Forage Indicator Development

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Chesapeake Bay Program
Science. Restoration. Partnership.

Chesapeake Bay Program

- 2014 Chesapeake Bay Watershed Agreement
  - Signed by state and federal entities
- Forage Outcome:
  - Continually improve our understanding of the role of forage in the Bay, and develop a strategy for assessing the forage base

Chesapeake Bay Program
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The Forage Action Team

Smithsonian Environmental Research Center

How do we address this outcome?

What do we really want to know?

- Is there enough prey available for predators in the Bay?
- How does prey availability change over time?

How can we track prey availability over time?

- Develop a suite of indicators that provide information about forage abundance

The Keys to Indicator Development

- Identify key forage species
- Quantify environmental relationships
- Determine prey consumption habits

The Long Road to Indicator Development

2014: STAC Workshop

Important Forage Species for the Chesapeake Bay

Representative Predators

Five predator species were selected by the Steering Committee of the 2014 Forage Workshop to serve as representative indicator species for the range of predators and lifestyle types in the Chesapeake Bay. The selected species included:

Striped Bass
anadromous, piscivore

Summer Flounder
mesohaline-polyhaline, piscivore

Atlantic Croaker
oligohaline-polyhaline, omnivore

Clearnose Skate
polyhaline, omnivore

White Perch
oligohaline, omnivore

To identify important forage in the Chesapeake Bay ecosystem, an analysis of a long term, fishery-independent survey (ChesMMAP) was conducted to quantify the gut contents of five representative predator species.

Forage species were considered important if the forage taxon or group composed at least 5% by wet weight of a predator's diet in at least one of the five ChesMMAP seasonal sampling cruises taken during any year of the study (on right).

Forage species are critical to sustaining production of economically and ecologically valuable fish species in the Chesapeake Bay.

Key Forage*

Bay Anchovy

Polychaetes

Mysids

Amphipods and isopods

Weakfish (juveniles)

Spot (juveniles)

Mantis shrimp

Razor clams

Sand shrimp

Atlantic croaker (juveniles)

Macoma clams

* Based on wet weight of prey in stomach analysis of 5 representative predators in the Chesapeake Bay (ChesMAPP)

Additional Important Forage

Managed forage species

Atlantic menhaden

Blue crab

Historically important

Shad & river herrings

Forage of Upriver Predators

Small bivalves

Atlantic Silverside

Mummichog

Additional species were added to the list of important forage by the participants of the Forage Workshop to include forage of under-represented freshwater predators, historically important forage, and managed forage (additional important forage above).

For more details on this analysis, please view the Scientific and Technical Advisory Committee's 2014 Forage Workshop Report.

Above data is based on the 2014 Scientific and Technical Advisory Committee Forage Workshop

The Long Road to Indicator Development

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2015-2016: GIT-funded studies

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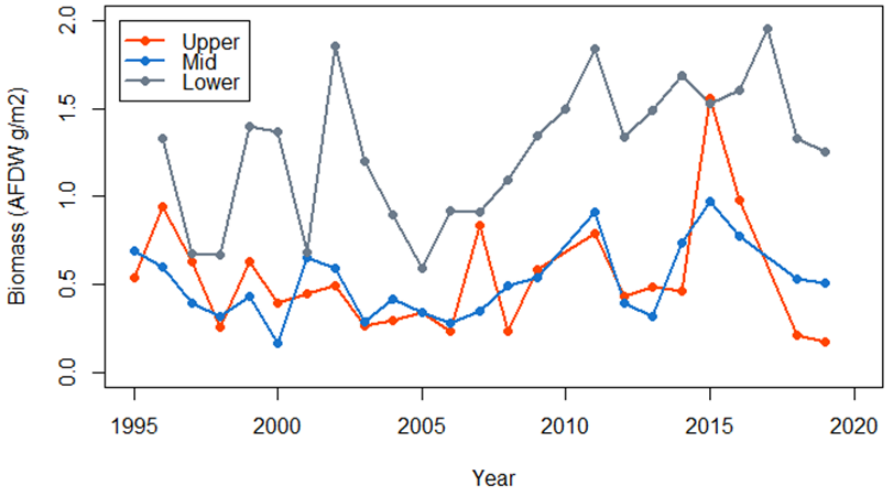
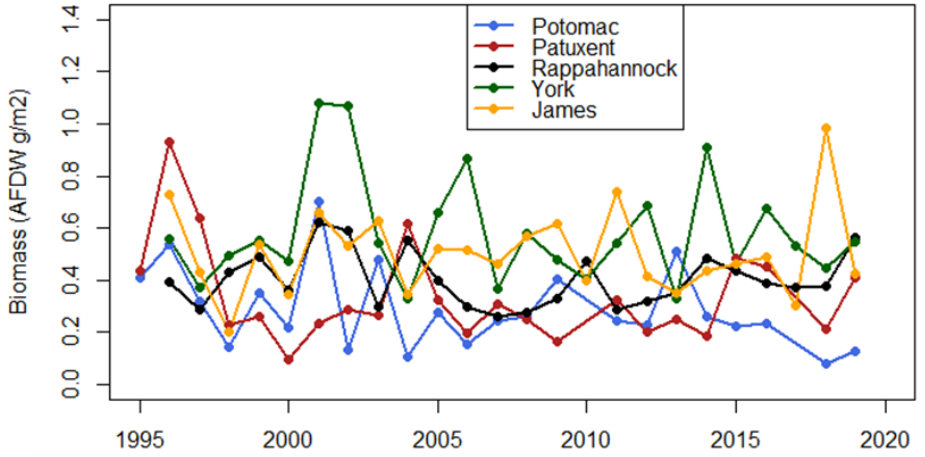
2020: Prioritized suite of initial indicators leading to the Forage Indicator Development Plan

