^0 production
  - Commercial fishery
- Migration
  - Reproduction
  - Contribution to coastal stock
- Sampling and data analysis
  - Juveniles
  - Adults
- Results and implications

Menhaden – Life History

- Adults
  - Coastal migratory stock
  - Spawn offshore south of Cape Hatteras
- Larvae
  - Transported to bays and estuaries
- Juveniles
  - Estuarine dependant
  - Abundance correlated w/ primary productivity
  - Migrate to coastal ocean during fall/winter

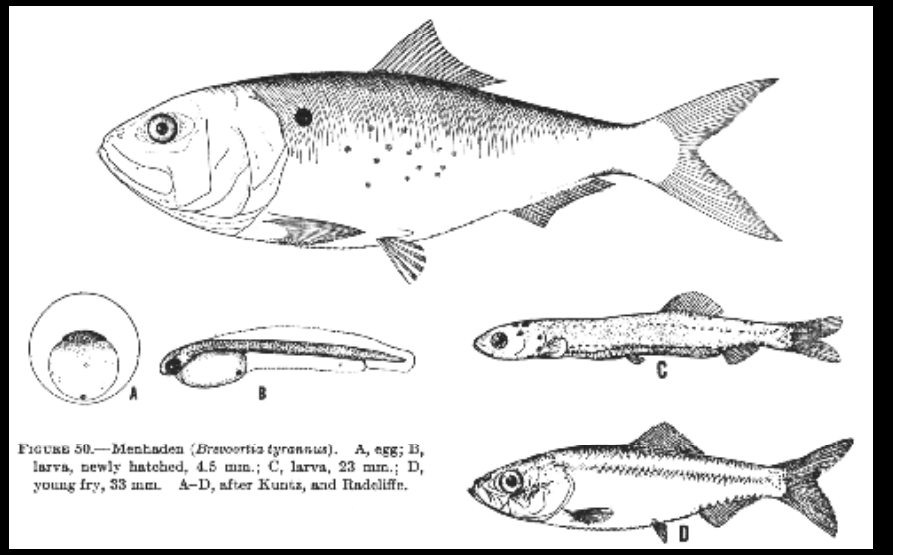
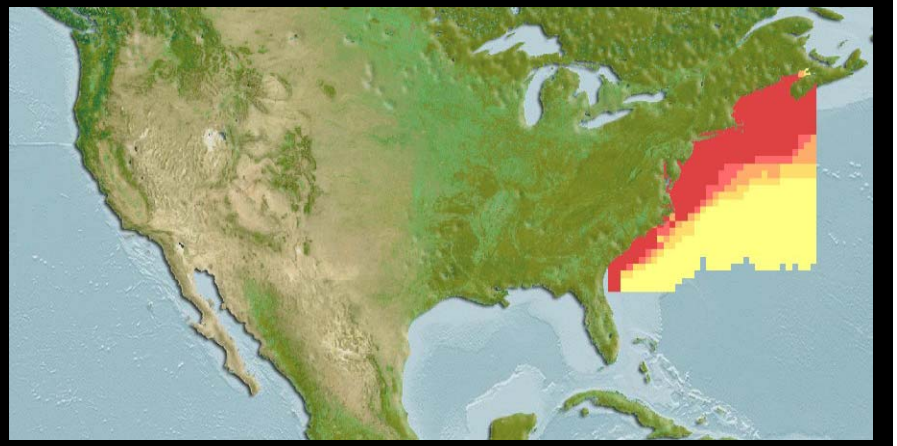


