

Forage Indicator Development

Mandy Bromilow
ERT, Inc. / NOAA Chesapeake Bay Office
Status and Trends Workgroup Meeting
April 5, 2021



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



The Forage Action Team



University of Maryland
CENTER FOR ENVIRONMENTAL SCIENCE



PRFC



Potomac River Fisheries Commission

VIMS

WILLIAM
& MARY

VIRGINIA INSTITUTE OF MARINE SCIENCE
SCHOOL OF MARINE SCIENCE



Chesapeake Bay Program
Science. Restoration. Partnership.



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 background image shows a scenic landscape with rolling hills and a winding asphalt road. The road starts in the foreground, curves to the right, and then continues into the distance, disappearing into the hills. The hills are covered in dry, yellowish-brown grass. In the foreground, there are some wooden fence posts and a small white building. The sky is a pale blue. A semi-transparent white rectangular box is overlaid on the top half of the image, containing the title text.

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 ([ChesMMA](#)) 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 ChesMMA 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 (ChesMMA)

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

2014: STAC Workshop

2015-2016: GIT-funded studies

The background of the slide is a photograph of a winding asphalt road that curves through a hilly landscape. The hills are covered in dry, yellowish-brown grass. The sky is a clear, pale blue. The road has white lane markings and a guardrail on the left side in the foreground.

The Long Road to Indicator Development

2014: STAC Workshop

2015-2016: GIT-funded studies

2017-2019: NCBO-funded studies

The background of the slide is a photograph of a winding asphalt road that curves through a hilly landscape. The hills are covered in dry, yellowish-brown grass. The sky is a clear, pale blue. The road has white lane markings and a yellow curb on the right side. In the distance, a small building is visible on the left side of the road.

The Long Road to Indicator Development

2014: STAC Workshop

2015-2016: GIT-funded studies

2017-2019: NCBO-funded studies

PERIOD OF UNCERTAINTY

The background of the slide is a photograph of a winding asphalt road that curves through a dry, hilly landscape. The hills are covered in sparse, yellowish-brown grass. In the distance, a small town or village is visible on a hillside. The sky is a clear, pale blue. The text is overlaid on semi-transparent white rectangular boxes.

The Long Road to Indicator Development

2014: STAC Workshop

2015-2016: GIT-funded studies

2017-2019: NCBO-funded studies

PERIOD OF UNCERTAINTY

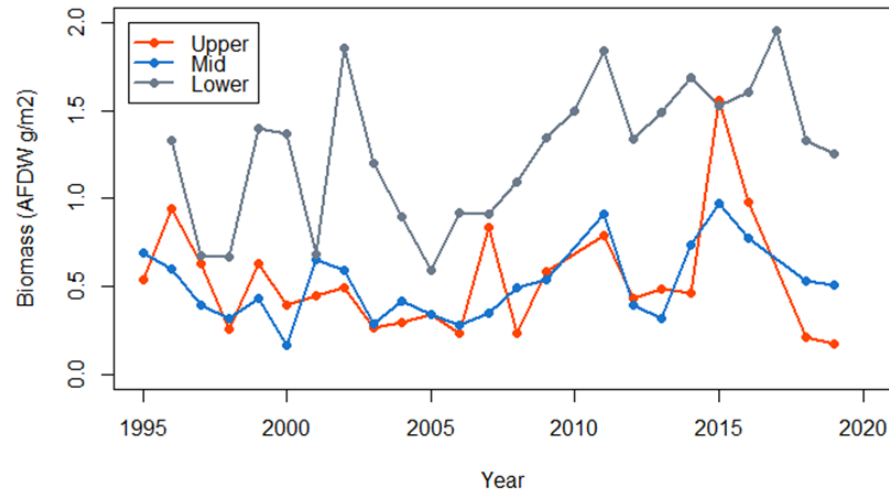
2020: Prioritized suite of initial indicators leading to the Forage Indicator Development Plan

