



**VIMS Trawl Survey
James River, 1997**

"What it represents, if it is a Chesapeake Bay fish, is kind of a ghost," said David Secor ... "It's a representative of something that once was - and probably no longer is - here."

In 25 years, 1964-1994, 7 YOY sturgeon were observed, the last in 1979. On this basis, Grogan and Boreman (1998) estimated a probability of extirpation of 0.99.

Grogan and Boreman. 1998. Estimating the probability that historical populations of fish species are extirpated. N. Am. J. Fish. Manage 18: 522-529.



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"I'm kind of optimistic," Secor said. "I'm just pleased that we have sturgeon to talk about in the Chesapeake. Ten to 15 years ago, I couldn't imagine having this conversation. We were much more pessimistic about their status."

Resilient Sturgeon ??

**Virginia
Commonwealth
University graduate
student Matt Balazik**



“Should we be surprised that no sturgeons are yet extinct? Sturgeons co-existed with dinosaurs and have survived asteroid blasts. Given that sturgeon species keep loping along, why are scientists, managers, and others in such a rush to restore them? “

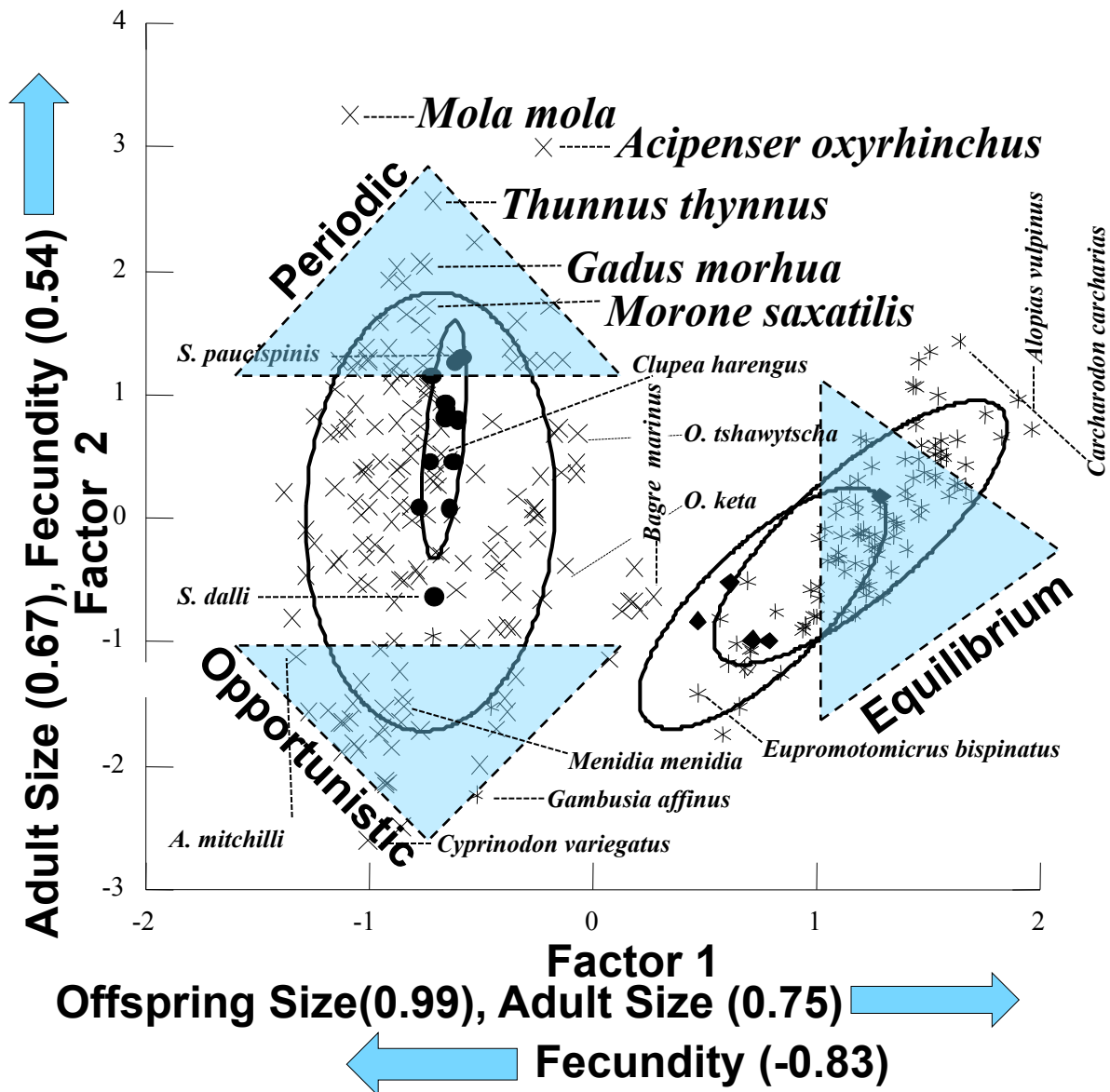


Secor et al. 01. Can we study sturgeons to extinction?

“The conundrum of sturgeon is that despite their resiliency through evolutionary time, they are particularly sensitive to human effects of harvest and habitat degradation.”

Resilience Point 1: Sturgeon are not K-selected!

