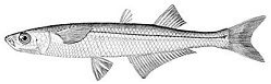
Forage Fish in Chesapeake Bay: Status, Trends, Science and Monitoring



GIT Meeting
Chesapeake Biological Lab
Solomons, MD
4 December 2013

Chesapeake Bay Watershed Agreement, Draft 11/3/13

Forage Fish Outcome: By 2016 develop a strategy for assessing the forage fish base available as food for predatory species in the Chesapeake Bay.

What Are Forage Fish?

- **Crucial species in food webs**
- **Small, often schooling pelagic species**
- **Sardines, anchovies, sand eels, krill, herring…**

  (Lenfest did not include squids)
- **Feed on plankton and transfer energy to upper trophic levels**

Because fish are hatched at small size, almost all fishes are prey for larger fishes and other predators. But, we generally don't consider species that have large adult size and non-schooling behavior as "forage species."

From Lenfest 2012

Economic Value of Forage Fish

Direct value of commercial catch = $5.6 billion

Supportive commercial value = $11.3 billion

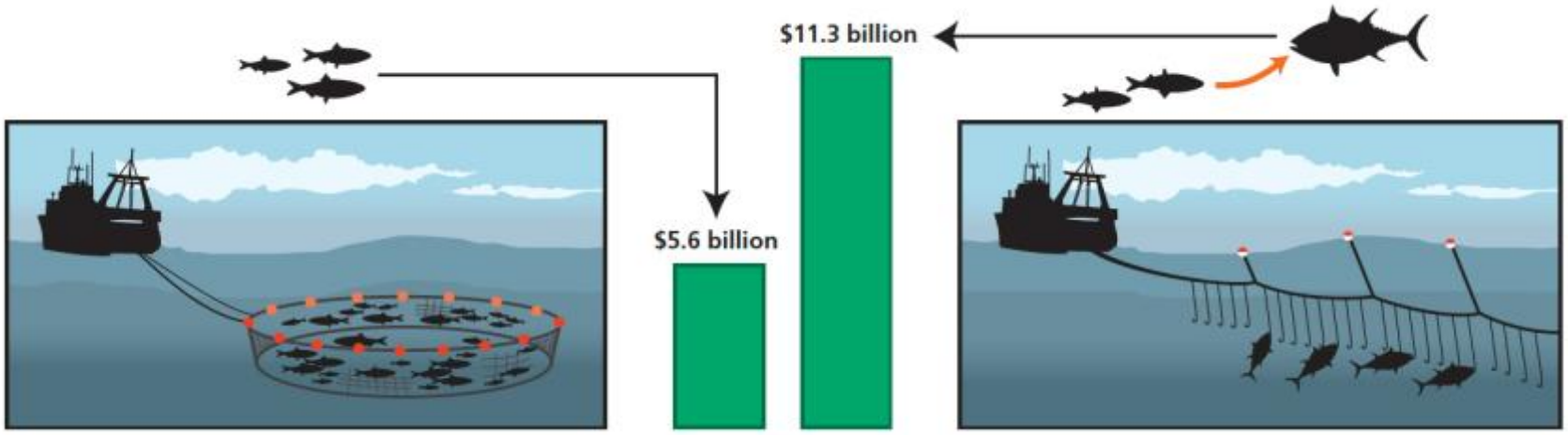
Total global commercial value = $16.9 billion

