

THE FORAGE (FISH) OUTCOME

Where are we?

Sara Coleman

December 2018 Biannual GIT Meeting

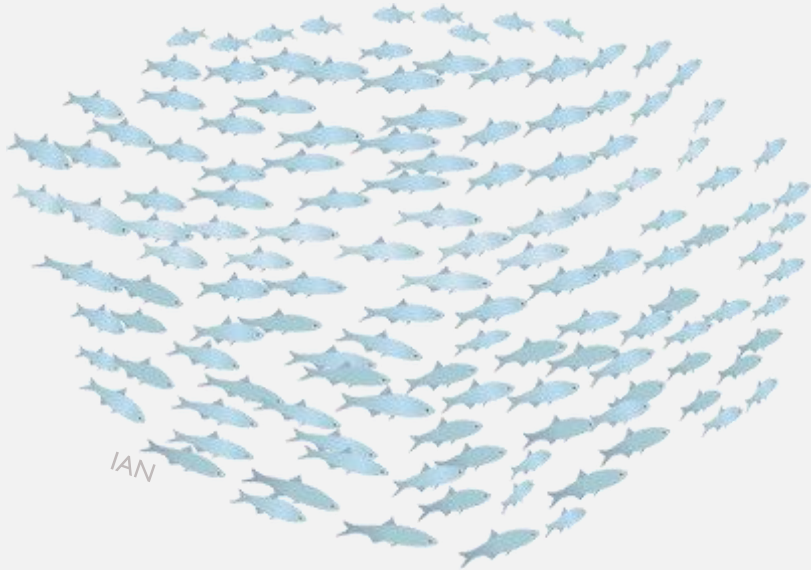


Chesapeake Bay Program
Science. Restoration. Partnership.



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

2018-19 WORKPLAN

- 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

ASSESSING THE CHESAPEAKE BAY FORAGE BASE

- 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

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 ([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).

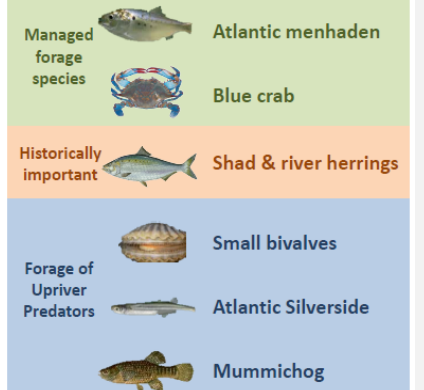
Forage species are critical to sustaining production of economically and ecologically valuable fish species in the Chesapeake Bay.

Key Forage*



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

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

GIT-FUNDED STUDIES

Buchheister and Houde, 2016

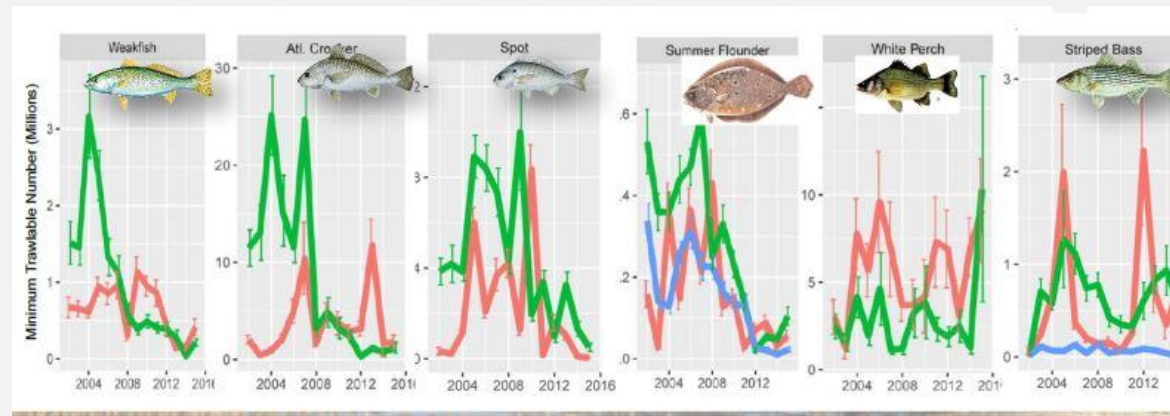
- 1st Objective: develop forage indicators using data from fishery independent surveys,
 - Relative prey abundance or biomass
 - Diet-based indices
 - Prey-predator ratios
 - Consumption-prey ratios
- 2nd Objective: develop nutritional profile to quantify relative, Bay-wide magnitude of prey consumed by 6 predator fishes



GIT-FUNDED STUDIES

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.