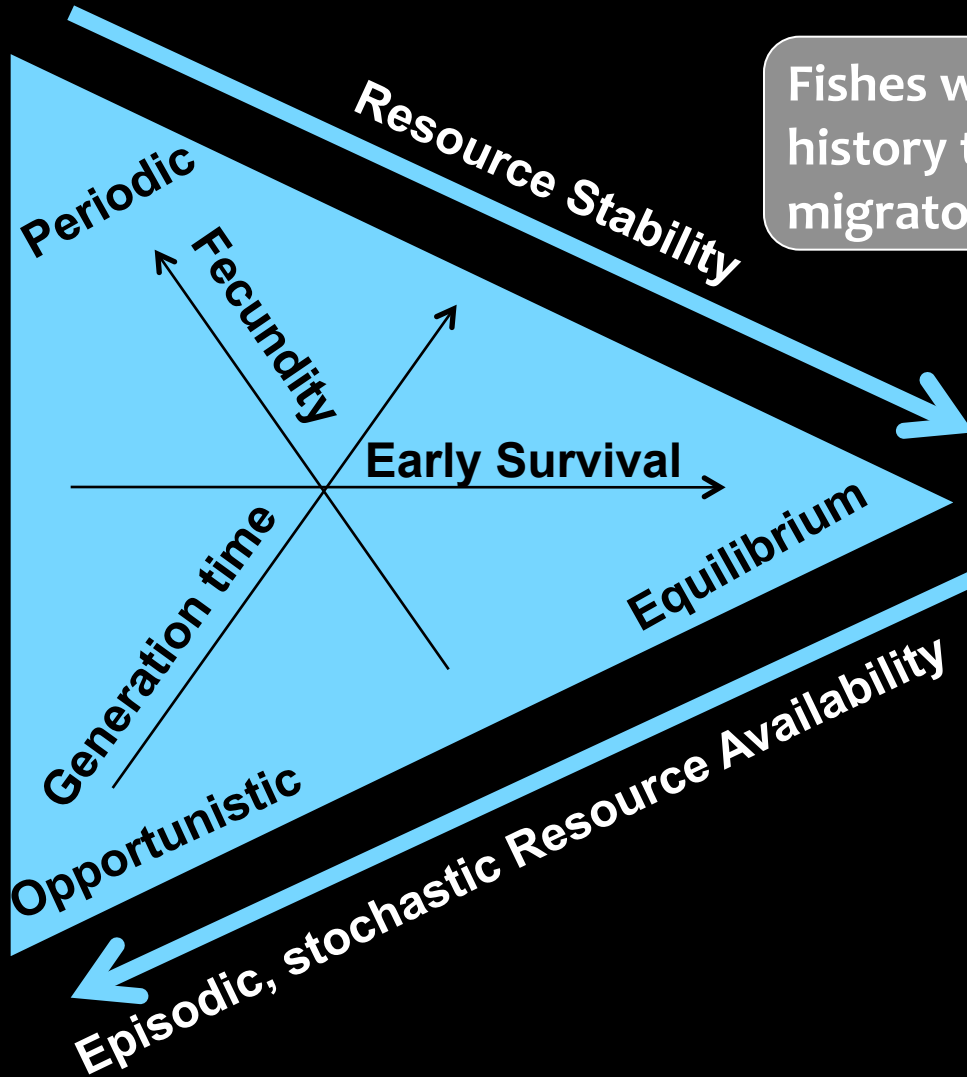
They epitomize Periodic Strategists



Resilient Sturgeon: Longevity coupled with high fecundity samples long term periodicity in the environment