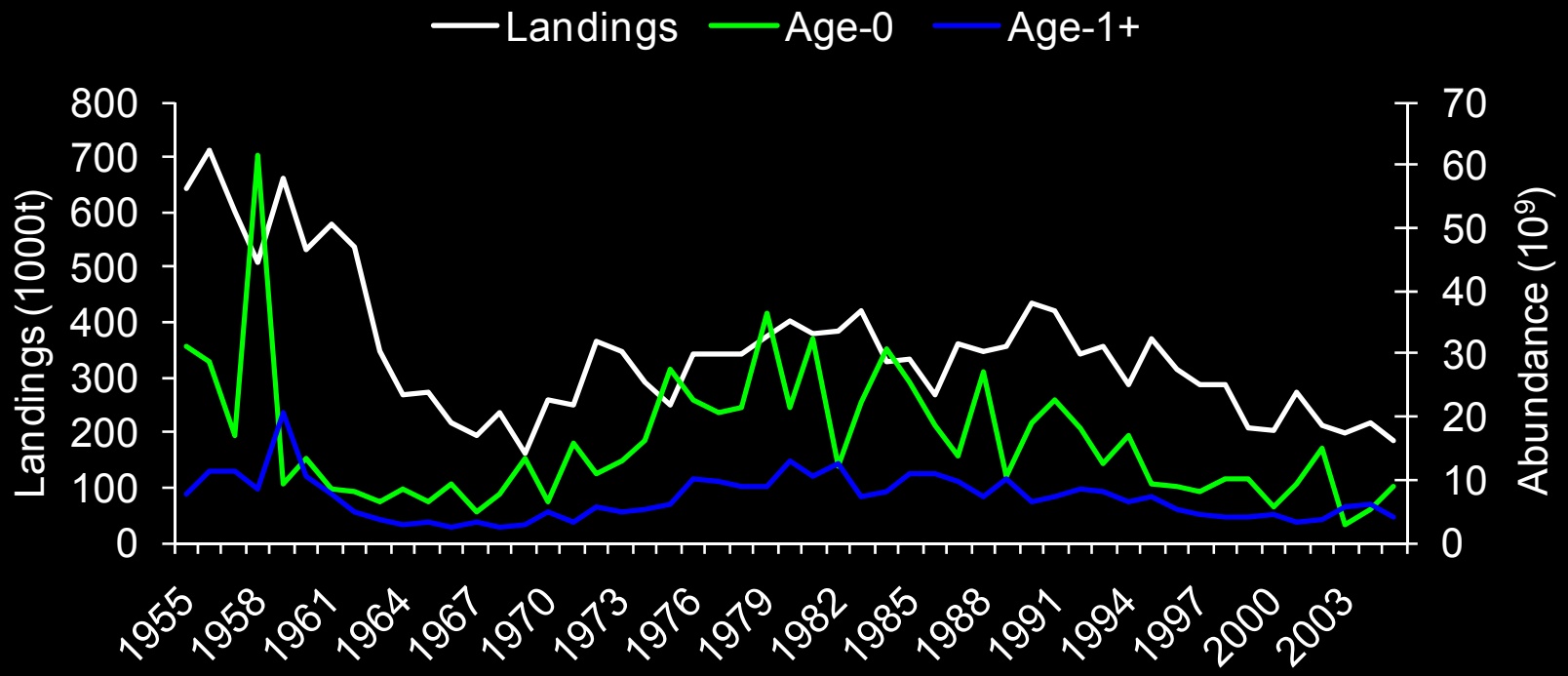
FIGURE 50.—Menhaden (*Brevoortia tyrannus*). A, egg; B, larva, newly hatched, 4.5 mm.; C, larva, 23 mm.; D, young fry, 33 mm. A–D, after Kuntz and Radcliffe.



Menhaden importance

- Filter feed on phytoplankton
  - Consume much of primary production in Chesapeake Bay
- Prey base for top piscivores
  - Striped bass, bluefish, weakfish
- Valuable commercial fishery (Reedville)
  - Largest fishery in US (+ gulf menhaden)
  - Effort and landings are declining

Commercial fishery



Atlantic States Marine Fisheries Commission 2006. Atlantic menhaden stock assessment report. Atlantic States Marine Fisheries Commission, Stock Assessment Report No. 06-01. 139 p.

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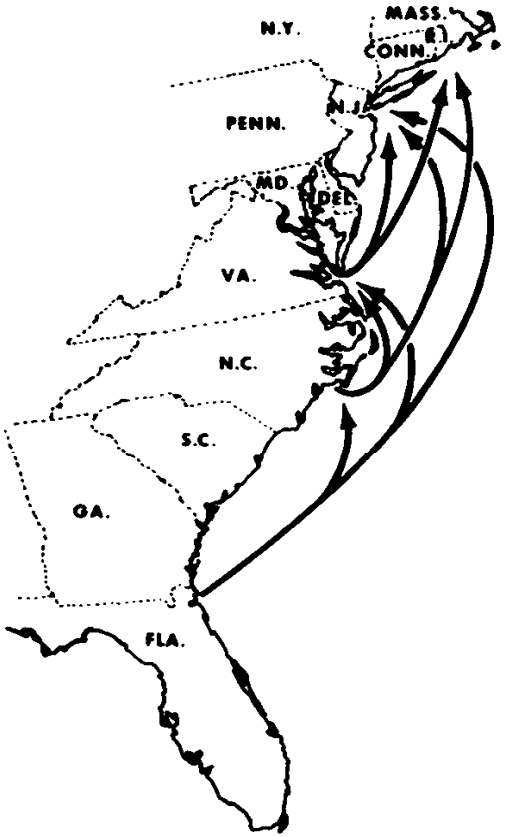
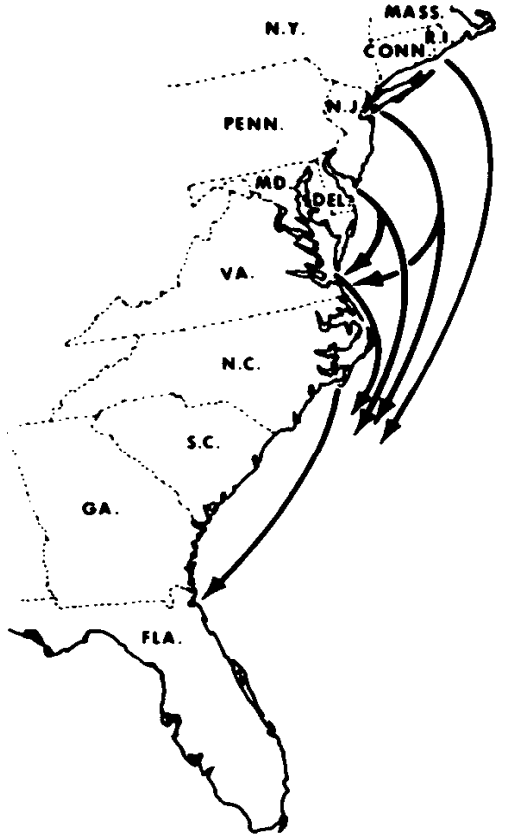
Menhaden movements