NCBO FUNDED RESEARCH

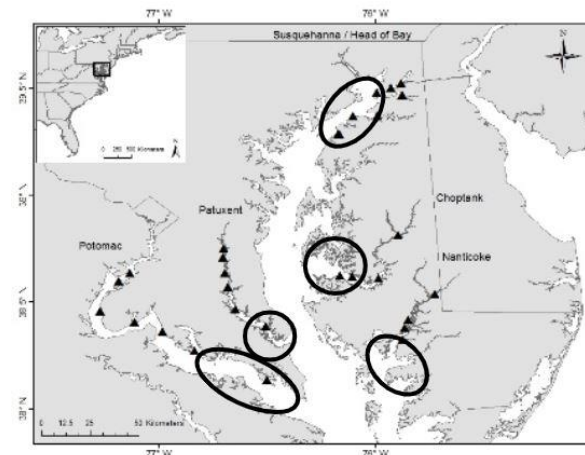
FY17 Request for Proposals: focus
on forage species and their
habitats.

Another step toward ecosystem-
based fisheries management in
Chesapeake Bay

The not-so-charismatic fauna:



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



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

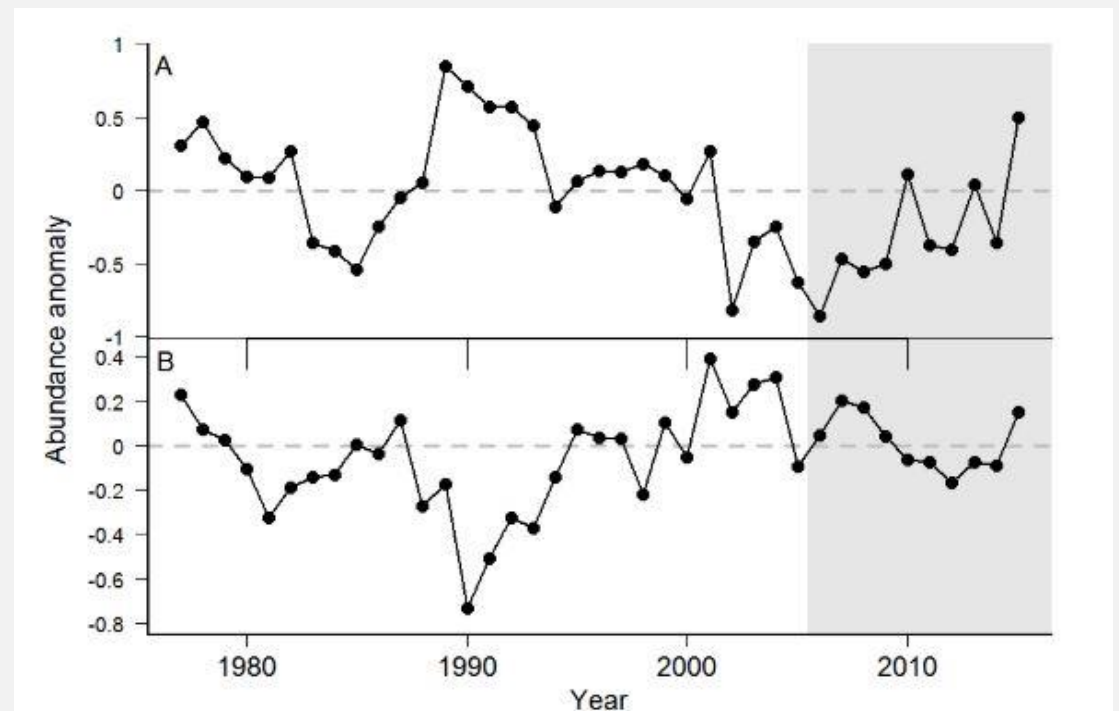
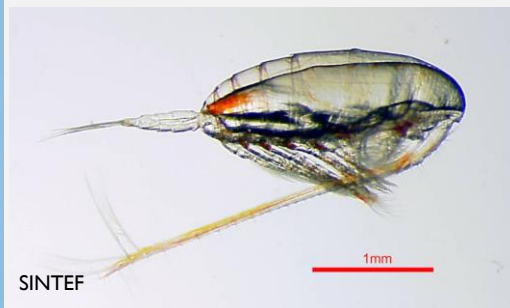