Periodicity and Predictable Patterns in Resources

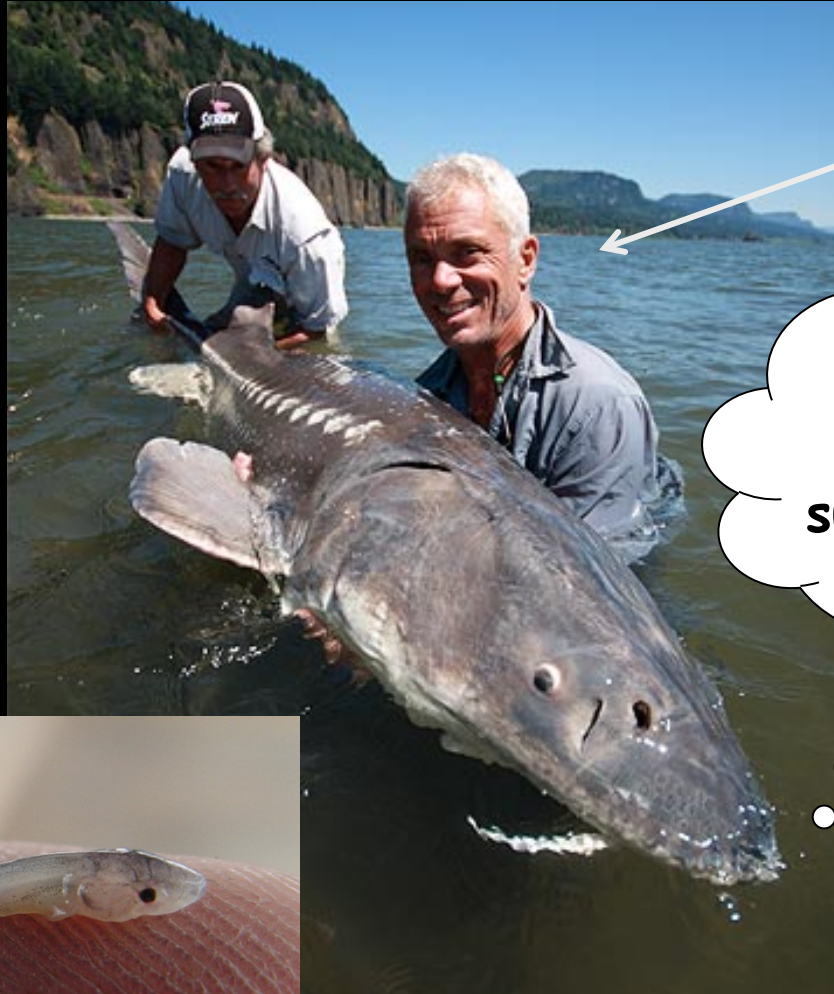


Fishes with periodic life history types also tend to be migratory

Sturgeons are not sharks!

