

# Atlantic Menhaden



# Atlantic Menhaden

## Reduction fishery

- processes whole fish into fish meal, fish oil, and fish solubles
- began in New England during the early 1800s, spread south after the Civil War
- landings in 2016 ~137,000 mt

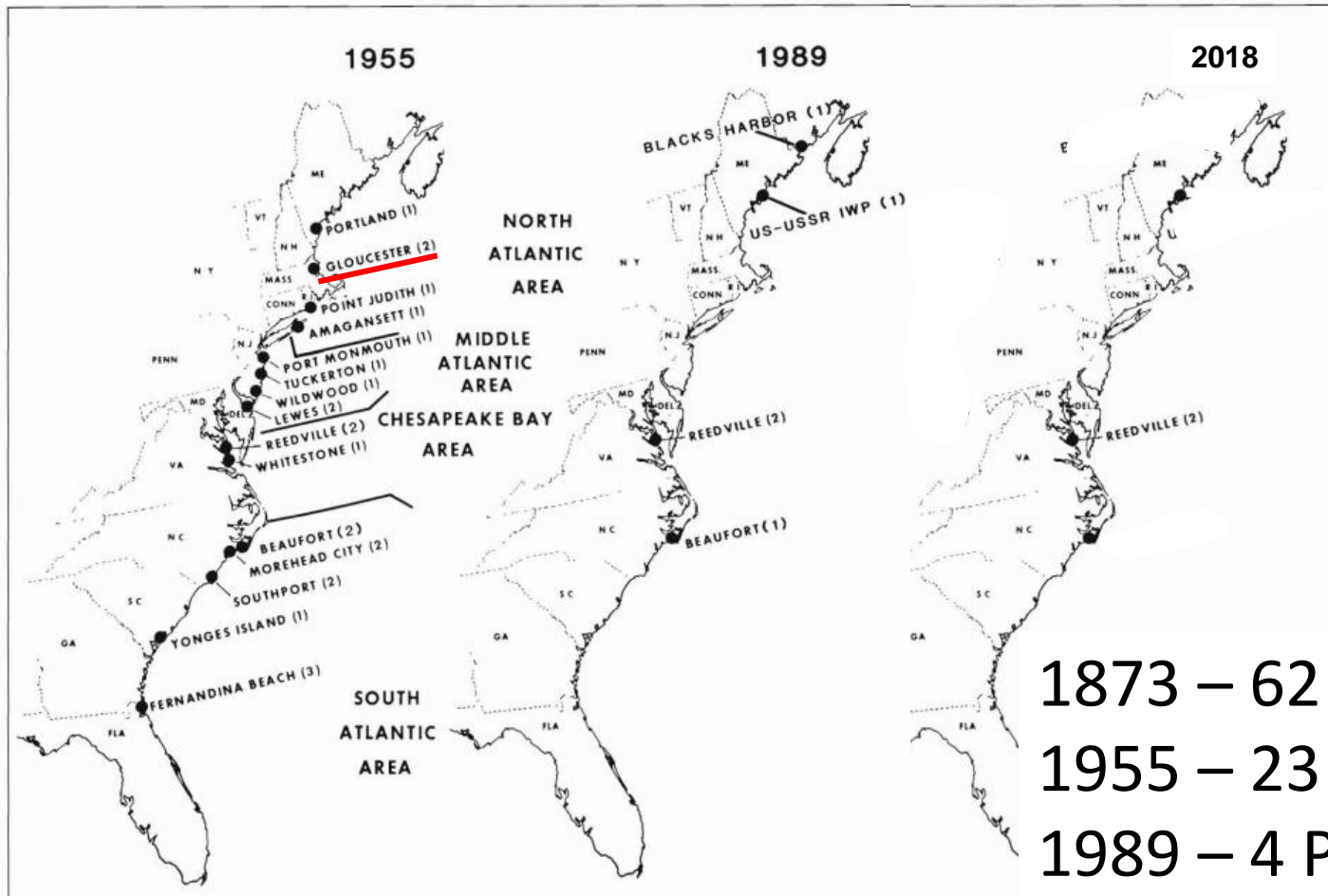


## Commercial bait fishery

- occurs coastwide
- a majority used commercially in crab, lobster, and hook-and-line fisheries
- Landings in 2016 ~44,000 mt



# Atlantic Menhaden

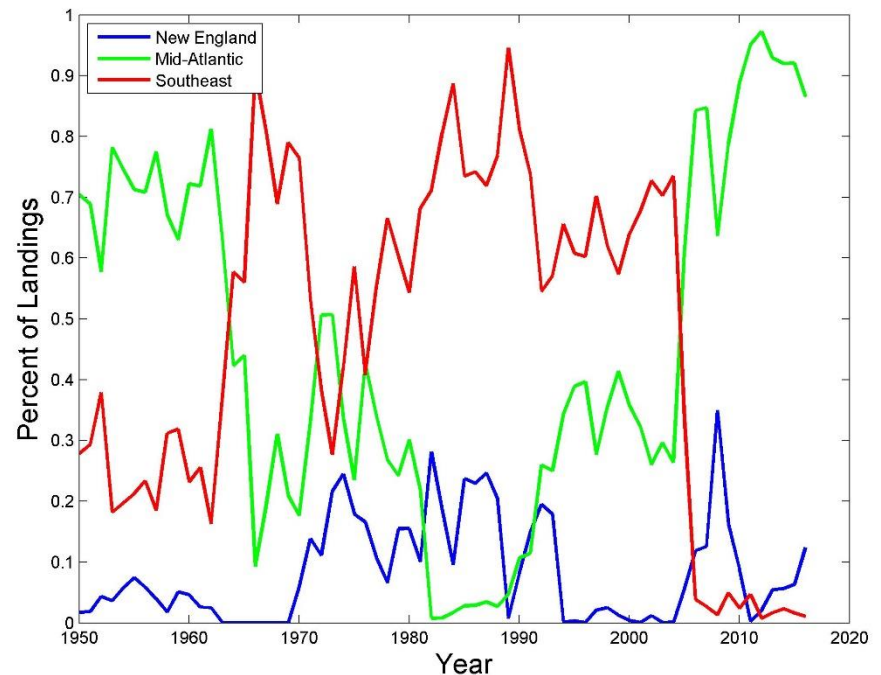
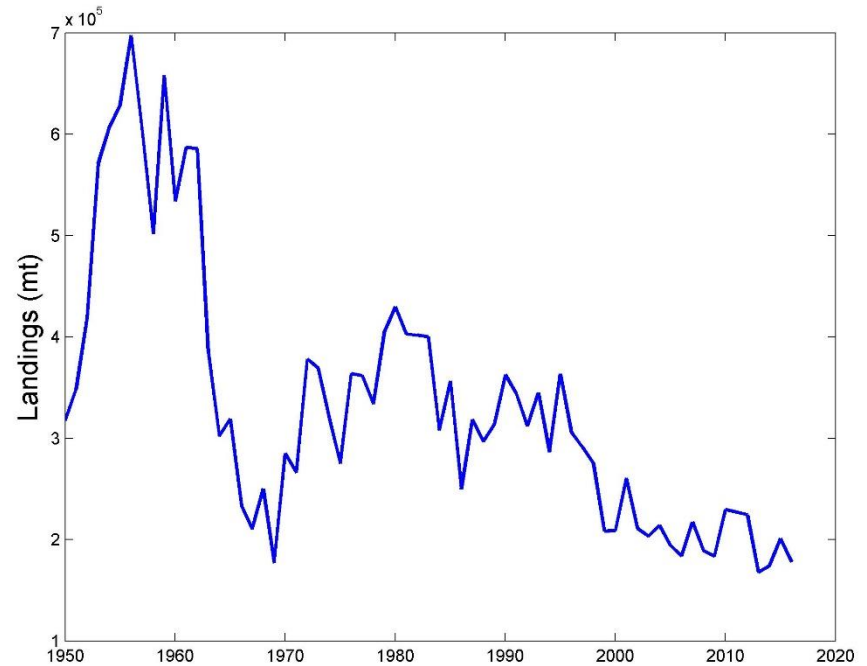


