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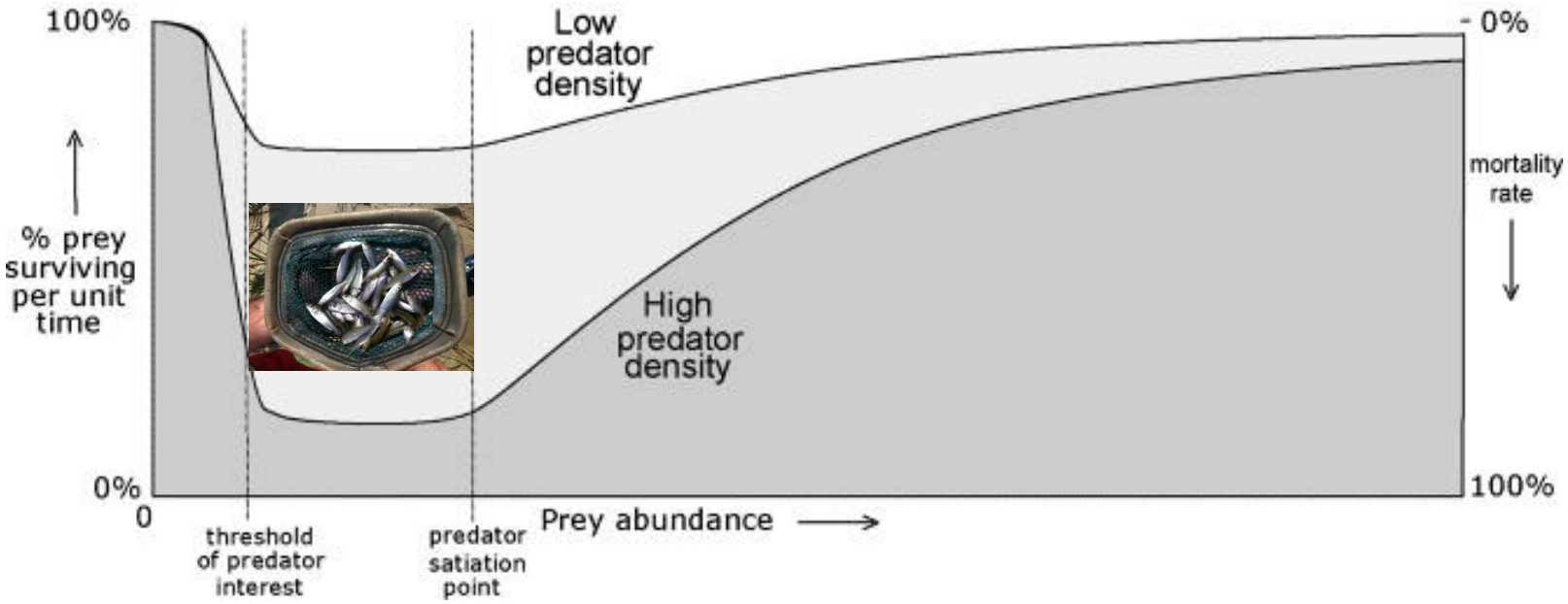
100 YEARS OF SCIENCE

Dave Secor, secor@umces.edu

"Over-Predation" of Striped Bass by Blue Catfish: A speculative hypothesis



In **predator pit**, then recruitments are fixed as predators crop them down to level of "lost predator interest"

Striped Bass Survey Assessment and Habitat Connections

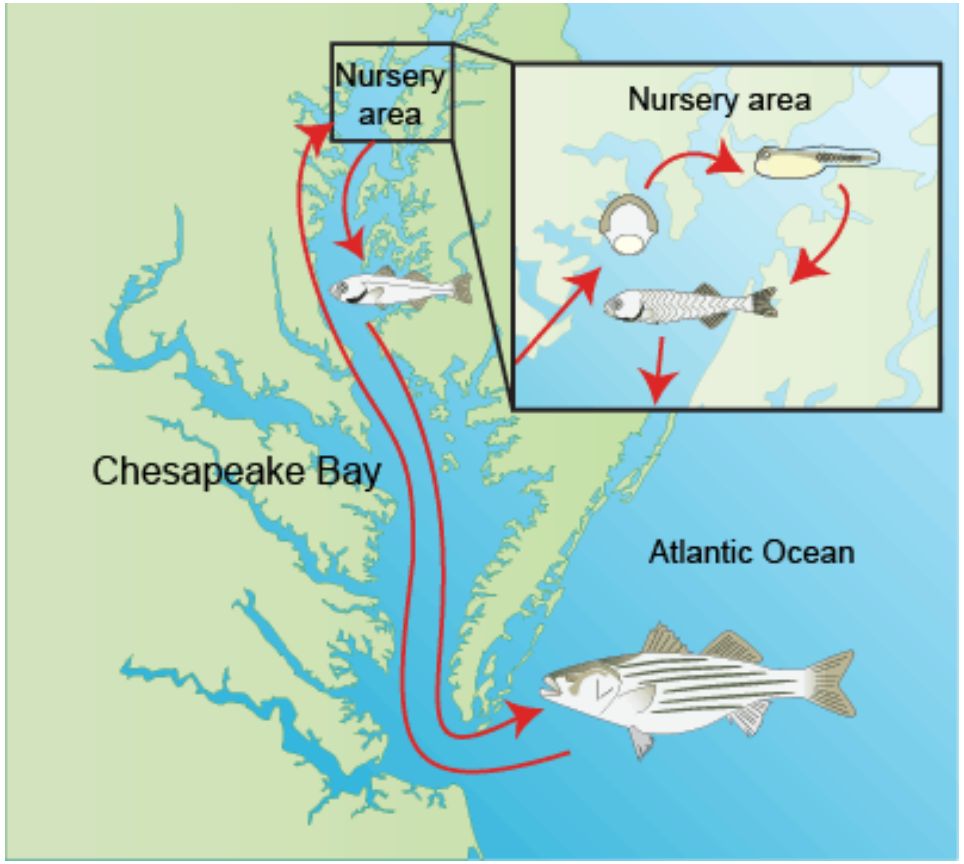
SERC, Edgewater, Feb, 2025

Bakun, A., 2006. Wasp-waist populations and marine ecosystem dynamics: Navigating the "predator pit" topographies. Progress in Oceanography, 68(2-4): 271-288.