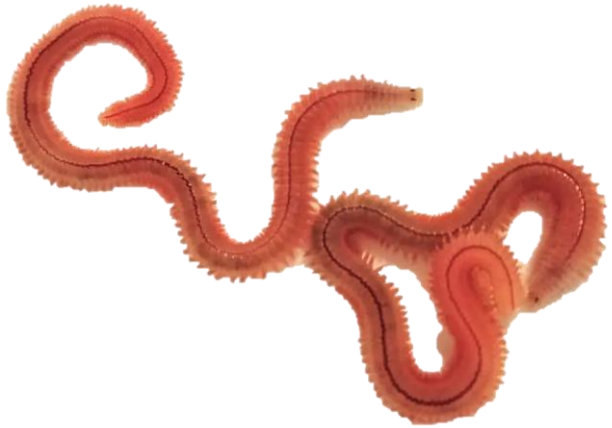
Forage Indicator Development Plan

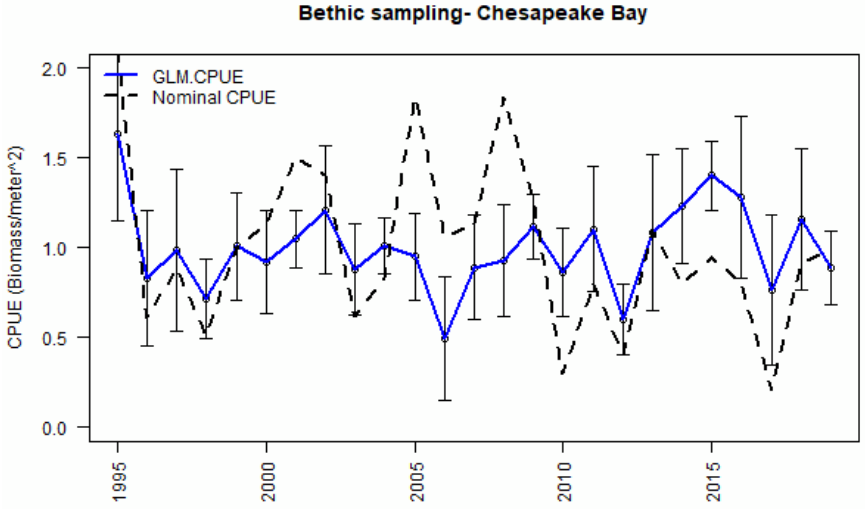
Tier 1: Abundance	Species of Interest
Benthic Invertebrates	Polychaetes
Demersal Finfishes	Atlantic croaker
Pelagic Finfishes	Bay anchovy Atlantic menhaden
Tier 2: Habitat and Environmental Factors	**Species of Interest**
Springtime Warming	Bay anchovy Polychaetes
Habitat Suitability Index	Bay anchovy
Hardened Shorelines	Juvenile blue crabs
Tier 3: Predator Consumption	**Species of Interest**
Diet Profiles	Striped bass