1873 – 62 Plants  
1955 – 23 Plants  
1989 – 4 Plants  
2018 – 1 Plant

# Atlantic Menhaden

- Decrease in landings
- Shift in landings from Mid-Atlantic to Southeast U.S. and back
- What factors are involved?

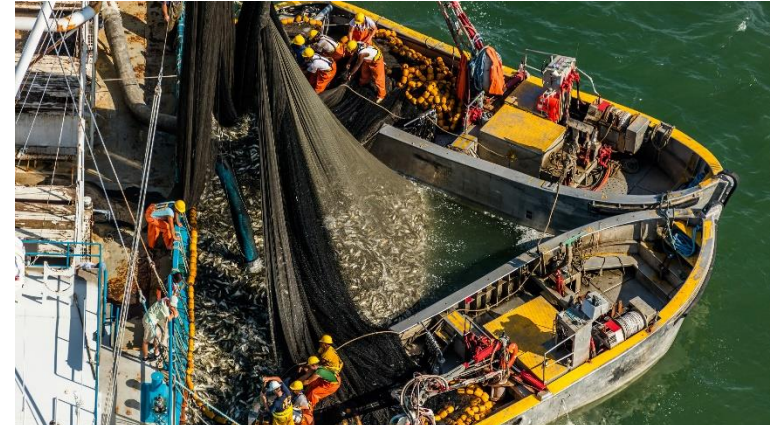
[NMFS Commercial Landings Data](#)



# Atlantic Menhaden – Fishery / Fishery Management Effects

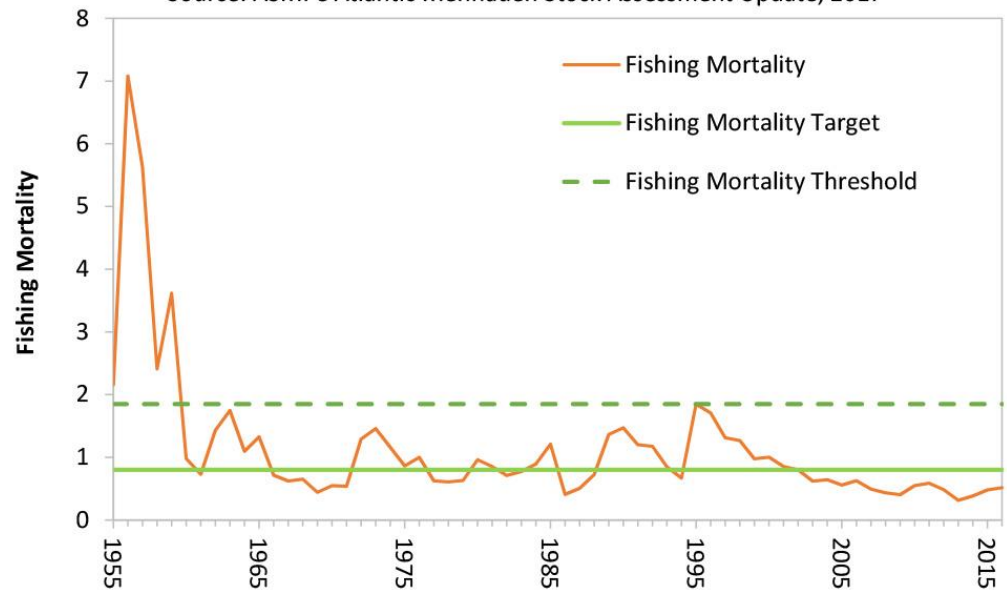
In the 1960s, the Atlantic menhaden stock contracted geographically, and many of the fish factories north of the Chesapeake Bay closed due to a scarcity of fish.

