UMCES
Chesapeake Biological Laboratory

100 YEARS OF SCIENCE

Migrations, Water Quality Selection, and Mortality of Chesapeake Striped Bass: Inferences from telemetry

Dave Secor, secor@umces.edu

If it's good enough for striped bass…

Striped Bass Survey Assessment and Habitat Connections

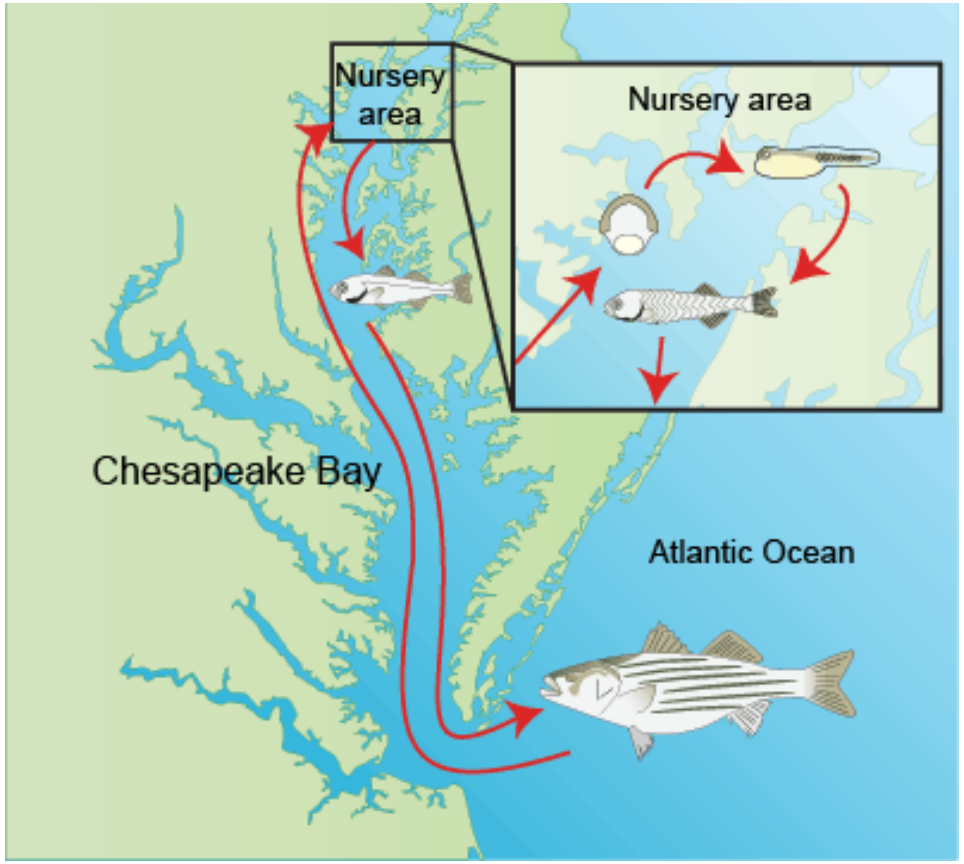
SERC, Edgewater, Feb, 2025

stac

Life Cycle: Migratory Striped Bass

Resident Striped Bass

- **Warming, disease**
- **Mortality problem**



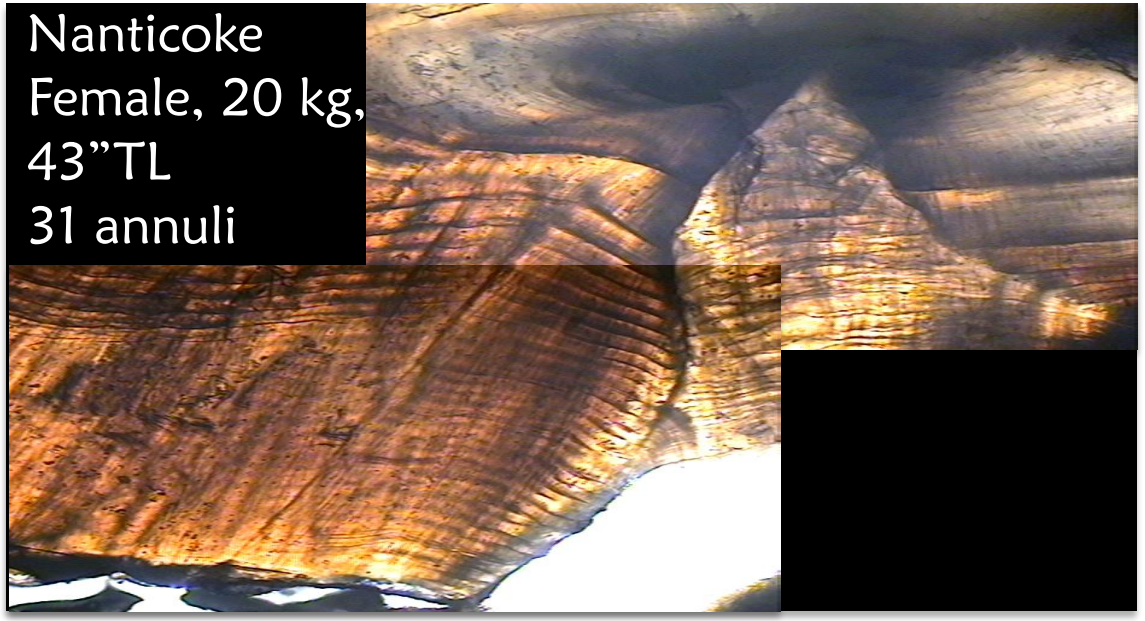
Vulnerable Part

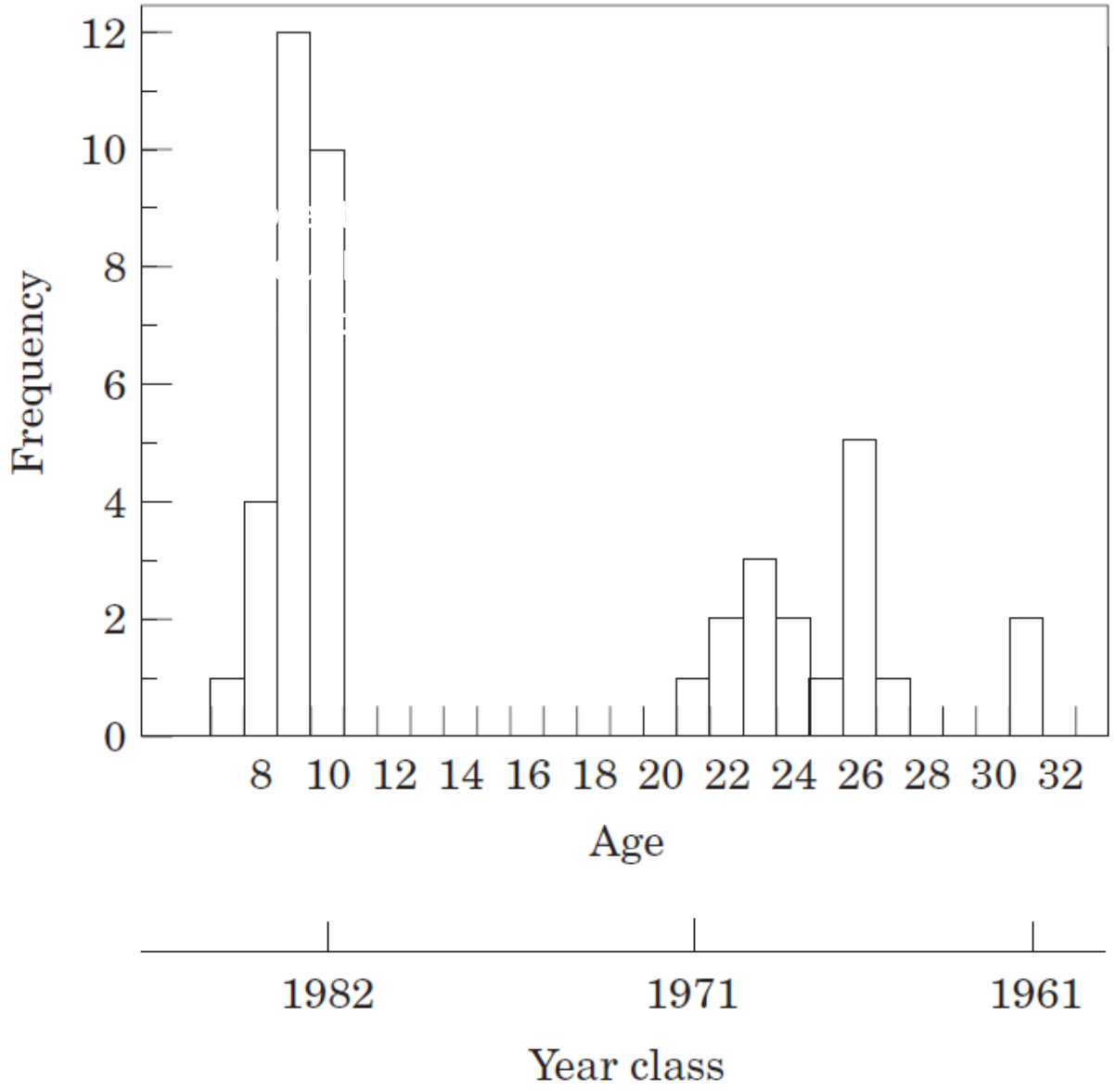
- **Recruitment Problem**

Resilient Part

- **Release Mortality Problem**

1992 sample





Secor, D. H. 2000. Longevity and resilience of Chesapeake Bay striped bass. – ICES Journal of Marine Science, 57: 808–815.

Increased Resiliency with Longevity

Wait it out for good habitats for reproduction

Add diversity - bigger fish use shelf ecosystems

Should I stay or should I go?

I should have gone to the ocean….

I should have stayed in the Chesapeake….