Resilience Point 2: The Storage Effect

Sturgeon life history is multi-phasic – one stage is sensitive to the environment, the other relatively invulnerable. This life history “stores” the capacity to respond to favorable conditions over many years.



Not Tom Miller's
older brother.

I spanned decades
of early
survival conditions



Resilience Pop Star

Hudson River Shortnose sturgeon

Federally protected since 1967

Low reproductive rates
(females mature @ 6-10 years; longevity=37)

Critically low abundances (<1,000) throughout most of range

Recent recovery in Hudson River (Bain et al. 2007)

1979: 13,000 (9,000 - 18,000)

1994: 57,000 (51,000 - 64,000)

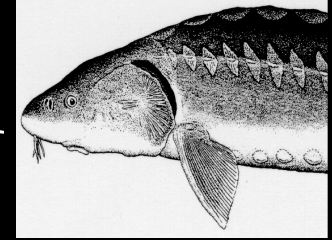
~ 4-fold increase in 15 years



The sturgeon flute is unique to the Hudson River valley

Bain et al. 2007. Recovery of a US Endangered Fish. Plos One e168

Where does resilience
come from?



Sturgeon Demographics

Recovery

4-fold increase in abundance in 15 years $\sim \ln(4)/15$ years
 $= 0.092$

$\lambda \sim 10\% \text{ yr}^{-1}$

From
me!



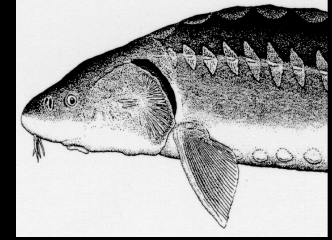
ESA protection

100% survival of all > 1 year-classes for 15 years (elasticity
analysis; Gross et al. '02)

$\lambda \sim 1\% \text{ yr}^{-1}$

Gross et al. '02. 2007. Sturgeon conservation: Insights
from elasticity analysis. Am. Fish. Soc. Symp 28

Resilience comes from long-term capacity to have strong year-classes



For Hudson River shortnose sturgeon,

- Only way to generate rapid population growth rate is through improvements to first year survival
- Circumstantial evidence for role of Clean Water Act in improving spawning and nursery habitats in the Hudson River (Woodland and Secor 2007; Woodland et al. 2009).



Resilient Sturgeon: the Good News

As periodic strategists, there is a relatively high scope for recovery in sturgeons. Further, the capacity for populations to respond to favorable conditions can span decades.

Resilient Sturgeon: the Bad News

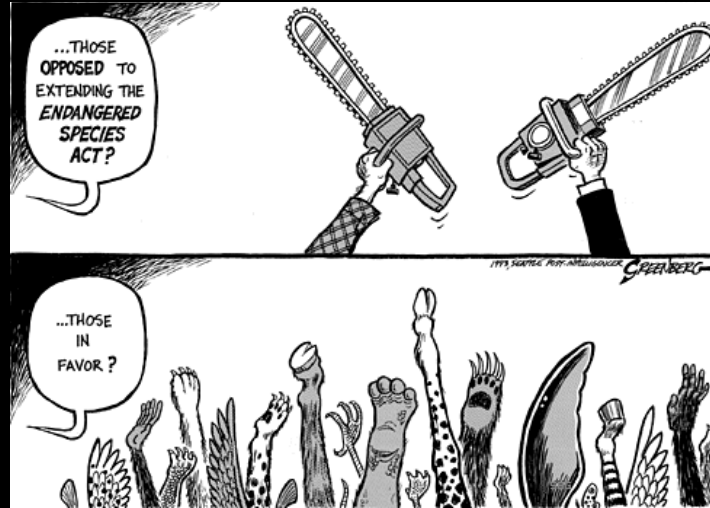
The stability part of resilience depends on sub-adult/adult survival

Protection strategies can include

- Reducing mortality (bycatch, poaching, strikes, dams, dredging, marine mammals)
- Maintaining metapopulation structure
- Improved assessments



