Bluefish Ecosystem and Socioeconomic Profile

Presentation to the Mid Atlantic SSC

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Outline

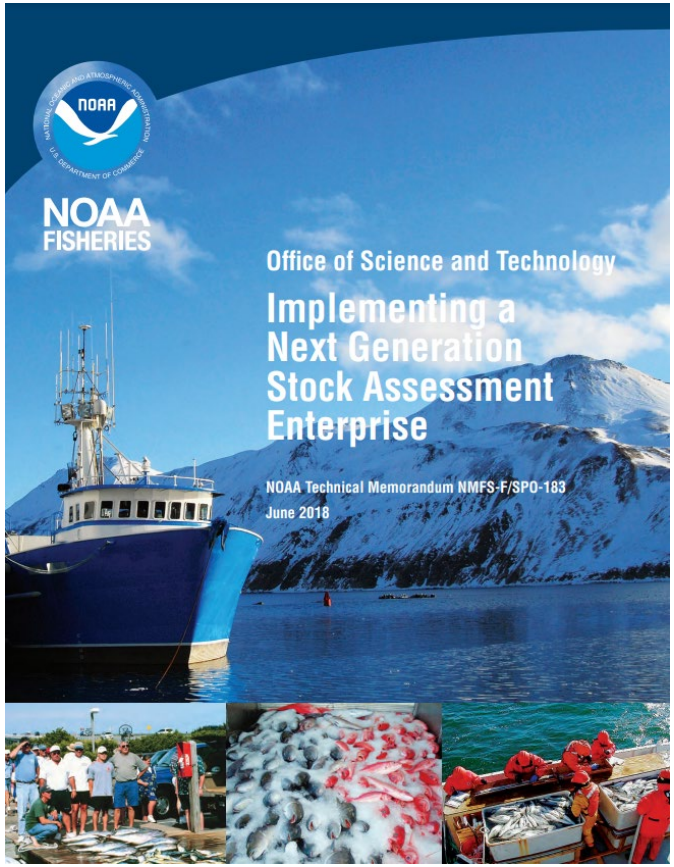
- Background: ESP purpose and objectives
- Bluefish ESP overview: process & results
- Discussion

Background

The need for ecosystem and socioeconomic information

- Changing systems
  - Population processes (e.g., productivity changes, natural mortality, and distribution)
  - Physical processes (e.g., circulation patterns and bottom temperatures)
  - Social and economic drivers, and ocean uses
- Precision and accuracy of assessment models, biological reference points, and harvest control rules may be adversely affected (see Next-Generation Stock Assessment Enterprise NMFS 2018)
- There are ongoing efforts to provide more holistic single-species advice
- Can we come up with a framework to consistently incorporate additional info into the process?