[ASMFC](http://asmfc.org)



Atlantic Menhaden Fishing Mortality (Ages 2-4)

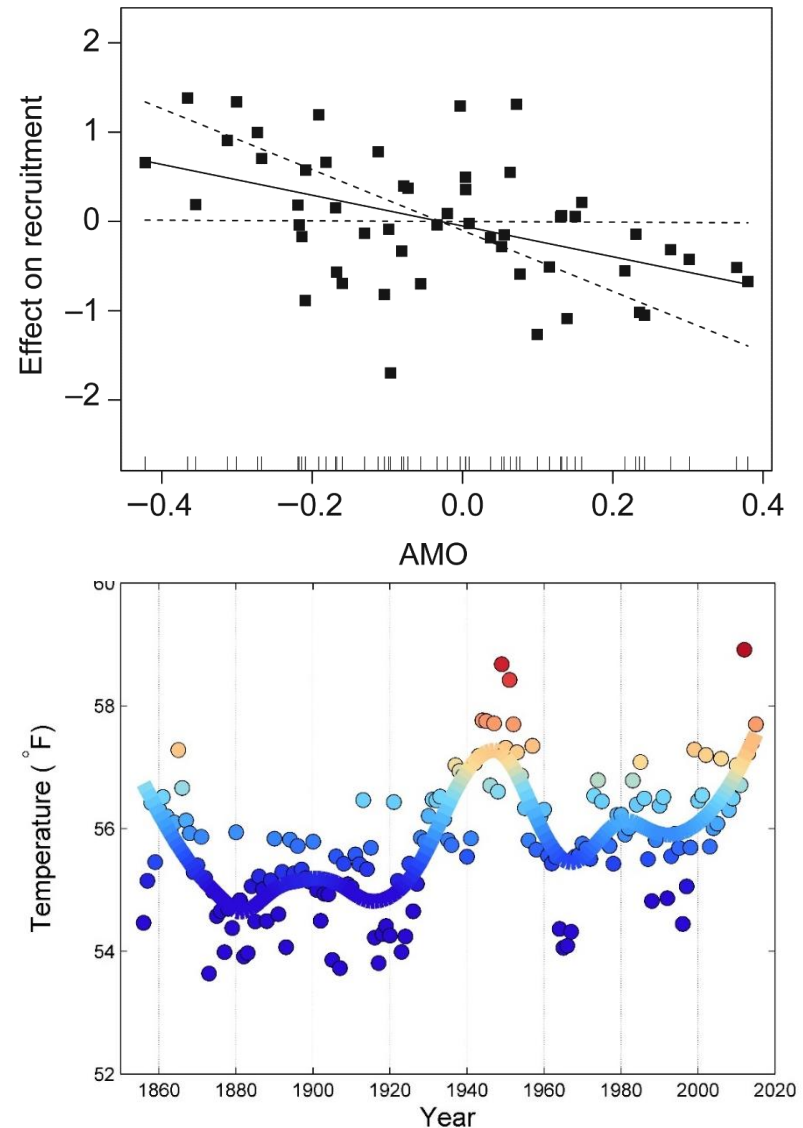
Source: ASMFC Atlantic Menhaden Stock Assessment Update, 2017



# Atlantic Menhaden – Climate Effects

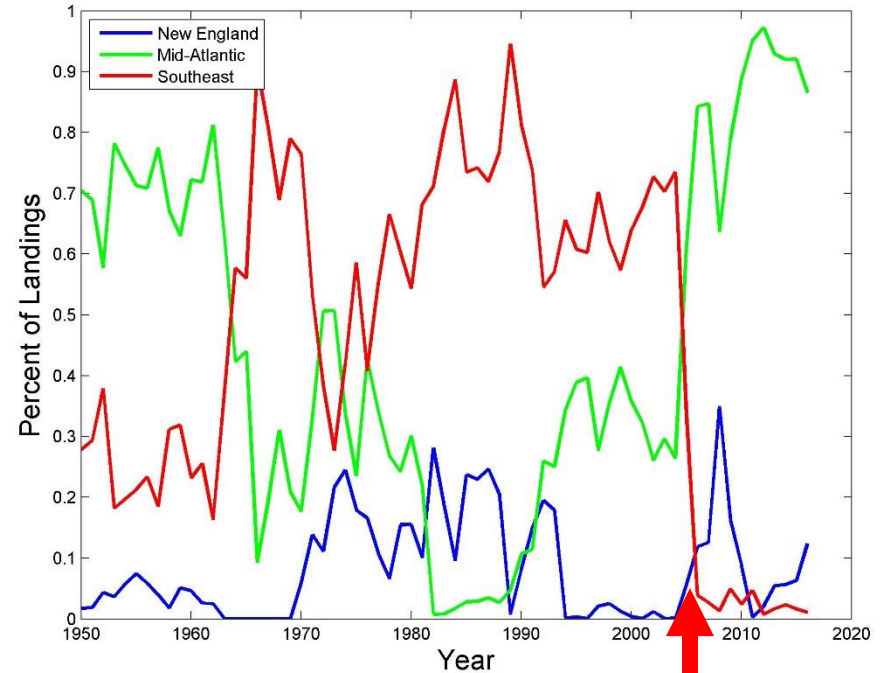
The Atlantic Multidecadal Oscillation is the best single predictor of coast-wide recruitment patterns, and had opposing effects on the Chesapeake Bay and Southern New England regions.

[Buchheister et al. 2016 ICES Journal of Marine Science](#)



# Atlantic Menhaden – Socio-economic Effects

The recent closure of reduction plants along the New England coast, and to some extent the Middle Atlantic coast, appears symptomatic of a trend referred to as "waterway gentrification".



Plant closure

# Atlantic Menhaden – Habitat Effects

The water quality index for the coastal waters of the Northeast Coast region is rated fair, with 9% of the coastal area rated poor and 53% of the area rated fair for water quality condition