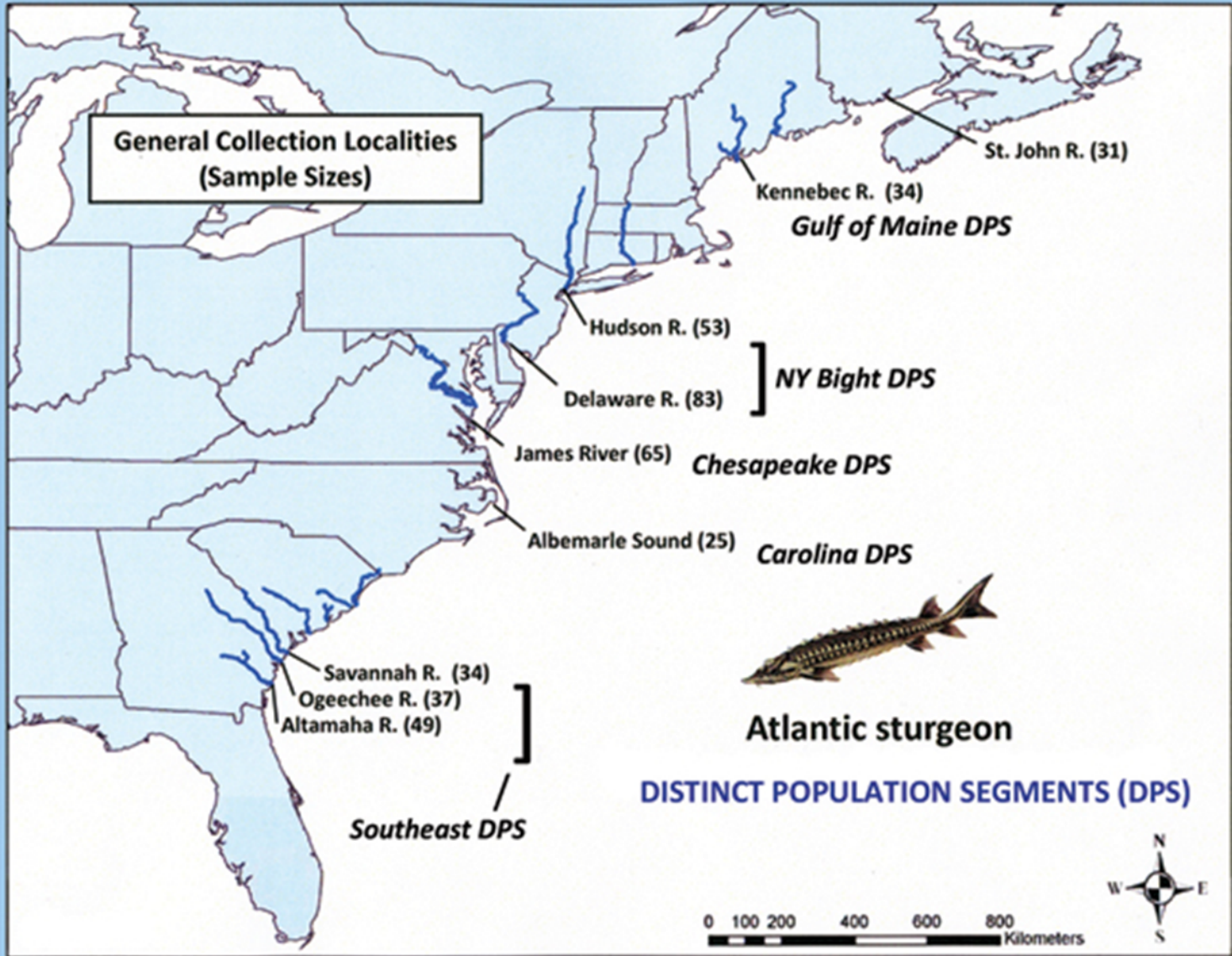
Sturgeon Resilience and the ESA



CSI: The Chesapeake Sturgeon Initiative

<http://fishconnectivity.cbl.umces.edu/research/CSI>







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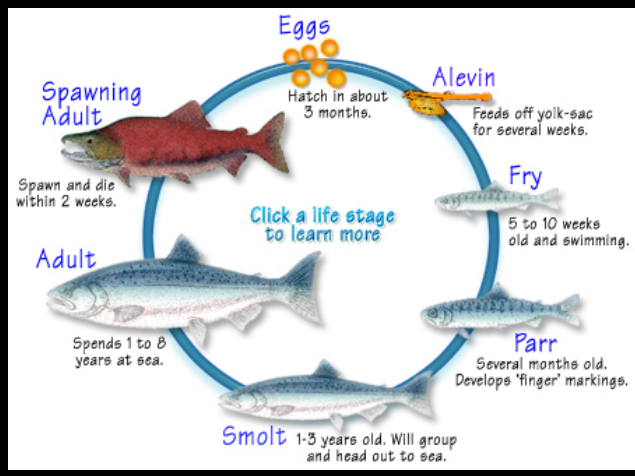