SPRING AND SUMMER



FALL AND WINTER

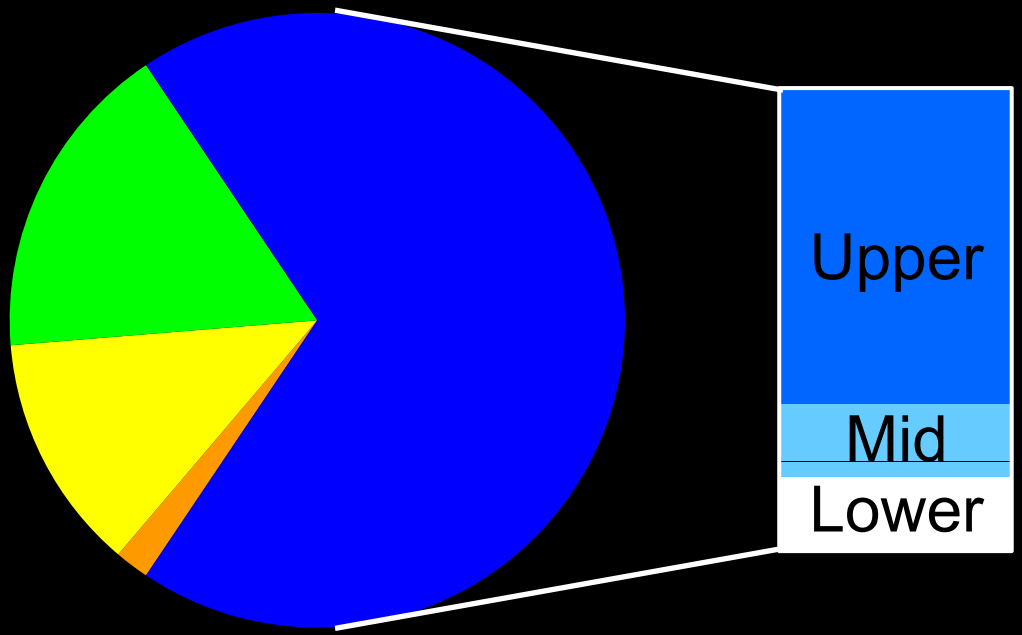
Generalized movements of tagged adult menhaden (from Dryfoss et al. 1973)

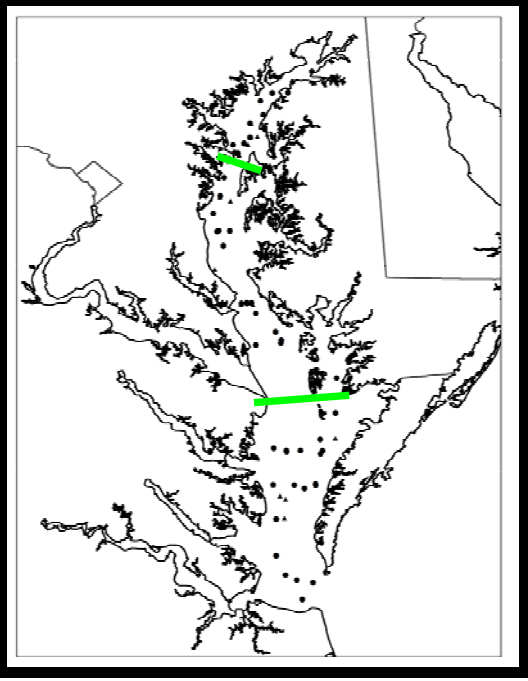
Menhaden management

- Atlantic menhaden managed as unit stock
- Stock assessments
  - Overfishing is not occurring
  - Not overfished
- Recruits
  - Near all time lows
- Has production shifted locations?
- Has YOY/juvenile survival changed?
- Are juvenile/sub-adult menhaden capable of providing desired ecosystem services?

Habitat Based Recruitment Indices

- Chesapeake Bay (Coastal VA) - 68.8%
- South Atlantic (FL-NC) - 16.9%
- Middle Atlantic (Coastal MD-NY) - 12.5%
- New England (CT-ME) - 1.8%





Objectives

- Examine contribution of major juvenile menhaden nurseries to adult stock
  - Success with spotted seatrout and weakfish
- Determine composition of Chesapeake Bay recruits in adult stock
  - Temporal variation?

