

# ADAPTIVE MANAGEMENT STRATEGY: THE FORAGE OUTCOME

Mandy Bromilow  
Forage Action Team Meeting  
August 21, 2019



**Chesapeake Bay Program**

*Science. Restoration. Partnership.*

# CHESAPEAKE BAY WATERSHED AGREEMENT

Purpose: To protect and restore the Chesapeake Bay and its watershed, making it environmentally and economically sustainable



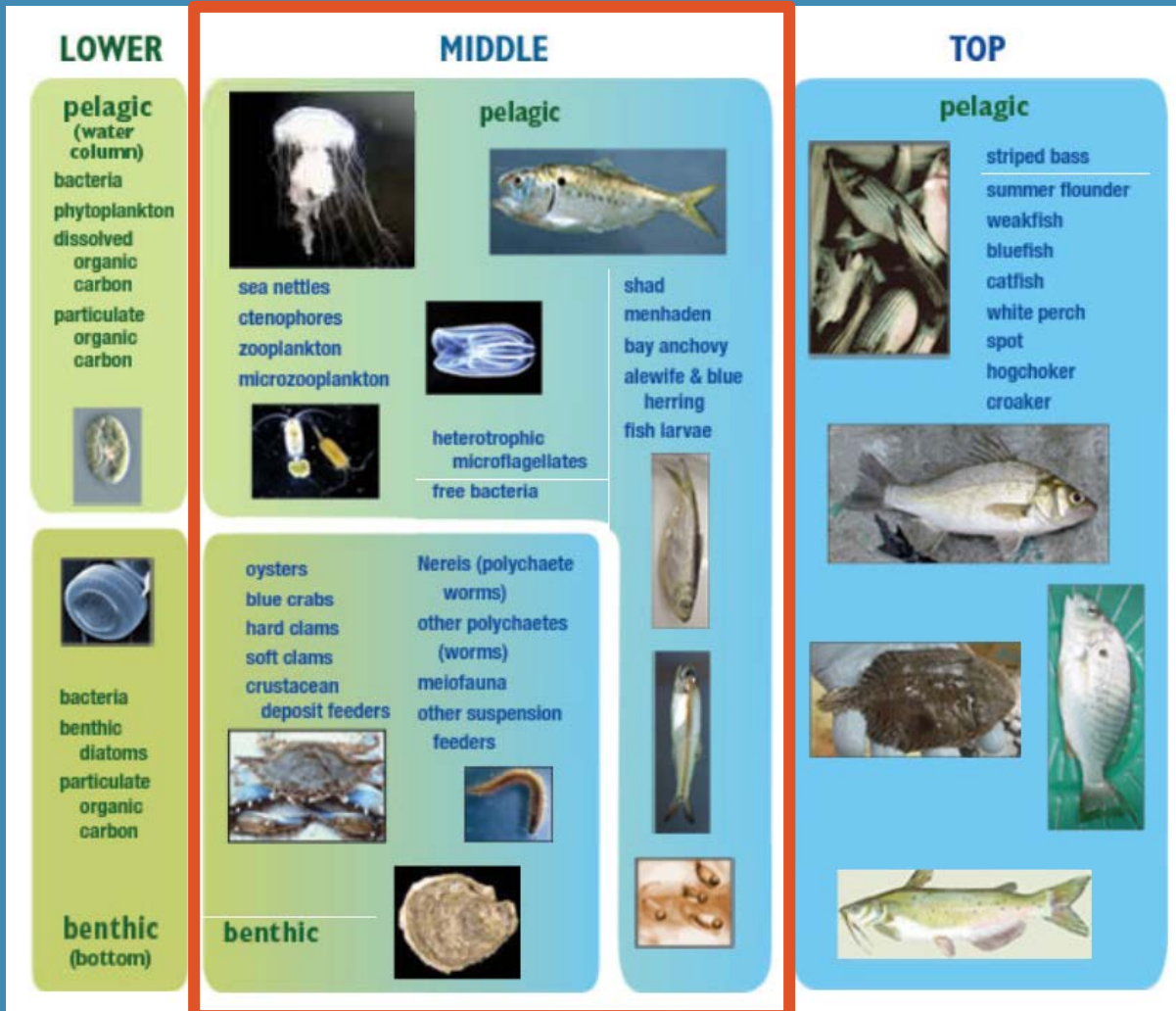
THEMES  
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GOALS  
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OUTCOMES  
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MANAGEMENT  
STRATEGY  
↓  
WORK PLAN

# THE FORAGE OUTCOME

Goal: Sustainable Fisheries

Continually improve the partnership's capacity to understand the role of forage fish populations in the Chesapeake Bay.

