Estimating Abundance of Atlantic Menhaden in Chesapeake Bay: Comparing and Evaluating Methods and Retrospective Analysis

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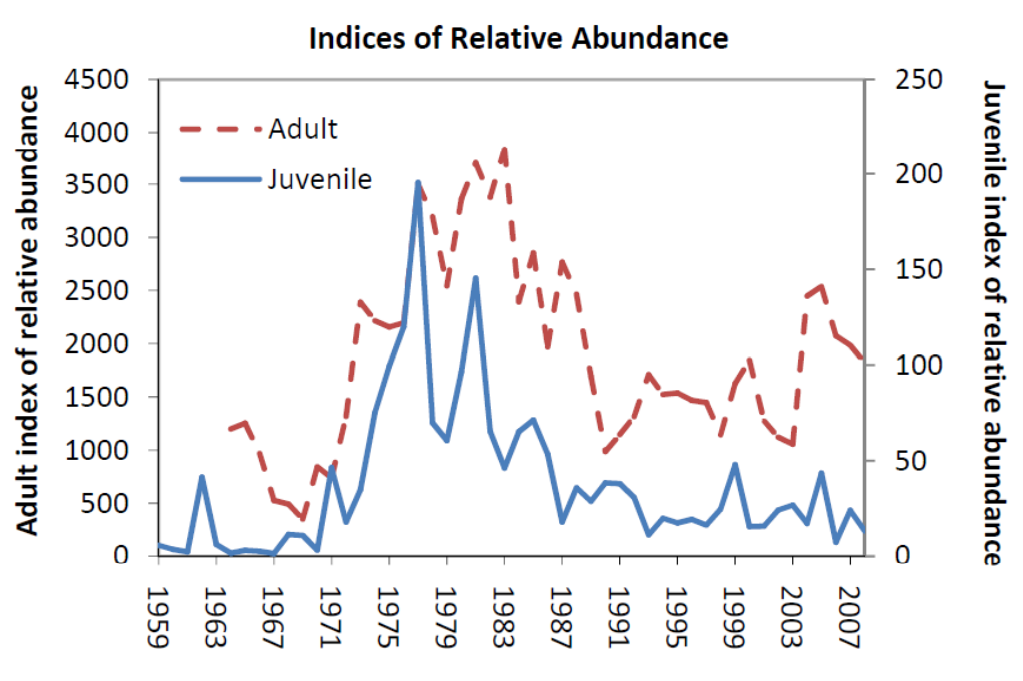
Assessment of menhaden that guides fisheries management is highly influenced by abundance of Chesapeake Bay juveniles.

Majority of coastal stock has historically relied on juveniles from the Chesapeake Bay.

Cause of decadal cycle in juvenile abundance in the Chesapeake Bay remains unknown.