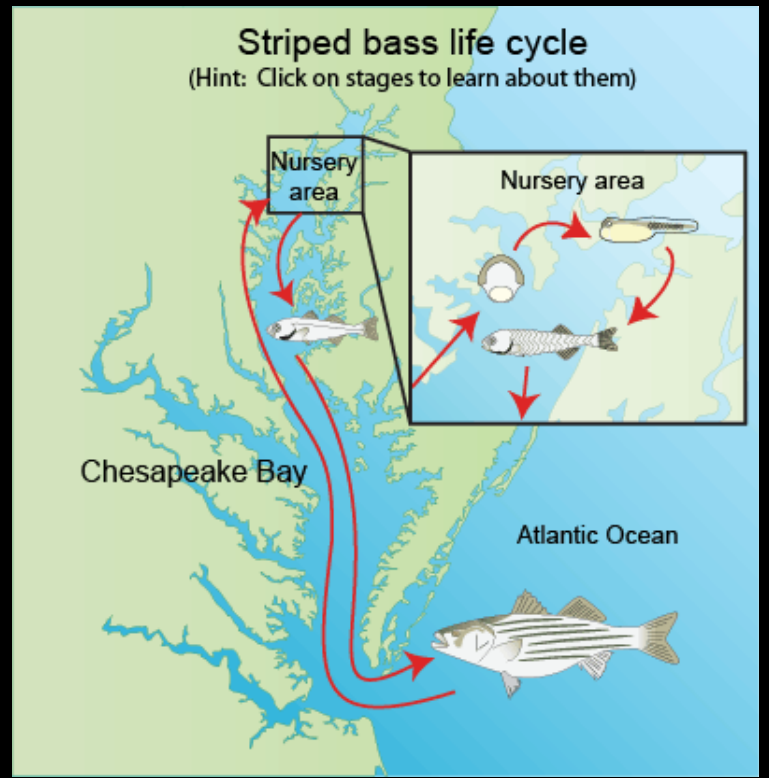
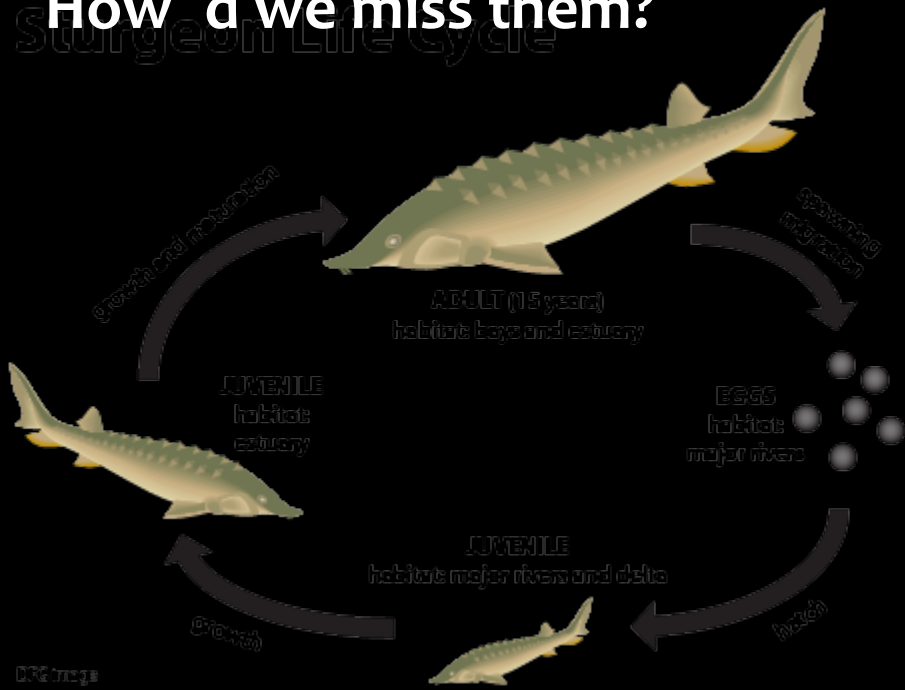
“Sturgeon may be a symbol of what we’ve lost in the Chesapeake Bay,” Secor said. “If we could bring back sturgeon, it would signify a huge change in the Chesapeake.”