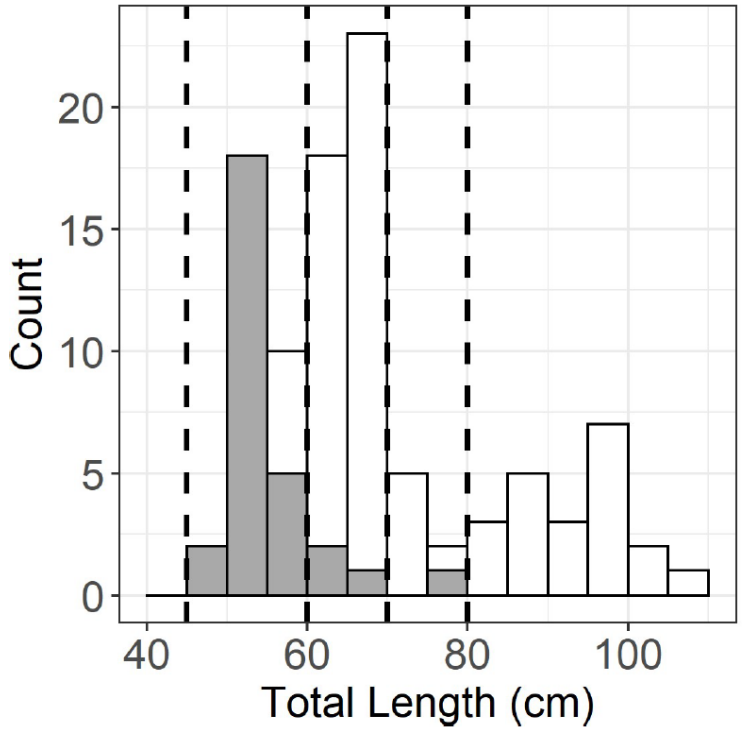
How the Secor lab loves striped bass….

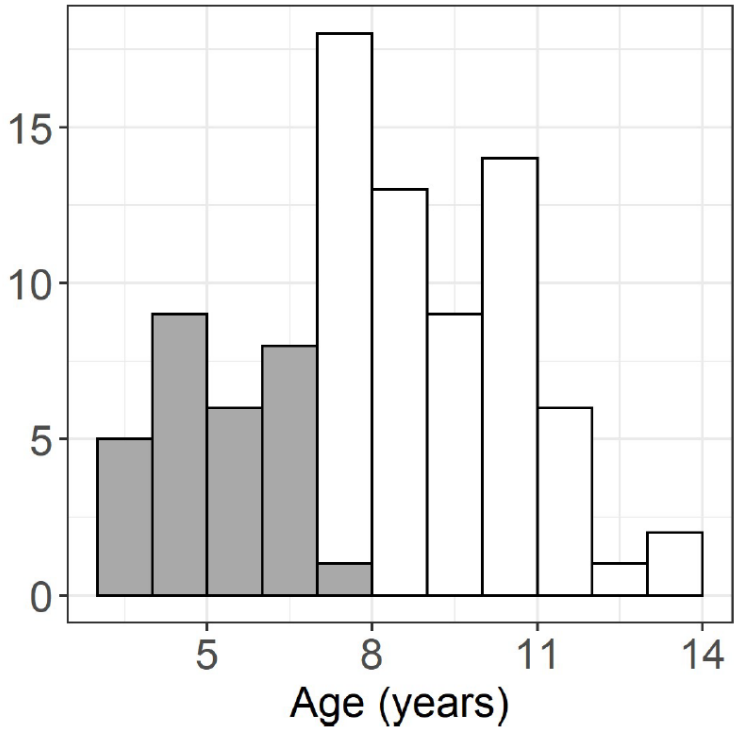
PLOS ONE

RESEARCH ARTICLE

Differential migration in Chesapeake Bay striped bass

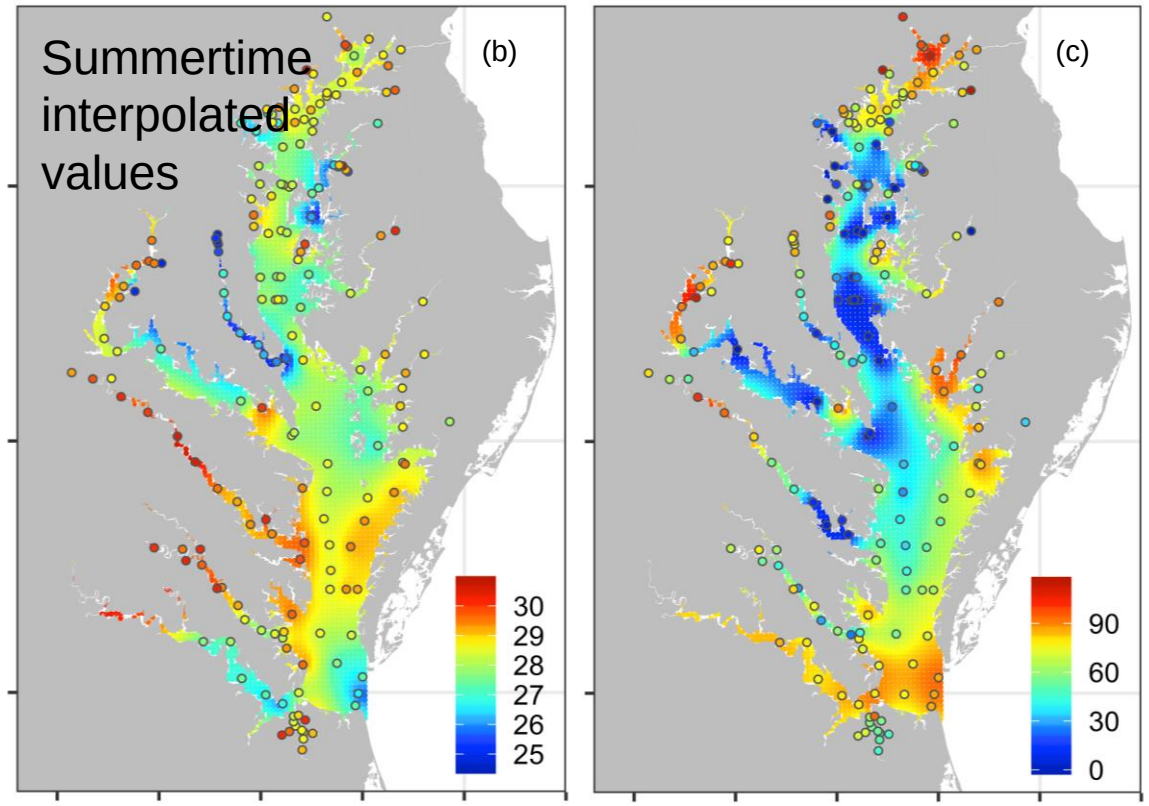
David H. Secor[1]*, Michael H. P. O'Brien[1], Benjamin I. Gahagan[2], J. Carter Watterson[3], Dewayne A. Fox[4]





N=100

Surface Temperature (reds bad) **Bottom Oxygen (blues bad)** **Biotelemetry Receivers**



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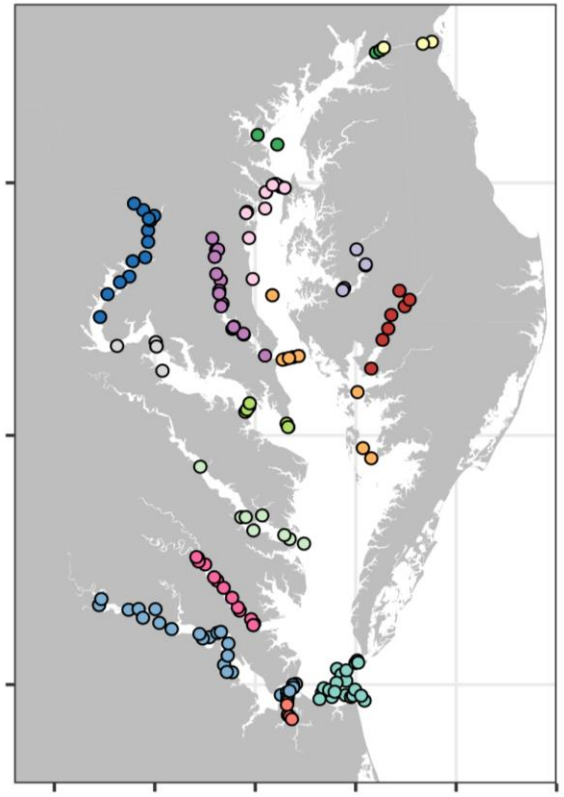


= ?