“Next-generation” stock assessment



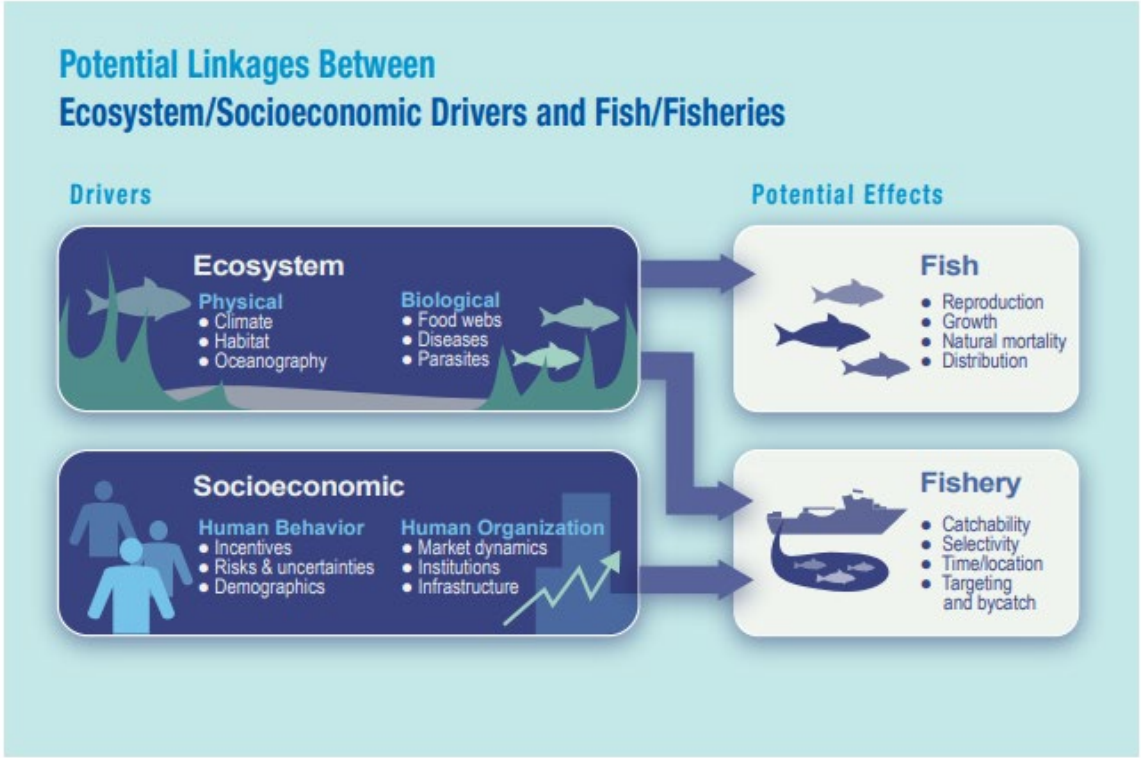
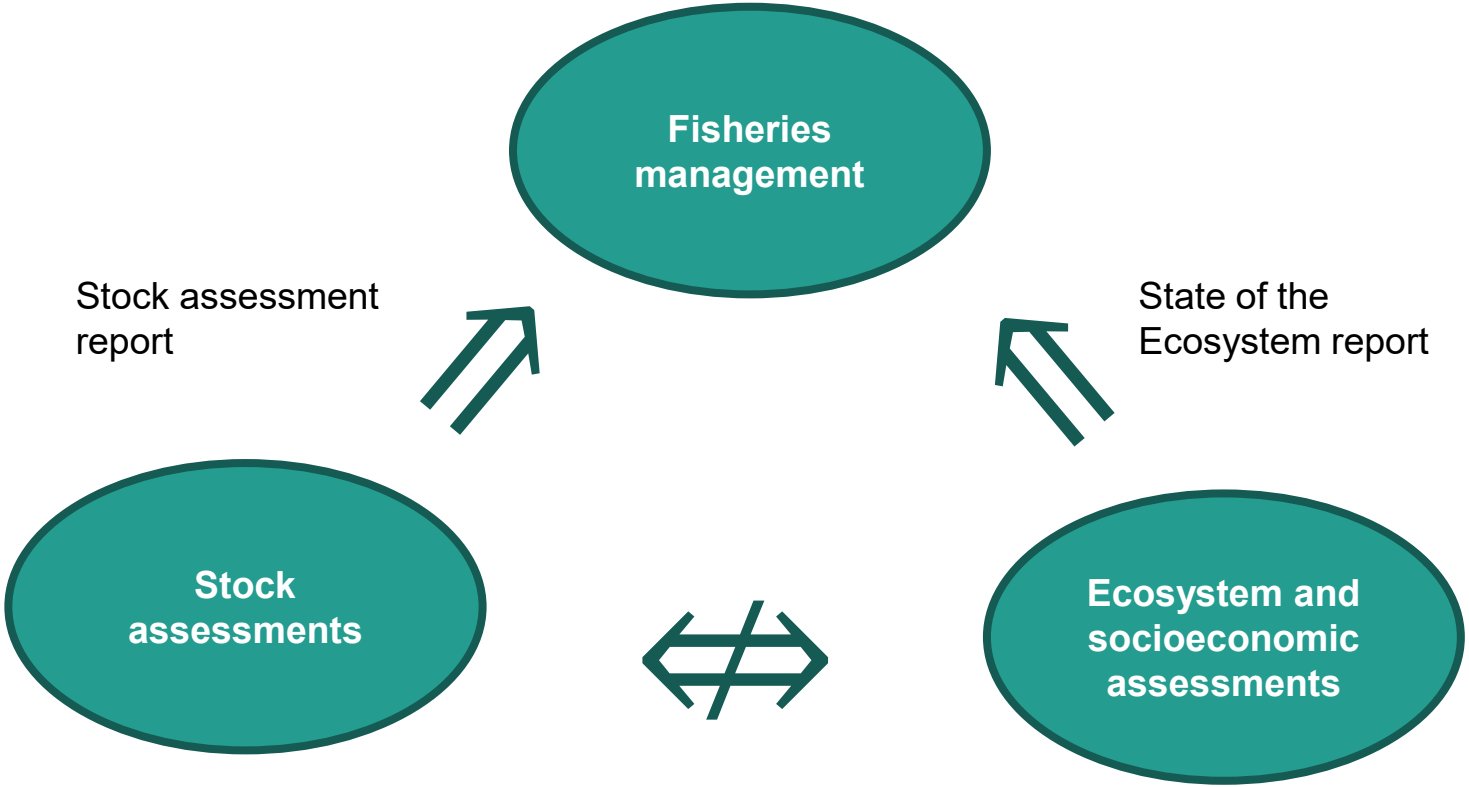
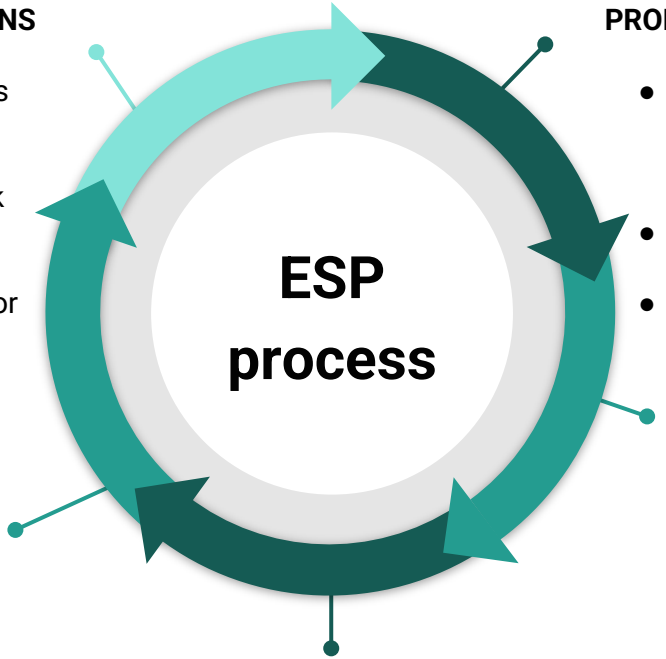