Smithsonian Environmental
Research Center

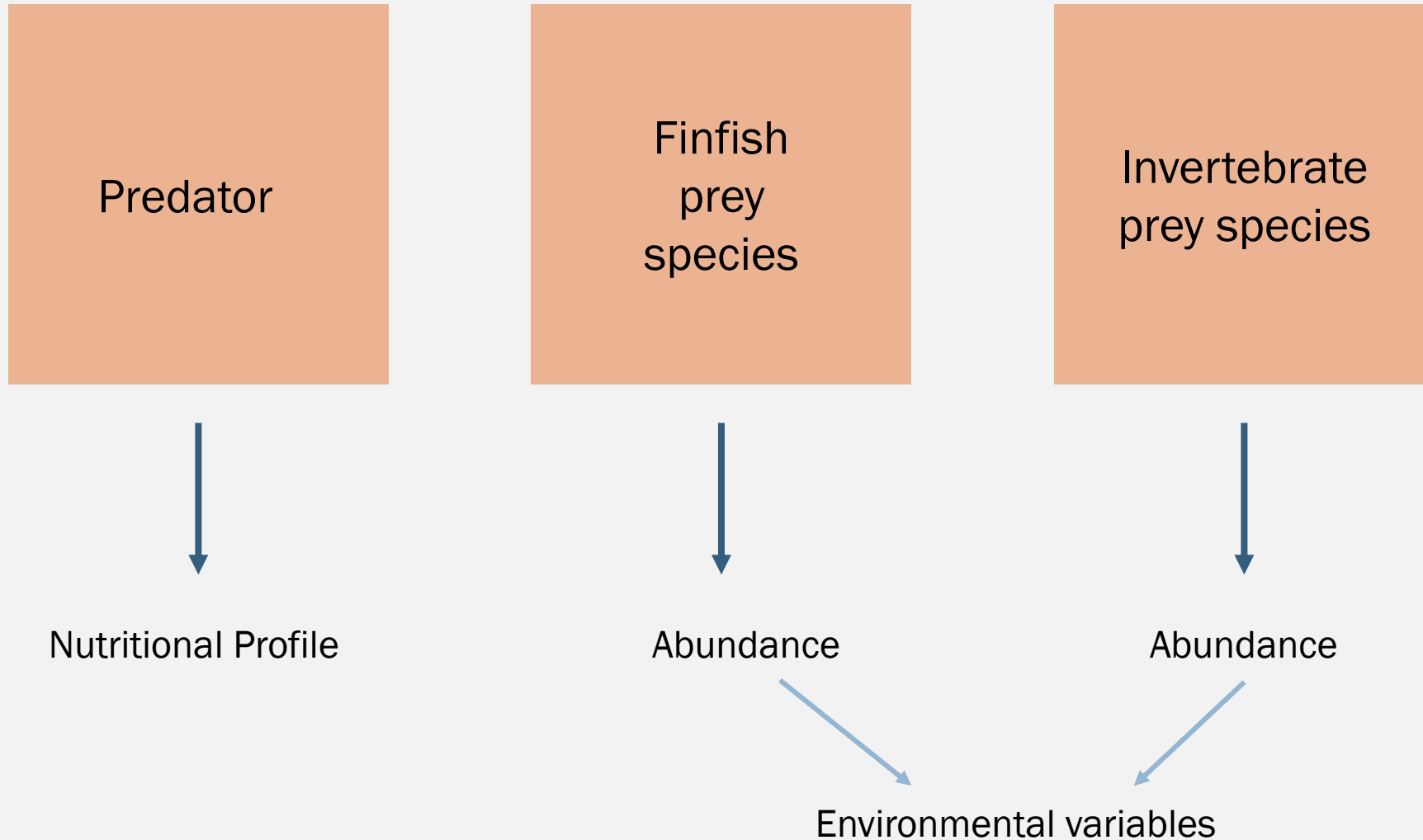
EXAMPLE: NORTHEAST IEA

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



MOCK-UP FROM MAY 2018 DISCUSSION



- Consider data available
- Choose a representative predator
- Choose 2-3 prey species
- Analyze these annually?
Seasonally?