Life Cycle: Migratory Striped Bass

Resident Striped Bass

- *Warming, disease*
- *Mortality problem*



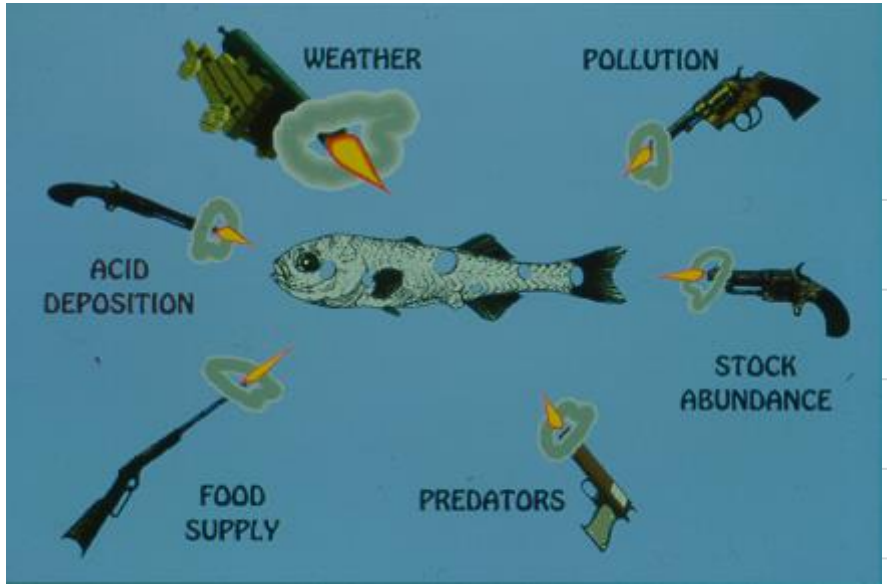
Vulnerable Part

- *Recruitment Problem*

Resilient Part

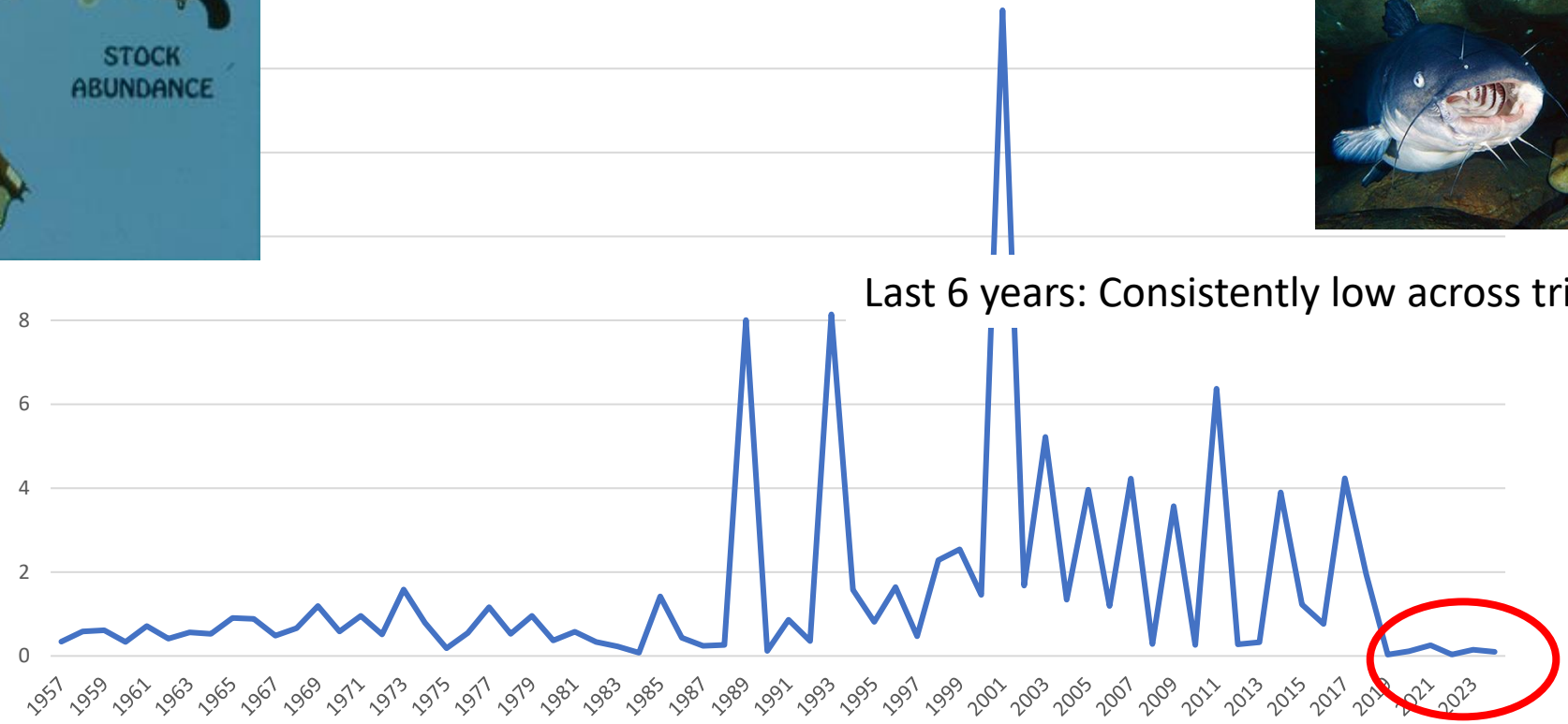
- *Release Mortality Problem*

Which Smoking Gun?