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



# MANAGEMENT STRATEGY

Primary goal: Determine how much forage is needed to support growth and productivity of predators and fisheries, and monitor the status of the forage base

Management approaches:

- 1) Define forage species and what comprises the forage base
- 2) Determine the status of the forage base
- 3) Inform management decisions to better address sustainability of the forage base
- 4) Maximize efficiency of monitoring programs and build on existing efforts

Specific actions needed to address these approaches are outlined in the work plan

# 2018-2019 WORK PLAN

Action	Description	Performance Target(s)	Responsible (Party or Parties)	Geographic Location	Expected Timeline
Management Approach 1: Define forage species and what comprises the forage base.					
1.1	Review management strategy and explore making changes to better reflect our goals.	Examine the steps necessary to change ‘Forage Fish’ language in the outcome to better represent the broad taxa that comprise the forage base.	Forage Action Team, Management Board	Baywide	September 2018
		Decide on other changes that should be made to management strategy.	Forage Action Team	Baywide	December 2018
Management Approach 2: Determine the status of the forage base including a definition of “balanced” state.					
2.1	Select Forage indicator or suite of indicators to track and assess status of forage base available to predators.	Develop criteria required to select forage indicators (data availability, cost of future monitoring, etc.) with guidance from Scientific, Technical Assessment and Reporting (STAR) team.	Forage Action Team, STAR	Baywide	June 2018
		Select forage species to include in suite of indicators based on criteria.	Forage Action Team	Baywide	September 2018
		Present chosen species and potential indicators to managers, and discuss how trends and thresholds may lead to management actions.	Forage Action Team, MD DNR, VMRC, PRFC	Baywide	December 2018
		Choose indicators.	Forage Action Team	Baywide	February 2019
2.2	Assist Climate Resiliency Workgroup in evaluating a climate indicator that involves forage.	Advise on how fish population distributions may be incorporated into a climate resiliency indicator.	Forage Action Team, CRWG	Baywide	Ongoing



# 2018-2019 WORK PLAN

## Management Approach 3: Inform management decisions to better address sustainability of the forage base

3.1	Communicate the results of ongoing forage research with a variety of audiences.	Examine the opportunities to create videos, articles, or other content to share the important of forage and project results with the scientific community and larger Chesapeake Bay community.	Forage Action Team, Comms Team, PIs	Baywide	Ongoing
3.2		Advise on the Shoreline Threshold study and consider how the results can be applied.	Forage Action Team	Baywide	Ongoing
	Complete the Shoreline Threshold Condition study and disseminate results.	Share results with the contacts for the Fish Habitat Watershed Implementation Plan Fact Sheet or create other tools for community planners/managers.	Forage Action Team, Fish Habitat Action Team	Baywide	Spring 2019

## Management Approach 4: Maximize the efficiency of monitoring programs and build on existing efforts.

4.1	Collaborate with the CBP's Scientific, Technical Assessment and Reporting Team to evaluate options for shallow water monitoring efforts and zooplankton surveys.	Inventory existing datasets and their potential to be incorporated into forage monitoring efforts, prioritize remaining data gaps (i.e. mysids, plankton surveys) and identify potential funding mechanisms to implement monitoring.	STAR, Forage Action Team, Budget and Finance Workgroup	Baywide	Spring 2018
		Disseminate results from the pilot citizen science monitoring pilot project (James, Severn, Eastern Bay, Choptank, and Susquehanna Flats). Continue to evaluate citizen science sampling as a means to gather data.	Forage Action Team, forage project PIs	Baywide	Spring 2019



## Narrative Analysis

### [INSERT OUTCOME NAME AND DATE OF QUARTERLY PROGRESS MEETING]

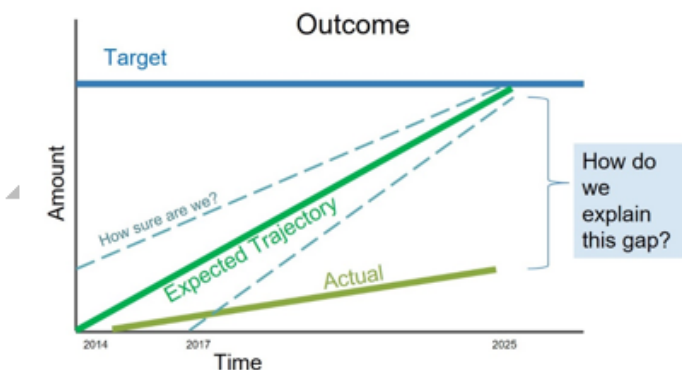
The narrative analysis summarizes the findings of the logic and action plan and serves as the bridge between the logic and action plan and the quarterly progress meeting presentation. Based on what you learned over the past two years from your successes and challenges, you will describe whether the partnership should make adaptations or change course.