Value in 2006 dollars

First ever estimate of total value of forage fish to all fisheries

FORAGE FISH DIRECT VALUE

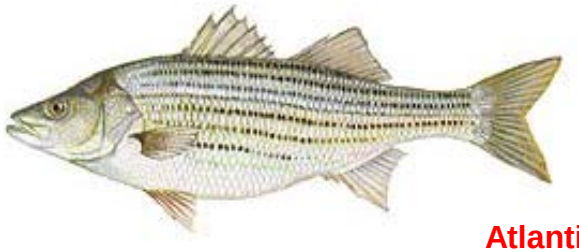
FORAGE FISH SUPPORTIVE VALUE



Lenfest 2012

Fishes of Chesapeake Bay

Striped Bass



Spot

Atlantic menhaden

Mummichog

Summer Flounder

Bay anchovy

Atlantic silverside

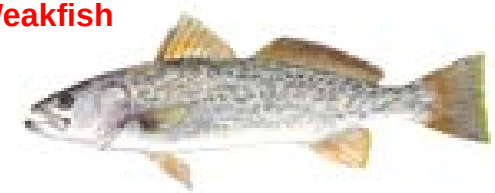
Atlantic Croaker

White Perch

Hogchoker

Yellow Perch

Weakfish



American Shad

Alewife

Blueback Herring

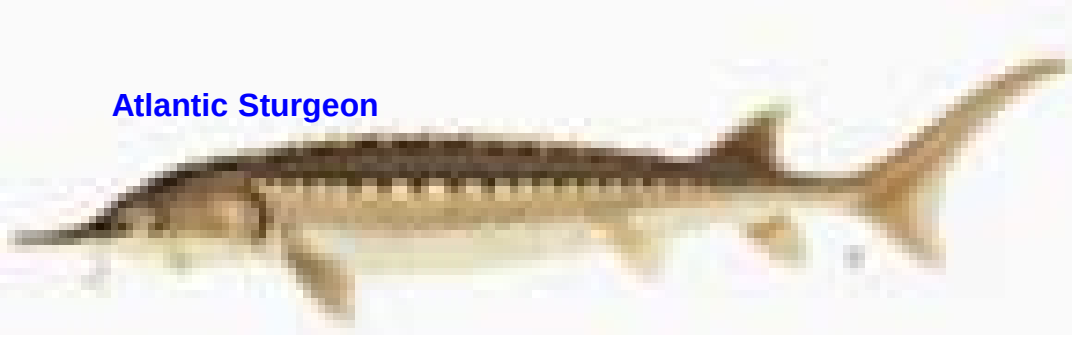
Cownose Ray

Bluefish

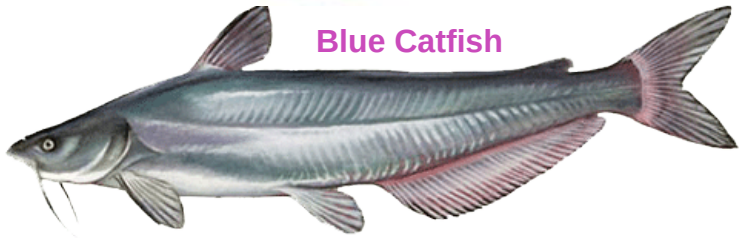
Northern Snakehead

American Eel

Atlantic Sturgeon



Blue Catfish



Forage Fishes in Chesapeake Bay

- Bay Anchovy
- Atlantic Menhaden
- Atlantic Silverside
- Striped Anchovy
- Gizzard Shad
- Mummichog
- YOY Alosines
- Spottail Shiner
- Other small fishes (gobies, blennies, etc.)

Forage fish are valuable as prey

Many predators are highly dependent on forage fish…

…and decline when forage fish decline.

Predators that have a higher proportion of forage fish in their diet generally exhibit greater declines as forage fish abundance decreases.

Forage fishes support a diverse spectrum of predators, not only exploitable, piscivorous fishes. Research and monitoring of the predators also is needed.