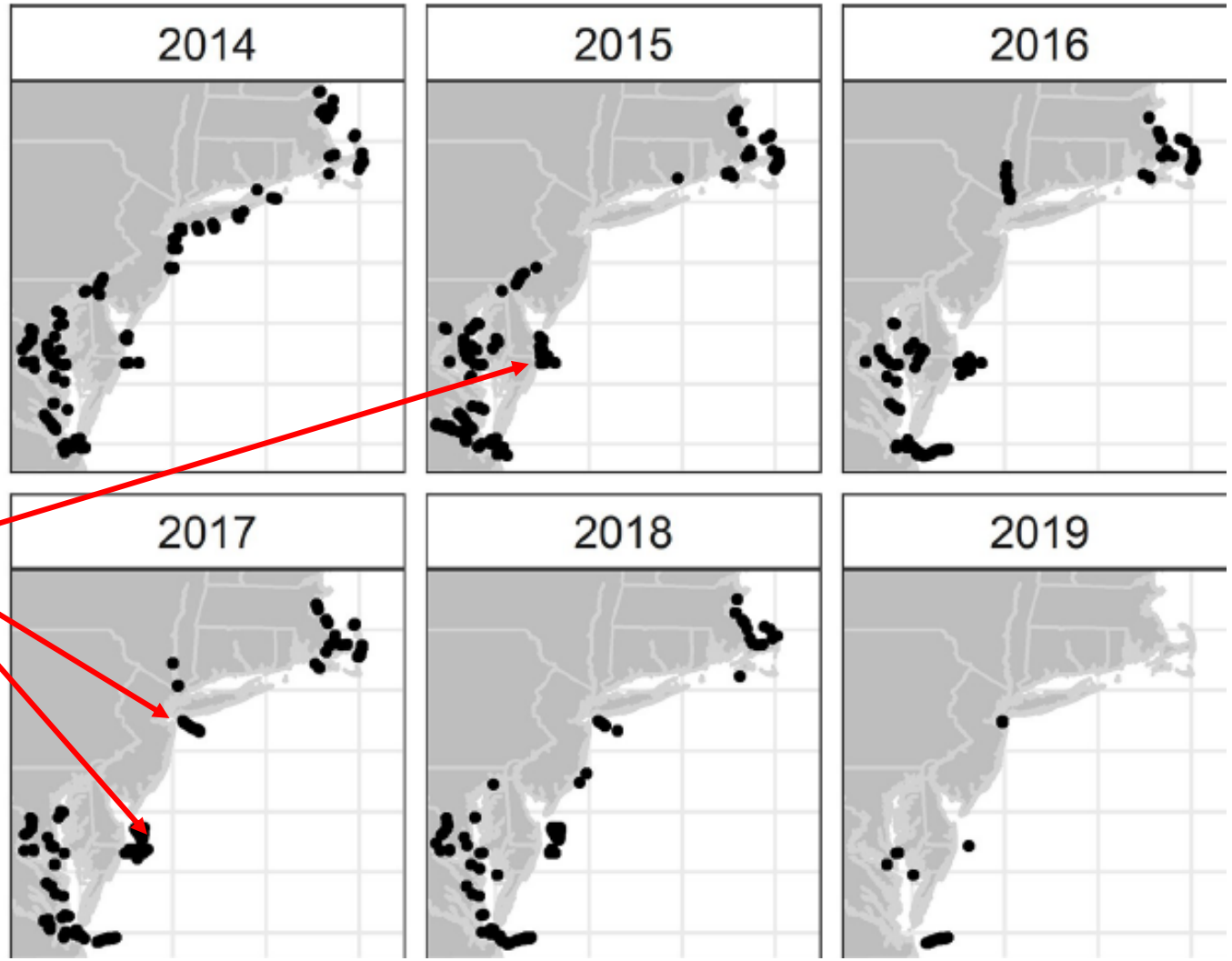
Please see talk by colleague Univ. Tokyo Dr. Hikaru Itakura:
Tracking oxy-thermal habitat compression encountered by Chesapeake Bay striped bass through acoustic telemetry

- 2014-2016
- 126 resident striped bass
- 400,000 detections

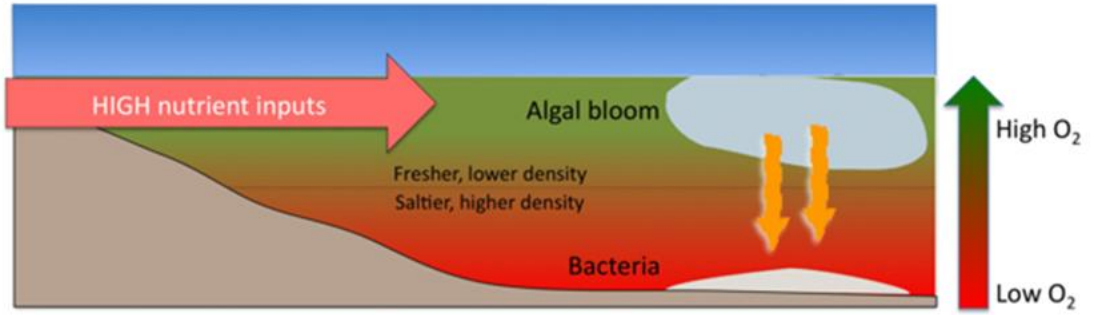
Itakura, H., M.H.P.O'Brien, and D.H. Secor. 2021. Tracking oxy-thermal habitat compressions encountered by Chesapeake Bay striped bass through biotelemetry. ICES J Marine Science. doi:10.1093/icesjms/fsab009

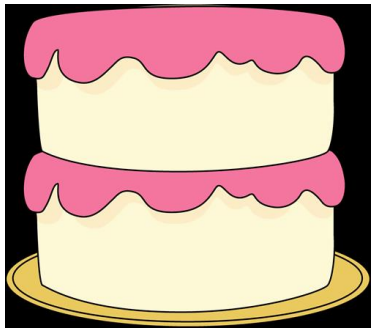
Chesapeake, Shelf Biotelemetry Receivers

