THE FORAGE (FISH) OUTCOME

Where are we?

Sara Coleman
December 2018 Biannual GIT Meeting

Chesapeake Bay Program
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

• Outcome acknowledges the connections among different species in the Bay food web
• A step toward multi-species ecosystem management
• Most forage species are short-lived and experience large swings in abundance annually, seasonally, and spatially
  • subject to environmental variability and other factors that control their populations and reproductive success, like water quality and predation
Management Approach 2: Determine the status of the forage base including a definition of “balanced” state.

- Select forage indicator or suite of indicators to track and assess status of forage base available to predators
- Assist climate resiliency workgroup in evaluating a climate indicator that involves forage
WHAT HAVE WE ACCOMPLISHED?

2014 STAC Workshop
GIT Funded Studies
NCBO Funded Studies

Assessing the Chesapeake Bay Forage Base: Existing Data and Research Priorities

STAC Workshop Report
November 12-13, 2014
Solomons, Maryland

STAC Publication 15-005
Workshop focus was to produce a system-wide scientific synthesis of forage and develop actionable recommendations for its management.

Participants were encouraged to consider creating products that could best facilitate decision-making by fishery managers.
1st Objective: develop forage indicators using data from fishery independent surveys,
  • Relative prey abundance or biomass
  • Diet-based indices
  • Prey-predator ratios
  • Consumption-prey ratios

2nd Objective: develop nutritional profile to quantify relative, Bay-wide magnitude of prey consumed by 6 predator fishes
Woodland et al. 2017

- 1st Objective: identify environmental gradients associated with spatial and temporal patterns in relative abundance of forage taxa in Chesapeake Bay
- 2nd Objective: explain how spatial and temporal gradients in environmental variables control consumption of forage taxa, and quantify the effect of forage abundance on consumer populations
- Results suggest that years in which winter water temperatures warm slowly are conducive to higher summertime forage abundances.
FY17 Request for Proposals: focus on forage species and their habitats.

Another step toward ecosystem-based fisheries management in Chesapeake Bay

Mary C. Fabrizio, Troy D. Tuckey, Aaron J. Bever, Michael L. MacWilliams

Matthew B. Ogburn, Katrina P. Lohan, Anson H. Hines
Pseudocalanus spp. (A) and C. finmarchicus (B) abundance anomalies in Gulf of Maine.

Pseudocalanus spp. is an important food source for juvenile cod and haddock.
Abundance

Nutritional Profile

Predator

Finfish prey species

Environmental variables

Invertebrate prey species

Abundance

• Consider data available
• Choose a representative predator
• Choose 2-3 prey species
• Analyze these annually? Seasonally?
## STRIPED BASS INDICATORS

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Metric</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resident bass abundance</td>
<td>Catch per recreational boat trip (September-October)</td>
</tr>
<tr>
<td>Potential attack success</td>
<td>Forage index / bass abundance index</td>
</tr>
<tr>
<td>Forage availability</td>
<td>Proportion of bass in fall with empty guts</td>
</tr>
<tr>
<td>Bass condition</td>
<td>Proportion in fall without visible body fat</td>
</tr>
<tr>
<td>Bass survival</td>
<td>Age 3 index / Juvenile index 3 years earlier</td>
</tr>
</tbody>
</table>

From Uphoff, 2018
## DATA SOURCES

<table>
<thead>
<tr>
<th>Index</th>
<th>Survey</th>
<th>Region</th>
<th>Years</th>
<th>Months</th>
<th>Gear Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abundance</td>
<td>Maryland DNR Juvenile Striped Bass Seine</td>
<td>Maryland tribes</td>
<td>1959-present</td>
<td>July-September</td>
<td>Beach seine</td>
</tr>
<tr>
<td></td>
<td>Maryland DNR Blue Crab Summer Trawl</td>
<td>Maryland tribes, Virginia eastern trib</td>
<td>1989-present</td>
<td>May-October</td>
<td>Otter trawl</td>
</tr>
<tr>
<td></td>
<td>VIMS Juvenile Trawl</td>
<td>Virginia tribus and mainstem</td>
<td>1988-present</td>
<td>April-December</td>
<td>Otter trawl</td>
</tr>
<tr>
<td></td>
<td>VIMS Juvenile Striped Bass Seine</td>
<td>Virginia tribus</td>
<td>1968-73, 1980-present</td>
<td>July-September</td>
<td>Beach seine</td>
</tr>
<tr>
<td></td>
<td>ChesMMAP</td>
<td>Mainstem</td>
<td>2002-present</td>
<td>March-November</td>
<td>Bottom trawl</td>
</tr>
<tr>
<td>Biomass</td>
<td>CBP Benthos</td>
<td>Tribs, mainstem</td>
<td>1995-present</td>
<td>January-December</td>
<td>Various benthic gears</td>
</tr>
<tr>
<td>Diet-based</td>
<td>ChesMMAP</td>
<td>Mainstem</td>
<td>2002-present</td>
<td>March-November</td>
<td>Bottom trawl</td>
</tr>
<tr>
<td>Prey-predator ratio</td>
<td>ChesMMAP</td>
<td>Mainstem</td>
<td>2002-present</td>
<td>March-November</td>
<td>Bottom trawl</td>
</tr>
<tr>
<td>Consumption-prey ratio</td>
<td>ChesMMAP</td>
<td>Mainstem</td>
<td>2002-present</td>
<td>March-November</td>
<td>Bottom trawl</td>
</tr>
</tbody>
</table>
**INVERTEBRATE BIOMASS**

- Used data from Chesapeake Bay Benthic Monitoring Program
  - Collected annually by Versar and ODU
  - 25 random sites within 10 strata
- Selected amphipods/isopods, *Macoma* clams, and polychaetes

![Graph showing biomass trend with years](image)
FINFISH ABUNDANCE INDICES

Bay Anchovy

Spot
HOW DO WE ENVISION USING AN INDICATOR?

A good indicator should be:

• Simple
• Easy to understand
• Representative and reflective of the current state
THOUGHTS? QUESTIONS?

WHAT SHOULD BE OUR NEXT STEPS?

• How do we incorporate environmental factors?
• Can a ‘stoplight model’ be developed to signal when forage abundances are at levels of concern?
• Can we map spatial distribution of forage species?
• What time frame would be useful for management?
Forage Fish Management Plan:

- Important points to the development of this plan:
  - Forage fish are subjected to fisheries, both commercial and recreational. These fisheries are often directed at spawning aggregations of fish.
  - Forage fish are a key component of the marine ecosystem in Washington.
  - Key management and biological information is usually lacking for most forage fish stocks.

- Proposed management approach:
  - Manages forage fish from an ecosystem based approach rather than a single species approach
  - Utilizes a precautionary, conservative approach to fisheries management.