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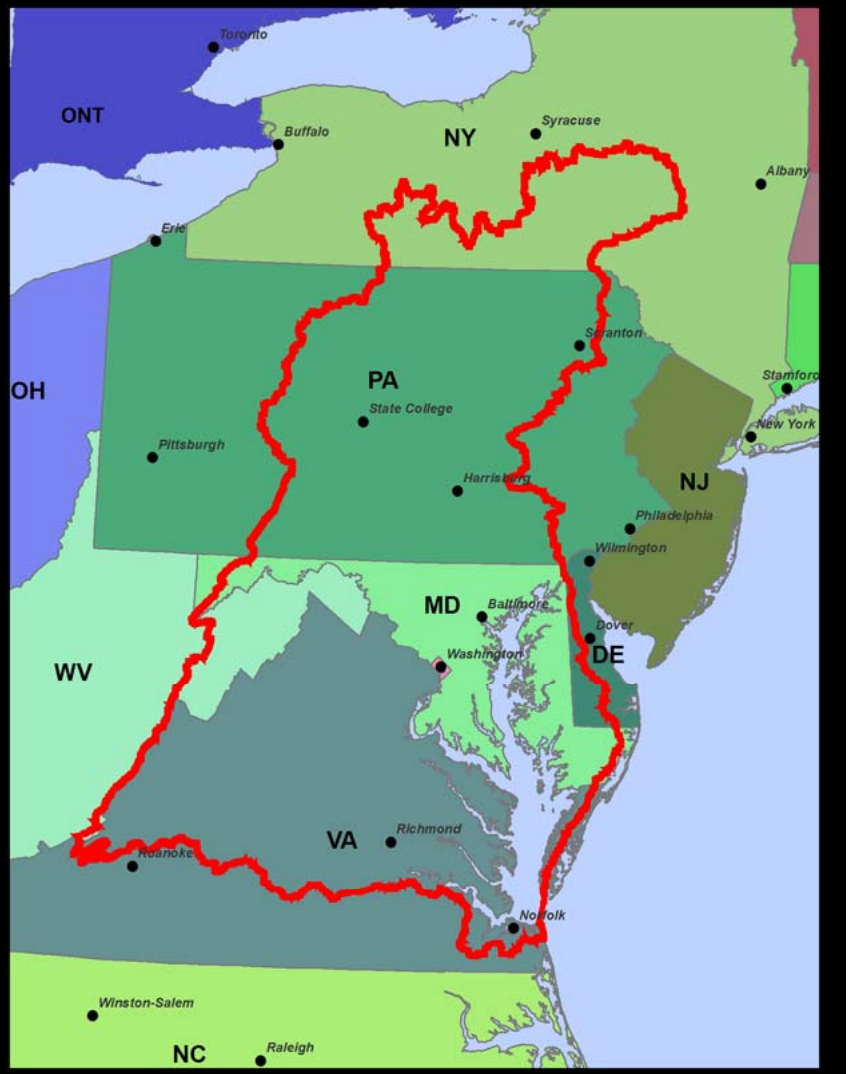
Sampling

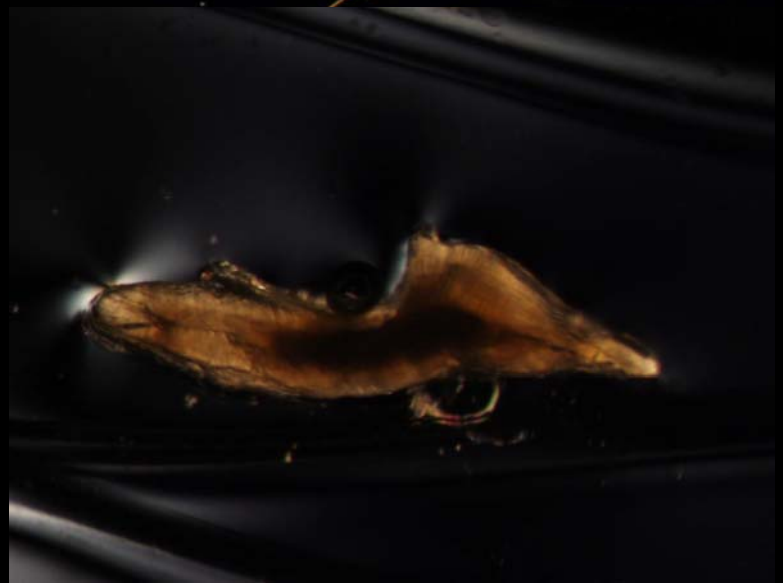
- Age-0 menhaden
  - July-September
  - 2005-2010
  - 2007-2008
- Adults (Age-1+)
  - 2008-2009
  - July-August
  - November-December

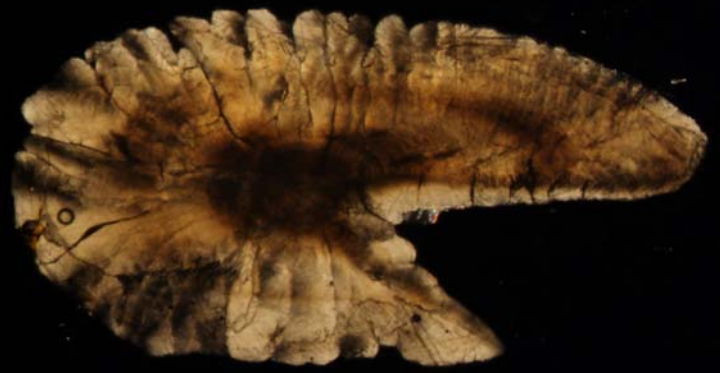


Otolith Chemistry

- Age-0 menhaden
  - July-September
  - 2005-2010
  - 2007-2008
- Solution ICP-MS
  - Li, Mg, Ca, Mn, Sr, Ba
  - Element:Ca molar ratios
- IRMS
  - $\delta^{13}C$, $\delta^{18}O$