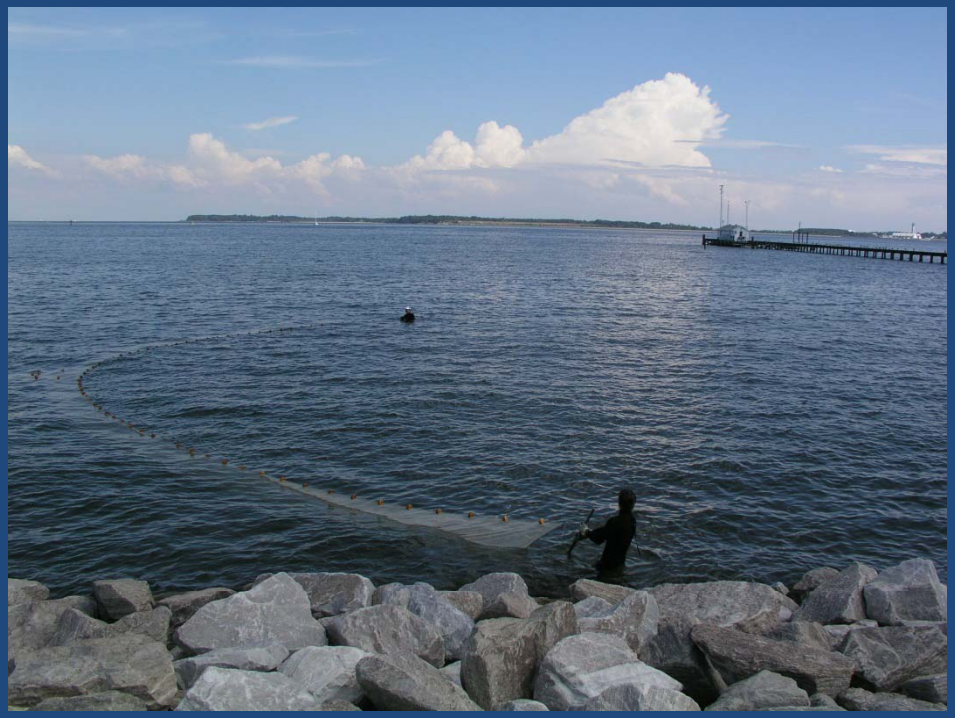


http://www.asmfc.org/atlanticMenhaden.htm

University of Maryland
Center for Environmental Science
Chesapeake Biological Laboratory

NOAA
Chesapeake Bay

Maryland
Department of Natural Resources



Juvenile abundances estimated through seine surveys.

Capturing juvenile menhaden by seine is hit or miss. Matters where and when you deploy the seine.

Chesapeake Biological Laboratory Weekly Seine Survey (24 weeks)

Year	Total	Mean	Max.	Incidence	Duration
2006	5	<1	3	2	1 week
2007	27	<1	15	5	7 weeks
2008	6728	118	3,300	4	16 weeks
2009	1385	27	962	7	8 weeks
2010	16462	274	6,000	14	20 weeks

Study Objectives

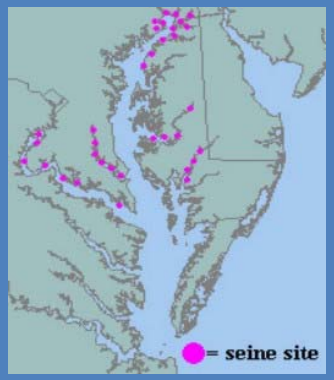
1. Compare seining and trawling methods in capture of menhaden.
2. Evaluate gears between and within tributaries: Upper Bay, Choptank and Patuxent Rivers.
3. Conduct a historical analysis of sizes, ages, and distribution of juvenile menhaden based on MD DNR seine survey data.
4. Investigate environmental correlates to abundance.
5. Estimate growth rates, hatch dates, and other juvenile attributes.

Test Methods to Measure Abundance

Build on Past Work

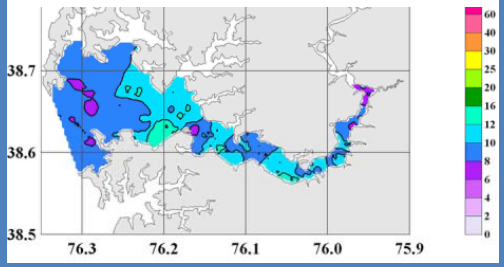
MD DNR Juvenile Index : Five tributaries, 22 sites 1954-present

http://dnr.maryland.gov/fisheries/juvindex/index.asp#Indices



Investigate Juvenile Ecology

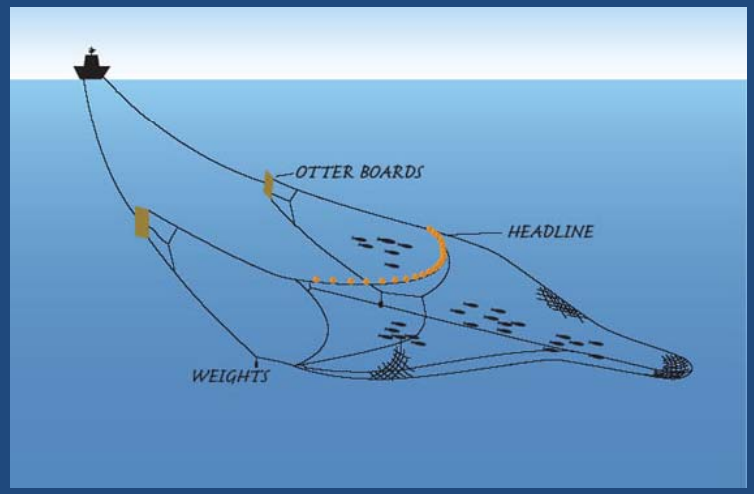
Chlorophyll *a*, Aug '07, Choptank R.