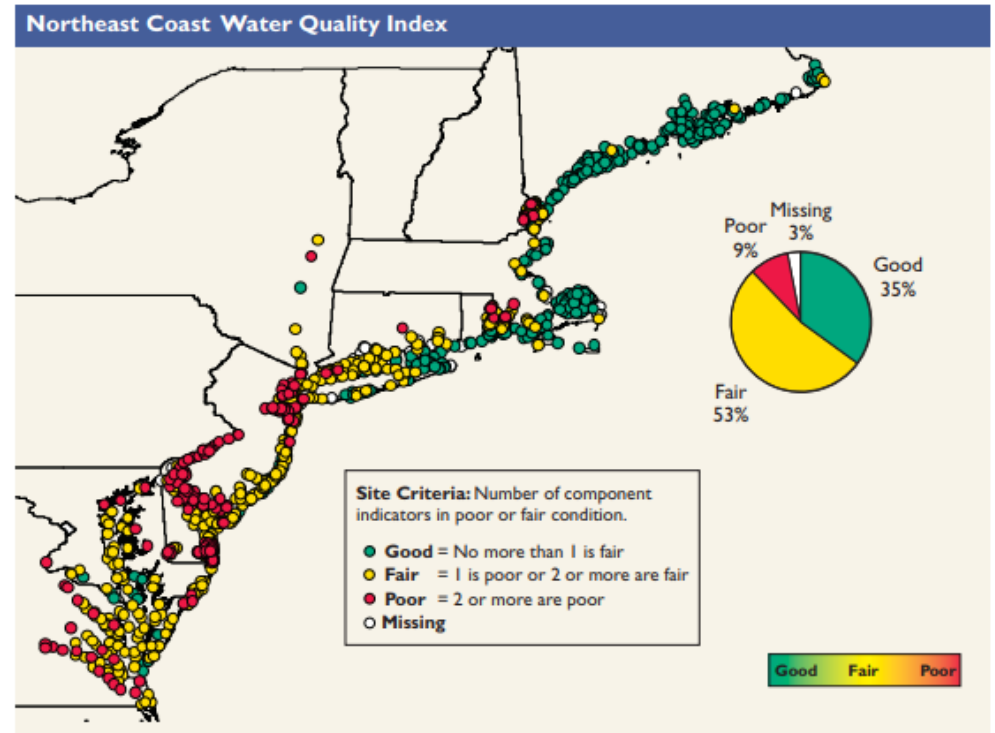


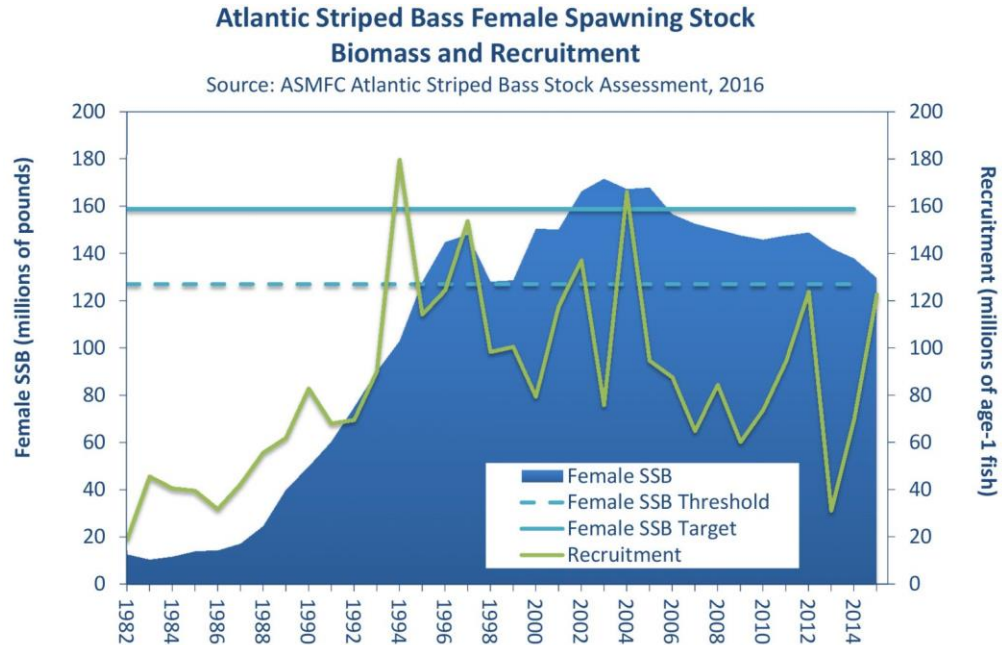
Figure 3-5. Water quality index data for Northeast Coast coastal waters (U.S. EPA/NCA).



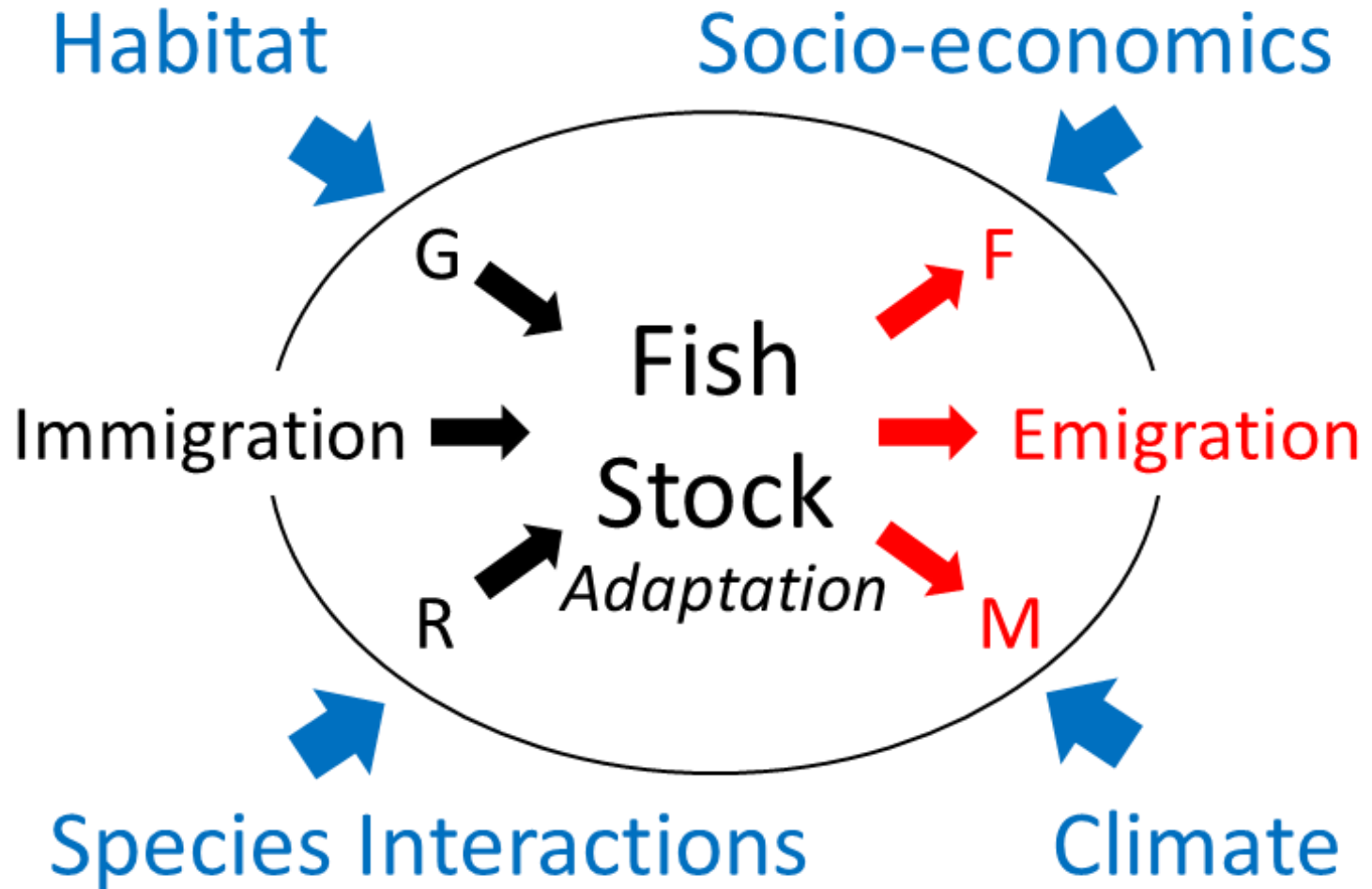
# Atlantic Menhaden – Species Interactions