Otolith Chemistry





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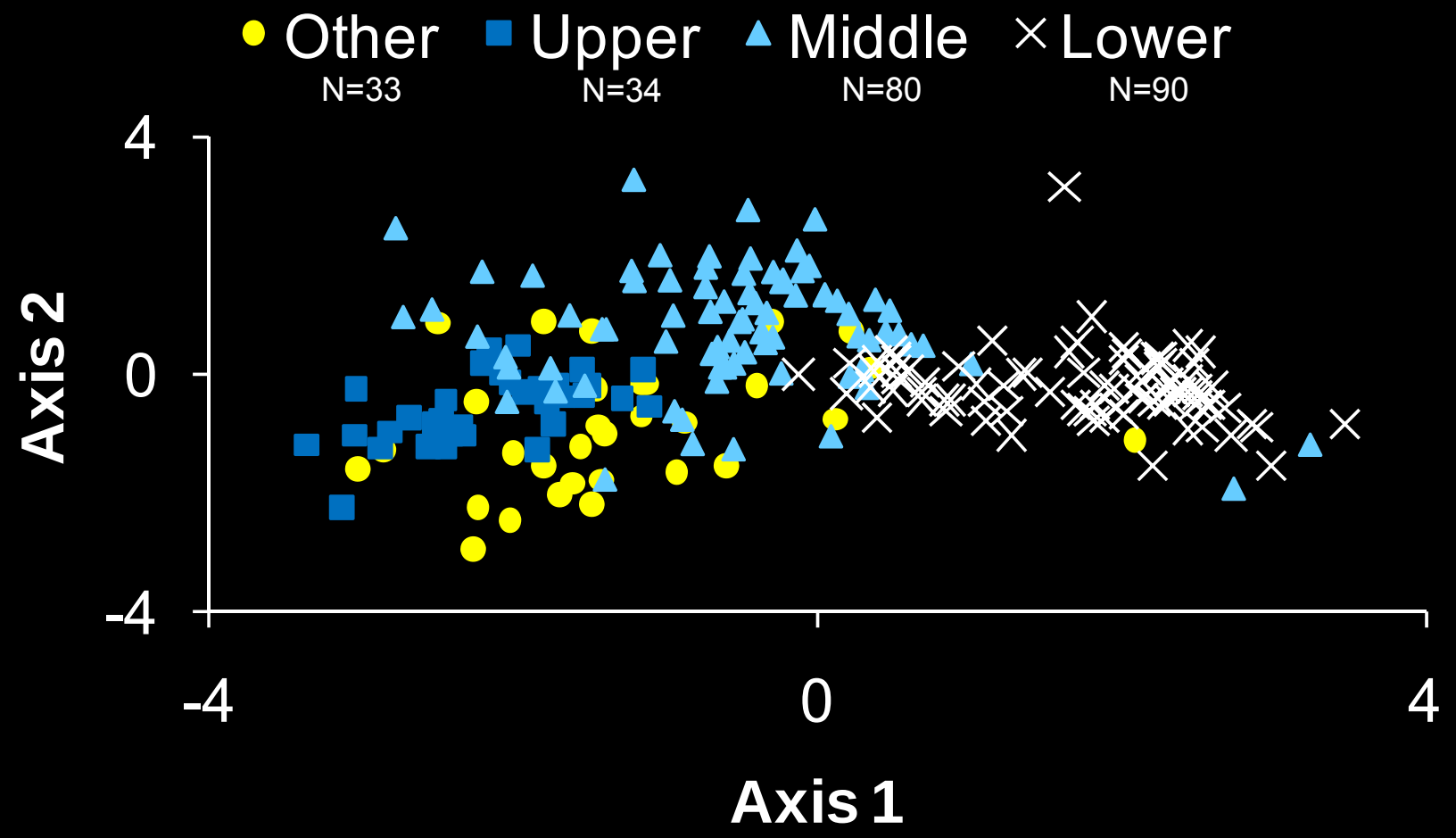