BOEM WEA
Telemetry studies



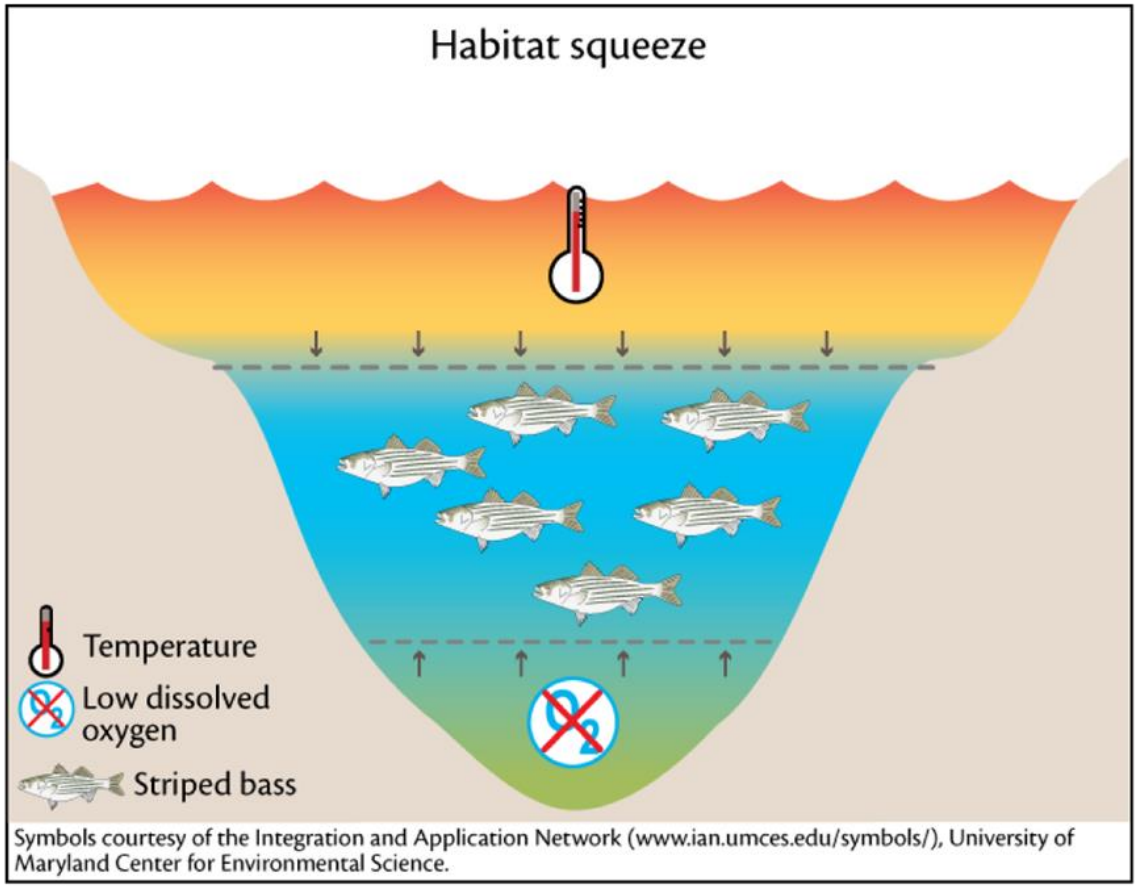
Eutrophication: Resident Striped Bass



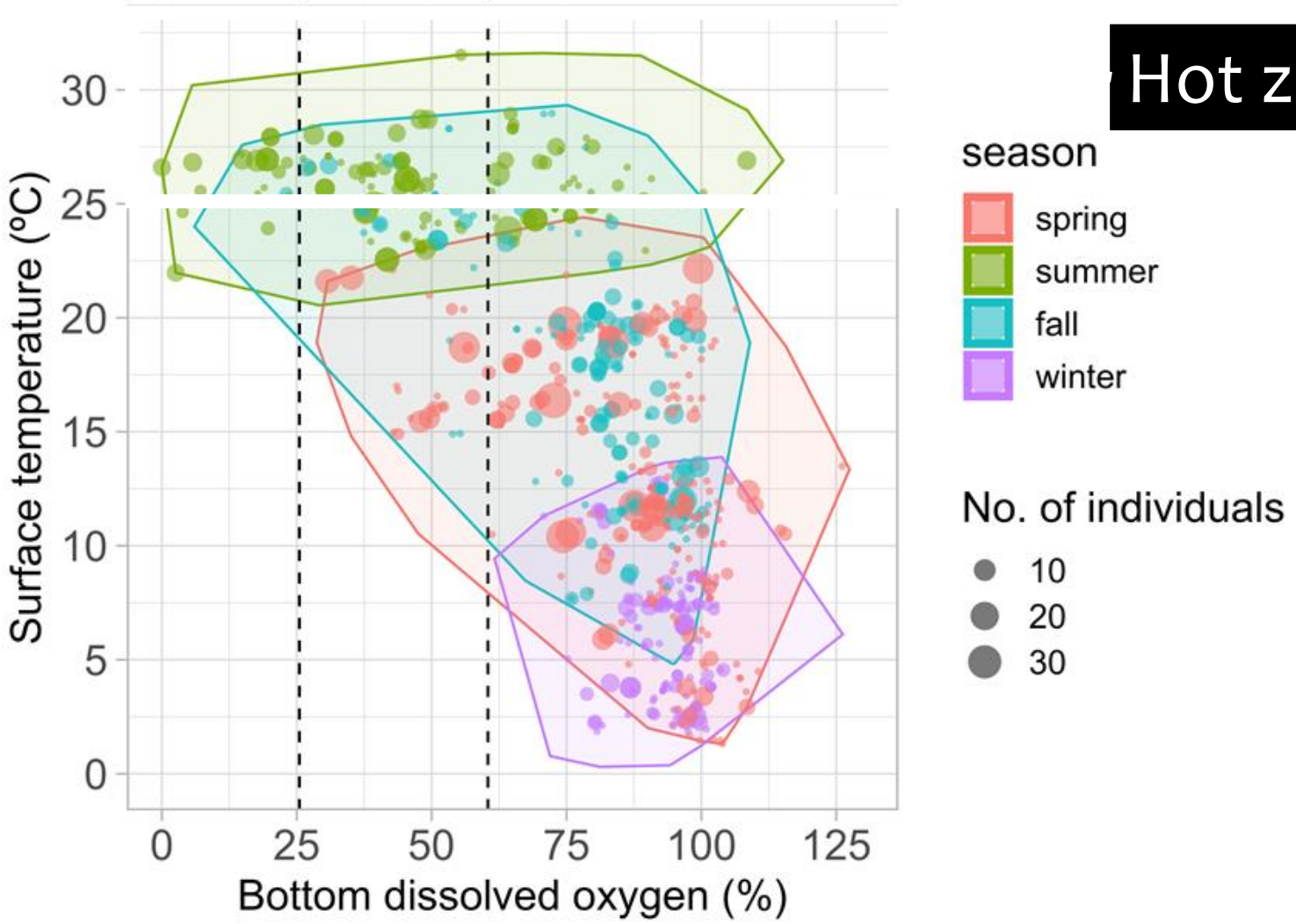


Chesapeake Bay Program
Science. Restoration. Partnership.

When multiple stressors are present at the same time, such as warmer waters with low oxygen, striped bass are even more vulnerable to disease and mortality.

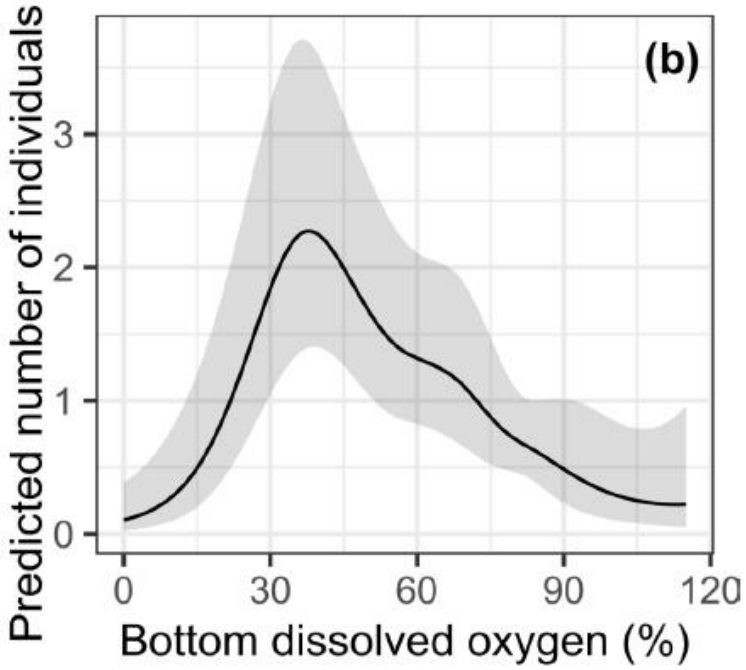


Conceptual diagram illustrating how change in a water source's oxygen and tempature can restrict the habitat of species.
Diagram courtesy of the Integration and Application Network (ian.umces.edu), University of Maryland Center for Environmental Science. Source: Ecocheck

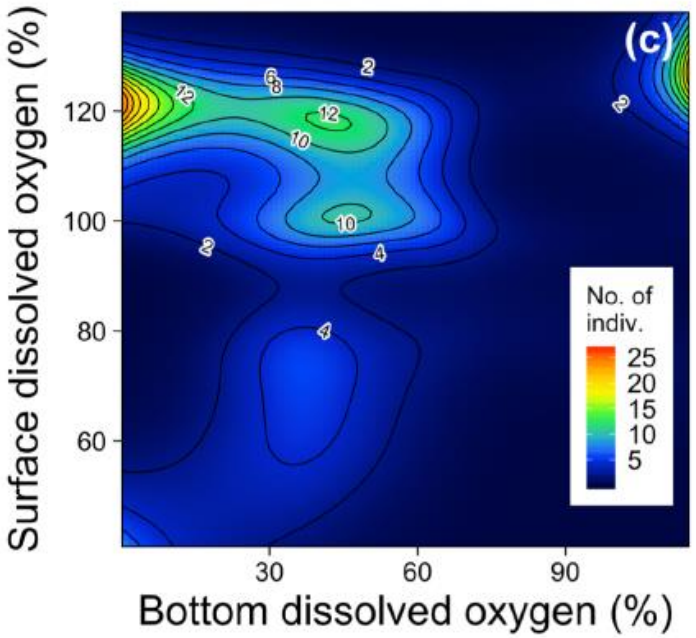

Surface temperature (°C)
30
25
20
15
10
5
0
0
25
50
75
100
125
Bottom dissolved oxygen (%)
season
spring
summer
fall
winter
No. of individuals
10
20
30

Hot zone?

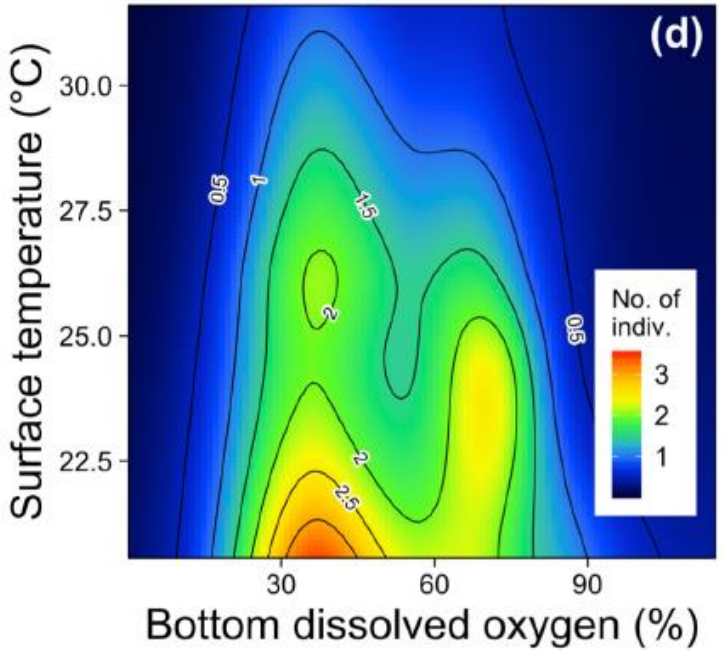
Striped bass prefer low oxygen?

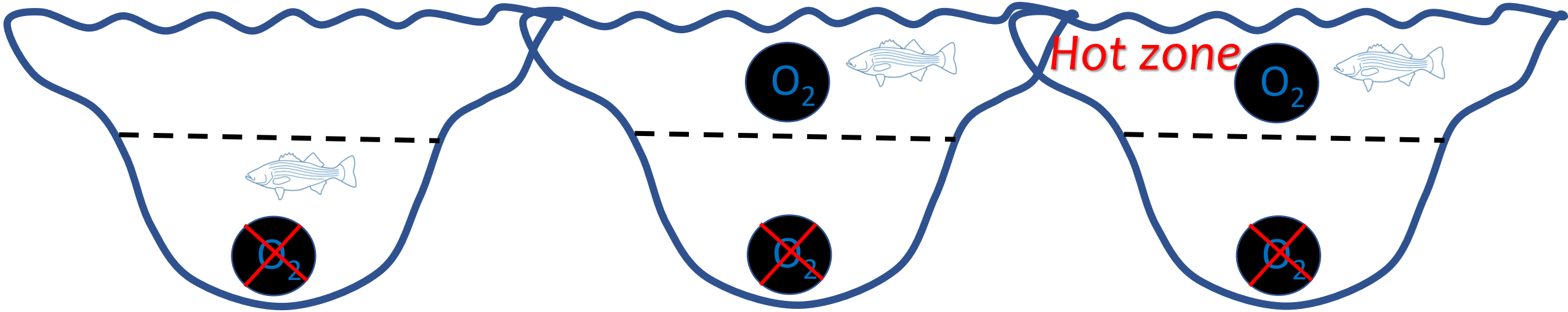


Can they escape low oxygen?