Survey Methods

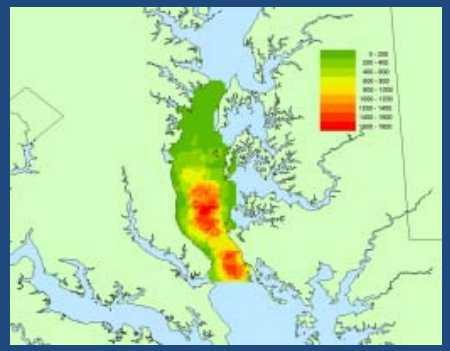
Beach Seine

- Encircle school of menhaden
- Human power, inexpensive
- Effective in shallow areas, amenable to survey designs, historical
- Efficiency depends on avoidance behaviors, tide, weather, experience



Midwater Trawl

- Herd and entrap school of menhaden
- Vessel power, moderately expensive
- Effective throughout water column
- Amenable to survey designs, precedence
- Efficiency depends on avoidance behaviors, vessel properties, and manner of gear deployment



Depiction of menhaden concentrations measured from airborne LIDAR

http://www.esrl.noaa.gov/csd/fishlidar/programs.html

Other Gears (for discussion)

- Purse seines
- Pound nets
- Acoustics, Airborne counts, and LIDAR (light detection and ranging)

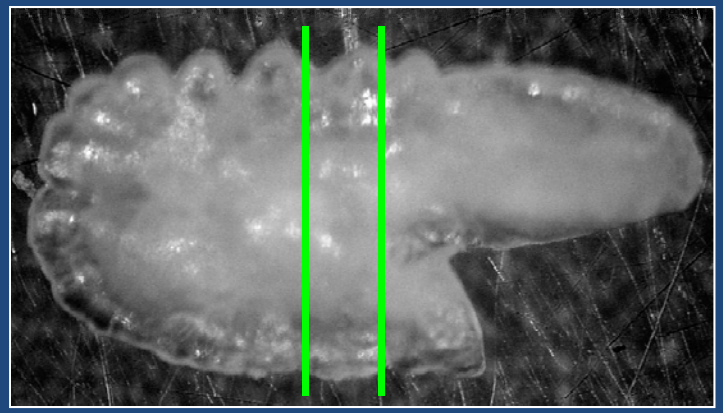
Preliminary Gear Comparison

UMCES Research Vessel *Rachel Carson*

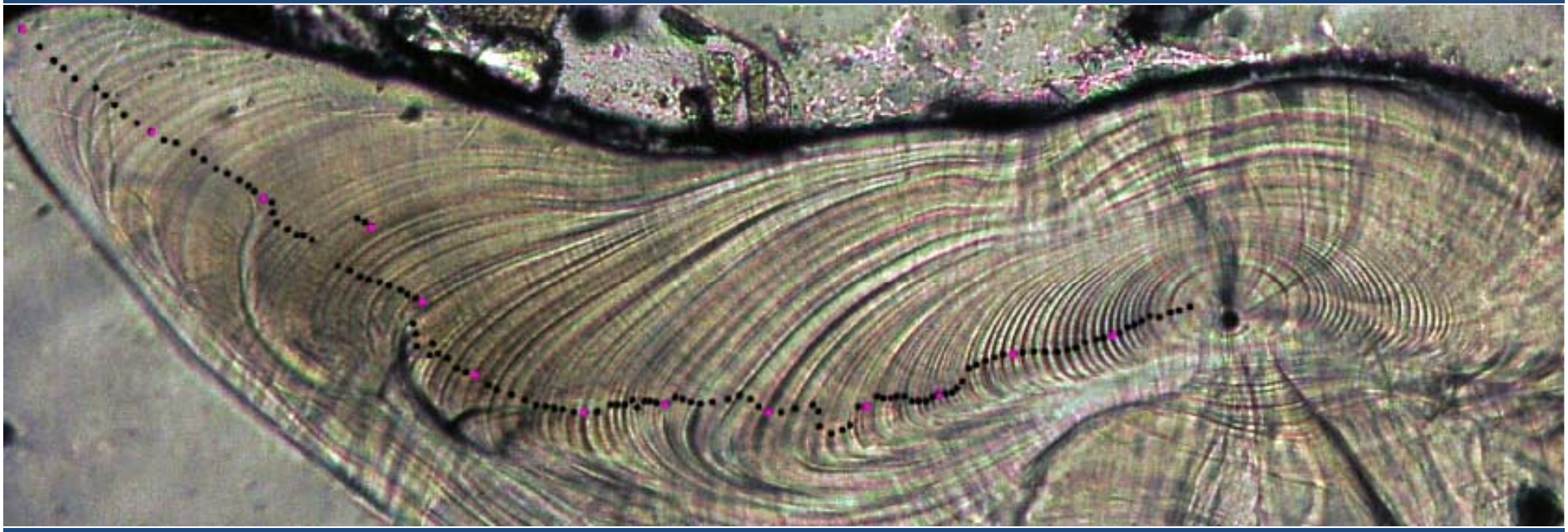
Juvenile Menhaden Catches July 2010, Choptank River