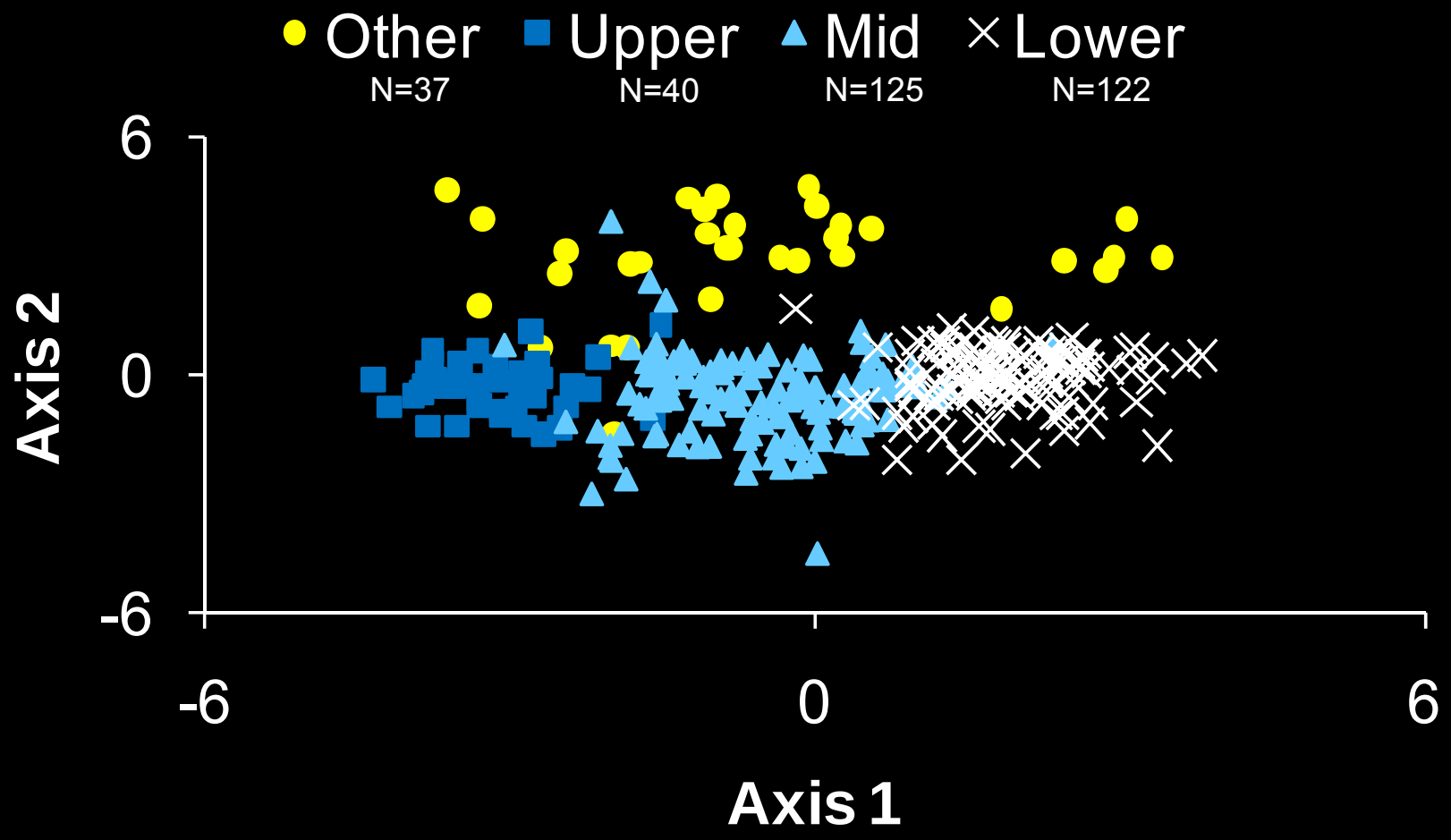
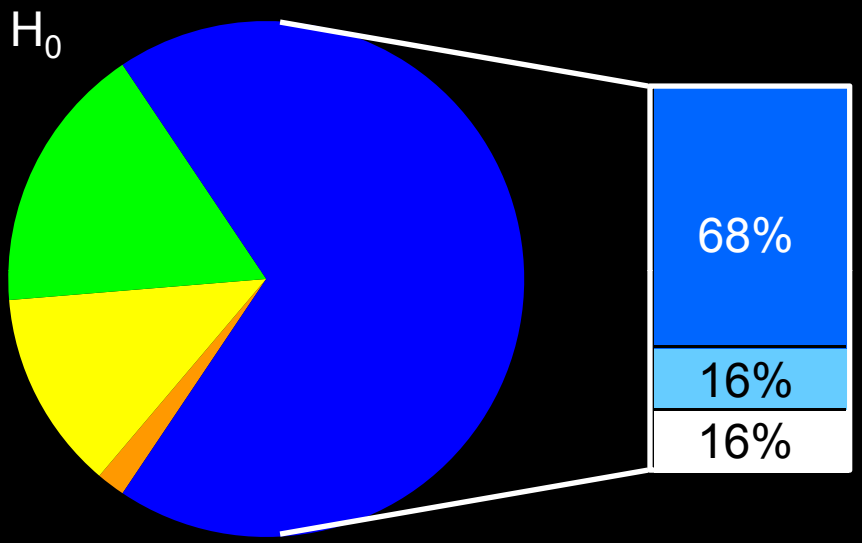
Juvenile Otolith Chemistry - 2007



