Population estimates to improve understanding of habitat effects on Chesapeake Bay

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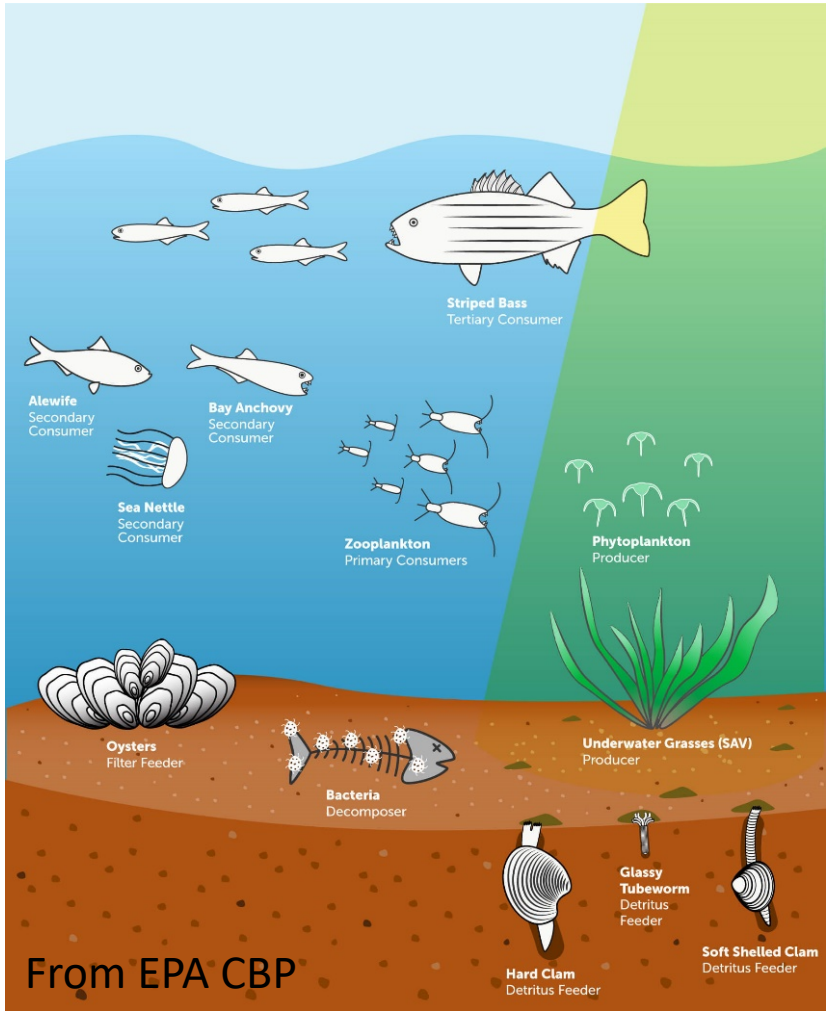
Objectives

- Estimate abundance of important populations in Chesapeake Bay (2 species per year)
- Evaluate effects of environmental drivers on population dynamics
- Develop spatial assessment methods

Interactions drive community dynamics



From EPA CBP

Desire to understand effects of ecosystem changes on habitat of important species and their dynamics

- Top down effects (e.g., fishing, striped bass management)
- Bottom-up effects (e.g., nutrient reduction, land use change)
- Middle-out effects (e.g., menhaden management)
- Habitat-mediated effects (e.g., oyster restoration, sea grass restoration, hypoxia reduction)

Relatively little understanding of habitat effects on populations

- Hypoxia
- Major changes in benthic habitat
- Major changes in forage availability

Challenges

- Understanding effects of the environment on populations is difficult – especially so in Chesapeake Bay
  - Lack of estimates of abundance for most species
    - E.g., population size is extremely important for determining potential effects of changes in predators or prey
  - Many species show extensive migrations and only use the Bay for part of the year or part of their life cycle
  - Historically, there has been a lack of data on trends in abundance (e.g., commercial fishery landings often used as a proxy)

Why now?

- Data availability is better than ever, and this project would fully leverage the investments in data collection
  - ChesMMAP and NEAMAP surveys provide information that can be used to estimate movement into and out of the Bay
- Assessment development tools are better than ever and can support spatial models
  - Template Model Builder allows for estimation of complex models with random effects to allow efficient estimation of spatially structured models
- We can build on recent successes of spatially explicit assessments that include habitat for oysters and other recent studies of menhaden dynamics

Approach

- Models would be developed to estimate abundance and mortality rates over time for two Bay species each year using new stock assessment approaches developed specifically for this project
- Models would be jointly developed by the team
- Two students (1 CBL, 1 VIMS) would implement the models
- Four in person modeling meetings per year to ensure joint development of the models
- Costs ~ $200-250k/yr

Benefits

- Will improve our understanding of how the CB fish community responds to habitat changes
  - Particularly important for forecasting effects of climate change, land use change, nutrient reductions, oyster restoration, etc.
- Estimates of abundance over time for two species per year (on average)
- Estimates of how environmental factors affect population dynamics for assessed species
- Abundance estimates would be made publicly available (similar to ChesMMAP and NEAMAP data) to facilitate other studies
- Train multiple students in stock assessment and quantitative fisheries (NOAA priority, could also potentially link with LMRCSC)

Potential interactions with management

- New models would be developed that could be considered for use in the management cycle
- Species would be chosen so that they would not conflict with recent assessments
- Management advice (e.g., quotas, overfishing limits) would not be produced because the focus is on estimating abundance and understanding drivers of community dynamics

Why the need for a broad partnership?

- Bay-wide focus for macrofauna requires cooperation among agencies
- States/PFRC/ASMFC/NOAA have jurisdiction over fisheries, and NCBO is the main agency with a focus on how Bay habitat affects fish and shellfish populations
- Many of the important species in the Bay are unmanaged, so they are not a priority for the management agencies
- Many species are managed at the coastwide scale (ASMFC or NOAA), so Chesapeake Bay estimates have not been a priority