Station	Trawl Number	Seine Number
Castle Haven	259	0
Hambrook	21	0
Jamaica Pt.	1570	1354
Dover Bridge	1246	77
Tuckahoe Mouth	Not sampled	52

Juvenile Menhaden Ecology: Age and Growth

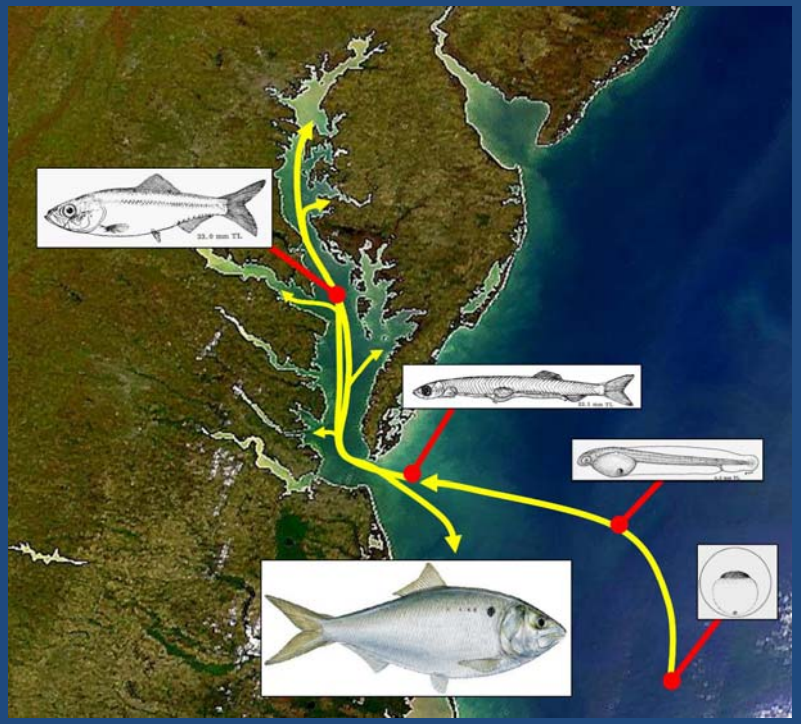


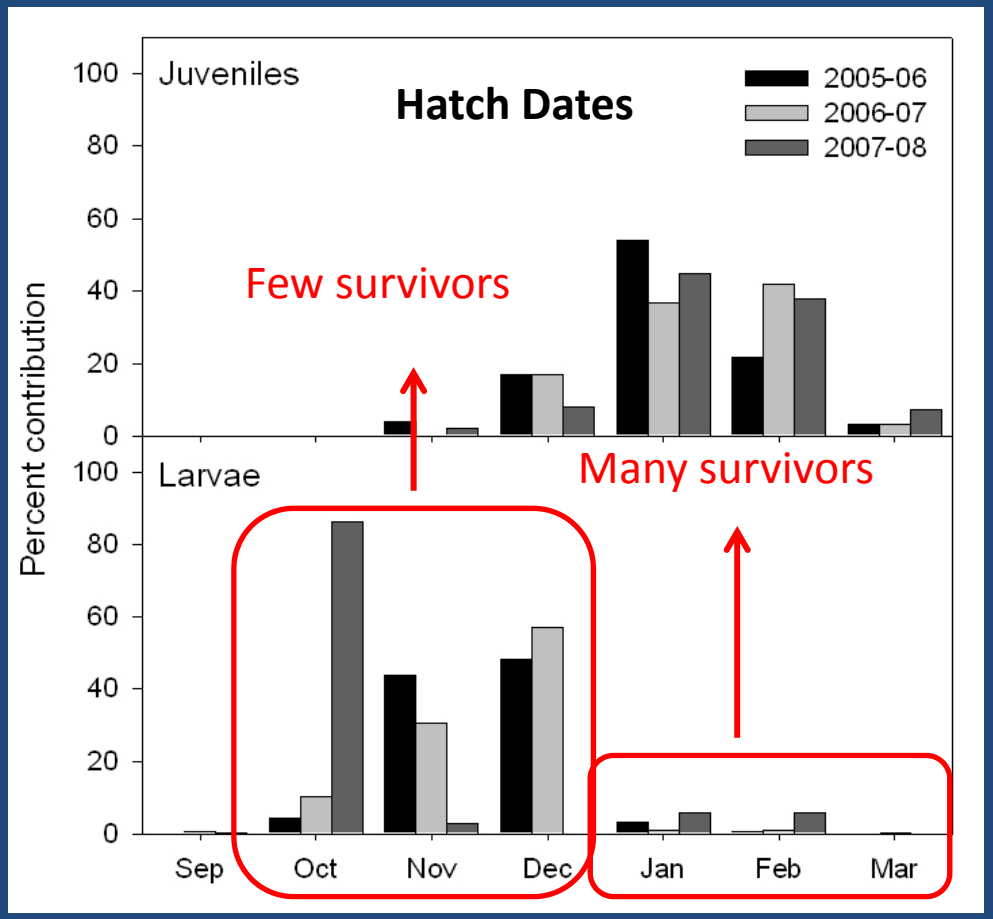
0.5” fish otolith (ear-stone)