Ron Klauda

MD Tributary JI CV

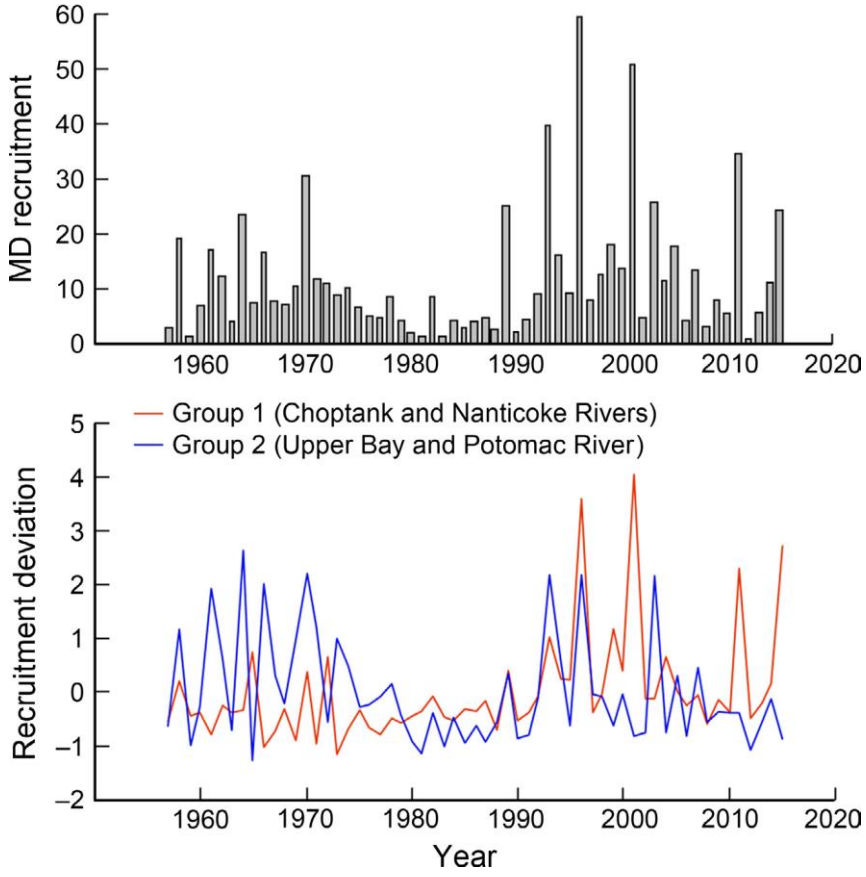


Last 6 years: Consistently low across tribs

Maybe this one

A shift towards very high covariation in the JI between tributaries may indicate a common stress to striped bass recruitment

1. **Resilience** in striped bass recruitment depends on tributaries producing differing levels of juvenile production. This diversity in tributary performance is known as the portfolio effect and promotes resilience and stability in recruitment levels.



In a given year, some tributaries do better than others, but because all tributaries contribute recruitment to the same population, differential production contributes to overall stability.

For instance, in the 60s and 70s, the Upper Bay and Potomac river had higher recruitments than the Choptank and Nanticoke Rivers, but in the more recent period this trend is reversed.

Wainger, L. A., D. H. Secor, C. Gurbisz, W. M. Kemp, P. M. Glibert, E. D. Houde, J. Richkus, and M. C. Barber. 2017. Resilience indicators support valuation of estuarine ecosystem restoration under climate change. Ecosystem Health and Sustainability 3(4):e01268. 10.1002/ehs2.1268