Use your completed pre-quarterly logic and action plan to answer the questions below. After the quarterly progress meeting, your responses to these questions will guide your updates to your logic and action plan. Additional guidance can be found on [ChesapeakeDecisions](#).

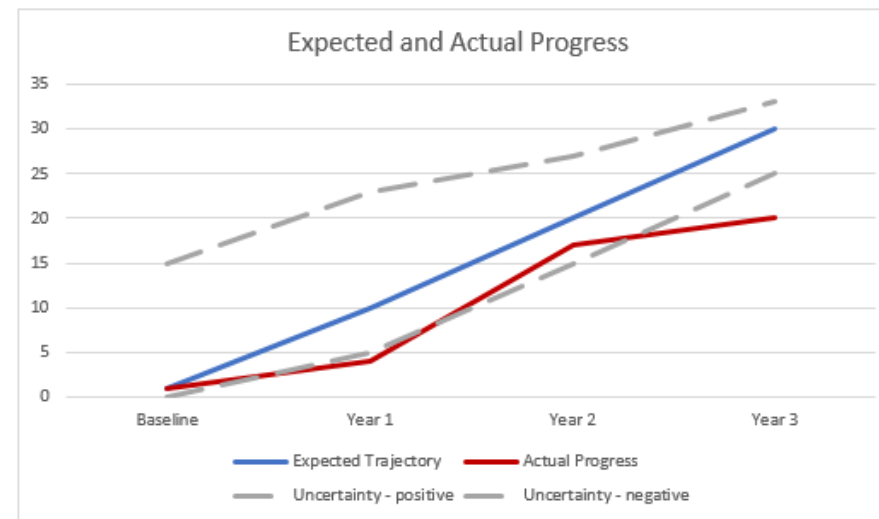
1. Examine your red/yellow/green analysis of your management actions. What lessons have you learned over the past two years of implementation?

*Summarize what you have learned about what worked and what didn't. For example, have you identified additional factors to consider or filled an information gap?*

2. Regardless of how successful your short-term progress has been over the past two years, indicate whether we are making progress at a rate that is necessary to achieve the outcome you are working toward. The example graph below illustrates this concept.



Use the **editable** graph below (or your own chart) to illustrate your progress. Explain any gap(s) between our actual progress and our anticipated trajectory.



3. What scientific, fiscal and policy-related developments will influence your work over the next two years?

*This may include information learned at the previous biennial SRS meeting or more specific information about your outcome such as an increase or decrease in funding, new programs that address gaps, and new scientific data or research. Describe how these developments are likely to impact your recommended measure(s) of progress, the factors you believe impact your ability to succeed, and newly created or filled gaps. These changes should be reflected in the first three columns of your revised logic and action plan after your quarterly progress meeting.*