STRIPED BASS INDICATORS

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

From Uphoff, 2018



DATA SOURCES

Index	Survey	Region	Years	Months	Gear Type
Abundance	Maryland DNR Juvenile Striped Bass Seine	Maryland tribs	1959-present	July-September	Beach seine
	Maryland DNR Blue Crab Summer Trawl	Maryland tribs, Virginia eastern tribs	1989-present	May-October	Otter trawl
	VIMS Juvenile Trawl	Virginia tribs and mainstem	1988-present	April-December	Otter trawl
	VIMS Juvenile Striped Bass Seine	Virginia tribs	1968-73, 1980-present	July-September	Beach seine
	TIES/CHESFIMS	Mainstem	1995-2007	January, March-November	Midwater trawl
	ChesMMAP	Mainstem	2002-present	March-November	Bottom trawl
Biomass	CBP Benthos	Tribs, mainstem	1995-present	January-December	Various benthic gears
Diet-based	ChesMMAP	Mainstem	2002-present	March-November	Bottom trawl
Prey-predator ratio	ChesMMAP	Mainstem	2002-present	March-November	Bottom trawl
Consumption-prey ratio	ChesMMAP	Mainstem	2002-present	March-November	Bottom trawl

INVERTEBRATE BIOMASS

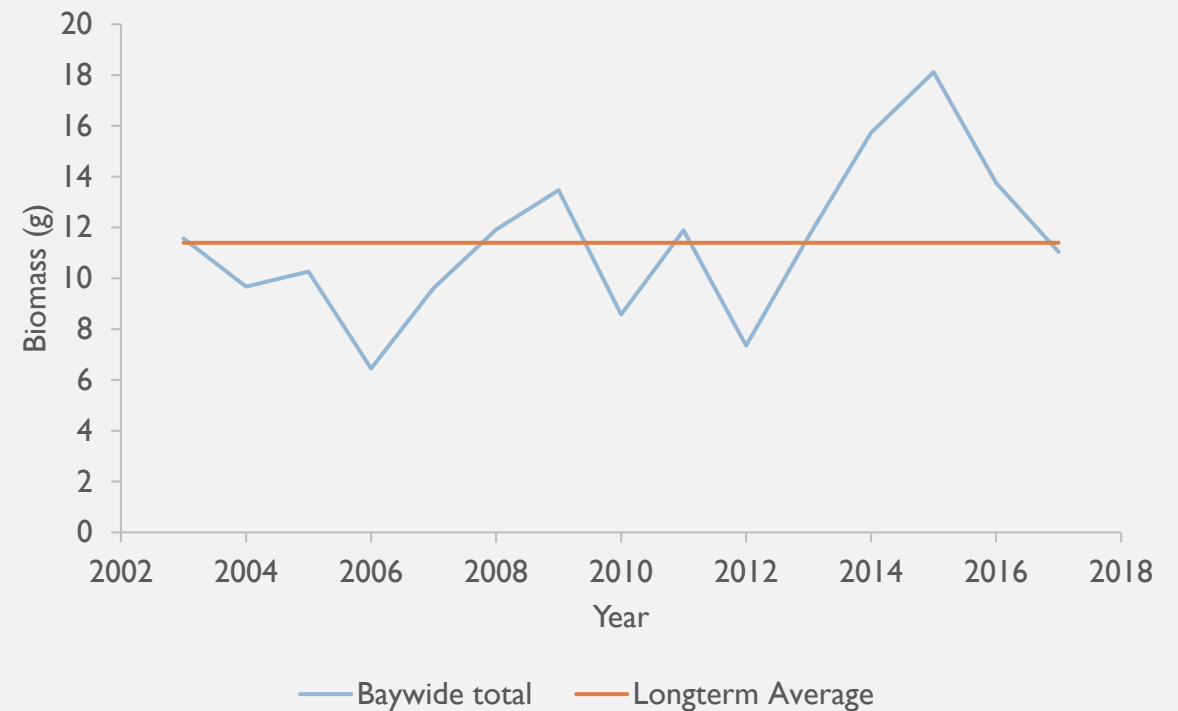
- Used data from Chesapeake Bay Benthic Monitoring Program
 - Collected annually by Versar and ODU
 - 25 random sites within 10 strata
- Selected amphipods/isopods, *Macoma* clams, and polychaetes