Juvenile Otolith Chemistry - 2008



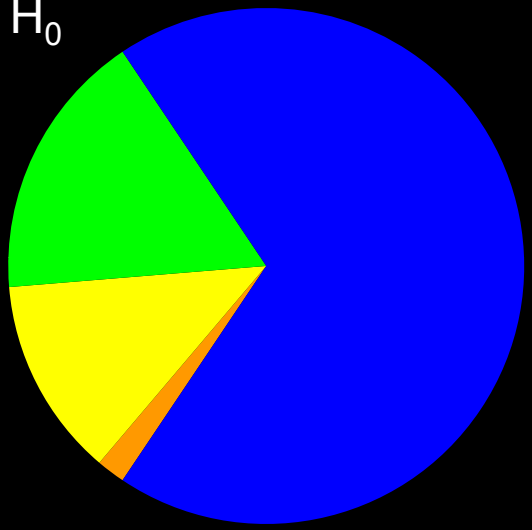
Adult assignment



Chesapeake Bay	69%
SAB	17%
MAB	12%
New England	2%

Adult assignment

H_0



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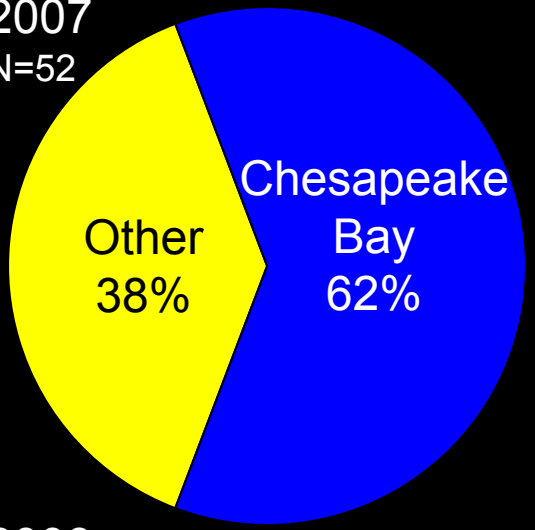
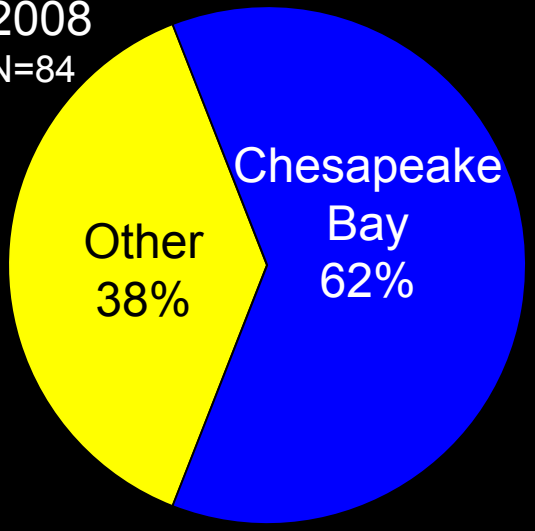
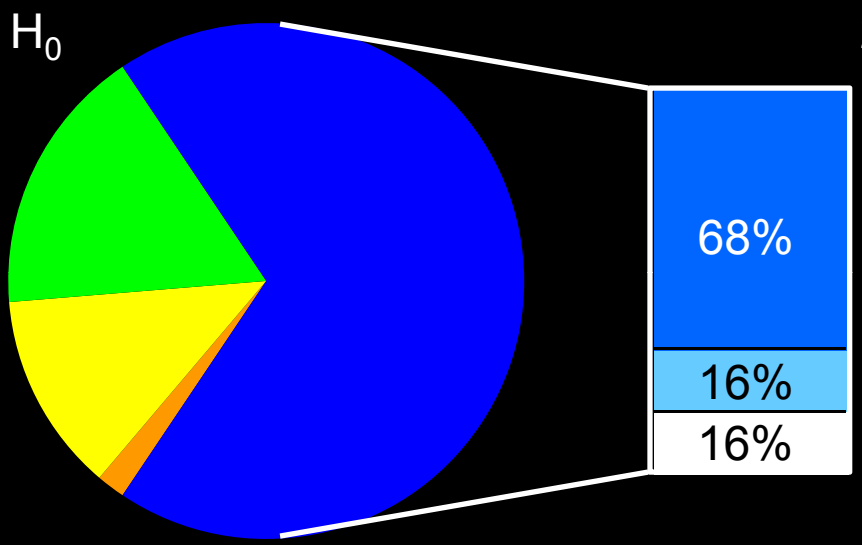
2007
N=52



2008
N=84



Adult assignment



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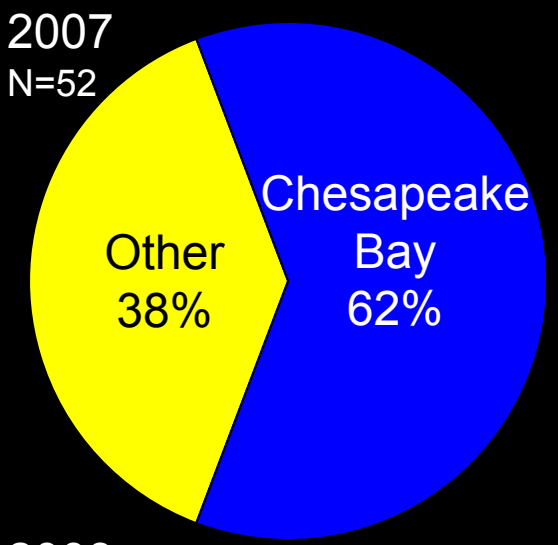