Lenfest 2012

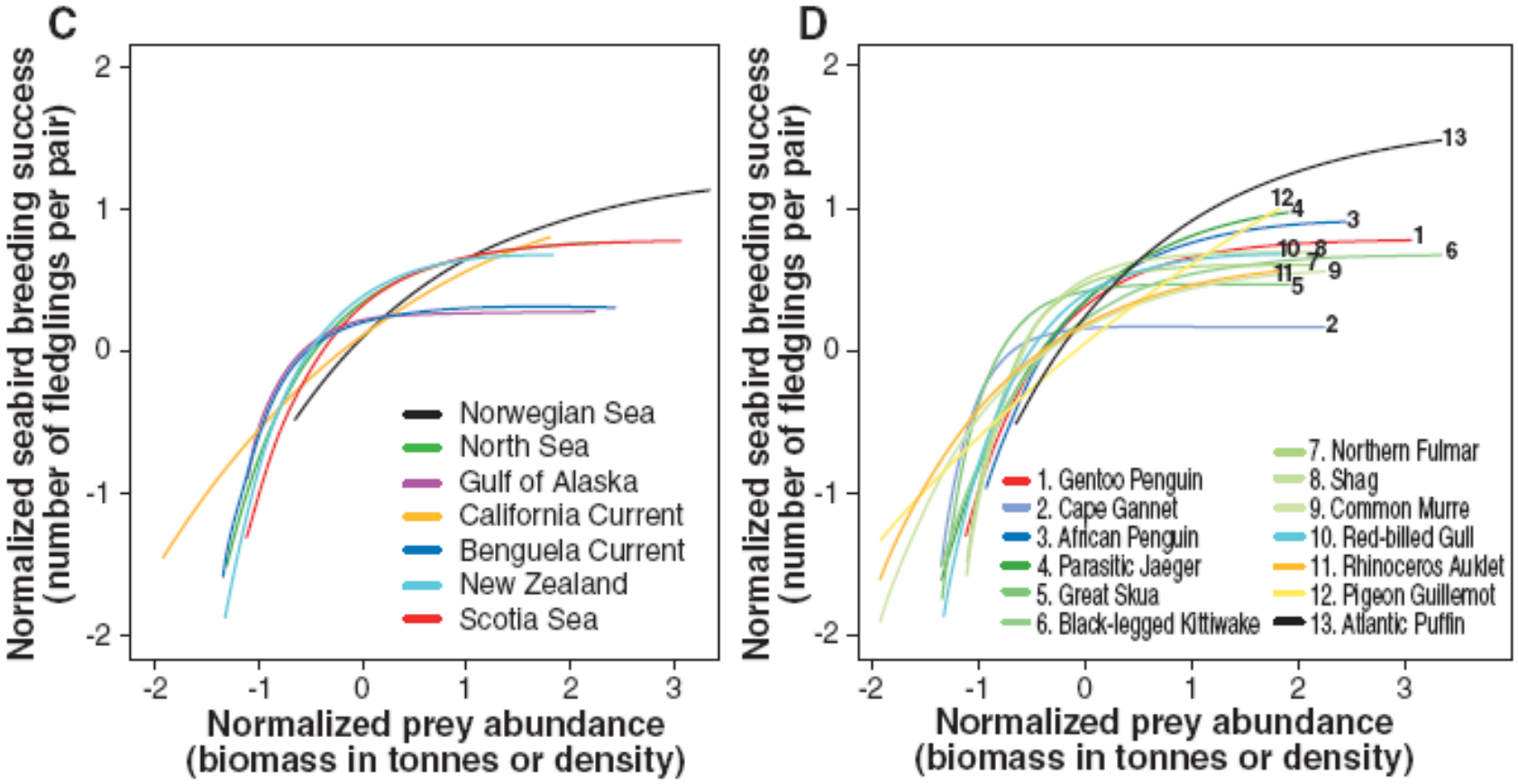
SSC National Workshop IV: EBFM and Forage Fish Issues

- Need better ways to estimate forage biomasses
- Need better ways to estimate predator demand
- Determining M2 is important
- Ecosystem forage buffers vs single-species buffers?