Figure 8.1 Ecosystem and socioeconomic processes affecting fish and fisheries.


Fisheries management
Stock assessment report
State of the Ecosystem report
Stock assessments
Ecosystem and socioeconomic assessments

ESP objectives

- Leverage existing information and knowledge pathways
- Incorporate a broad range of information
- Facilitate interpretation and use in management with a standardized framework and standardized visuals
- Improve transparency and reproducibility



PROBLEM STATEMENT

- Identify problems from previous assessments/benchmarks ("top-down")
- Gather and summarize existing literature ("bottom-up")
- Use repeatable, well-documented methods

CONCEPTUAL MODEL

- Identify important processes and linkages
- Can develop multiple conceptual models; for example, life history, human dimensions, and stock assessment process

INDICATOR DEVELOPMENT

- Indicators of a pressure, mechanism, and/or outcome
- Can be simple or complex
- Can add and evaluate indicators iteratively

INDICATOR ANALYSIS

- Determine indicator status
- Determine indicator importance
- Modeling/predictions

SUMMARY & RECOMMENDATIONS

- Provide a general recommendation as to whether the system is overall “favorable” or “unfavorable”
- Could link to assessment through risk table approach
- Recommendations for model assumptions, parameterization, and/or covariates

Pathways for scientific advice

Inform uncertainty

Provide additional context

- Do recent data seem consistent with past observations?
- Is there anything happening that might affect the stock in ways that the assessment model can't capture?

Inform assessment model…

assumptions

- Is the model consistent with the stock's life history?
- Are major biological processes accounted for?

choices

- Are parameter values consistent with existing information?
  - For example, natural mortality, catchability
- Inform data conditioning