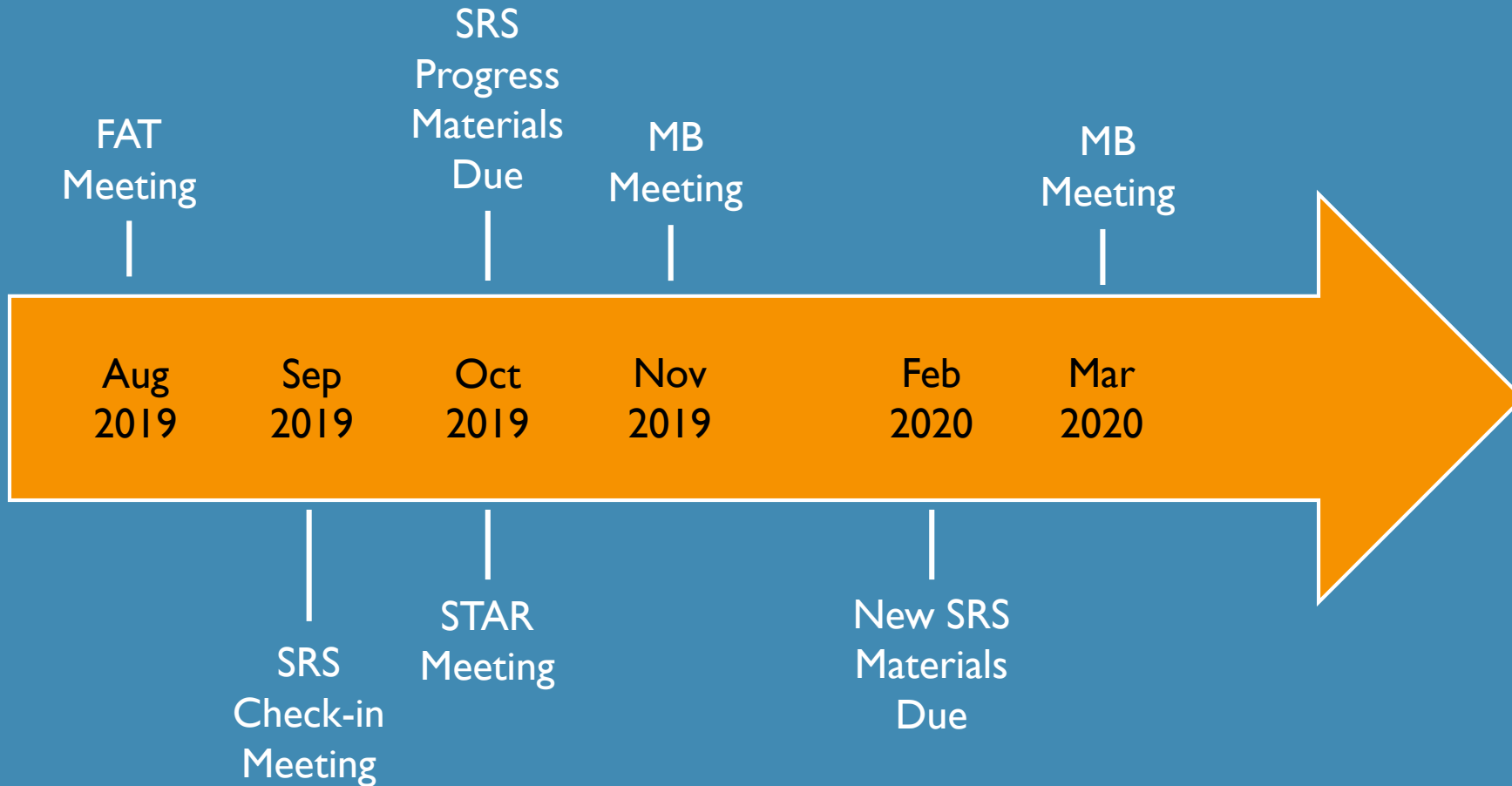
4. Based on your response to the questions above, how will your work change over the next two years?

*Describe the adaptations that will be necessary to more efficiently achieve your outcome and explain how these changes will lead you to adjust your management strategy or the actions described in column four of your logic and action plan. Changes that the workgroup, GIT or Management Board consider significant should be reflected in your management strategy.*

5. What, if any, actions can the Management Board take to help ensure success in achieving your outcome?

*Please be as specific as possible. Do you need direct action by the Management Board? Or can the Management Board direct or facilitate action through other groups? Can you describe efforts the workgroup has already taken to address this issue? If this need is not met, how will progress toward your outcome be affected? This assistance may include support from within a Management Board member's jurisdiction or agency.*

# STRATEGIC REVIEW SYSTEM





# FORAGE INDICATOR DEVELOPMENT

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## ACCOMPLISHMENTS

2014 STAC Workshop

NCBO-Funded Studies

GIT-Funded Studies

# ASSESSING THE CHESAPEAKE BAY FORAGE BASE

- Identified key forage species based on analysis of 5 predators
- Identified factors influencing the forage base
- Identified metrics/indicators
- Prioritized research needs

## STAC Workshop Report

November 12-13, 2014

Solomons, Maryland



STAC Publication 15-005

### 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:



To identify important forage in the Chesapeake Bay ecosystem, an analysis of a long term, fishery-independent survey ([ChesMMAAP](#)) 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 ChesMMAAP 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\*