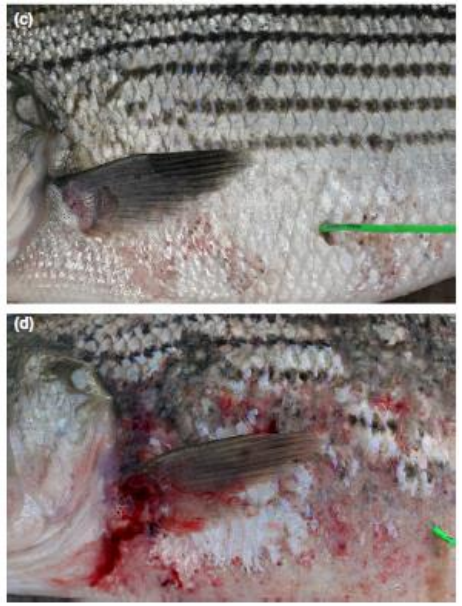


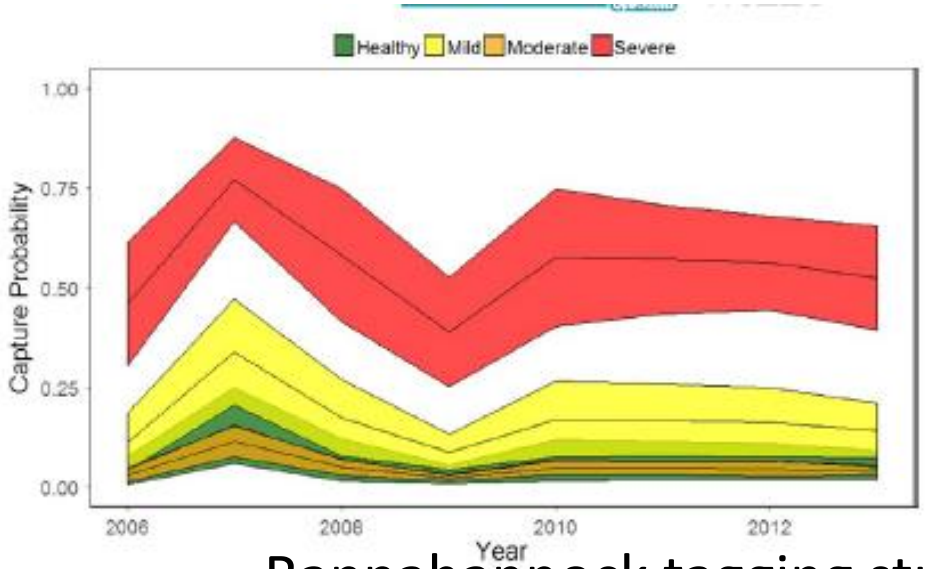
Do they make the trade-off?





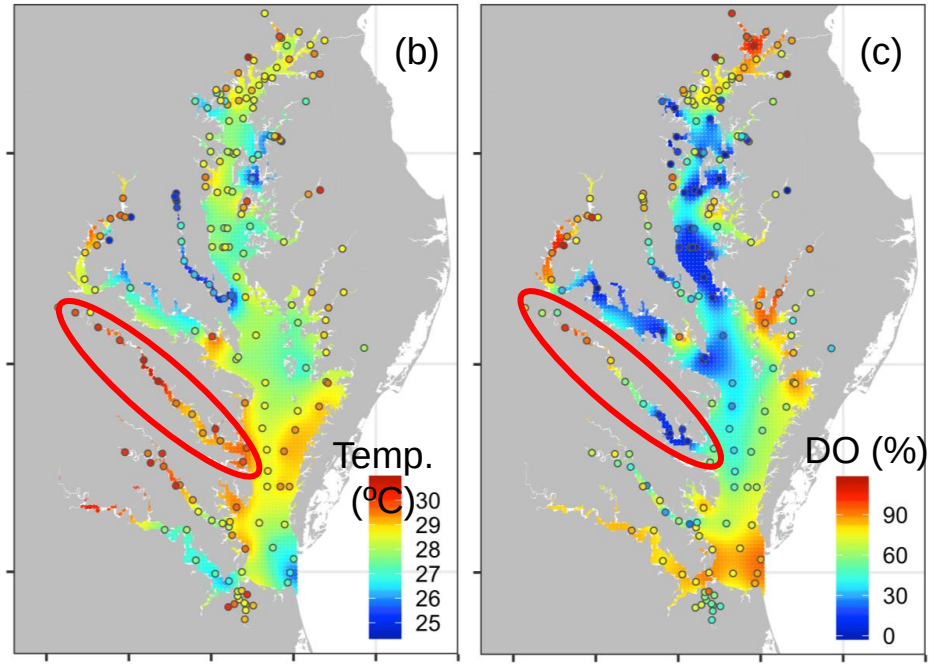
Mortality and disease





Surface Temperature (reds bad)

Bottom Oxygen (blues bad)



Rappahannock tagging study: Groner et al. 2018

Mycobacteriosis

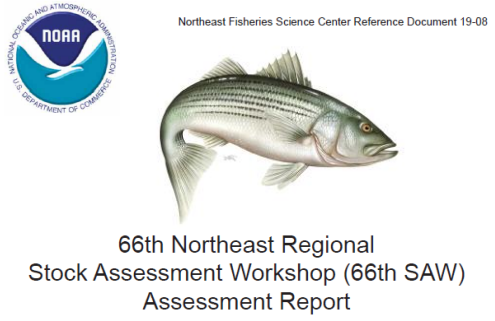
Dermal mycobacteriosis and warming sea surface temperatures are associated with elevated mortality of striped bass in Chesapeake Bay

Maya L. Groner[1] | John M. Hoenig[1] | Roger Pradel[2] | Rémi Choquet[2] | Wolfgang K. Vogelbein[1] | David T. Gauthier[3] | Marjorie A. M. Friedrichs[1]

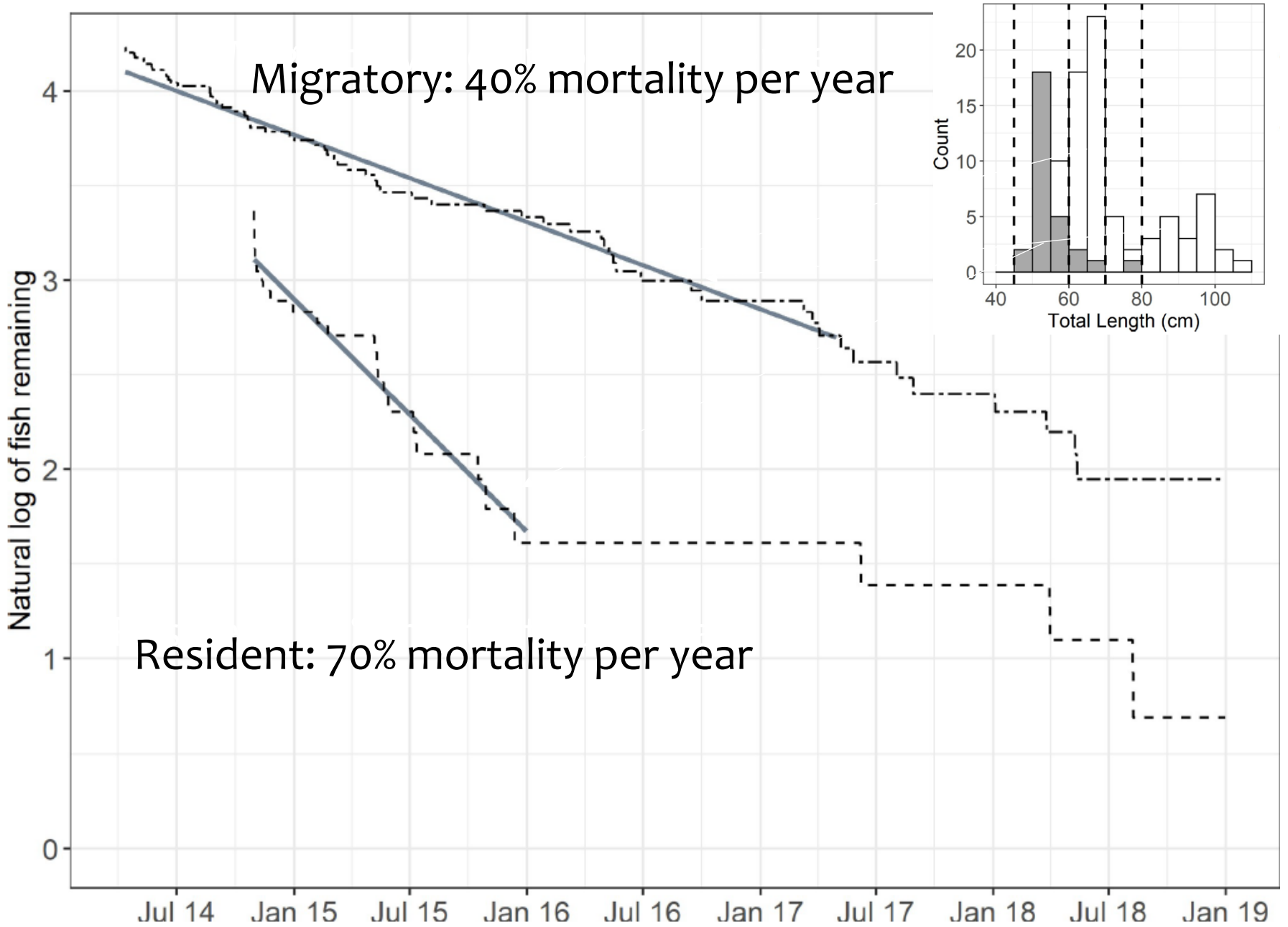
WILEY Ecology and Evolution Open Access

- Mortality approached 80% for severely infected fish
- Diseased fish more vulnerable to being caught
- Disease exacerbated in Rappahannock owing to poor water quality

Spring-tagged fish (mix of migratory and resident sizes) showed lower Z than the fall group (exclusively resident sizes).



2019 Stock Assessment:
Migratory: 36%
Chesapeake resident: 64%



In the Chesapeake, summertime striped bass fishing is in hot water

Dave Secor & Marty Gary Jul 5, 2023 4

Chesapeake Bay a
summertime fishi
become an ever-di

Chesapeake Bay anglers are facing a stark future - a future in which summertime fishing for striped bass, once a hallmark of Bay fishing, may become an ever-distant memory.

A century ago, fis
table. Then sportfishing boomed in the 1950s, '60s and '70s, with increased incomes, leisure and boat ownership. The public embraced the enthusiasm of Bill Burton, famed angler and Baltimore *Sun* reporter, for a day on the water.