Forage Indicator Development Plan

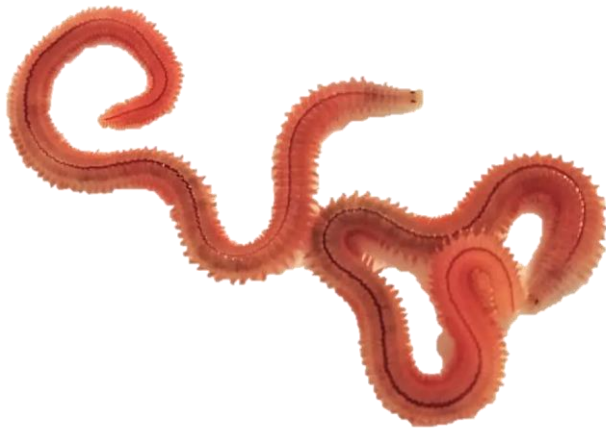
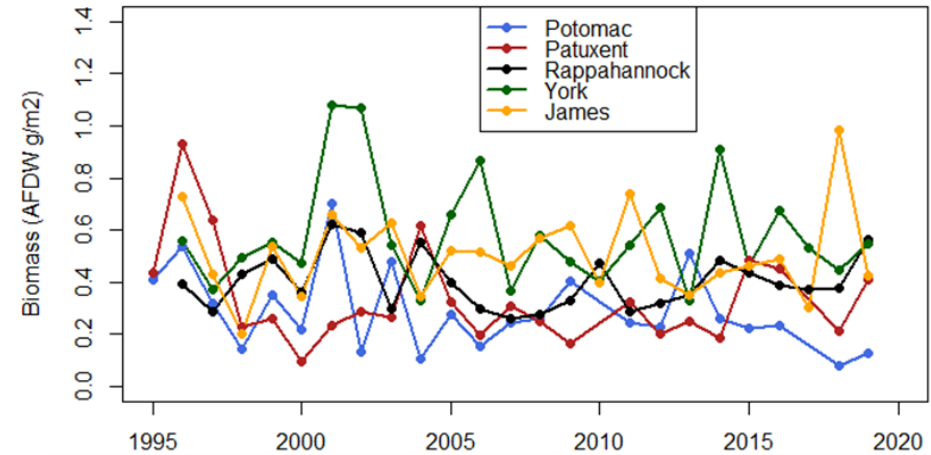
Tier 1: Abundance		Species of Interest
Benthic Invertebrates		Polychaetes
Demersal Finfishes		Atlantic croaker
Pelagic Finfishes		Bay anchovy Atlantic menhaden
Tier 2: Habitat and Environmental Factors		Species of Interest
Springtime Warming		Bay anchovy Polychaetes
Habitat Suitability Index		Bay anchovy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

Time Series of Polychaete Biomass

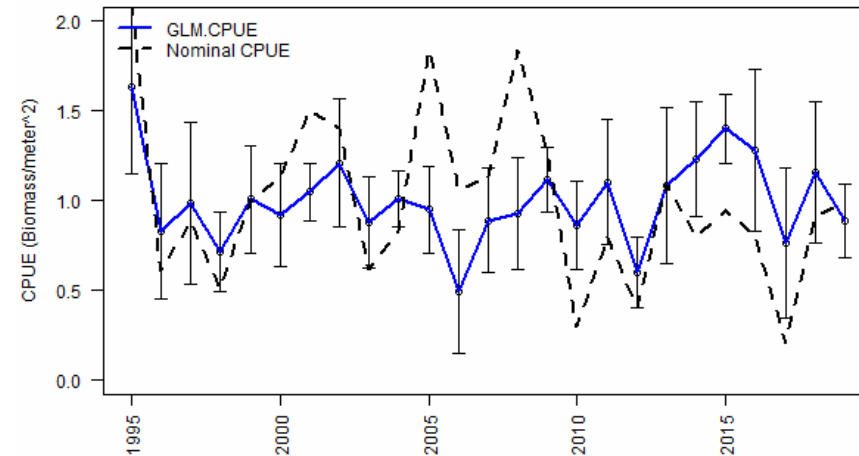
Polychaetes in the Chesapeake Bay Mainstem