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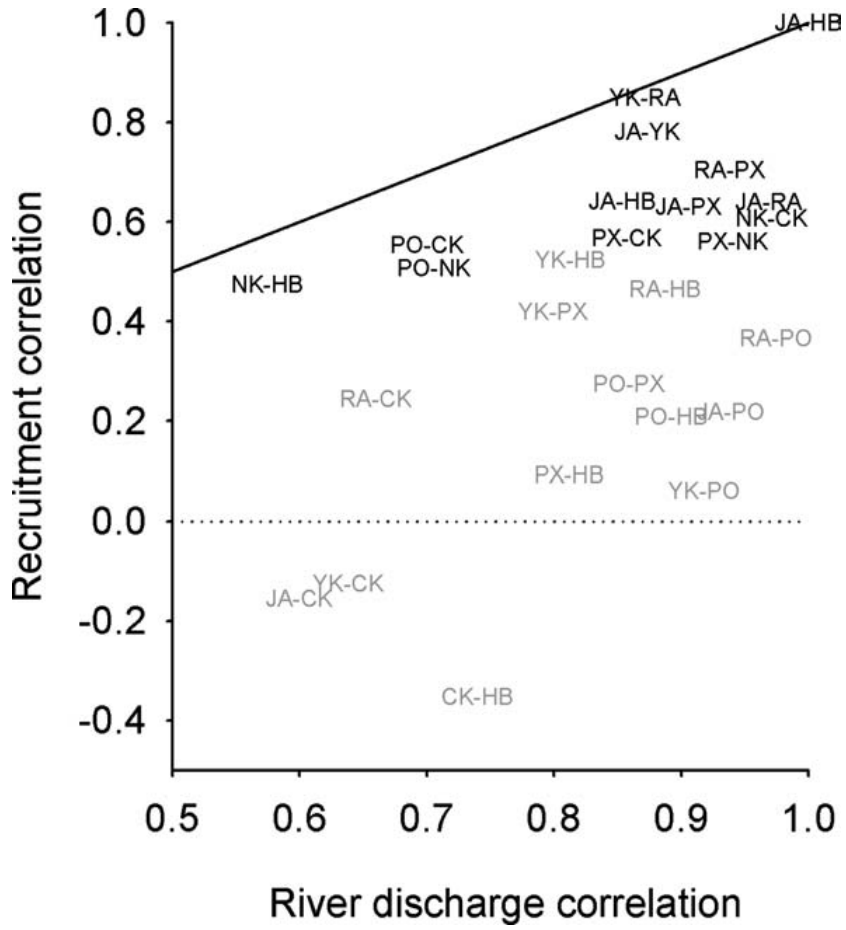
2. Drivers in striped bass recruitment can be identified by how the degree with which an ecosystem factor causes recruitments to covary. Synchrony between groups of tributaries would indicate the same controlling driver.



Highly correlated tributary pairs are also highly correlated with river charge. Also known at the Moran effect, it indicates that flow is similarly affecting the correlated tributaries.

Bold font shows highly correlated tributary pairs for white perch JIs. Note many uncorrelated tributaries. Here, tributaries show higher asynchrony and factors other than flow contribute to recruitment.

Kraus, R.T. and Secor, D.H. 2005. Evaluation of connectivity in estuarine-dependent white perch populations of Chesapeake Bay. Estuarine and Coastal Shelf Science. 64: 94-107.

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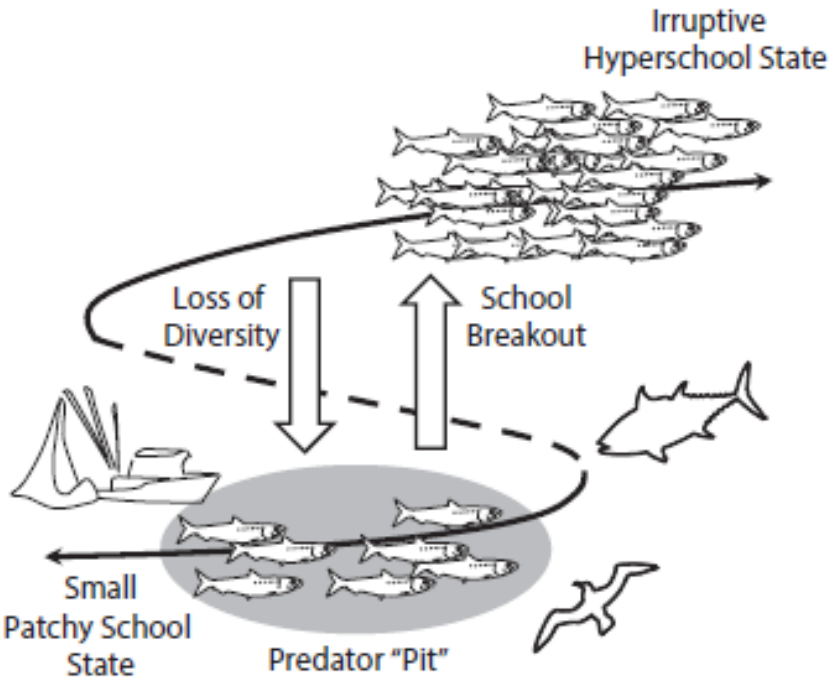
3. Predation Pits represent “overpredation,” where juvenile production is cropped down to a very low level regardless of the potential to produce a strong year-class.

Predation pits are suggested as a cause for the high fluctuations of schooling fish like sardines, which are held in check over many years in predator pits and then suddenly breakout as a large irruptive population.



Secor, D.H. 2015. Migration Ecology of Marine Fishes. Johns Hopkins University Press. 304 p.

Bakun, A., 2006. Wasp-waist populations and marine ecosystem dynamics: Navigating the "predator pit" topographies. Progress in Oceanography, 68(2-4): 271-288.

A shift towards very high covariation in the JI between tributaries may indicate a common stress to striped bass recruitment

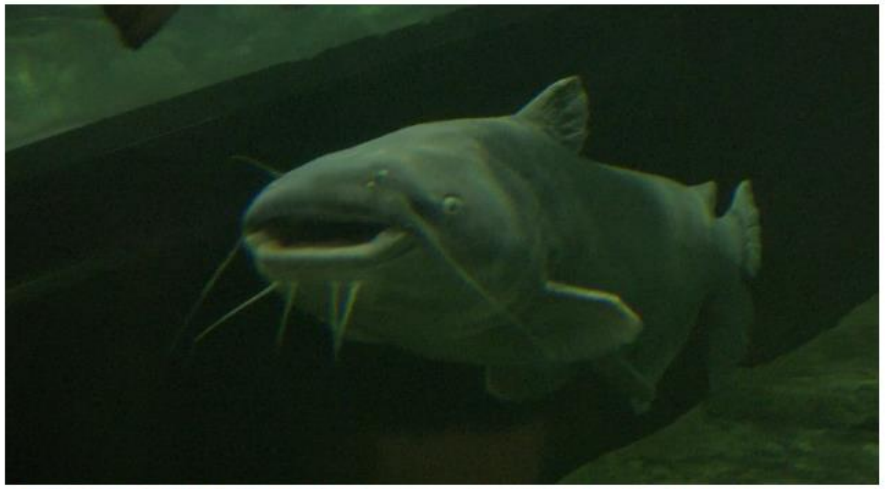
4. **A speculative hypothesis:** Recent irruption of blue catfish in MD tributaries has caused
   - Overpredation of striped bass juveniles
   - Depressed recruitment
   - More synchronous recruitments owing to common driver (i.e. blue catfish predation)
   - A changed recruitment regime