Menhaden are an important component of the food chain, providing ... forage for species such as striped bass, bluefish, and weakfish, to name just a few.

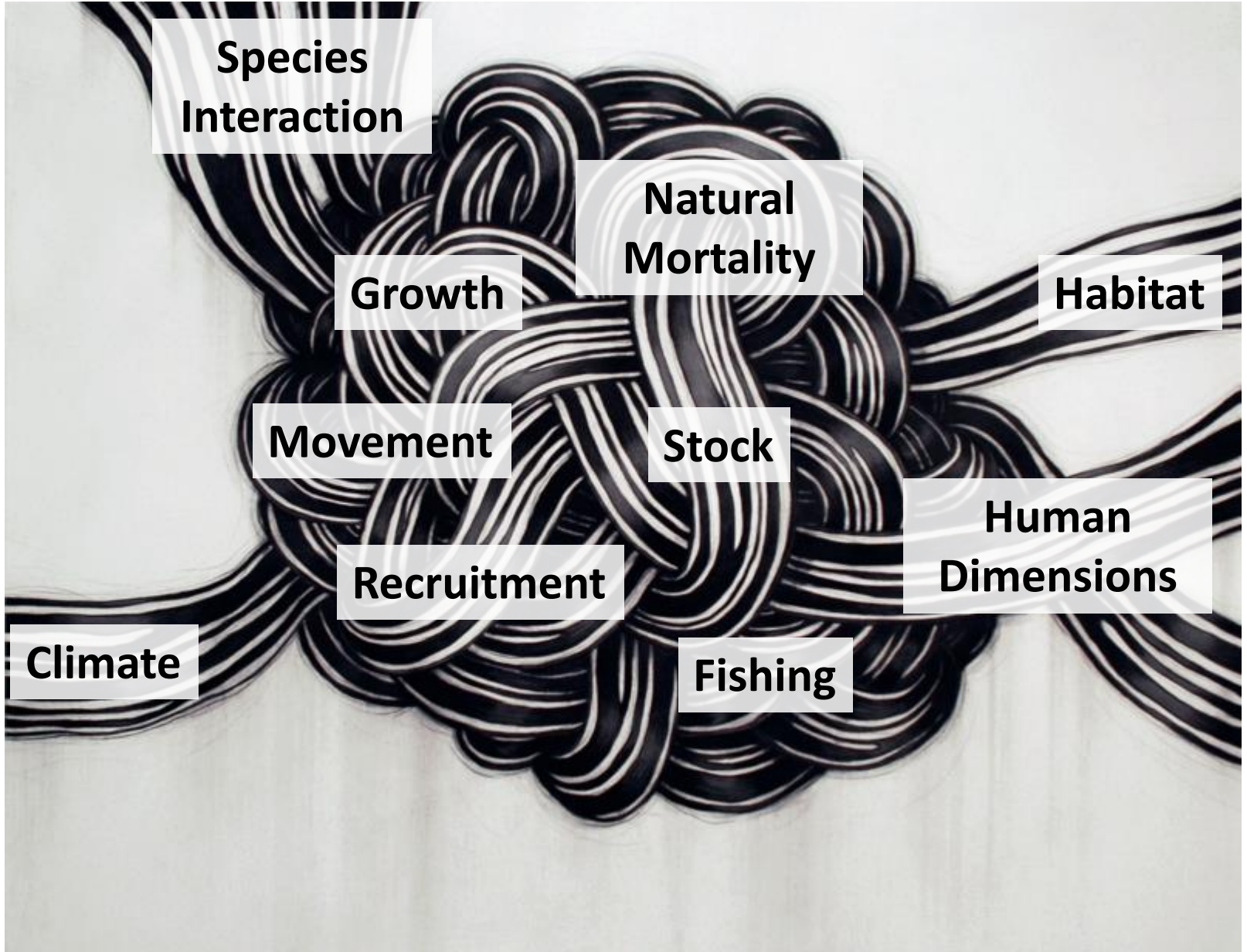
[ASMFC](http://asmfc.org)



# Atlantic Menhaden – EBFM



# Atlantic Menhaden – EBFM



**Species  
Interaction**

**Natural  
Mortality**

**Growth**

**Habitat**

**Movement**

**Stock**

**Recruitment**

**Human  
Dimensions**

**Climate**

**Fishing**

# Ecosystem Based Fisheries Management

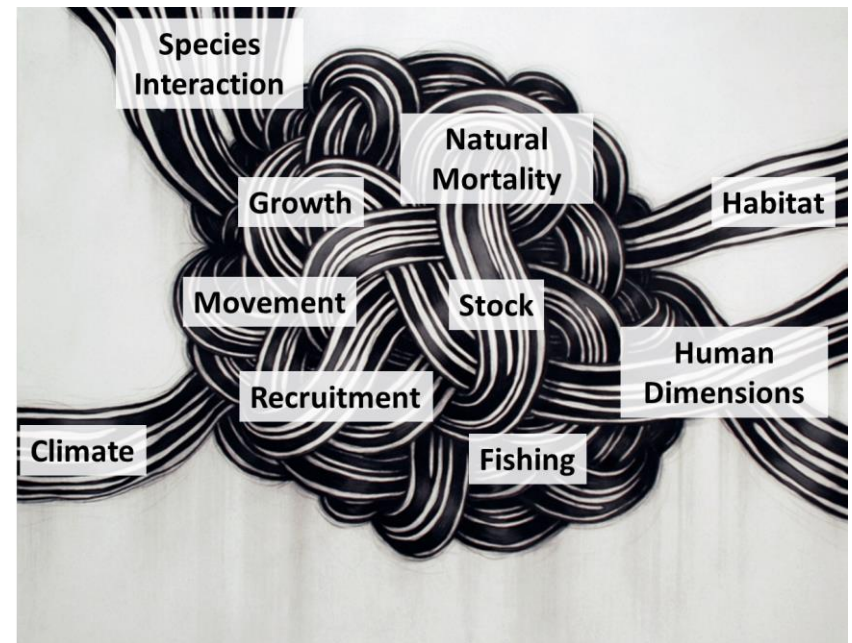
Wicked Problems - difficult or impossible to solve because of incomplete, contradictory, ill-defined, and changing requirements