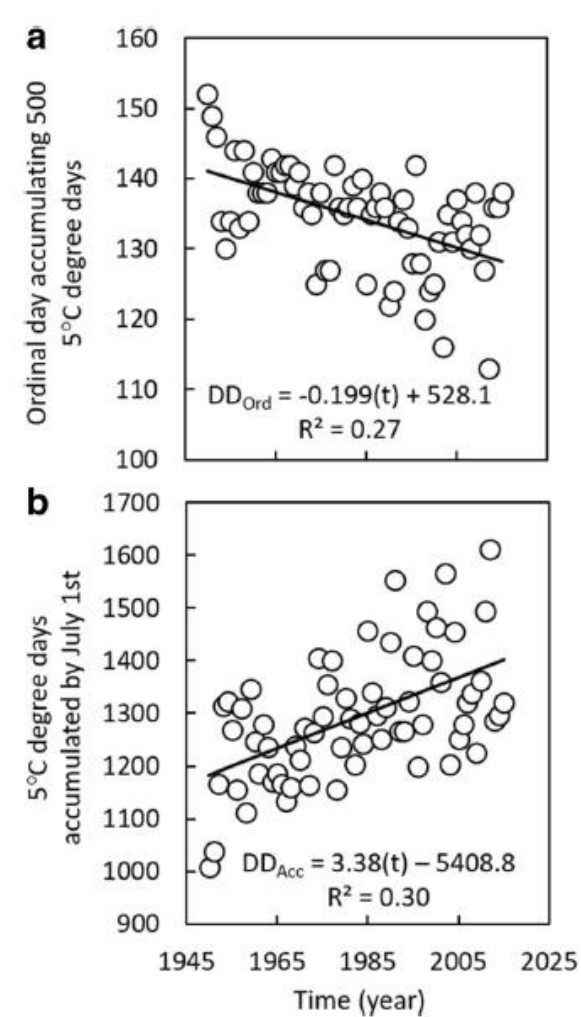