<u>Premise 1</u>. Recent irruption of blue catfish in MD tributaries

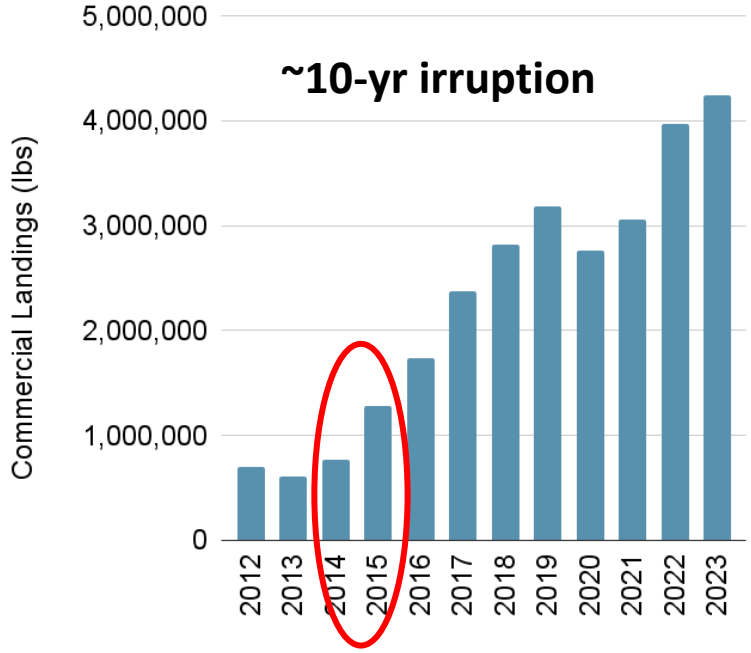
Blue Catfish Are Spreading Rapidly in Maryland Waters, as State Officials and the Fishing Community Work To Contain the Invasive Species

April 4, 2024

The invasive species is quickly becoming abundant in Maryland rivers



Blue catfish are big, fast predators that spread quickly and can tolerate salinity. Now in all Maryland's major rivers, blue cats are preying on and outcompeting native fish. Photo by Winn Brewer, DNR



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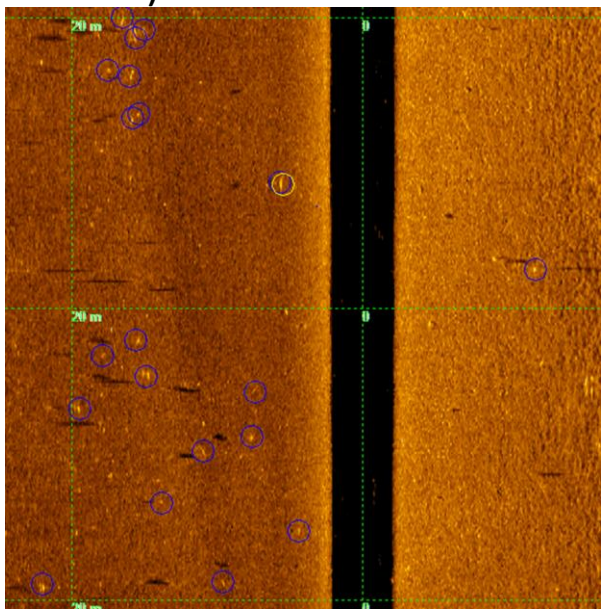
<u>Premise 2</u>. Overpredation of striped bass juveniles

- In the Marshyhope Creek (Nanticoke River) side-scan sturgeon survey detected countless targets 18-36”
- Coincident bottom trawls dominated by blue catfish
- Targets are ~1 fish per 30 m^2 or 125 fish per acre
- Fabrizio et al. 2018 estimates for fw tidal James River is 220 blue catfish per acre
- James River stimate for total striped bass consumption by blue catfish is 5.4 metric tons (Hilling et al. 2023)
- If age-0 juveniles dominate diet, this is equivalent to 5.4 million 1-g (60 mm TL) juveniles
- Not many age-0 abundance estimates. In 1992 and 1993, Nanticoke mid-summer abundances of 1.7 and 4.6 million juveniles (Secor et al. 2017).

~1 fish per 30 sq m
~125 fish per acre[1]



Hilling, C.D., Schmitt, J.D., Jiao, Y., Orth, D.J., 2023. Predatory impacts of invasive Blue Catfish in an Atlantic coast estuary. Marine and Coastal Fisheries, 15(5).

Fabrizio, M.C., Tuckey, T.D., Latour, R.J., White, G.C., Norris, A.J., 2018. Tidal Habitats Support Large Numbers of Invasive Blue Catfish in a Chesapeake Bay Subestuary. Estuaries and Coasts, 41(3): 827-840.