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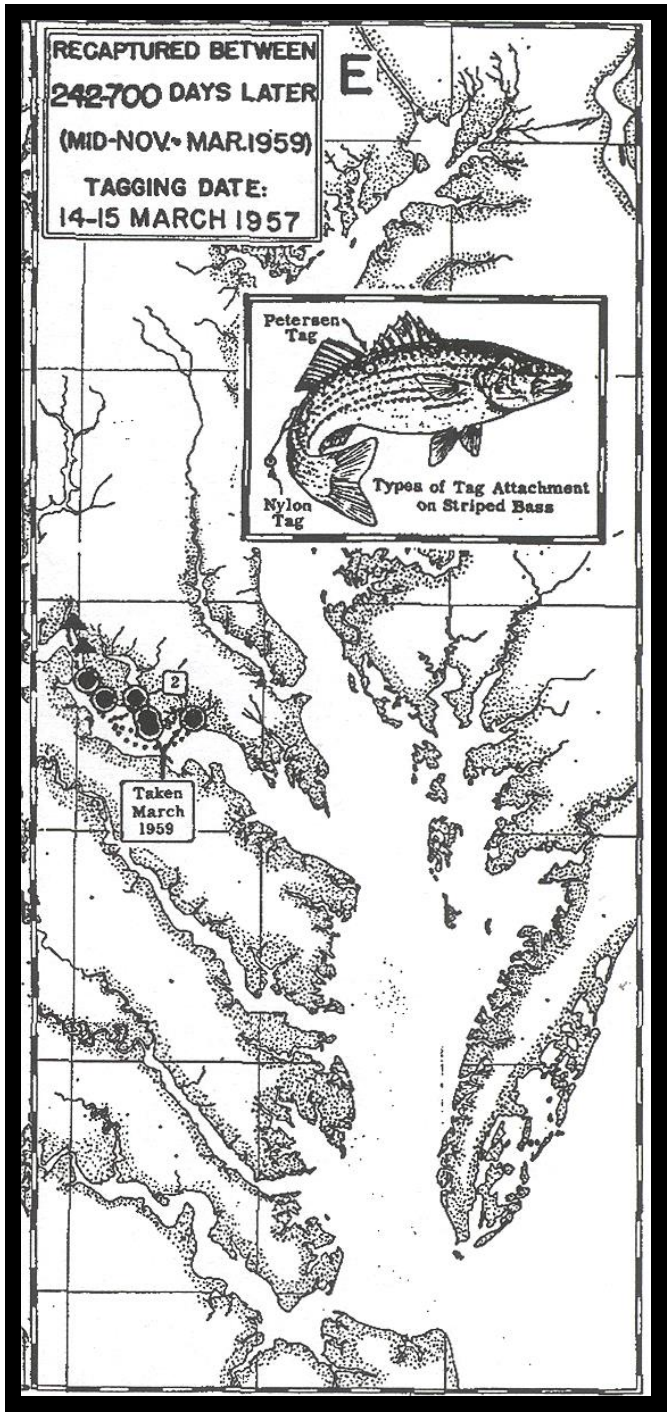
100 YEARS OF SCIENCE

Romeo J. Mansueti (1923-1963)
CBL Professor



Early Tagging Studies: A few coastal "stragglers"

Merriman 1941 (Fish. Bull. Fish.&Wildl. Serv.):

> 'the dominant 1934 year-class (observed in New England waters as 2-yr olds in 1936) originated chiefly in the Chesapeake Bay'

Vladykov and Wallace 1938 (TAFS vol 67):

> 'Is the striped bass of Chesapeake Bay a Migratory Fish?…. the question may be quite definitively answered in the negative'

Mansueti 1961 (Ches Sci. Vol. 2):

> 'In cases of dominant year-classes, an insignificant percentage of coastal migrants may represent an important contribution to northern coastal waters'
>
> 'It is obvious that tagging studies up to now have not yet shown the true relationship between the available population and the migratory segment.'

Attack of the Numerate:

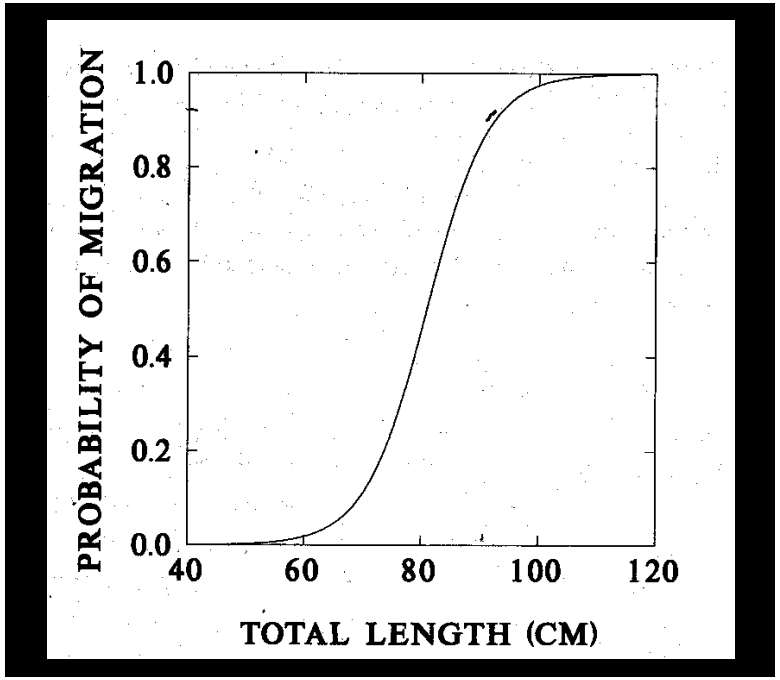
Kohlenstein 1981 (TAFS Vol. 110)

Conundrum="a few percent of the Chesapeake Bay stock could not support the coastal fishery."

"few males leave the bay and ca. one-half of the 3-year-old females migrate to coastal waters."

Dorazio et al. 1994 (TAFS Vol. 123)

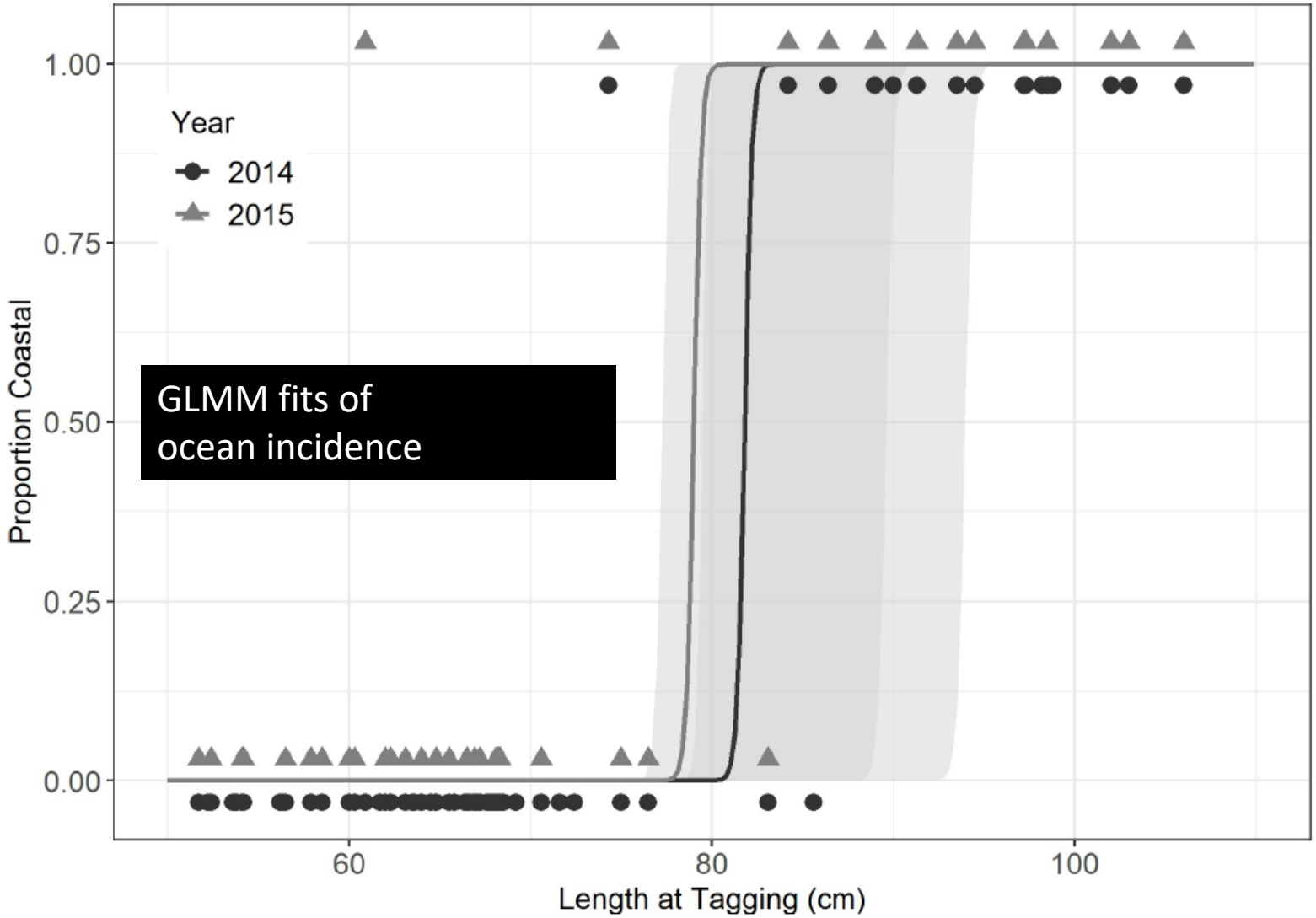
"Sex-specific differences in migration appear to be associated with the differences in body size of mature males and females.."