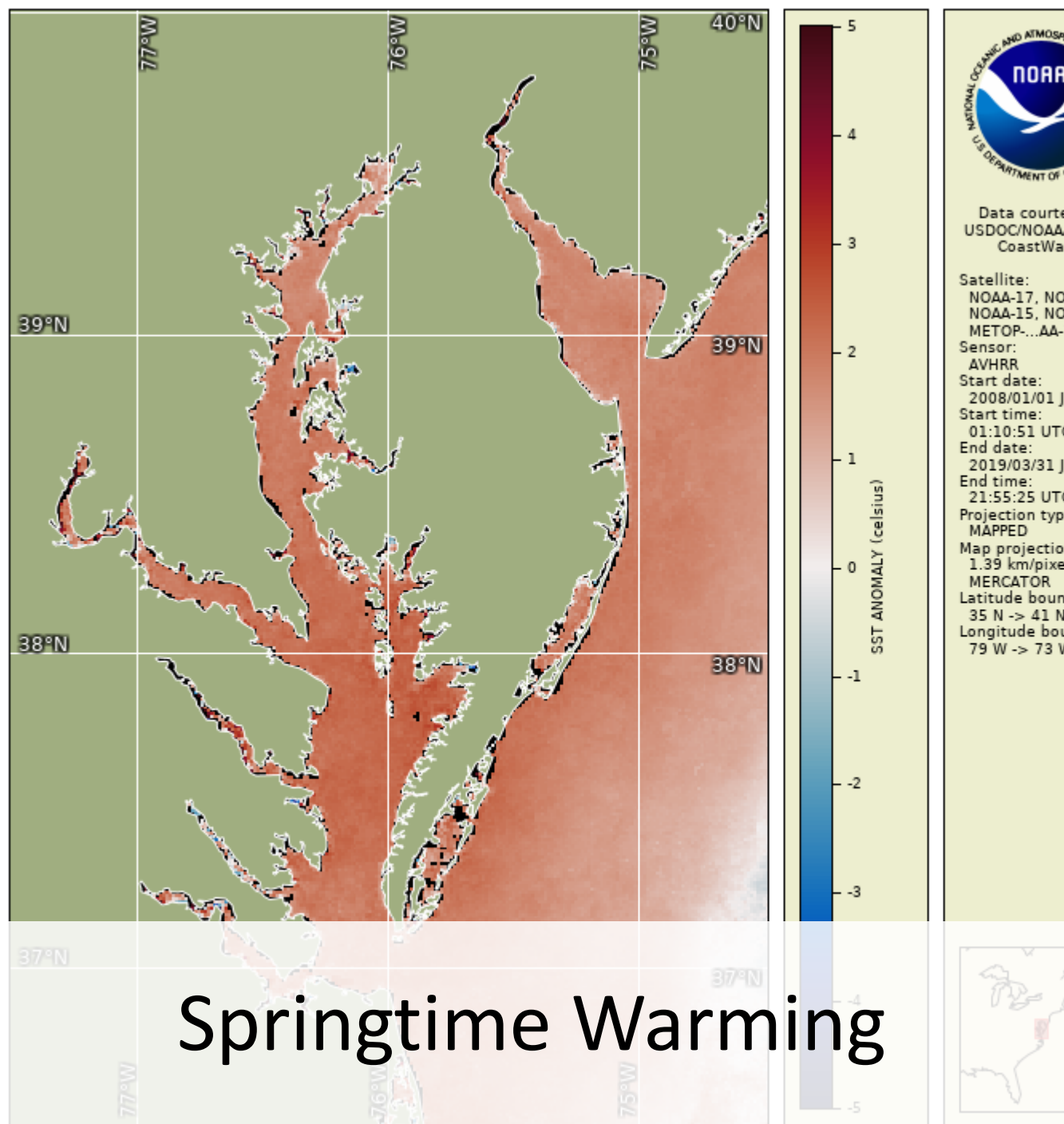