For consideration

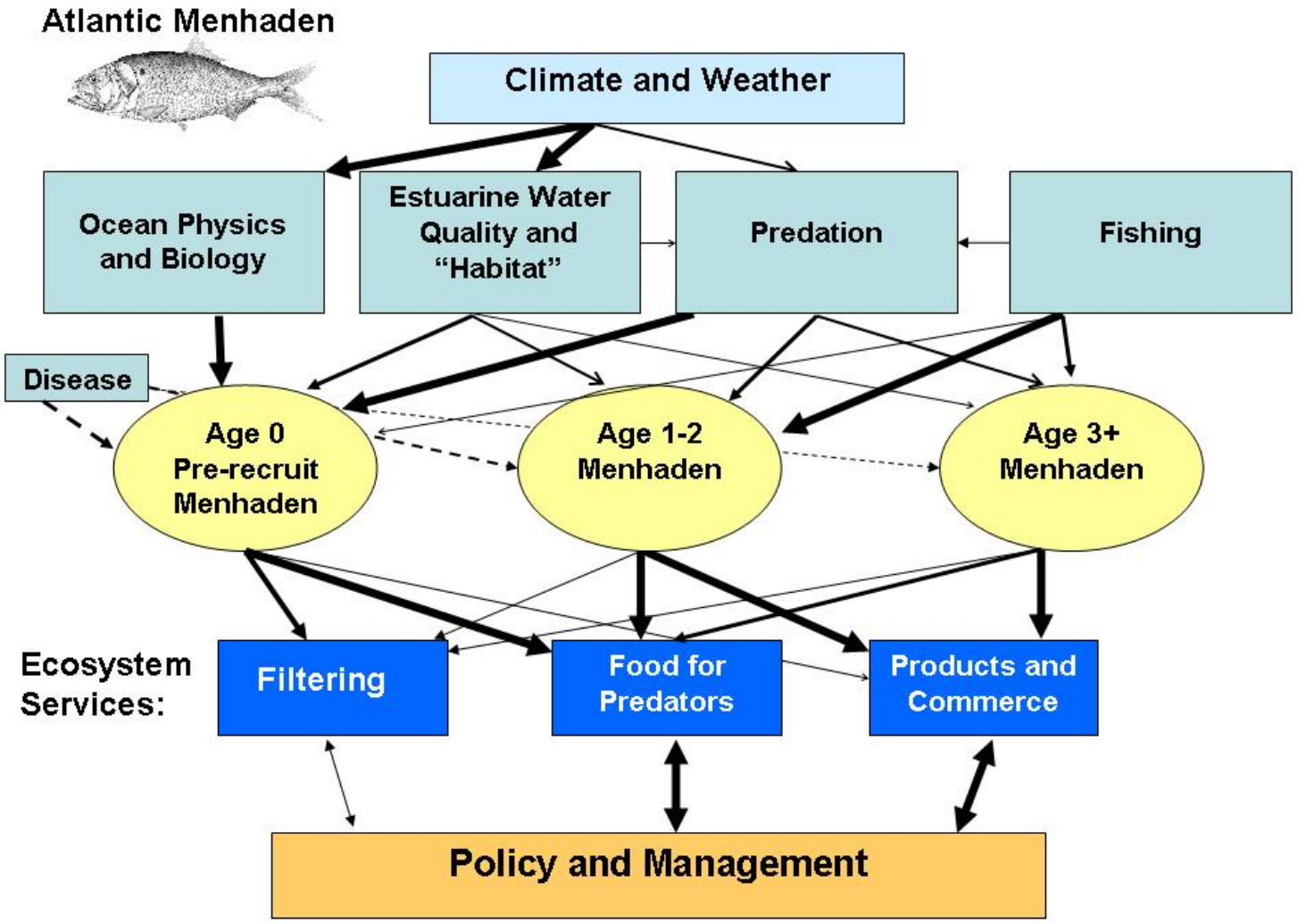
- Indicators and reference points
- Are there any rules of thumb, e.g., $F < M$, Biomass threshold, hockey-stick (Restrepo, Lenfest) rules, appropriate *F* and *B* levels.
- Can predator demand be indexed from stock assessments of predators?
- What indices of ecosystem state are available that are indicative of predator demand and prey availability?
- Can energetics modeling be useful to estimate demand?
- What about ecosystem modeling? Strategic or tactical?