Mea Culpa – They’ re Still Here in the Chesapeake! Not where and when we expected!



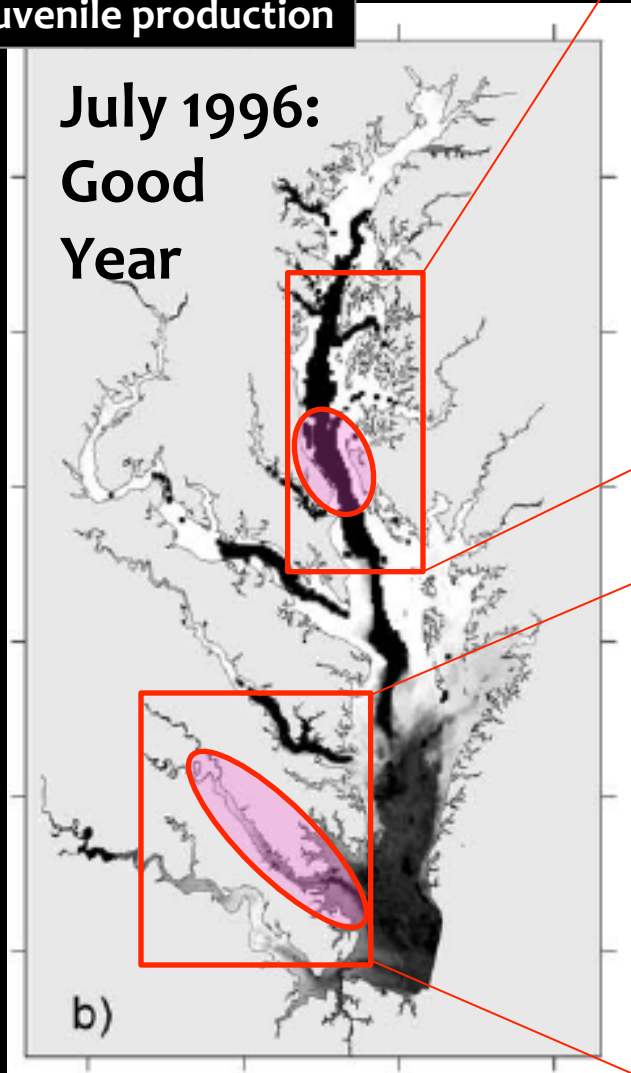
How'd we miss them?