Secor, D.H., E.D. Houde, and L.L. Kellogg. 2017. Estuarine retention and production of striped bass larvae: a mark recapture experiment. ICES Journal of Marine Science 74:1735-1748.

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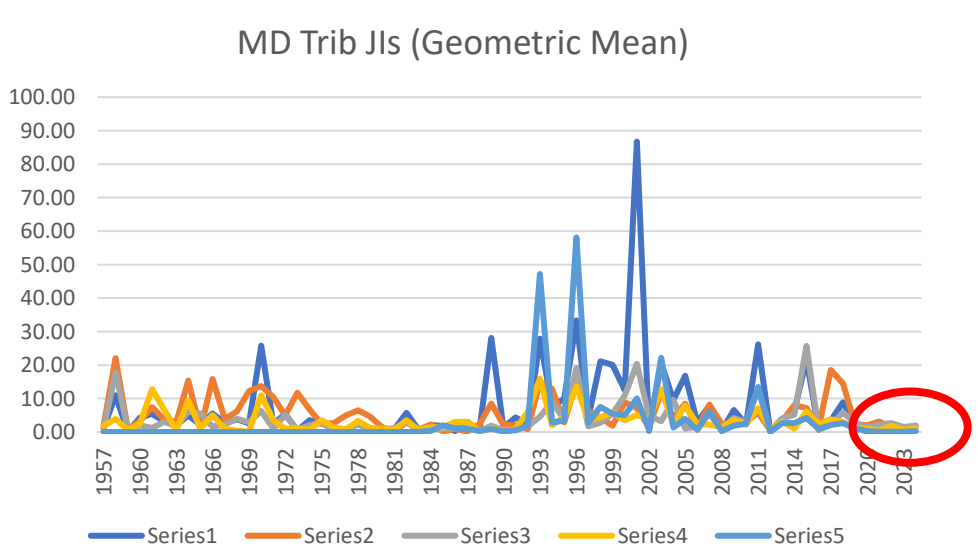
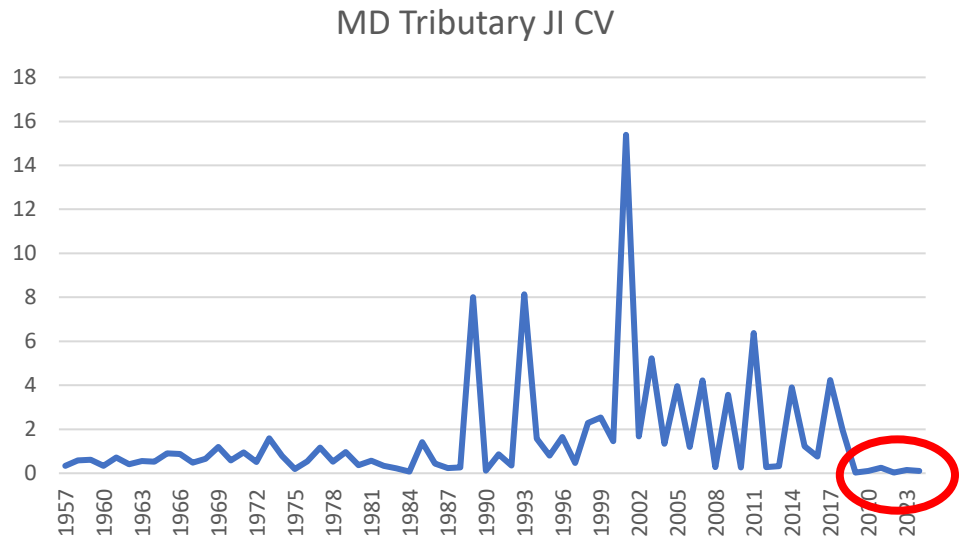
<u>Premise 3 and 4</u>. More synchronous and depressed recruitments associated with blue catfish irruption

- MD tributaries appear to be completely synchronous (coefficient of variance CV approaching nil)
- No other part of the time series shows this level of synchronous behavior
- Synchrony indicative of common driver
- That synchrony is associated with depressed recruitments suggests a predator pit stable state.