Leave one third for the birds



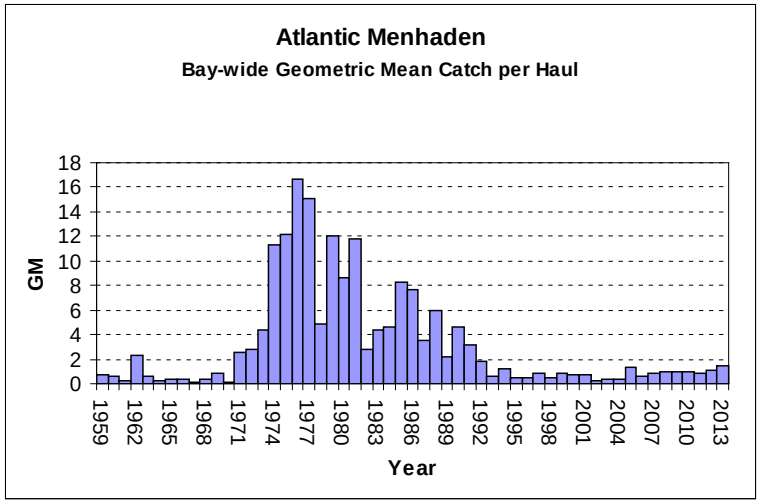
Cury et al. 2011

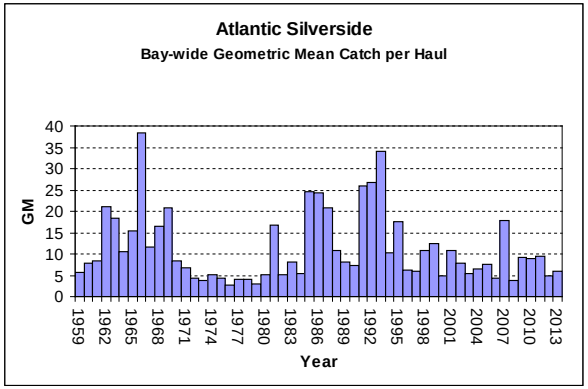
Atlantic Menhaden

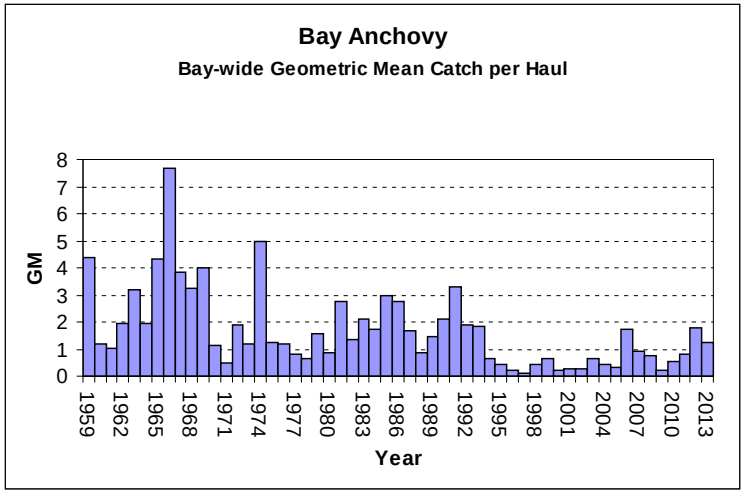


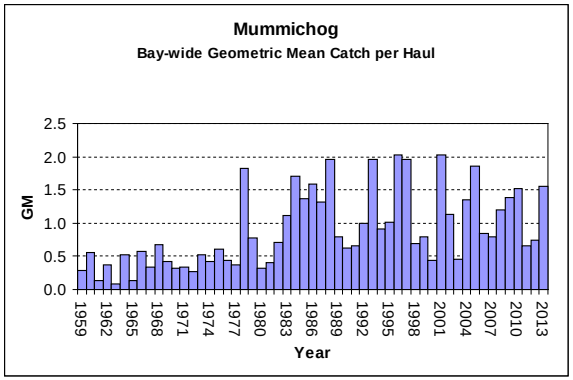
E. Houde

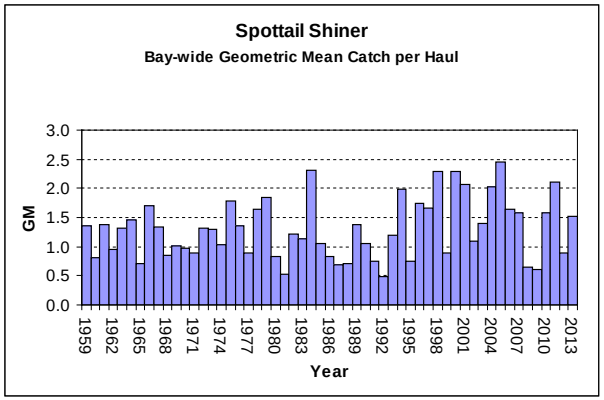
Young-of-the-Year Abundances



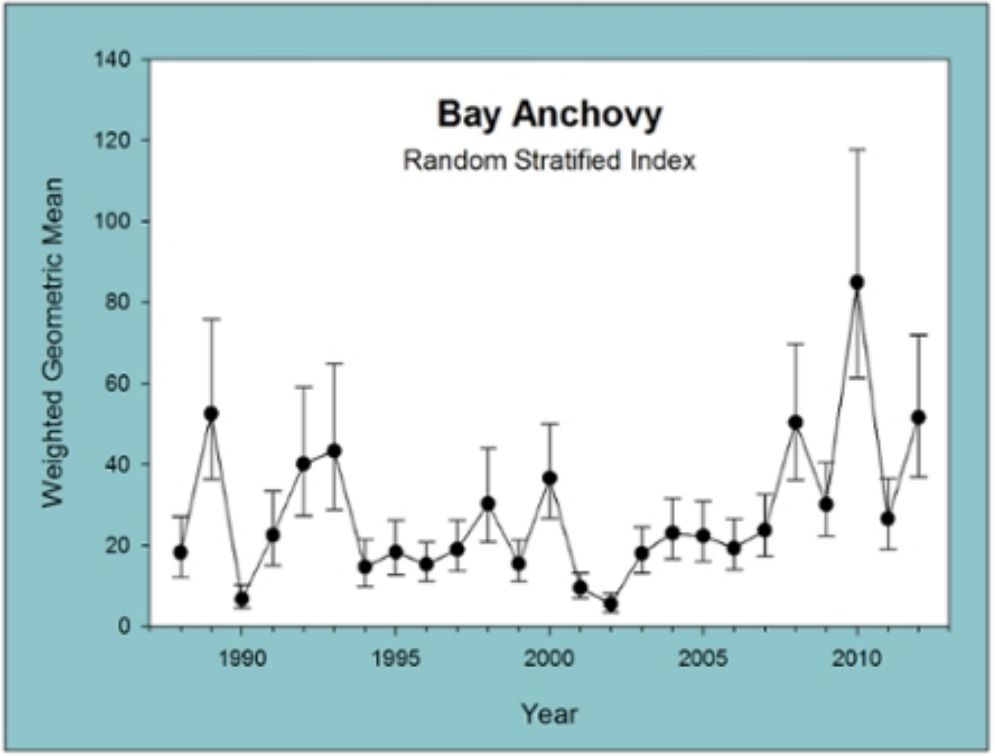


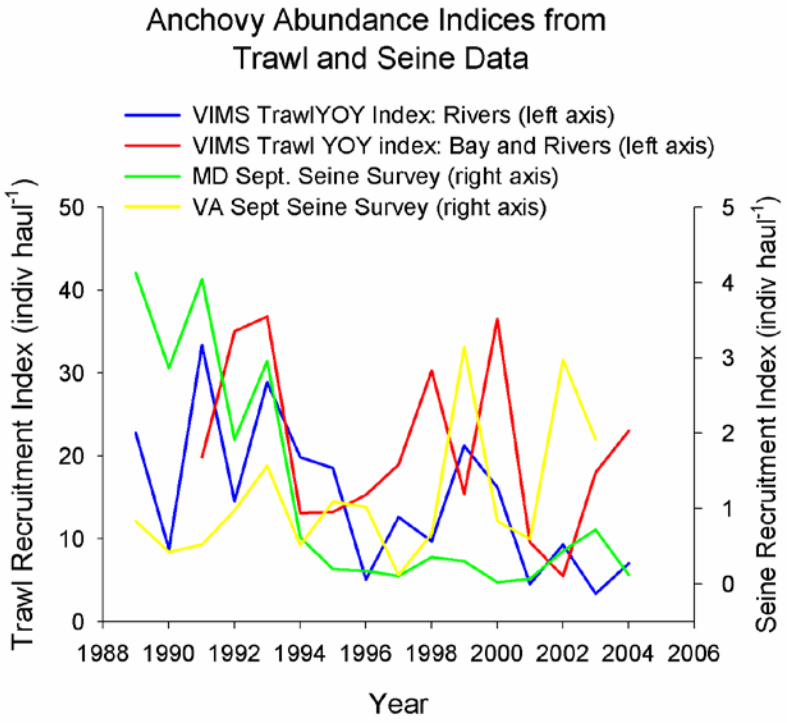