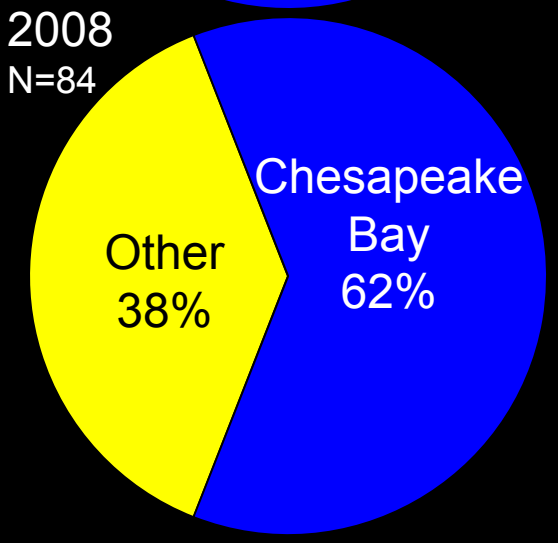

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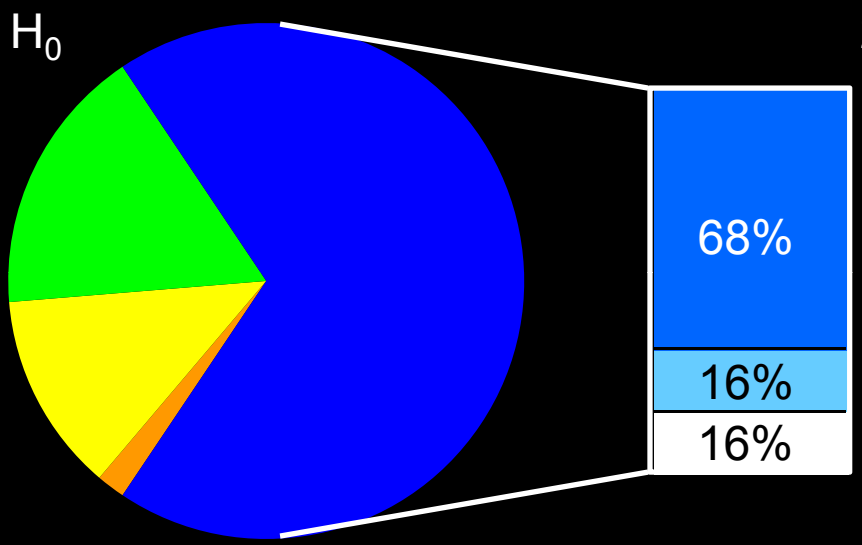

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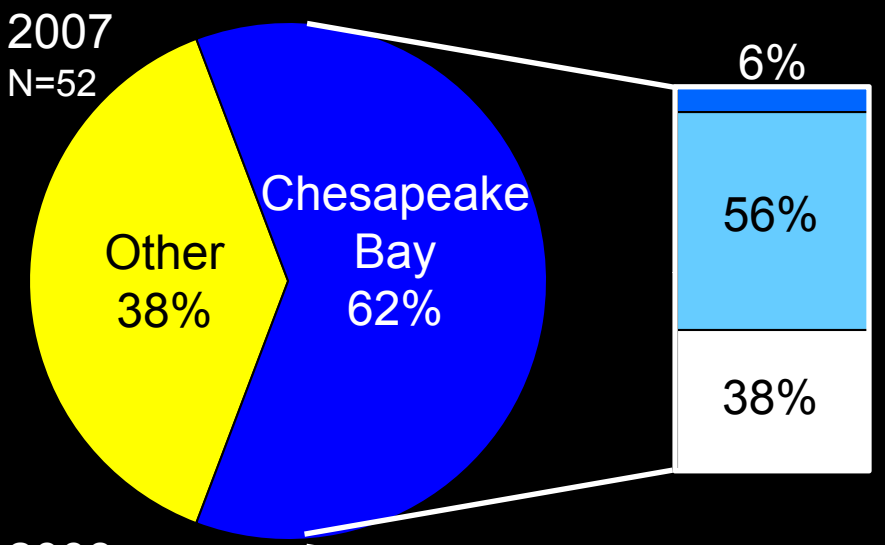

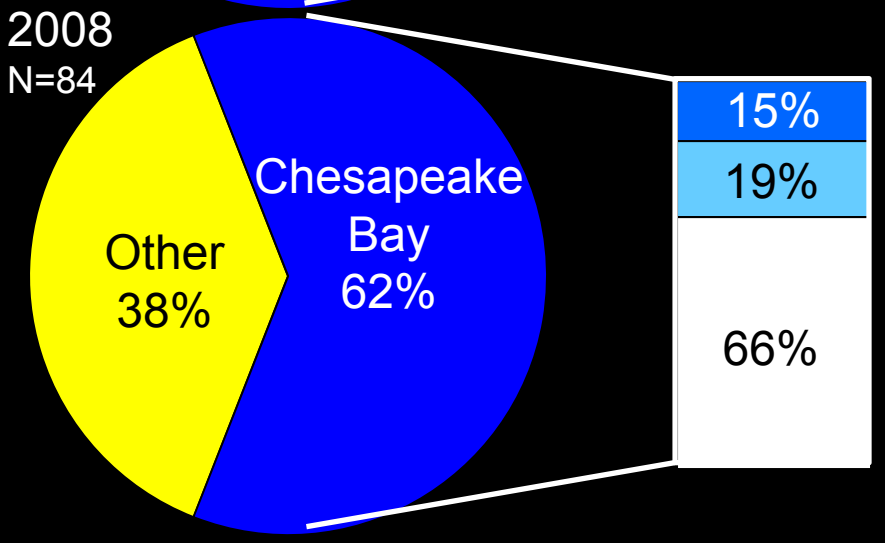

Summary

- Quantify juvenile otolith signature from unknown adult menhaden otoliths
- Proportion of recruits originating from Chesapeake Bay is consistent with projections from the stock assessment
- There appears to be significant spatial variability in the origin of recruits from within Chesapeake Bay
- Few recruits were derived from the upper Chesapeake Bay
  - Recruitment may be declining (Love et al. 2006)

Further Questions

- What about areas outside of Chesapeake Bay?
  - Delaware Bay and NC sounds
- Other markers?
  - Otolith shape analysis, growth rates, etc.
- Are these estimates stabile between years?
  - Increased adult sampling

Acknowledgements

- Samples
  - T. Miller, E. Durell - Juveniles
  - J. Smith, B. O'Bier, J. Brust, J. McNamee - Adults
- Processing samples for otolith chemistry
  - S. Krumreich, B. Culver, M. Phanibhushandra
- Z. Chen, S. Birdwhistle, and S. Beharry
  - ICP-MS
- B. Williams, B. Jenna, A. Schauer
  - IRMS
- Funding
  - NOAA NCBO, Virginia SeaGrant, NSF