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

#### Additional Important Forage



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

## NCBO-FUNDED STUDIES

FY2017 and FY2018 RFPs funded studies  
focused on important forage and  
predator species and their habitats

### Integrative Assessment of the Quality of Shallow Tributary Forage Habitats for Striped Bass in Chesapeake Bay



Smithsonian Environmental  
Research Center

Matthew B. Ogburn  
Katrina P. Lohan  
Anson H. Hines

### Quantifying Habitat Suitability for Forage Fishes in Chesapeake Bay: A Coupled Modeling Approach Using Fishery Surveys and a Hydrodynamic Model

Mary C. Fabrizio  
Troy D. Tuckey



## GIT-FUNDED STUDIES

Buchheister and Houde 2016

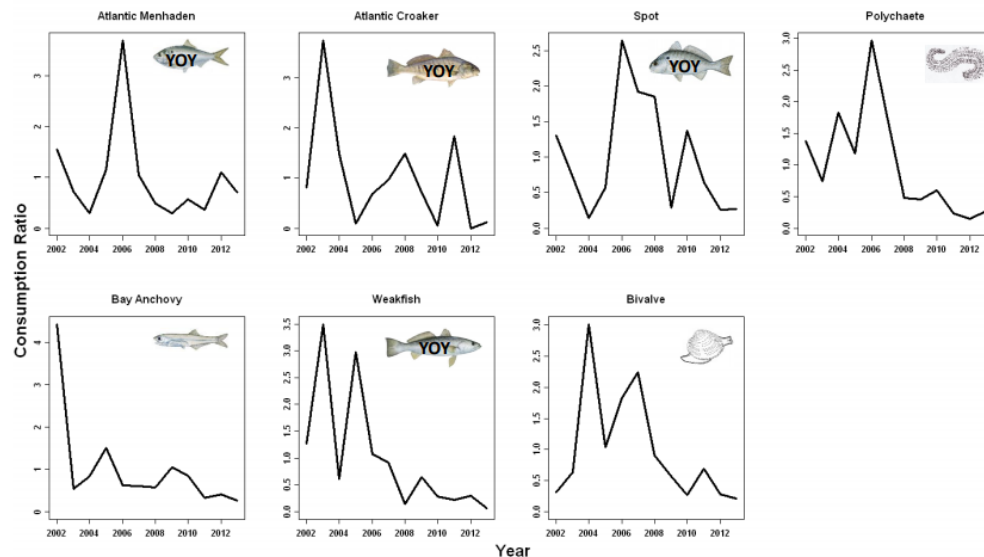
Objective #1: Develop indicators for 14 dominant forage groups

- Relative prey abundance/biomass
- Diet-based indices
- Predator-prey ratios
- Consumption-prey ratios

Objective #2: Develop consumption profiles to quantify relative, Bay-wide magnitude of prey consumed by 6 predator fishes