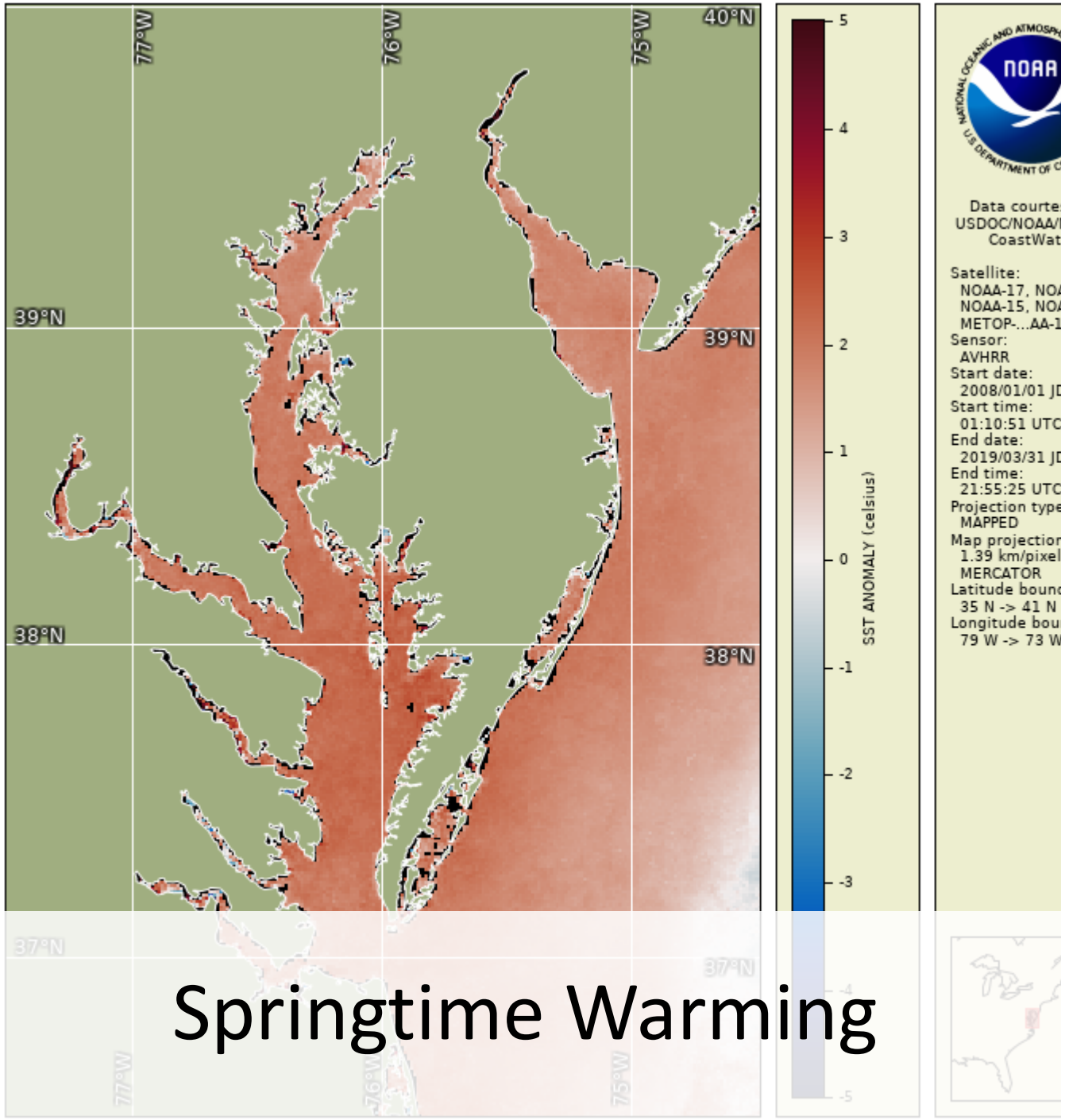
Time Series of Polychaete Biomass



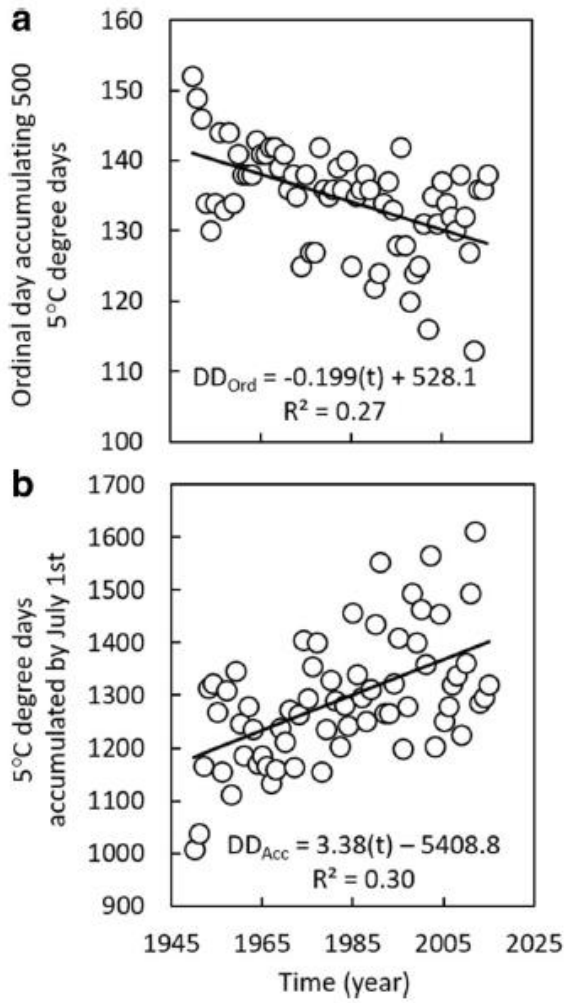








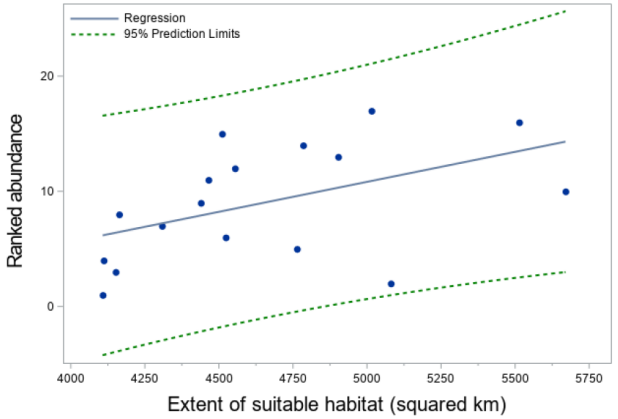
Springtime Warming

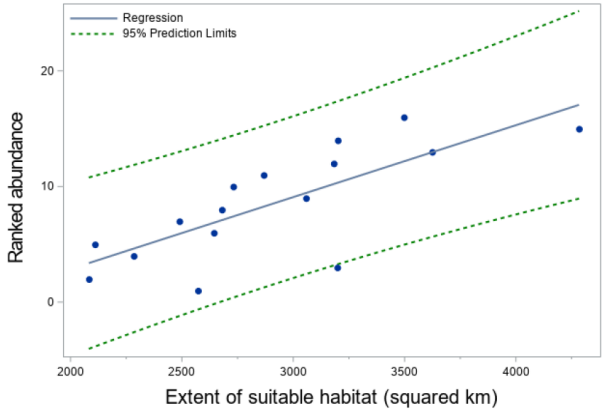


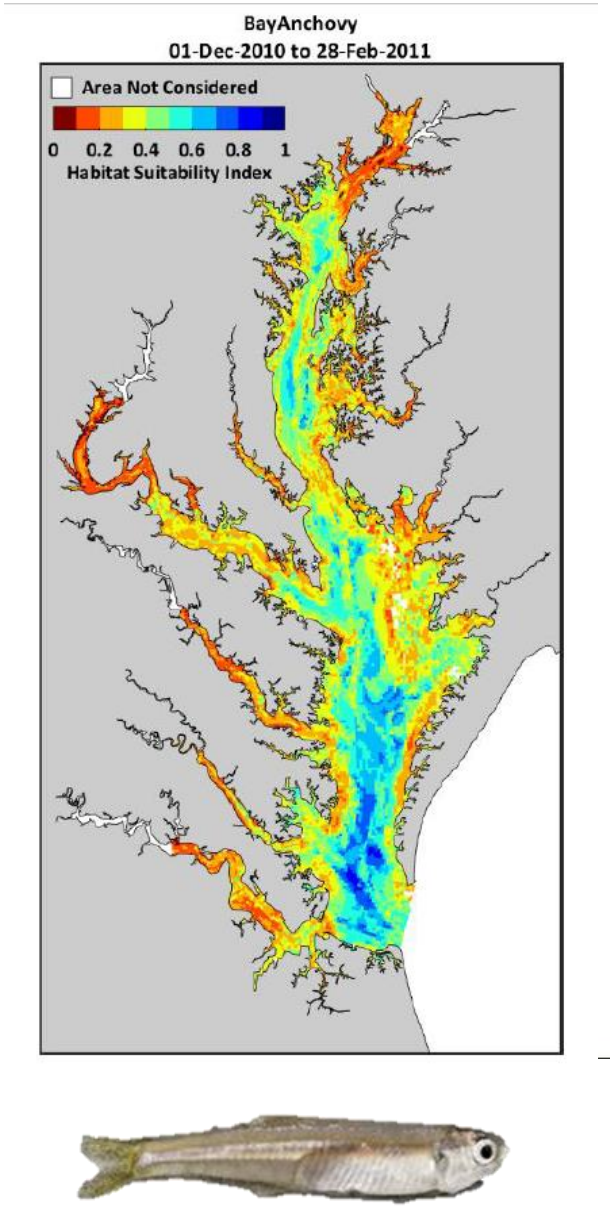
Woodland et al. 2017

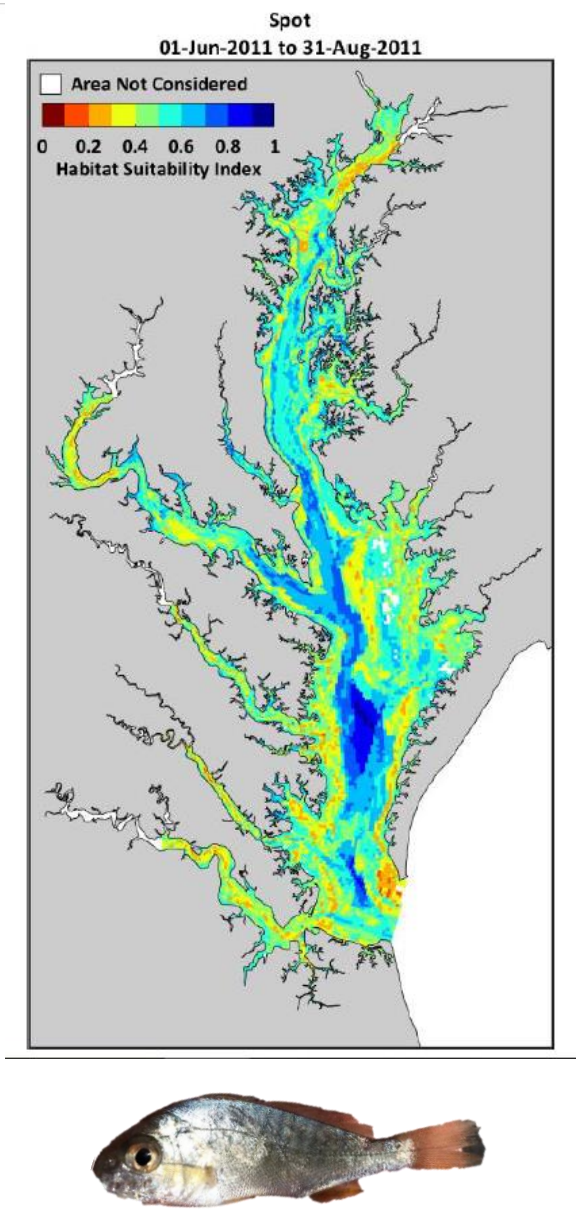
Habitat Suitability Index

- NCBO-funded research conducted by VIMS and AnchorQEA
- Assessed the extent of suitable habitat for 4 key forage species
  - Fisheries survey data
  - Modeled environmental conditions (water temperature, salinity, DO)









Management Applications

- Addressing fisheries and CBP priorities and interests
  - Ecosystem-based fisheries management (EBFM)
  - Climate change impacts
  - Informing habitat management/conservation
- Particularly focused on striped bass and summer flounder as managed species
  - Rely heavily on bay anchovy, spot, and polychaetes as prey
  - Summer flounder management looking to incorporate ecological drivers in stock assessment and MSE


Thank you!