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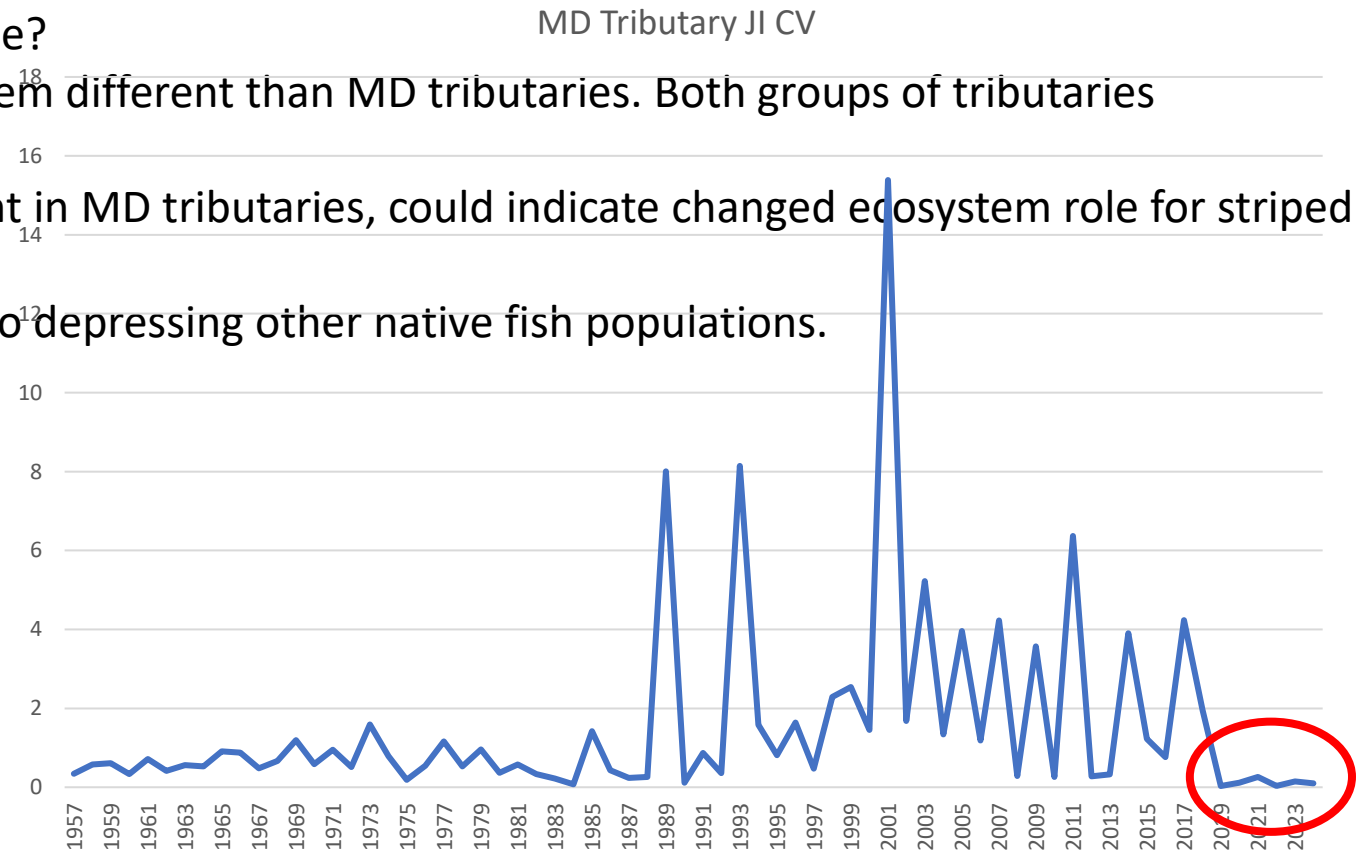
<u>Premise 5</u>. Changed recruitment regime?

- VA tributary covariance patterns seem different than MD tributaries. Both groups of tributaries contribute to overall population.
- If homing does occur to some extent in MD tributaries, could indicate changed ecosystem role for striped bass in those systems
- Blue catfish overpredation likely also depressing other native fish populations.



A too speculative hypothesis? Science priorities

- Predation demand on striped bass juveniles
  - Blue catfish abundance, density estimates
  - Blue catfish diet data, particularly related to juvenile sizes preyed upon
  - Blue catfish consumption demand
  - Increased look at lack of synchrony between VA tributaries. Are juveniles in VA tributaries somehow adapted to blue catfish

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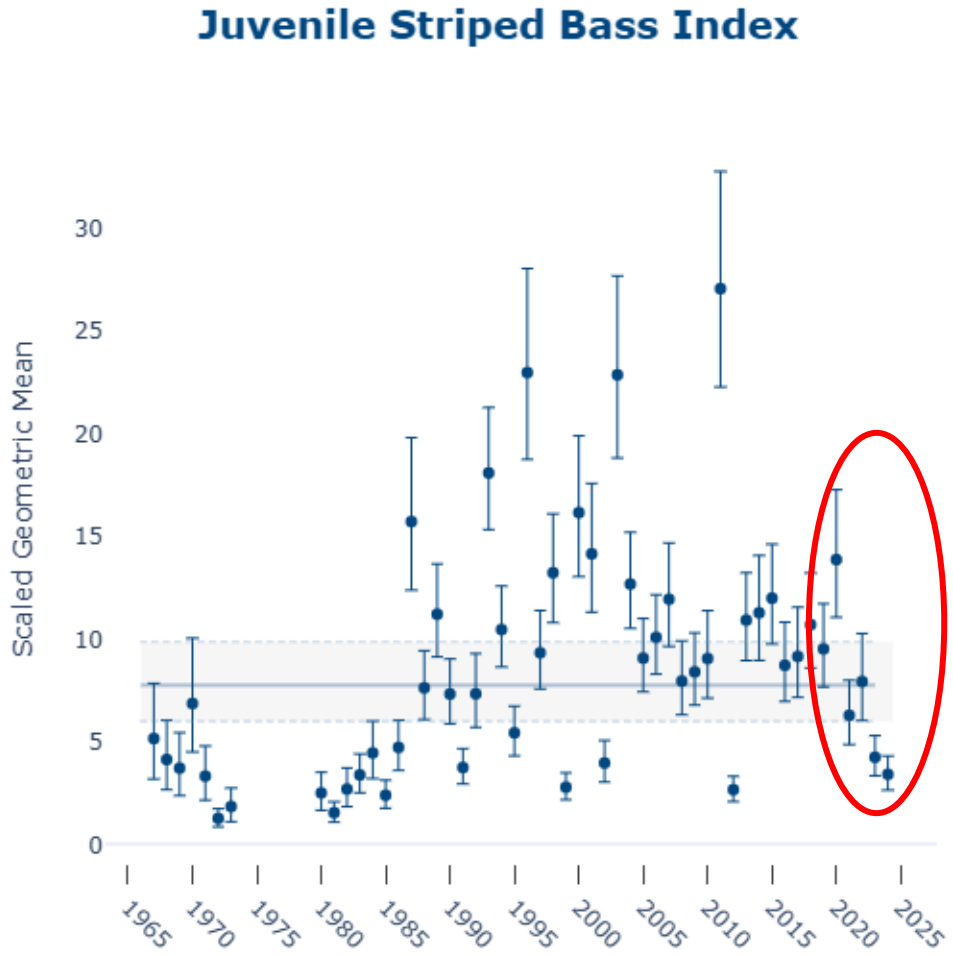
VIMS



https://www.vims.edu/newsandevents/topstories/2024/juvenile-striped-bass-survey.php