### Consumption-Prey Ratios



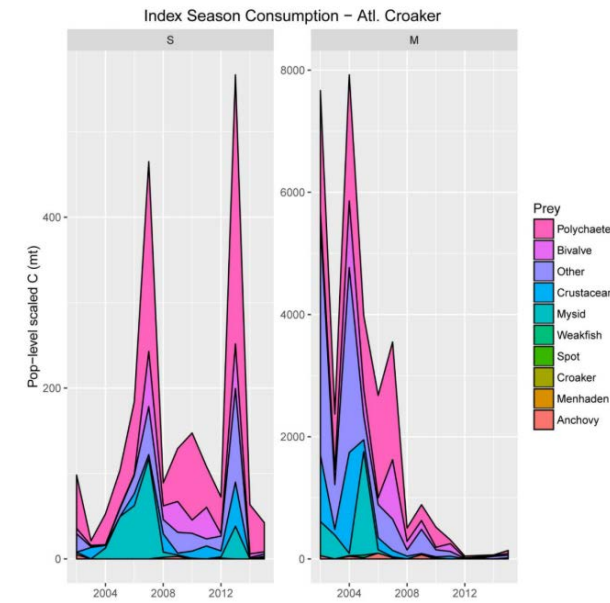
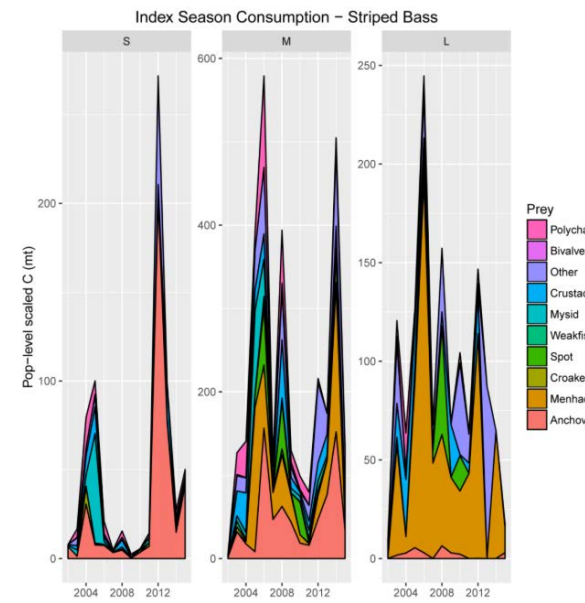
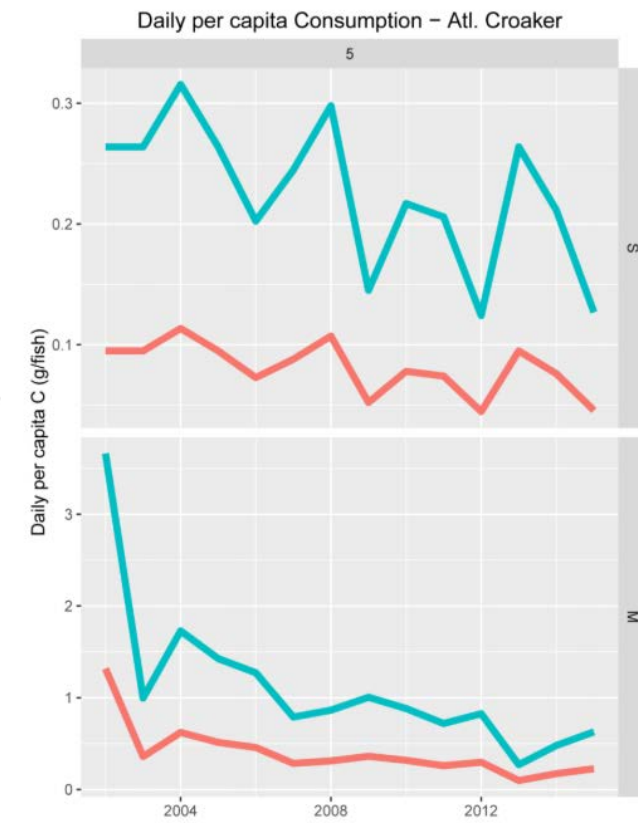
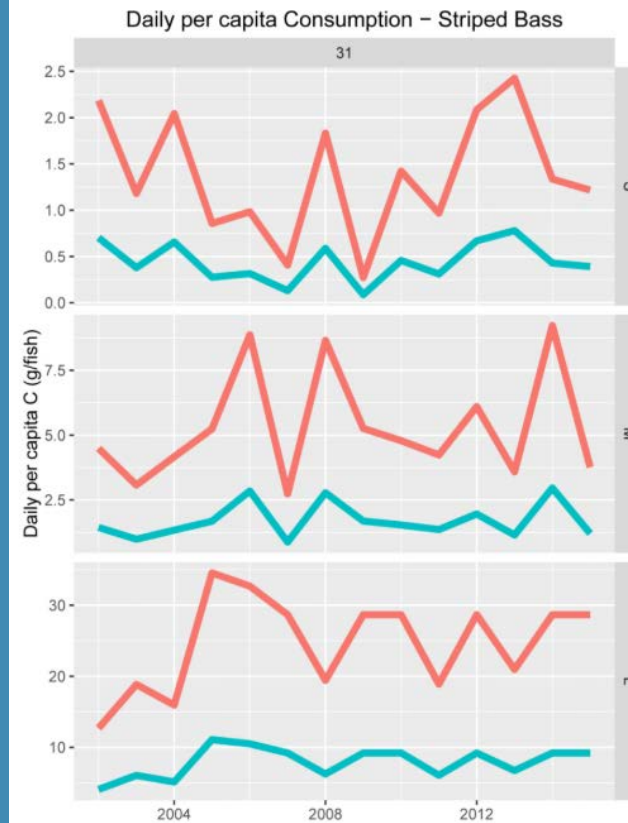