- Near knife-edge recruitment to coastal stock

- 50% threshold = 80 cm TL
- Agrees with Dorazio et al. analysis of conventional tags

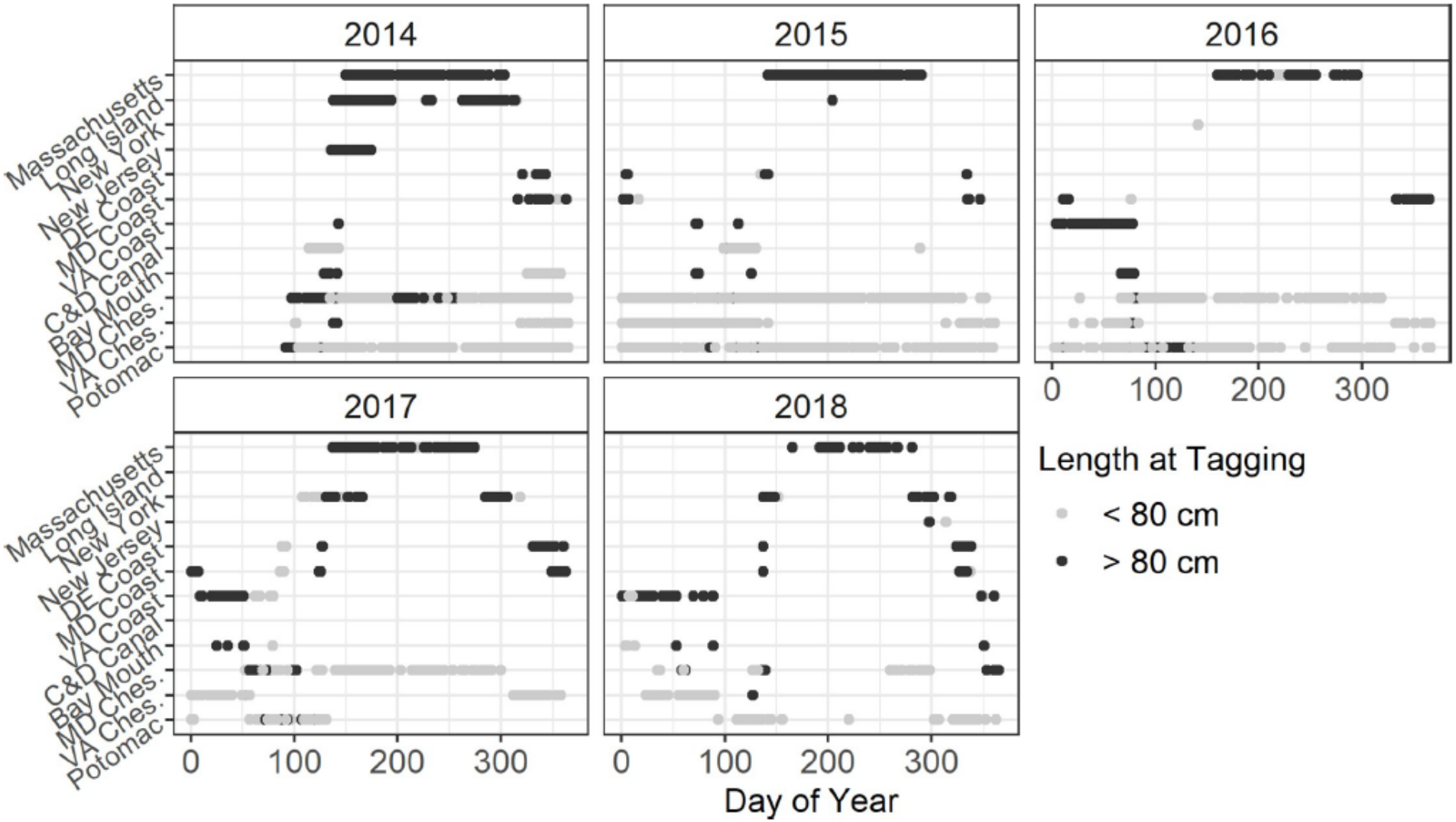
- Agrees with Secor and Piccoli analysis of otolith chemistry



Dorazio RM, Hattala KA, McCollough CB, Skjeveland JE. 1994. Tag recovery estimates of migration of striped bass from spawning areas of the Chesapeake Bay. Transactions of the American Fisheries Society. 1994; 123:950–63. 3363.

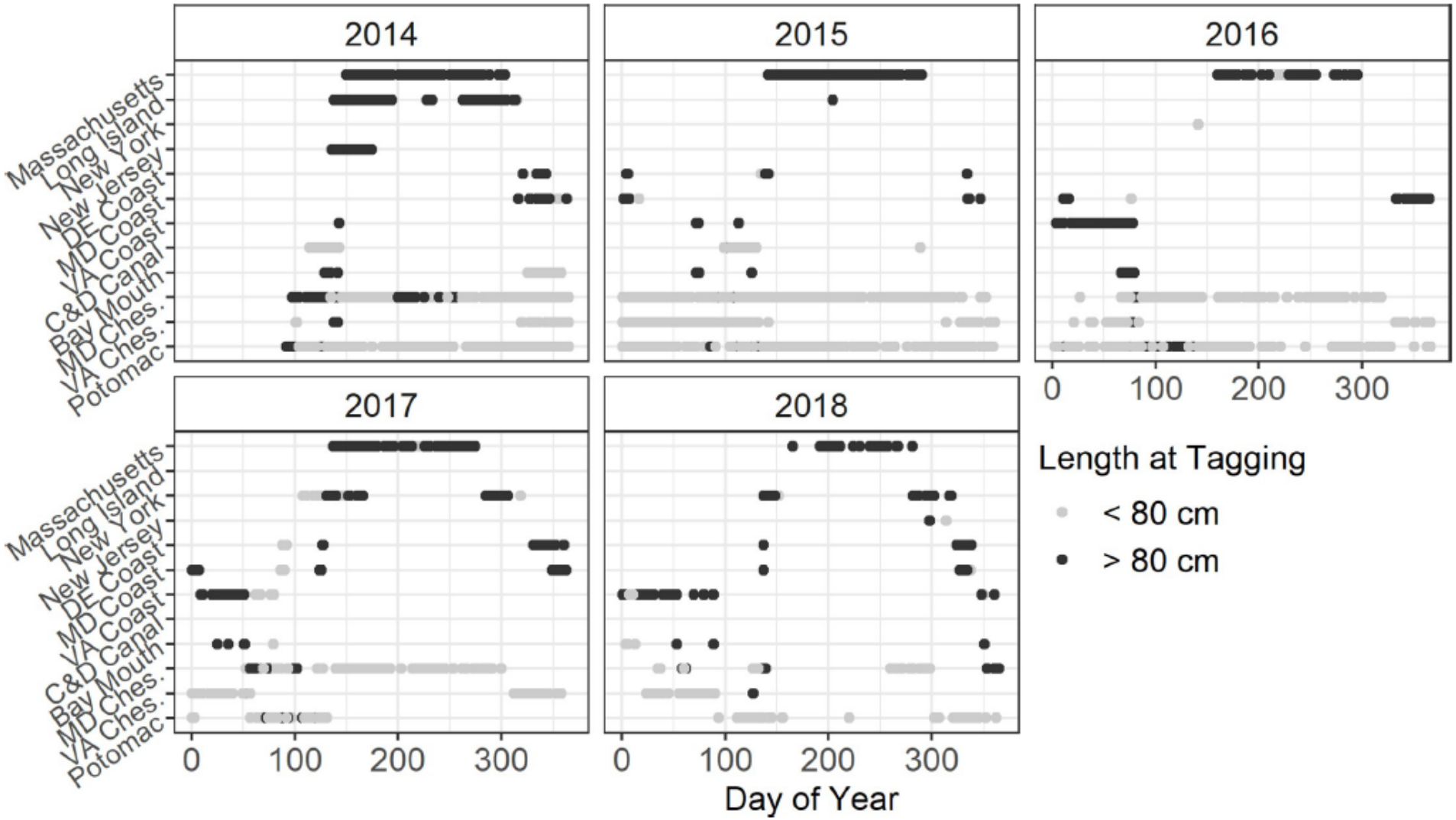
Secor DH, Piccoli PM. 2007. Oceanic migration rates of Upper Chesapeake Bay striped bass (*Morone saxatilis*), determined by otolith microchemical analysis. Fishery Bulletin. 2007; 105(1):62–73.

- As we add in later years of detections, evidence that fish < 80 cm TL are growing into the migratory group
- Fish < 80 cm TL at tagging either remain resident or grow into the migratory group during the 4-yr study
- Sex did not influence the size-threshold
- Rejection of Kohlenstein premise of sex-dependent migrations: ≥ 50% females depart age ages ≥ 3.



Kohlenstein LC. 1981. On the proportion of the Chesapeake stock of striped bass that migrates into the coastal fishery. Transactions of the American Fisheries Society. 1981; 110:168–79. 645.