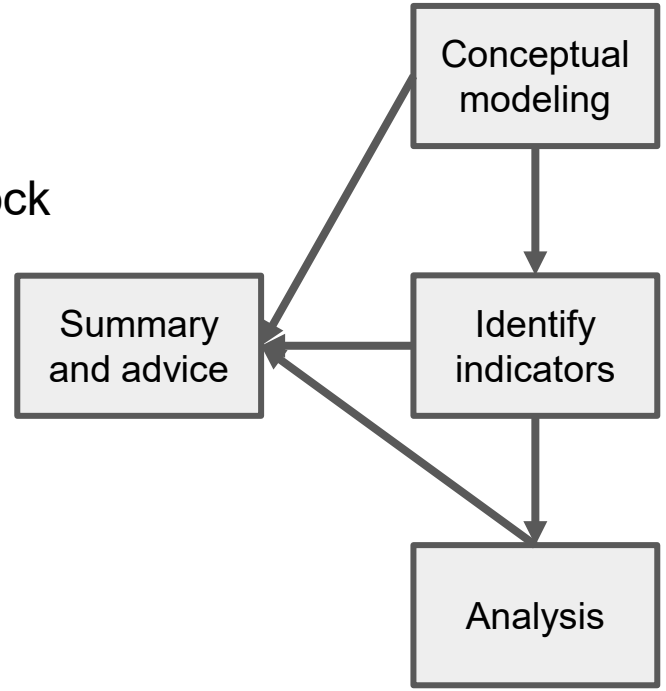
covariates

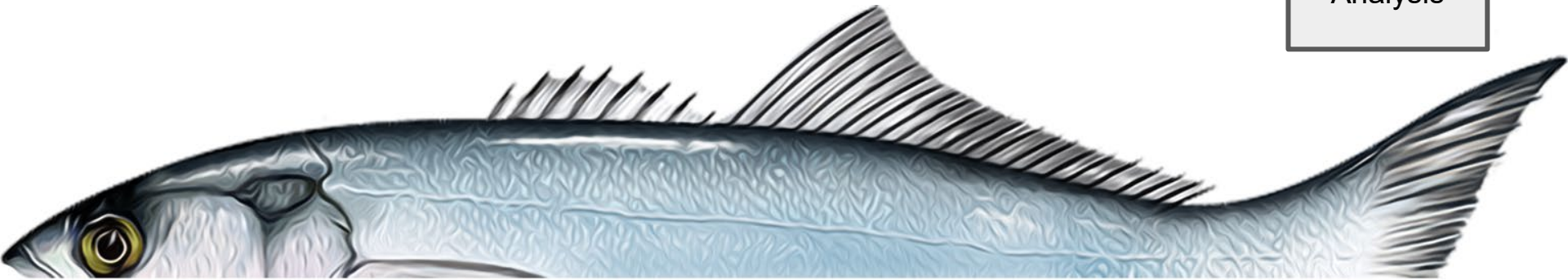
- Indicator time series directly included in a model (ex, Woods Hole Assessment Model)

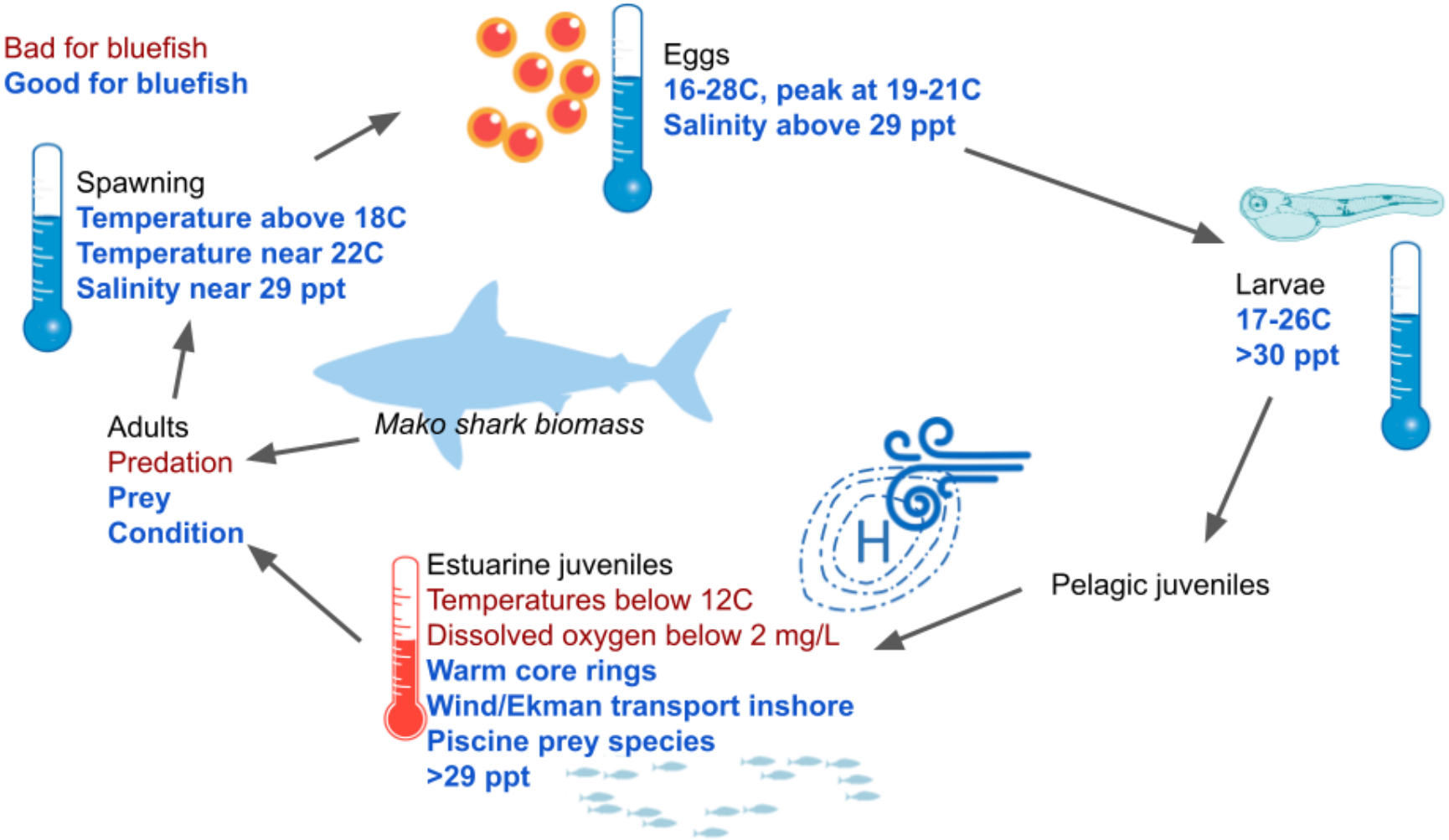
Bluefish

Bluefish

- TOR 1: Ecosystem & climate influences on stock
- TOR 7: Research recommendations