# GIT-FUNDED STUDIES

Woodland et al. 2017

Objective #1: Identify environmental gradients associated with spatial and temporal patterns in relative abundance of Chesapeake Bay forage taxa

Objective #2: Examine how spatial and temporal environmental gradients control consumption of forage taxa, and quantify the effect of forage abundance on consumer populations



## PROPOSED PLAN FOR FURTHER DEVELOPMENT

- Want to develop indicators that are informative and actionable for management (i.e. create reference points)
- Want to incorporate environmental drivers of forage populations, not just predators (i.e. habitat, water quality, shoreline hardening)

## TOP-DOWN APPROACH

1. Determine diet proportions of forage species for each predator

2. Determine the per capita annual consumption of each predator species

3. Extrapolate PCAC to the population

$$\text{TAC} = \text{PCAC} \times (\text{abundance})$$

4. Determine prey biomass needed to sustain the population (“balanced”) – target reference point

$$\text{Prey Target} = (\% \text{ prey in diet}) \times (\text{TAC})$$

5. Compare actual prey biomass to target

6. Present indicator as stoplight chart

### Striped bass example

1. Large striper diet:  
50% menhaden  
20% bay anchovy  
20% invertebrates  
10% spot
2. Striper PCAC = 500 mt  
(previous studies)

3. Abundance = 1000  
TAC = 500 mt x 1000  
= 500,000 mt
4. Menhaden target =  
0.5 x 500,000 mt  
= 250,000 mt

5. Menhaden target = 250,000 mt  
Menhaden biomass = 260,000 mt

6.

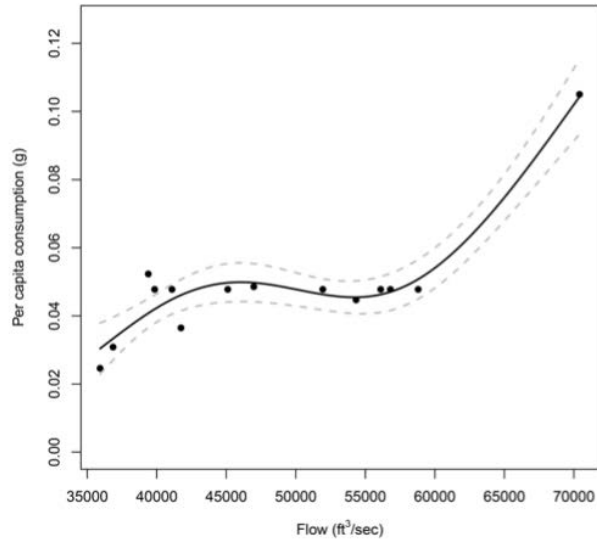
Indicator	Year
Menhaden	

## ISSUES WITH TOP-DOWN APPROACH

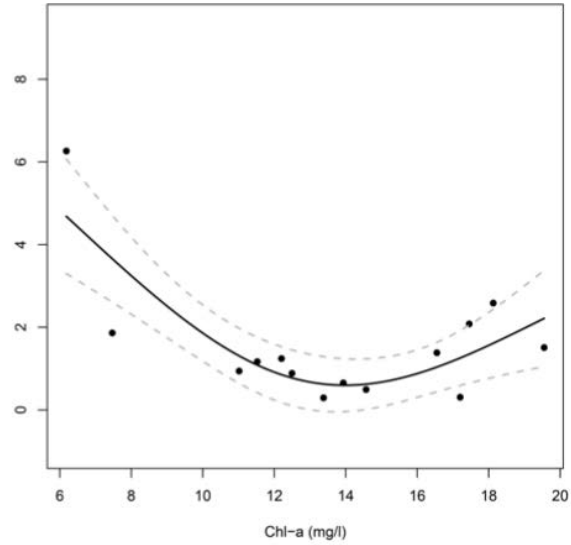
- Spatial variability of abundance, diet, and consumption
- Lacking data, particularly in shallow water habitats

Focus on one region/tributary and just a few key species to act a model for future efforts and/or regional management

Spot (sm)



Weakfish (med)



## BOTTOM-UP APPROACH

Are habitat conditions suitable to support forage biomass?

Potential indicators:

- Degree-days (warming rates)
- Chl-a
- DO
- Flow
- Temperature
- % developed shoreline



## NEXT STEPS

- Identify region/tributary and species to target for initial analyses
- Estimate abundance/biomass of predators and prey using existing survey data
- Analyze diet proportions based on ChesMMAAP data and literature

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