- Large adults beeline to LI and MA coastal waters
- All migrants entered MA coastal waters and summered there
- Latitudinal patterns of seasonal migration very bird-like (regular)
- Similar migration patterns described by Kneebone et al. for MA-tagged SB



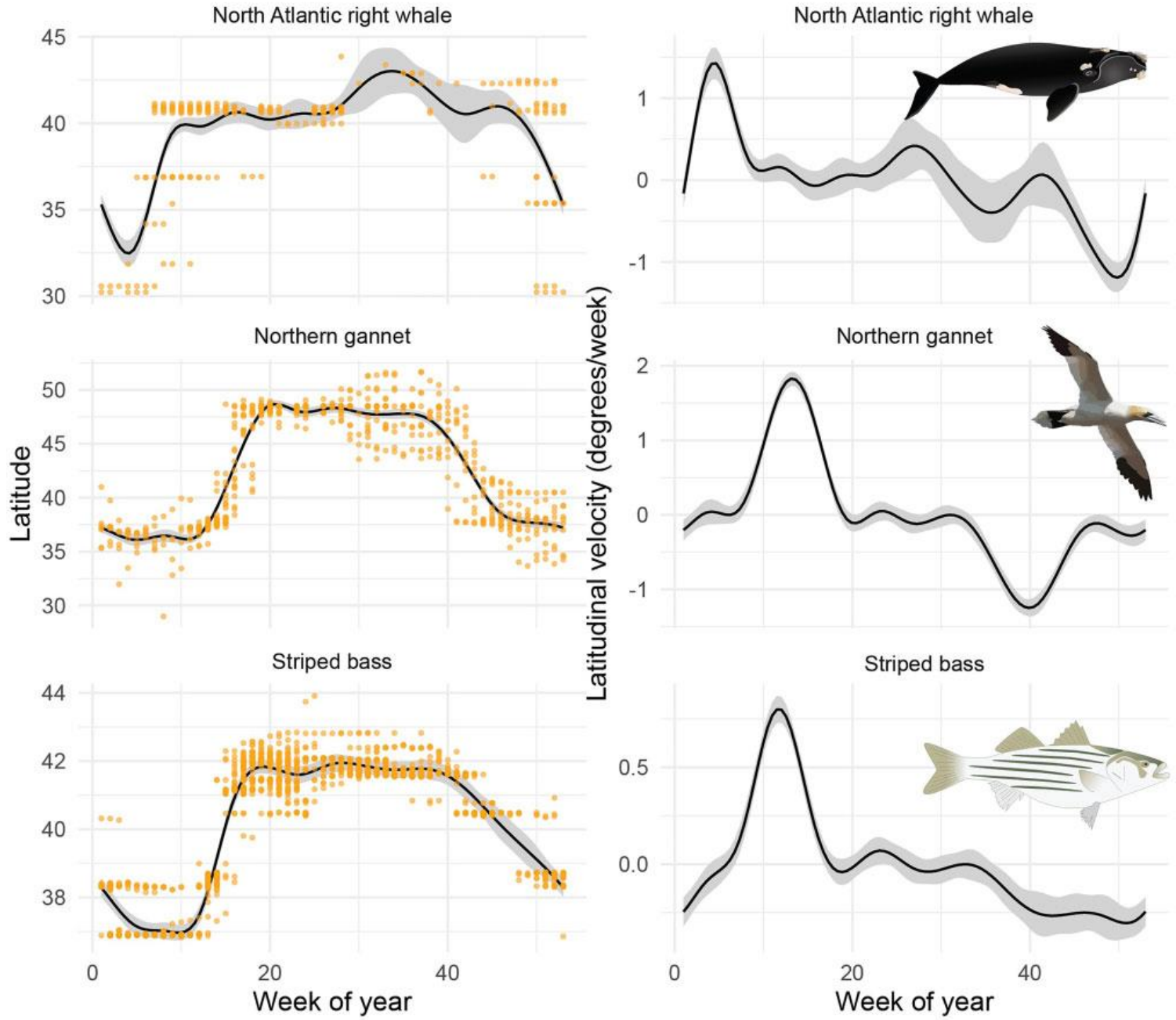
Kneebone J, Hoffman WS, Dean MJ, Fox DA, Armstrong MP. 2014. Movement patterns and stock composition of adult striped bass tagged in Massachusetts coastal waters. Transactions of the American Fisheries Society. 2014; 143(5):1115–29.

ICES Journal of Marine Science, 2024, Vol. 0, Issue 0, 1–15
https://doi.org/10.1093/icesjms/fsae138
Received: 23 May 2024; **revised:** 3 September 2024; **accepted:** 4 September 2024
Quo Vadimus

The flyway construct and assessment of offshore wind farm impacts on migratory marine fauna

David H. Secor[1,*], Michael H.P. O'Brien[1], Helen Bailey[2]

The flyway construct was developed in the 1930s to protect networks of bird stopover habitats along annual migration circuits. Here flyway is conceived as a quantifiable vector, a construct of the seasonal velocity and the geographic route taken among networked habitats, generalizable among marine migratory animals, and a way forward in assessing regional offshore wind (OW) development impacts.



Hook and release mortality

Biggest source of loss is recreational release mortality

NOAA (MRIP) statistics:

- In 2019, 32 million brought to the boat, for every single fish retained, 13 were released.
- In 2010, 25 million brought to boat, for every single fish retained, 5 were released.
- 9% of released fish are believed to die

Why are so many fish released?

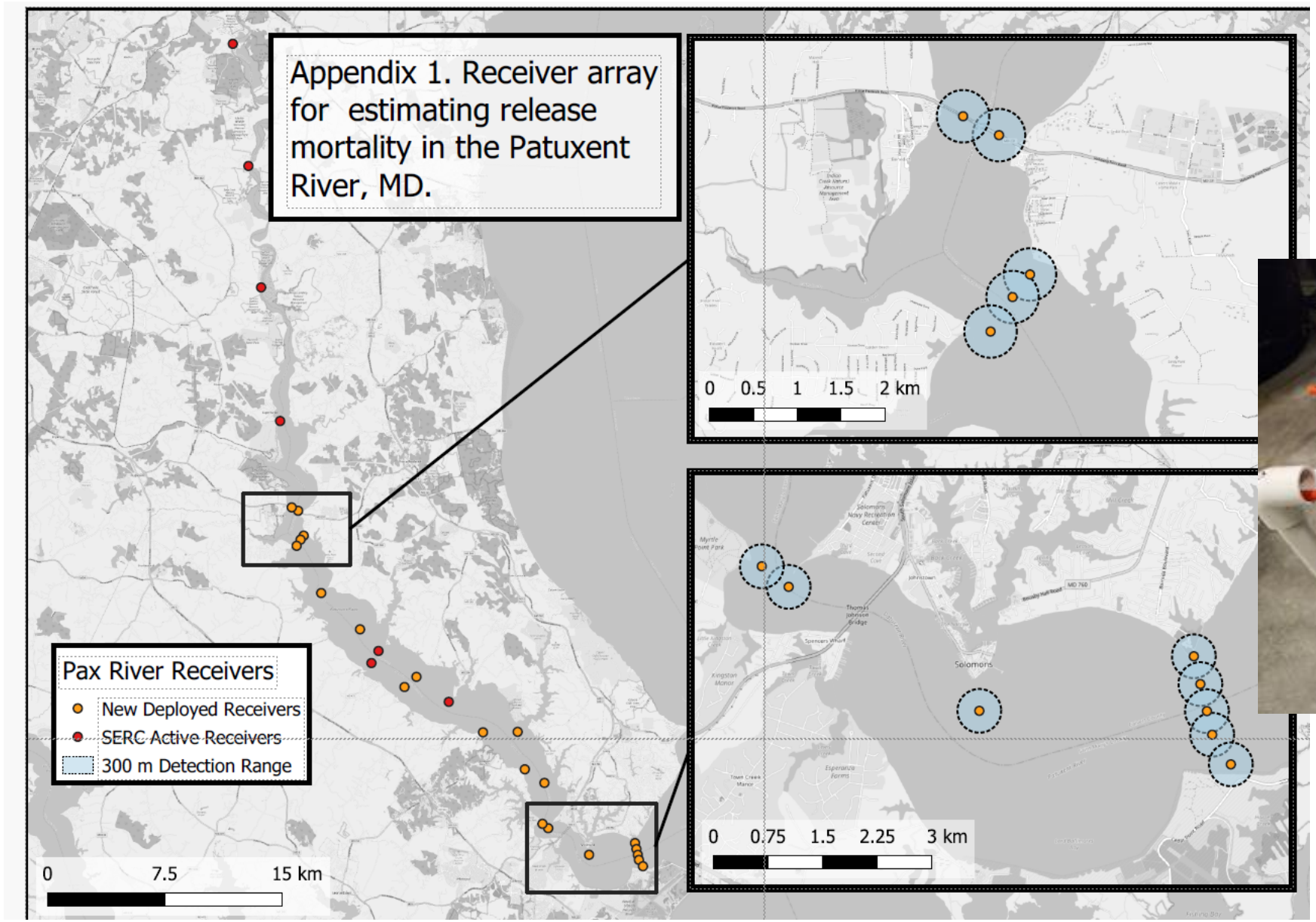
- Size limits, prohibited possessions
- Desire to catch the biggest fish
- Desire to catch as many fish as possible
- Unintended catch

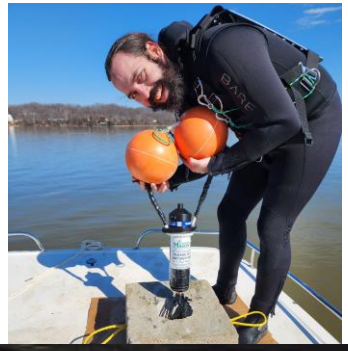
Need improved analysis and broader conversation to better understand interplay of regulations and motivations

Award Number NA23NMF4720405-T1-01

Estimating recreational catch and release mortality of Striped Bass

George Mason University PI**: Dr. T. Reid Nelson,**
Co-PIs: Dr. Brendan Runde (TNC), Dr. David Secor (UMCES)





Releasable external acoustic tags

1. Telemetry in general has held up premises of water quality selectivity and differential migration in striped bass.
2. Striped bass in particular avoid high temperatures > 27 C.
3. The pernicious feedback of temperature, disease, and release mortality means summer fishing days are numbered.
4. Telemetry mortality rates are high, biased high? or do we have a real problem?
5. Size specific migration maps on Dorazio et al. estimates quite well. 50% migration at 80 cm, 31” TL
6. No differences between sexes in size-dependent migration
7. BUT… recent genetic data (Gahagan unpubl) or New England shelf samples shows lots of school sized fish (2-3 year olds) originate from the Chesapeake, supporting Merriman’s observations.
8. Migrants from the Chesapeake may occur as contingents with a smaller contingent of 1 and 2 year olds leaving the Bay (missed in our Potomac sample).
9. Release mortality merits additional research - anticipate Reid Nelson’s talk later today