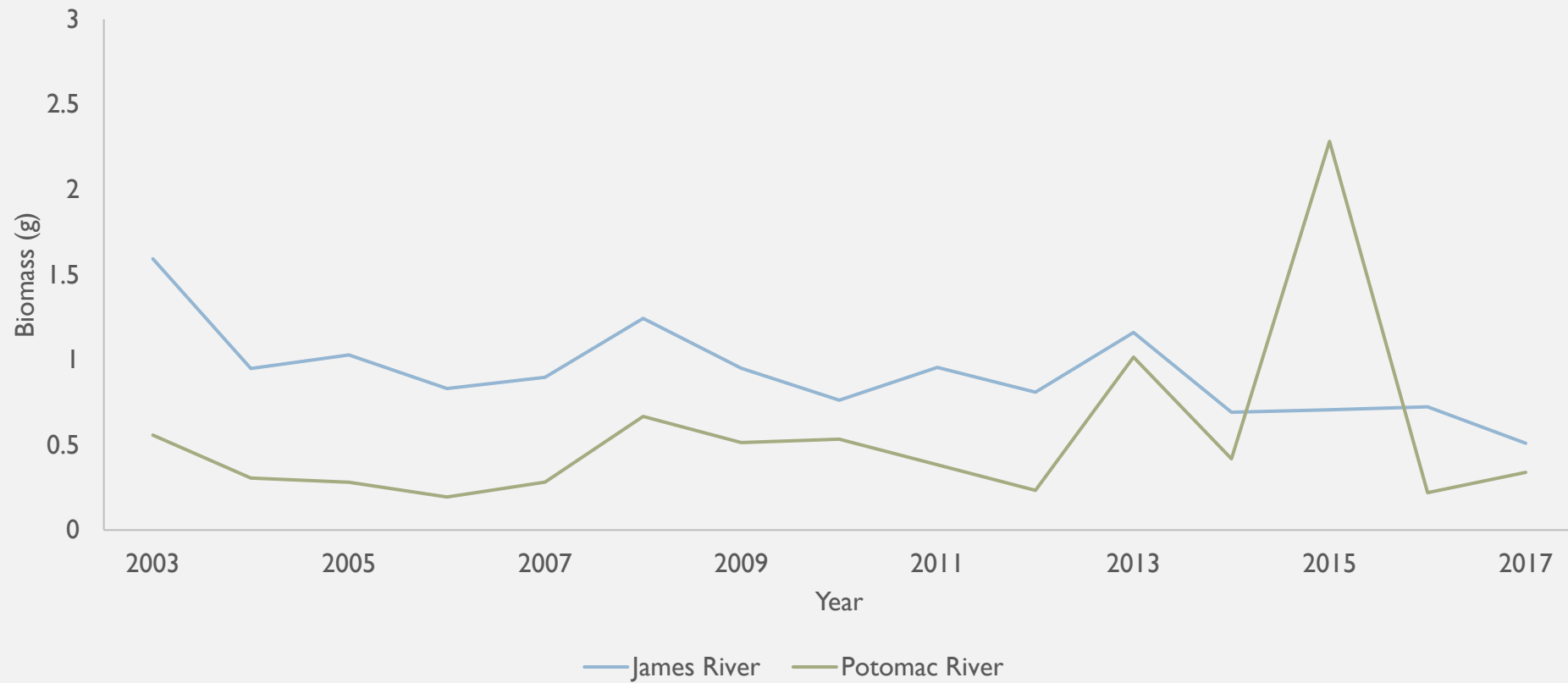
Yale.edu

uas.Alaska.edu

invasions.si.edu

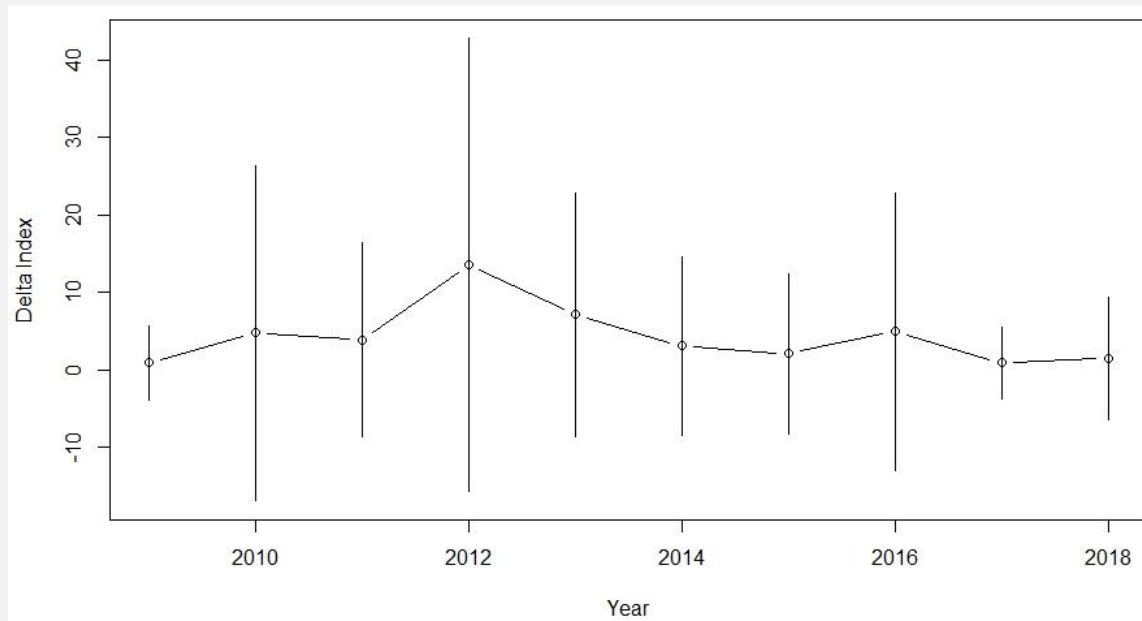


TRIBUTARY-SPECIFIC BIOMASS

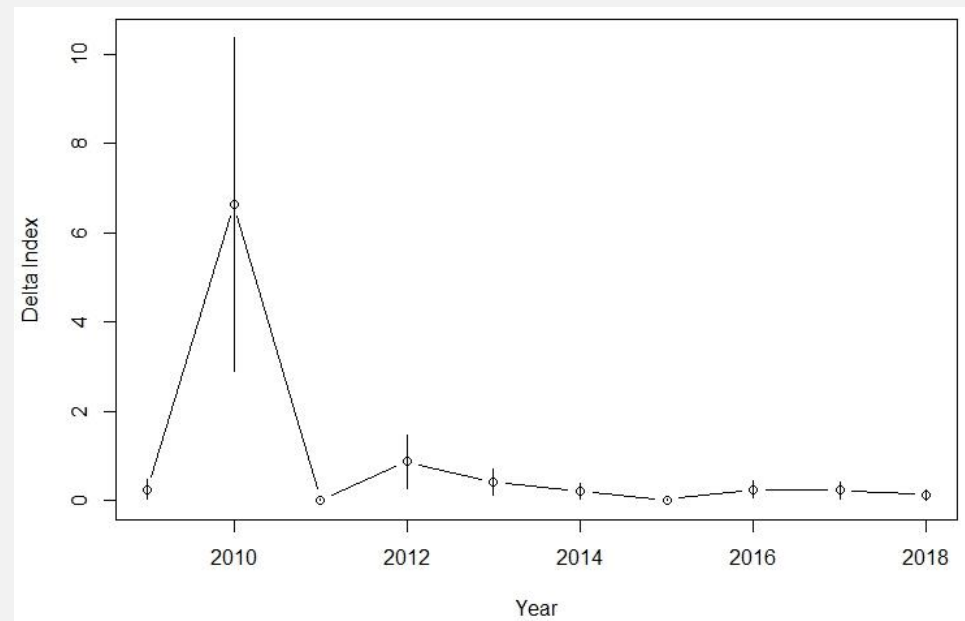


FINFISH ABUNDANCE INDICES

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?



WA DEPARTMENT OF FISH AND WILDLIFE

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.