REVIEW

## Ecosystem management as a wicked problem

Ruth DeFries<sup>1\*</sup> and Harini Nagendra<sup>2</sup>

Ecosystems are self-regulating systems that provide societies with food, water, timber, and other resources. As demands for resources increase, management decisions are replacing self-regulating properties. Counter to previous technical approaches that applied simple formulas to estimate sustainable yields of single species, current research recognizes the inherent complexity of ecosystems and the inability to foresee all consequences of interventions across different spatial, temporal, and administrative scales. Ecosystem management is thus more realistically seen as a "wicked problem" that has no clear-cut solution. Approaches for addressing such problems include multisector decision-making, institutions that enable management to span across administrative boundaries, adaptive management, markets that incorporate natural capital, and collaborative processes to engage diverse stakeholders and address inequalities. Ecosystem management must avoid two traps: falsely assuming a tame solution and inaction from overwhelming complexity. An incremental approach can help to avoid these traps.



[DeFries and Nagendra 2017 Science](#)

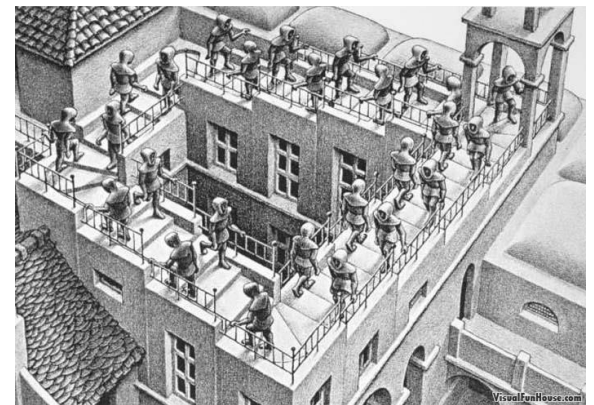
[Wicked Problems - Rittel, Horst. "Dilemmas in a General Theory of Planning." Policy Sciences, 1973: 155-169.](#)

# Ecosystem Based Fisheries Management

Wicked Problems - difficult or impossible to solve because of incomplete, contradictory, ill-defined, and changing requirements

## Wicked Problem Traps

- Falsely assuming tame solution  
*“one model to rule them all”*
- Inaction from overwhelming complexity  
*“let’s keep doing what we are doing”*



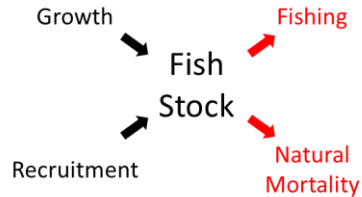
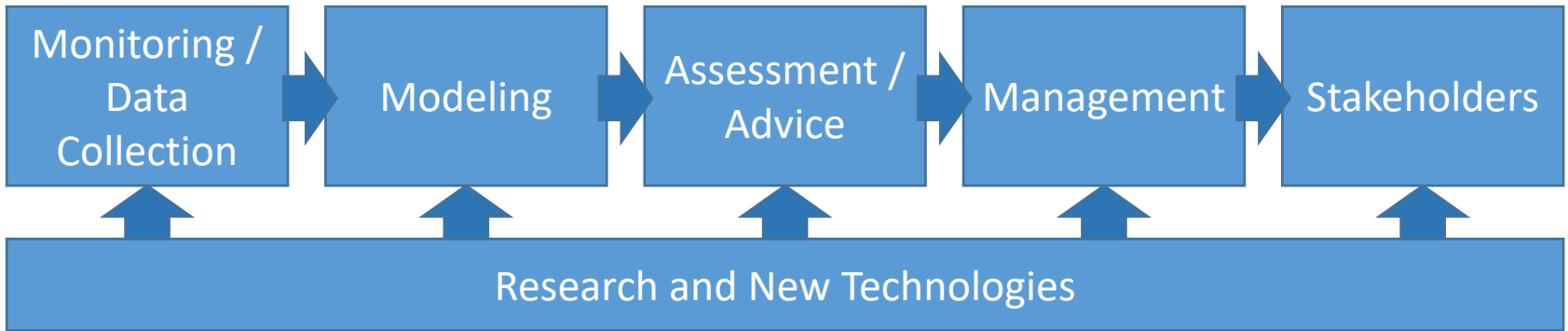
# Ecosystem Based Fisheries Management

Wicked Problems - difficult or impossible to solve because of incomplete, contradictory, ill-defined, and changing requirements

Approaches for addressing such problems include:

- adaptive management - increase knowledge and reduce uncertainty through iterative decision making and implementation of processes that prioritize learning
- collaborative processes to engage diverse stakeholders and address inequalities