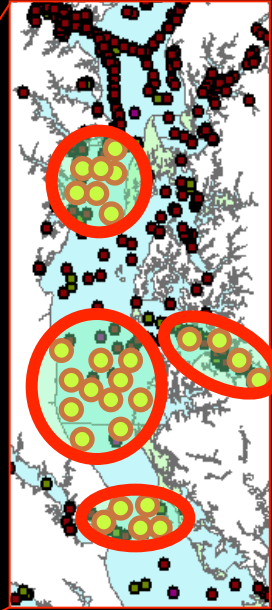
Section 6 Award: Assessment of Critical Habitats for Recovering the Chesapeake Bay Atlantic Sturgeon

Black is negative
Juvenile production

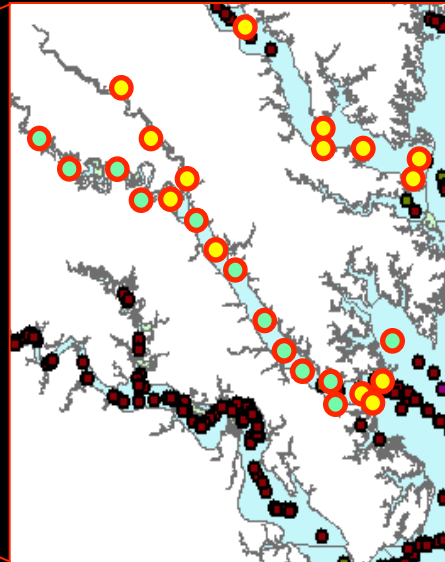
July 1996:
Good
Year



Corridor

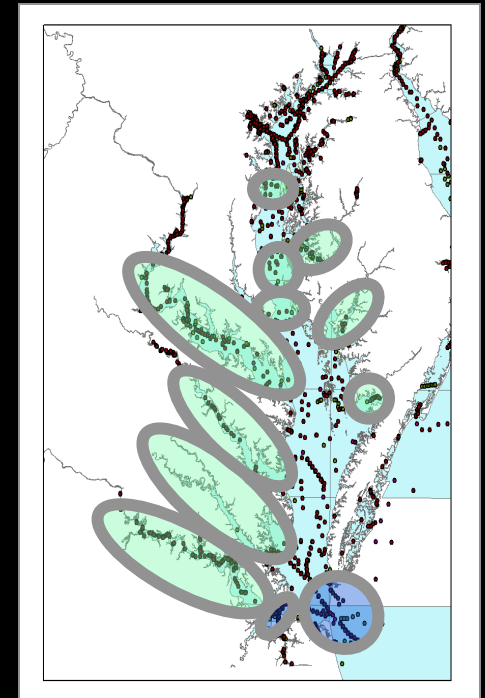


Nursery/Forage



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



Careful for what you wish for....

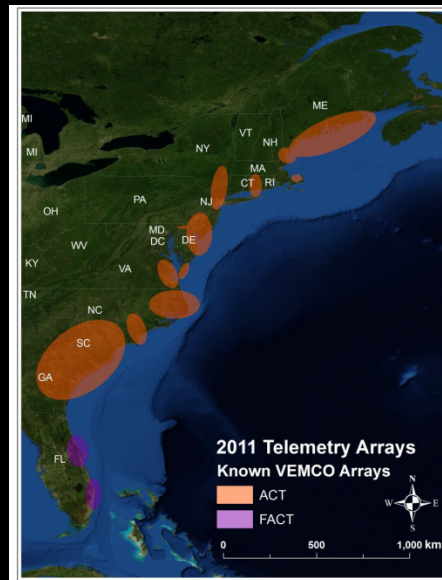
Data Sharing: Who's data? How to collaborate? How to gain access to data?

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**



<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 49 identified species currently being studied along the east coast.

Being Wrong - In Good Company

Romeo J. Mansueti
(1923-1963)
CBL Professor

Romeo J. Mansueti
(1923-1963)
CBL Professor