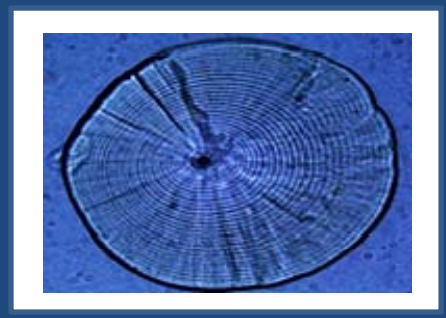


Sectioned juvenile menhaden otolith showing ~130 daily rings

Linking what happens in the Chesapeake to offshore spawning: hatch dates







Otolith of larval menhaden
Showing ~30 daily rings

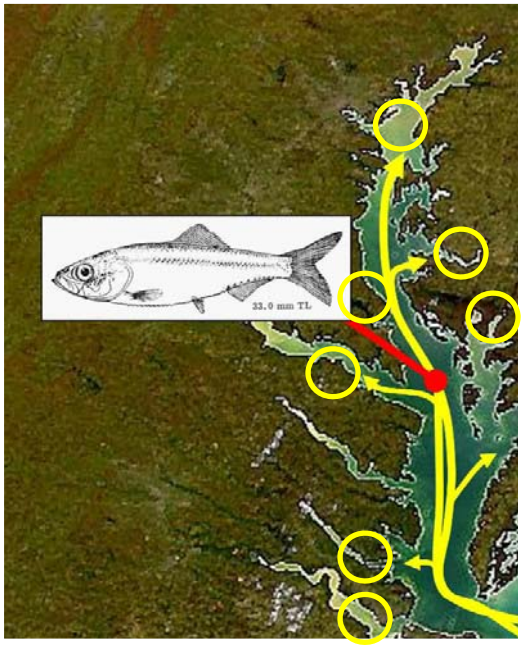
Most Chesapeake juveniles originated Jan – Feb.

Most Chesapeake larvae originated Oct-Dec.