# Scientific-Management Enterprise

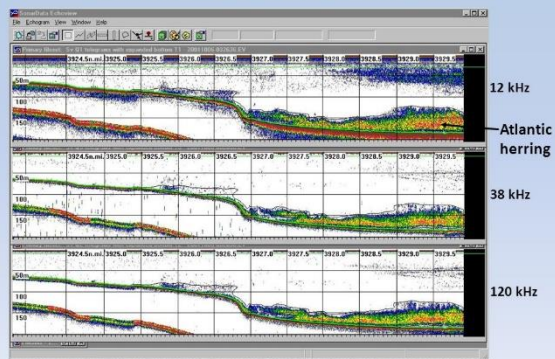


OLF

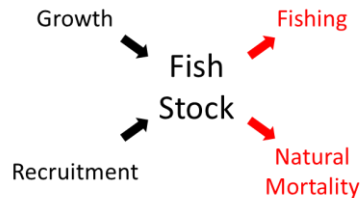
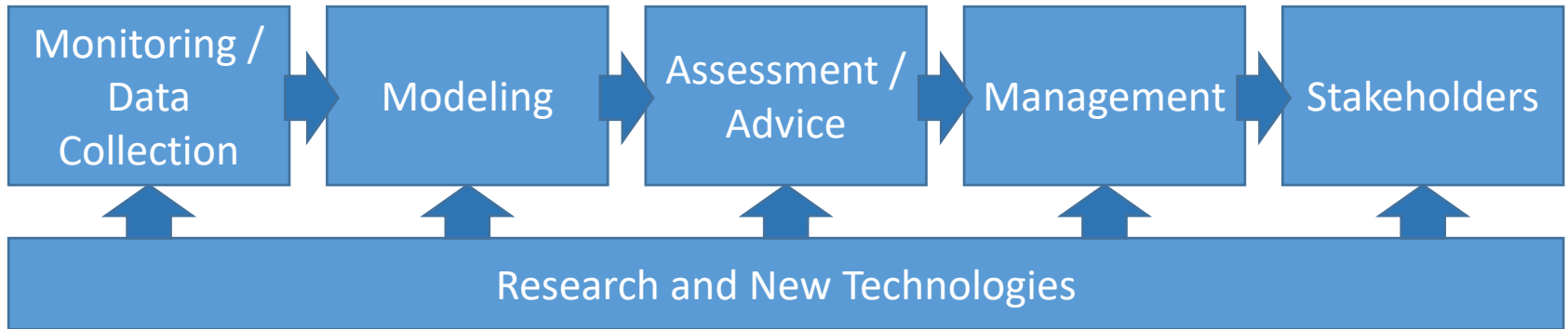
ACL



Herring Aggregations on the Northern Edge of Georges Bank (2001)

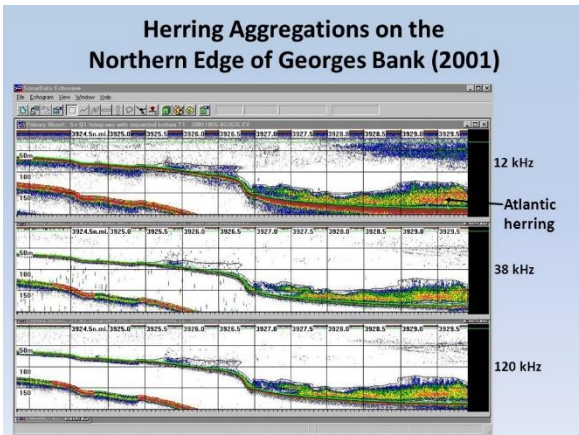


# Scientific-Management Enterprise



OLF

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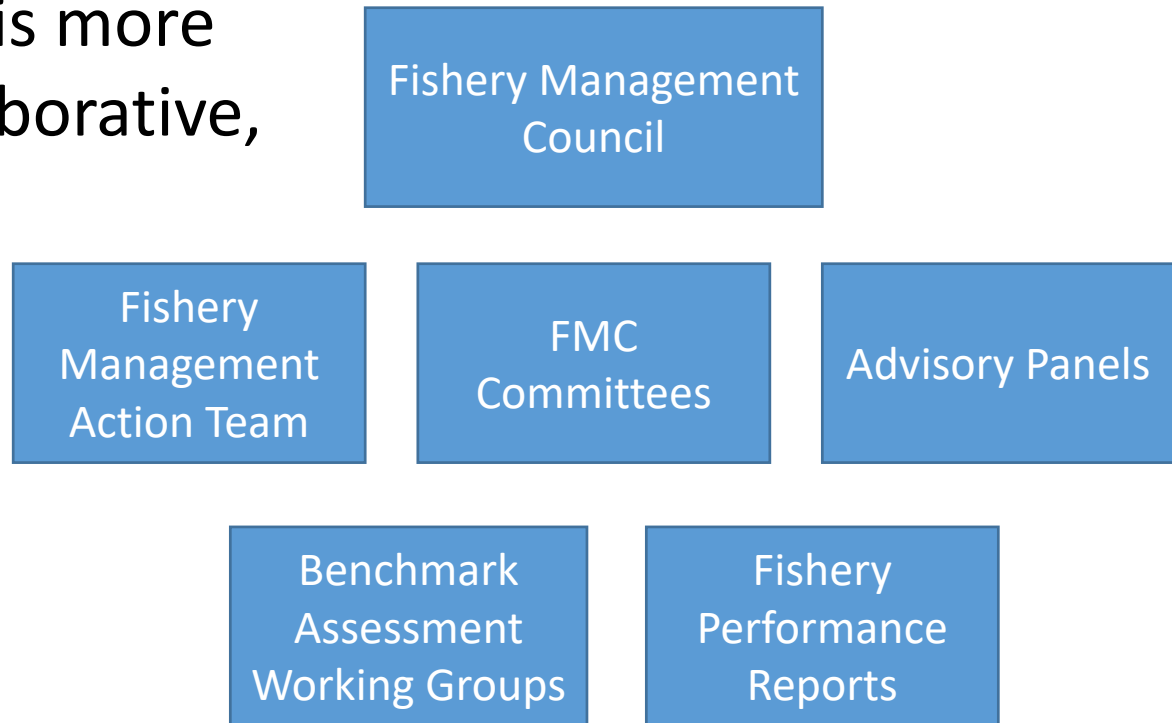
Enterprise is linear, designed to compartmentalize components and pass information from one compartment to another



# Scientific-Management Enterprise

## Adaptive management and collaborative processes

Management is more  
iterative, collaborative,  
participatory



Science supporting management is less iterative,  
collaborative, participatory

# Ecosystem Based Fisheries Management

Examples of iterative, collaborative, participatory science (particularly focused on forage)

- Butterfish Working Group contributing to Benchmark Assessment
- Atlantic Mackerel Working Group contributing to Benchmark Assessment
- River Herring Technical Expert Working Group
- Atlantic Menhaden Biological Ecological Reference Points Workgroup

# Ecosystem Based Fisheries Management

Examples of iterative, collaborative, participatory science (particularly focused on forage)

- MAFMC Risk Assessment and EAFM Guidance (Sarah's talk yesterday)
- Atlantic Herring Management Strategy Evaluation (Min-Yang's Talk Yesterday)
- River Herring Bycatch Avoidance (Dave's Talk Today)
- Electronic Monitoring Evaluation (Niki's Talk Today)