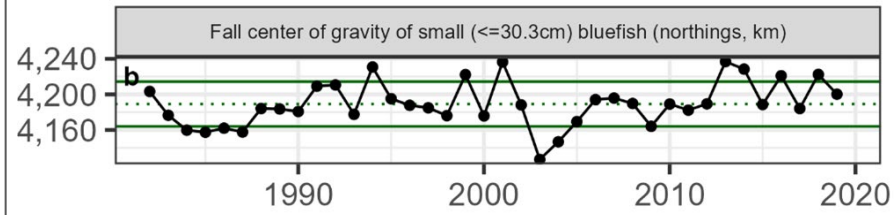



Bad for bluefish
Good for bluefish
Eggs
16-28C, peak at 19-21C
Salinity above 29 ppt
Spawning
Temperature above 18C
Temperature near 22C
Salinity near 29 ppt
Larvae
17-26C
>30 ppt
Mako shark biomass
Adults
Predation
Prey
Condition
H
Estuarine juveniles
Temperatures below 12C
Dissolved oxygen below 2 mg/L
Warm core rings
Wind/Ekman transport inshore
Piscine prey species
>29 ppt
Pelagic juveniles

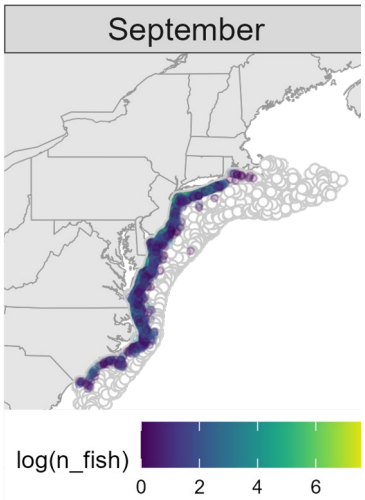
Indicator development

- Indicator objectives: priority topics for study
  - Ecosystem: spatial distribution, climate, natural mortality
  - Socioeconomic: recreational, commercial, community
- Identify indicators and document reasoning
  - Document connection to bluefish and references supporting that connection
  - Document how the indicator could be used to inform the model and/or management advice
- Assess indicator feasibility based on data availability, data quality, effort needed, and theoretical basis
  - Indicator scorecard survey sent to working group members
- Create indicators, document methods, data sources, and scripts

Spatial distribution of bluefish

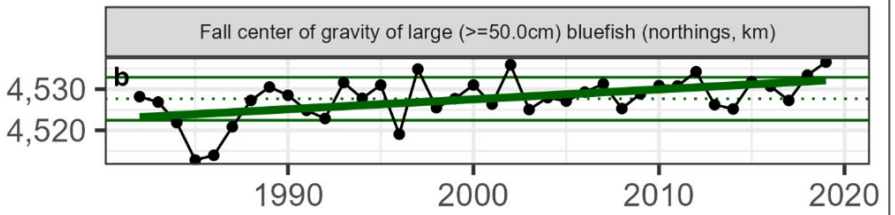


Small fish (<=30.3cm)

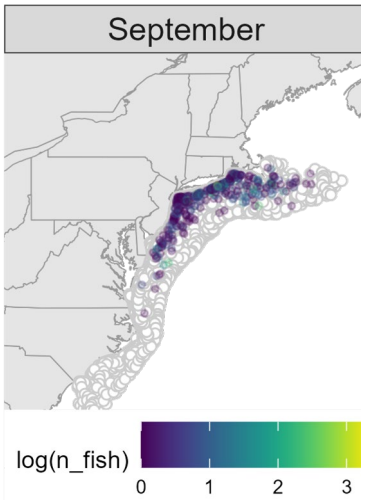


Bluefish <=30.3cm were broadly distributed in the nearshore Central Atlantic (between NC and Cape Cod)

- 30.3cm was the average length at age 1
- No change in center of gravity over time (1982 - 2019); dependent on fixed habitat (estuaries)