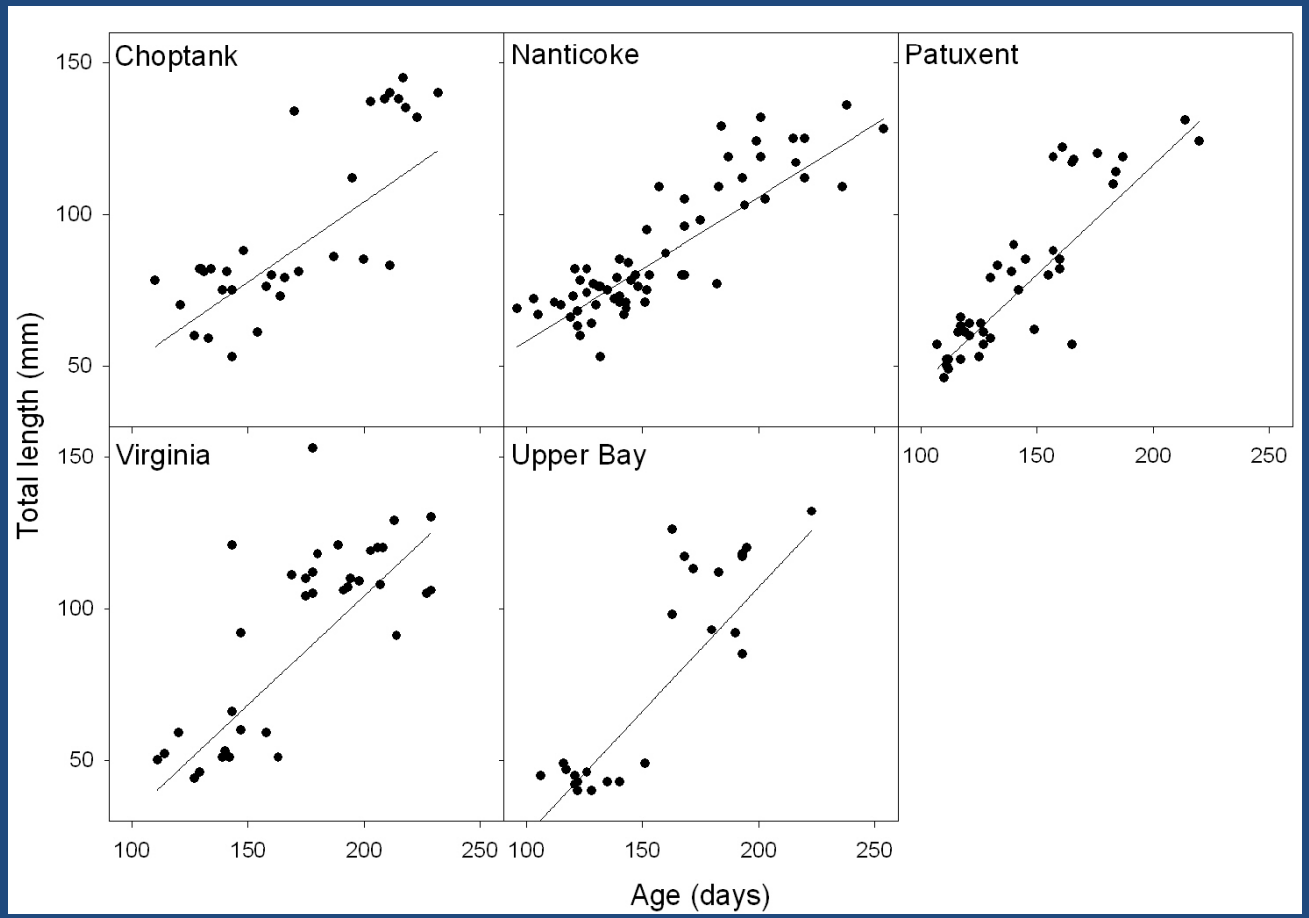
Inference: Winter mortality of larvae entering during fall and early winter months.

Is this pattern of early survival typical?

Juvenile growth rate varies among tributaries within the Chesapeake Bay



System	Growth mm/d
Choptank	0.53
Nanticoke	0.48
Patuxent	0.72
Virginia	0.72
Upper Bay	0.82



Study Benefits

1. Test and improve approaches to survey juvenile menhaden abundance.
2. Audit how historical seine survey measures seasonal, spatial, and annual trends in juvenile menhaden abundance.
3. Improve understanding on what environmental factors drive juvenile menhaden abundance in the Chesapeake Bay.

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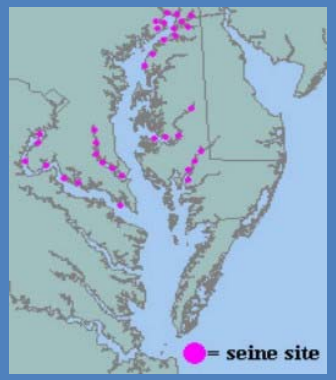

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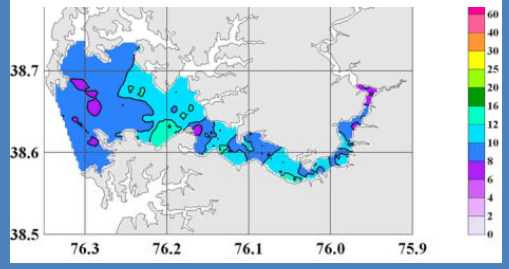
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