# Ecosystem Based Fisheries Management

Examples of iterative, collaborative, participatory science (more broadly in the region)

- Quota set-aside for Scallop, Herring, and Monkfish research
- Study Fleet – commercial vessels collecting tow-by-tow information
- Biosampling Program – commercial vessels collect samples for age, maturity, and growth

# Ecosystem Based Fisheries Management

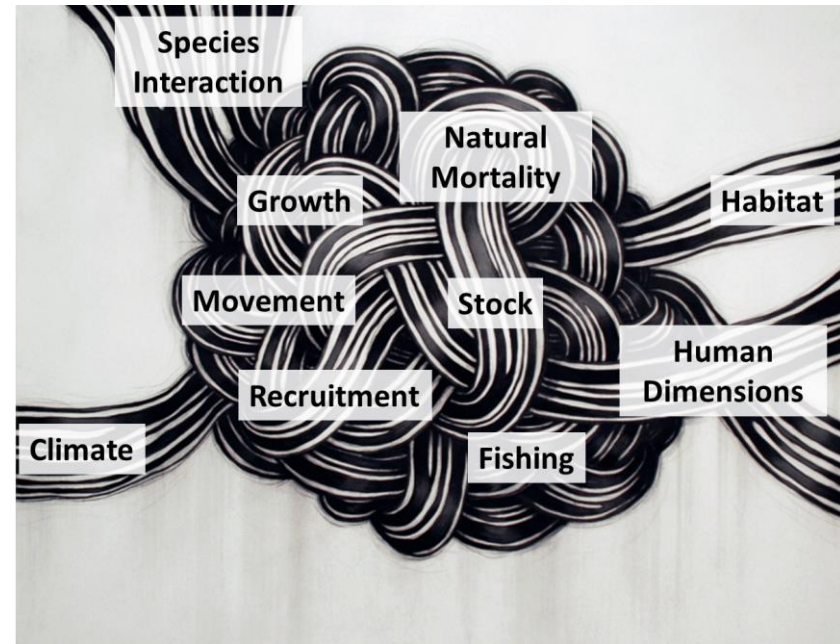
Examples of iterative, collaborative, participatory science (more broadly in the region)

- Scientific long-line surveys on commercial vessels in Gulf of Maine and for sharks
- Northeast Trawl Advisory Panel – improving fishery-independent trawl surveys

# Ecosystem Based Fisheries Management

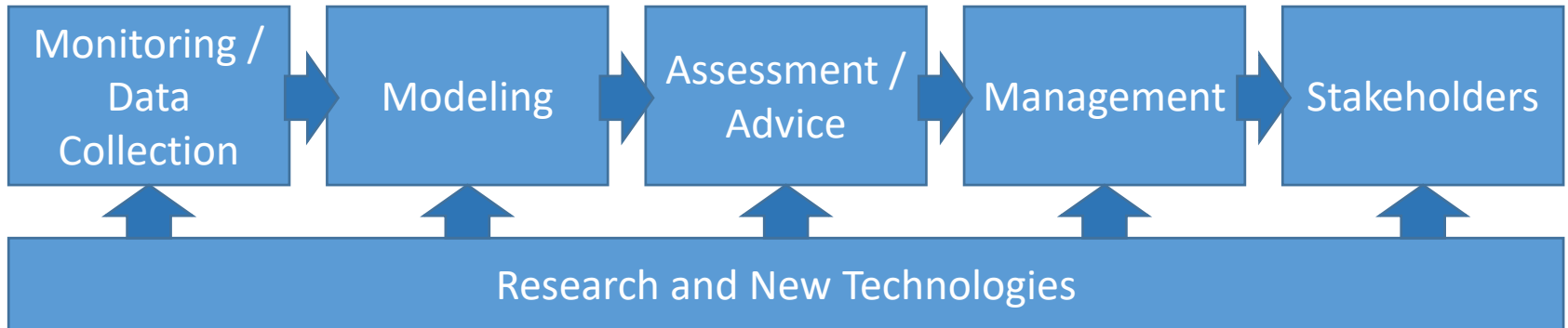
We have the many of the pieces – science and management

How do we put it together?

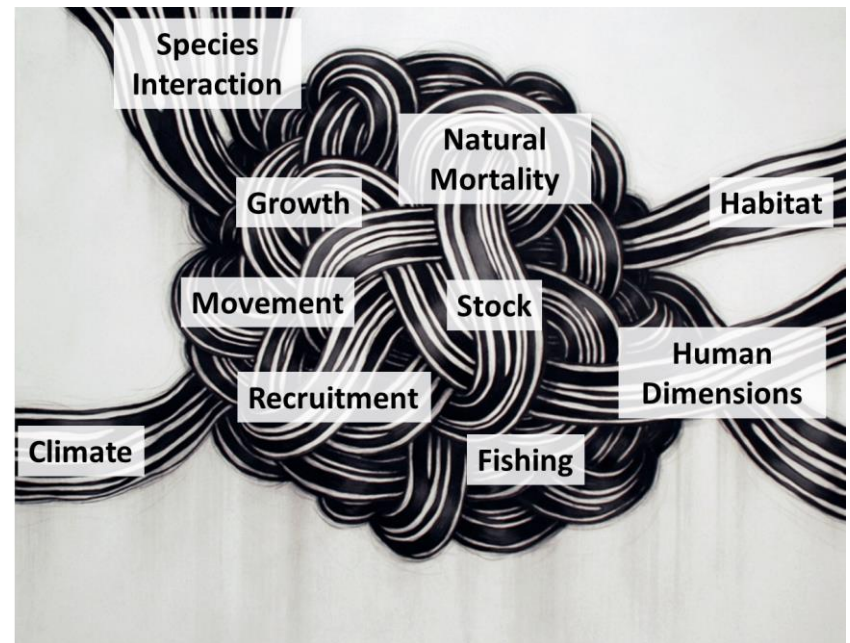


# Ecosystem Based Fisheries Management

## Scientific-Management Enterprise



- adaptive management - increase knowledge, reduce uncertainty, iterative decision making, prioritize learning
- collaborative processes engage diverse stakeholders, address inequalities



# Ecosystem Based Fisheries Management

## Scientific-Management Enterprise

- How to integrate science, management, and stakeholders?
- How to make enterprise more iterative, collaborative, participatory?
- How to encourage learning? What can we learn from efforts to date?
- How to enable adaptive management?