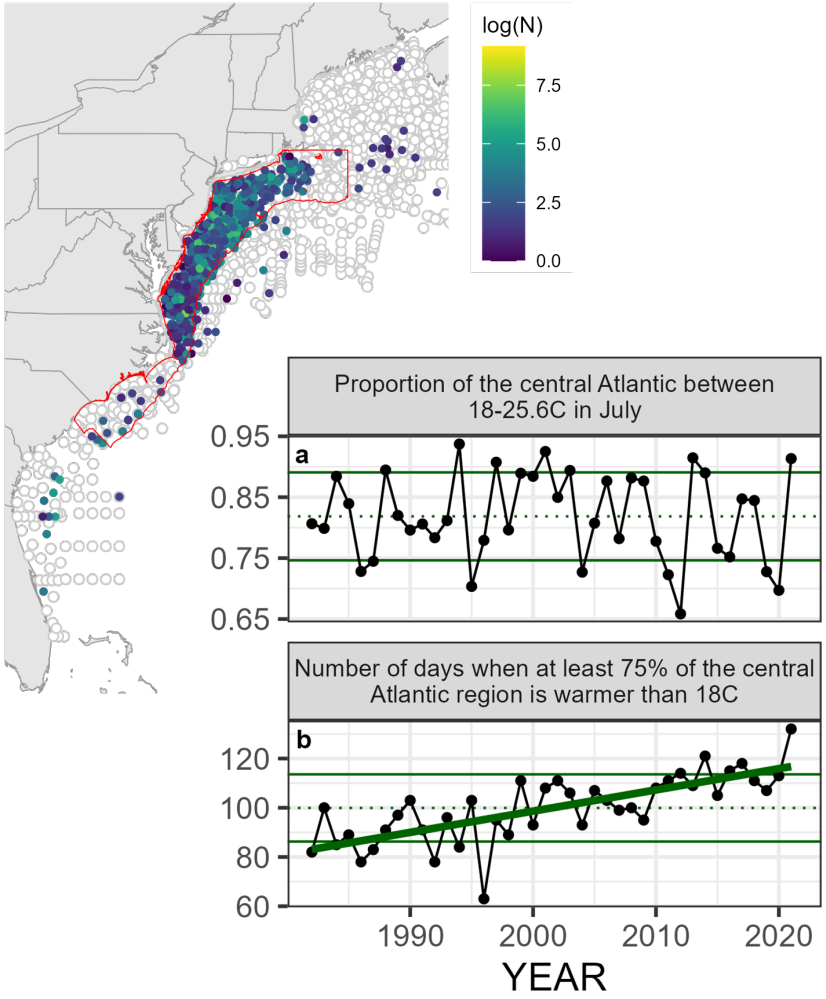


Large fish (>=50.0cm)



Bluefish >=50.0cm were broadly distributed in the New York Bight and on Georges Bank

- 50.0cm was the average length at age 3
- Center of gravity moving ~0.2km/year more north and ~0.5km/year more east over time (1982 - 2019)

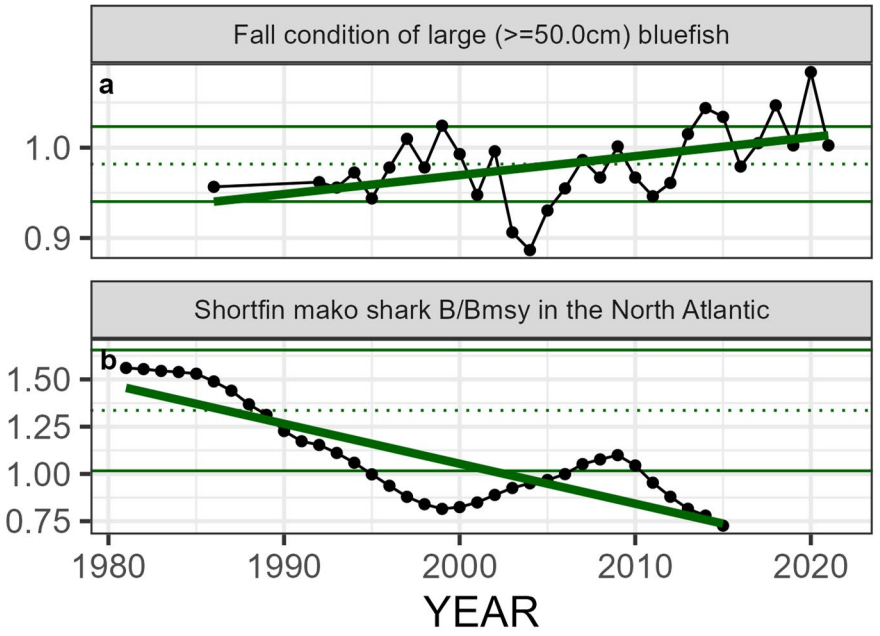


Climate influences on timing & location of potential spawning

- Overall, there are more days with optimal spawning temperatures
  - No change in the first day of the year when the mean regional temperature first reaches 18°C
    - Occurs around June 14th
    - Proxy for no change in the beginning of the spawning season
  - The last day of the year when the mean regional temperature is above 18°C has been occurring later over time
    - Now occurring towards the mid/end of October rather than in early/mid October; approximately 15 day change between 1982-2021
    - Proxy for the spawning season extending later in the year
- No change in proportion of region with optimal spawning temperatures (18-25.6°C)
  - However, the amount of habitat with colder-than-optimal temperatures is decreasing, while the amount of habitat with warmer-than-optimal temperatures is increasing
    - Eventually, no habitat will be colder-than- optimal, and the amount of optimal habitat will decrease as more habitat becomes warmer- than-optimal