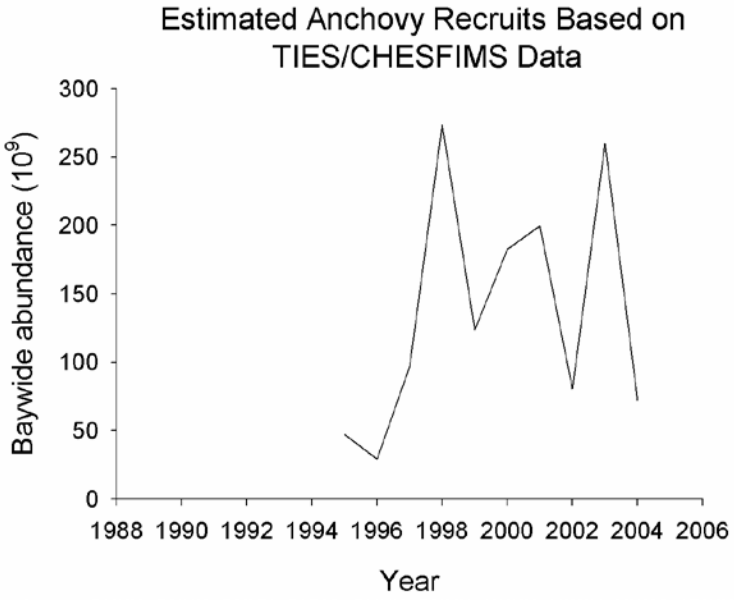


Maryland DNR Juvenile Fish Seine Survey





VIMS Juvenile Fish Trawl Survey

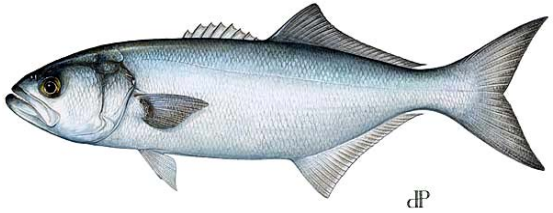


Houde et al. 2006. Progress Report to MD Sea Grant

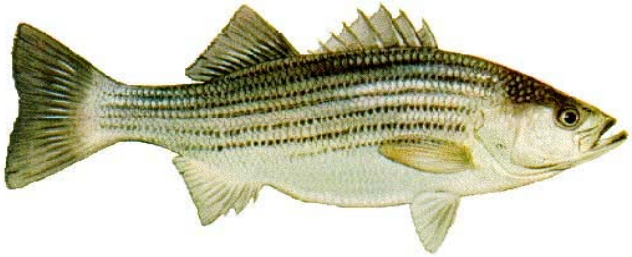
Commercial Fishery

Menhaden: Allocation and EBFM

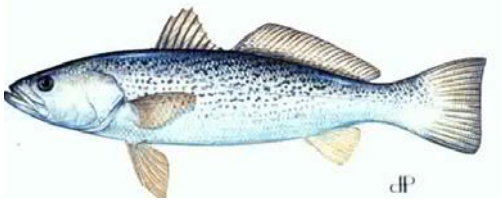
Bluefish



Predators/Piscivores



Striped Bass



Weakfish

Osprey

What is a "Fair" **Allocation** Plan?

Can Humans Cause
"Localized Depletion?"

Recreational Striped Bass Fishing

Research Needs

- Abundance Estimates
- Predator Demand
- Connectivity: Ocean & Estuary
- Forecasting Long-term Trends
- Energetics and Productivity
- Environment and Habitat
- Climate Effects

Monitoring Needs

- Continue Juvenile Index Surveys
- Baywide Trawl Survey
- Ingress Monitoring
- Predators Abundances
- Predators Stomach Analyses