Polychaetes in Chesapeake Bay Tributaries



Benthic sampling- Chesapeake Bay



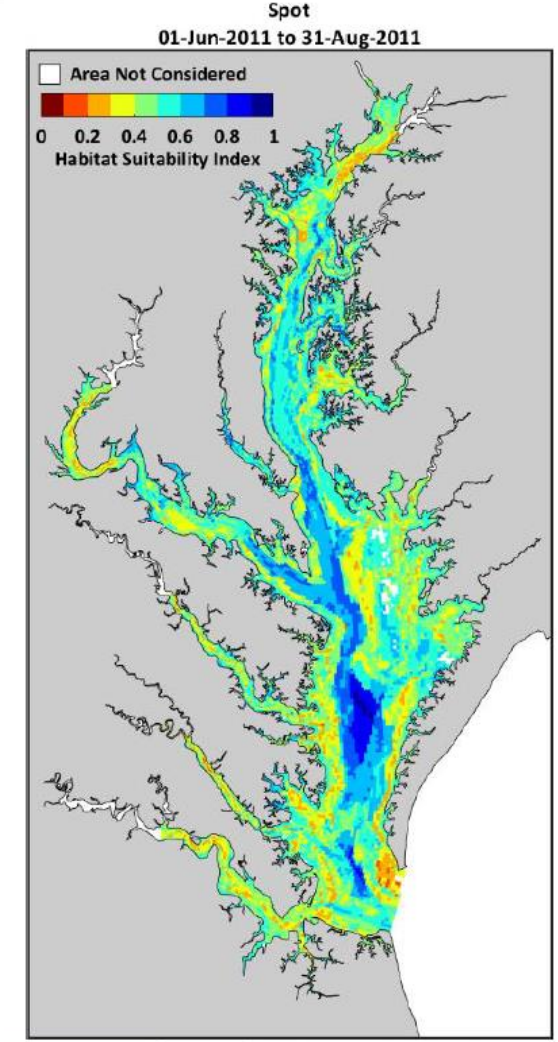
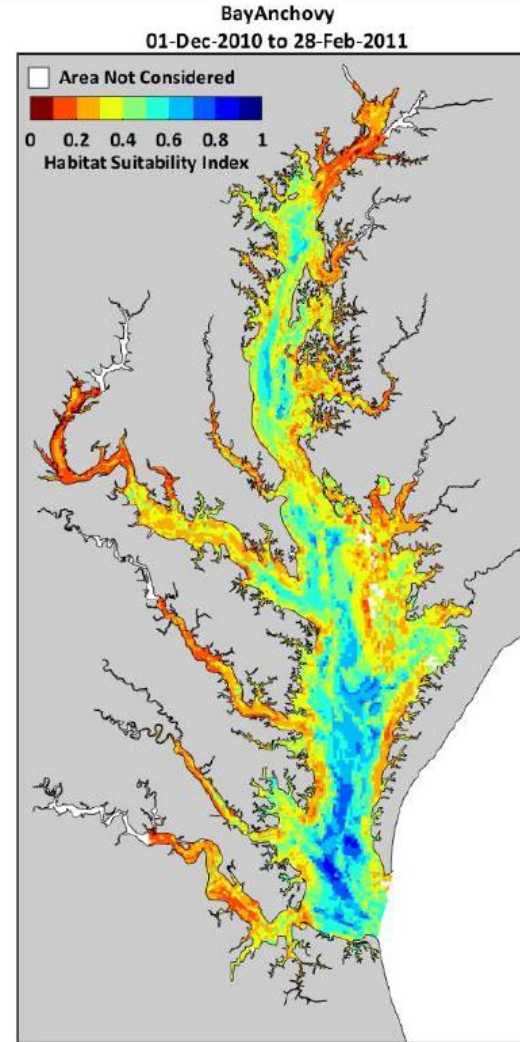
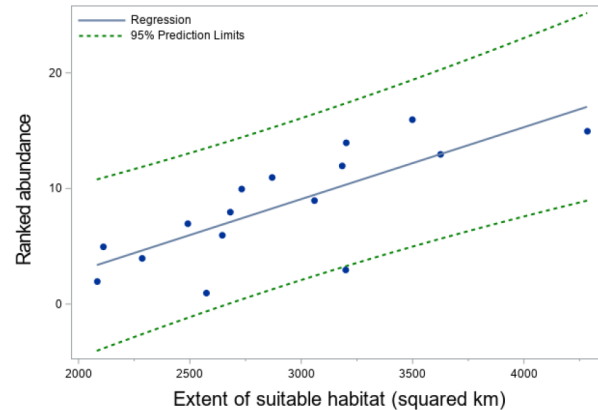
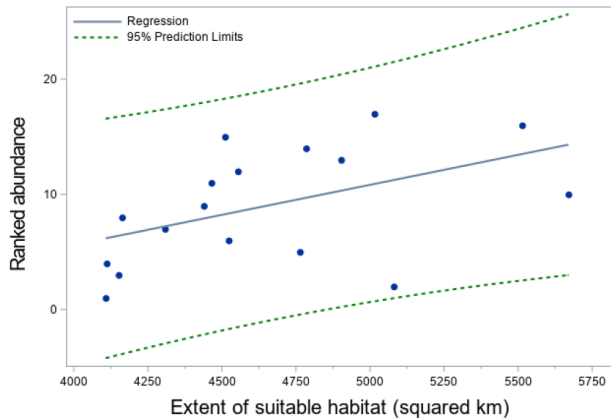


Woodland et al. 2017



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!