Natural mortality: fish condition & predation

- Lack of data on bluefish predator abundance
- Shortfin mako shark population trends indicate that it is unlikely that mako are consuming more bluefish than in the past
  - Shortfin mako shark B/B_{msy} provided by ICCAT
- Increasing trend in large fish condition could benefit spawning/ recruitment

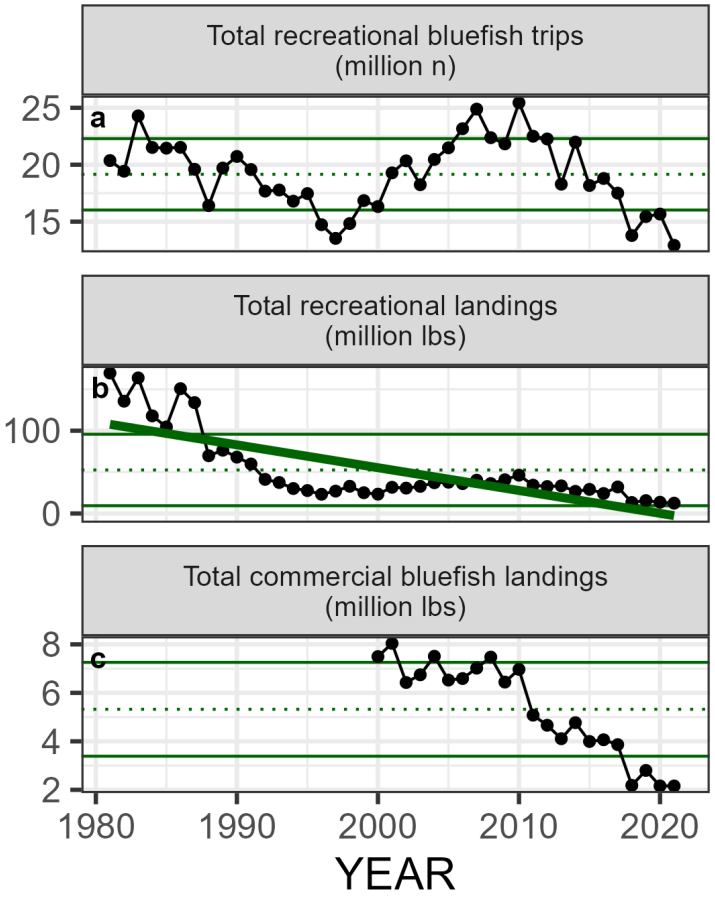


Ecosystem indicator summary

Category	Indicator	2017	2018	2019	2020	2021
Distribution	Fall center of gravity of small (<=30.3cm) bluefish (northings, km)	neutral	**high**	neutral	NA	NA
	Fall center of gravity of medium (30.3-50.0cm) bluefish (northings, km)	neutral	neutral	**high**	NA	NA
	Fall center of gravity of large (>=50.0cm) bluefish (northings, km)	neutral	**high**	**high**	NA	NA
	Fall center of gravity of small (<=30.3cm) bluefish (eastings, km)	neutral	neutral	neutral	NA	NA
	Fall center of gravity of medium (30.3-50.0cm) bluefish (eastings, km)	neutral	neutral	**high**	NA	NA
	Fall center of gravity of large (>=50.0cm) bluefish (eastings, km)	neutral	neutral	**high**	NA	NA
Climate	First day of the year when the mean temperature of the region is >18°C	neutral	neutral	neutral	neutral	*low*
	Last day of the year when the mean temperature of the region is >18°C	**high**	neutral	neutral	**high**	**high**
	Number of days when at least 75% of the region is >18°C	**high**	neutral	neutral	neutral	**high**
	Proportion of the central Atlantic colder than 18°C in July	neutral	neutral	neutral	*low*	*low*
	Proportion of the central Atlantic between 18-25.6°C in July	neutral	neutral	*low*	*low*	**high**
	Proportion of the central Atlantic warmer than 25.6°C in July	neutral	neutral	**high**	**high**	neutral
	Mean crossshore wind in the central Atlantic in April and May	neutral	**high**	neutral	*low*	*low*
	Mean alongshore wind in the central Atlantic in April and May	*low*	**high**	*low*	neutral	neutral
Natural mortality	Spring condition of small (<=30.3cm) bluefish	neutral	neutral	neutral	*low*	neutral
	Spring condition of medium (30.3-50.0cm) bluefish	neutral	neutral	neutral	**high**	neutral
	Spring condition of large (>=50.0cm) bluefish	*low*	neutral	**high**	**high**	**high**
	Fall condition of small (<=30.3cm) bluefish	neutral	neutral	neutral	**high**	**high**
	Fall condition of medium (30.3-50.0cm) bluefish	neutral	neutral	neutral	**high**	**high**
	Fall condition of large (>=50.0cm) bluefish	neutral	**high**	neutral	**high**	neutral