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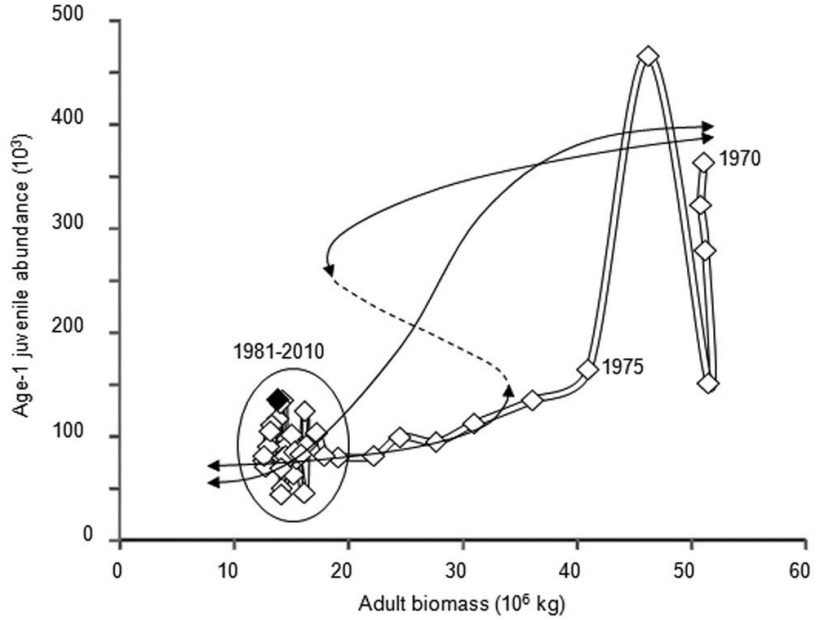
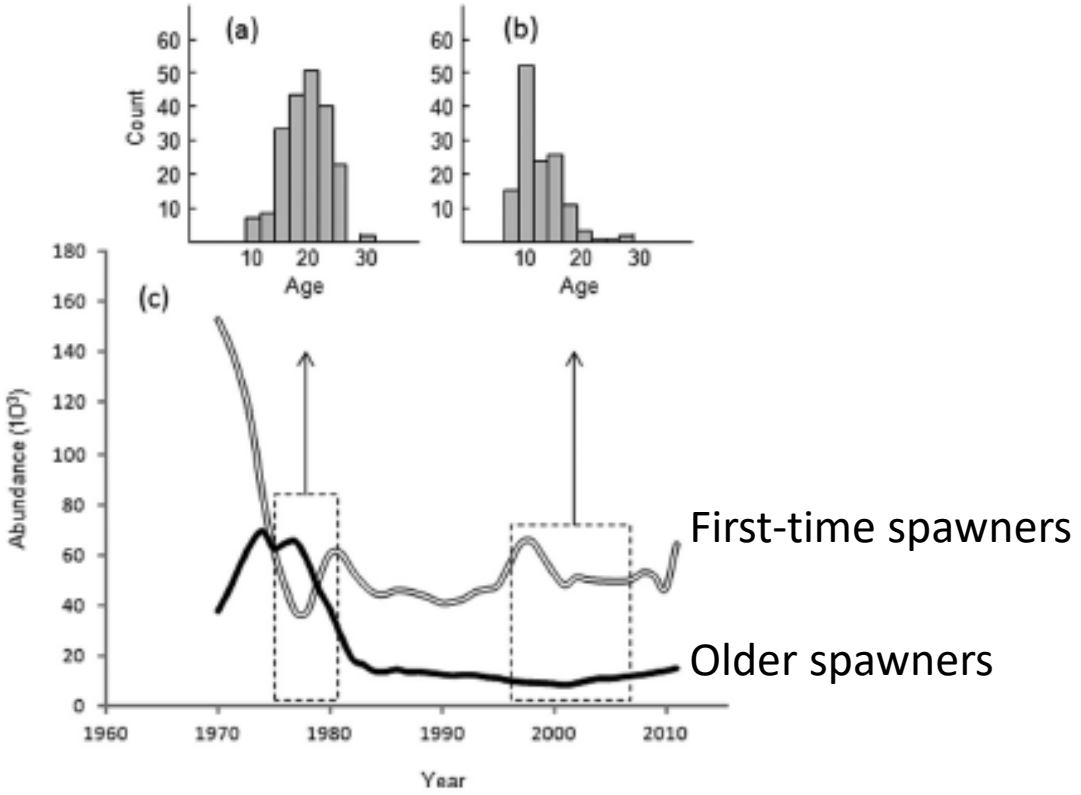
3. Predation Regimes can cause recruitments to suddenly shift.





Overfishing of large bluefin tuna caused age truncation and a predominance of first-time spawners in the adult stock. This was associated with a large shift in the expected recruitment.

Secor, D.H., Gahagan, B.I., Siskey, M., Wingate R.A., and J.R. Rooker. 2015. Depressed resilience of bluefin tuna in the Western Atlantic and age truncation. Conservation Biology 29 (2):400-408.