Socioeconomic indicators

- No long-term trend in recreational bluefish catch or number of trips
- Long-term decrease in landings (potential shift to catch-and-release)
- Smaller proportion of recreational trips now targeting blufish
- The commercial fishery is small compared to the recreational fishery
- Recent low recreational indicators, low commercial landings & revenue are likely attributable to management restrictions rather than lack of interest in the fishery
- Highest recreational fishing engagement and reliance in the Southeast, lower in the Mid and Northeast



Socioeconomic indicator summary

Category	Indicator	2017	2018	2019	2020	2021
Recreational	Total recreational bluefish trips (n)	neutral	*low*	*low*	*low*	*low*
	Proportion of recreational trips targeting bluefish	neutral	*low*	*low*	*low*	*low*
	Total recreational catch (n)	neutral	*low*	neutral	*low*	*low*
	Total recreational landings (lbs)	neutral	neutral	neutral	neutral	neutral
Commercial	Commercial vessels landing bluefish (n)	neutral	*low*	*low*	*low*	*low*
	Total commercial bluefish landings (lbs)	neutral	*low*	*low*	*low*	*low*
	Average price of bluefish (real dollars/lb)	neutral	**high**	**high**	**high**	**high**
	Total bluefish revenue (real dollars)	neutral	*low*	neutral	*low*	*low*
	Average price of diesel fuel (real dollars/gallon)	neutral	neutral	neutral	*low*	neutral
Community	Mean recreational fishing engagement in the Northeast	neutral	*low*	neutral	NA	NA
	Mean recreational fishing engagement in the Mid Atlantic	**high**	neutral	neutral	NA	NA
	Mean recreational fishing engagement in the Southeast	**high**	neutral	neutral	NA	NA
	Mean recreational fishing reliance in the Northeast	neutral	**high**	**high**	NA	NA
	Mean recreational fishing reliance in the Mid Atlantic	neutral	neutral	neutral	NA	NA
	Mean recreational fishing reliance in the Southeast	**high**	neutral	*low*	NA	NA

"Operationalizing" ESPs

ESP logistics

	Bluefish	Cod	Mackerel
Who	Bluefish Research Track Stock Assessment Working Group	Cod Research Track Stock Assessment Working Group	Informal group of collaborators
What	~100 page report covering bluefish life history, indicator development, and analyses	Multiple ~20 page working papers covering life history and ecosystem linkages, indicator development, and analyses	~20 page report summarizing mackerel life history, ecosystem conditions, and potential indicators
When	~1.5 year stock assessment process	~2 year stock assessment process	~1.5 year collaborative process
Where	Working paper attached to the research track stock assessment	Working papers attached to the research track stock assessment	Working paper attached to the management track stock assessment
Why	Address TOR1 of the research track stock assessment	Address TOR1 of the research track stock assessment, develop ecosystem linked covariates for model testing	Identify ecosystem information that could help improve assessment modelling
How	Indicators discussed and selected by Working Group	Indicators discussed and selected by Working Group	Indicators discussed and selected by collaborators

Discussion

- How can ESP information be used by the SSC?
- What SSC processes and products would benefit most from ESPs?
- Are there any modifications that would make the ESPs more useful for the SSC?
- What type of update frequency would the SSC like to see once an ESP has been established for a stock?
- Suggestions for how to prioritize species for ESPs?

Extra slides

Connections to OFL CV

- ESP provides a framework to consider ecosystem effects on the stock
- ESP documents ecosystem context for the stock

Decision Criteria	Default OFL CV=60%	Default OFL CV=100%	Default OFL CV=150%
Ecosystem factors accounted	Assessment considered habitat and ecosystem effects on stock productivity, distribution, mortality and quantitatively included appropriate factors reducing uncertainty in short term predictions. Evidence outside the assessment suggests that ecosystem productivity and habitat quality are stable. Comparable species in the region have synchronous production characteristics and stable short-term predictions. Climate vulnerability analysis suggests low risk of change in productivity due to changing climate.	Assessment considered habitat/ecosystem factors but did not demonstrate either reduced or inflated short-term prediction uncertainty based on these factors. Evidence outside the assessment suggests that ecosystem productivity and habitat quality are variable, with mixed productivity and uncertainty signals among comparable species in the region. Climate vulnerability analysis suggests moderate risk of change in productivity from changing climate.	Assessment either demonstrated that including appropriate ecosystem/habitat factors increases short-term prediction uncertainty, or did not consider habitat and ecosystem factors. Evidence outside the assessment suggests that ecosystem productivity and habitat quality are variable and degrading. Comparable species in the region have high uncertainty in short term predictions. Climate vulnerability analysis suggests high risk of changing productivity from changing climate.