Indicators to Support Risk Policy Framework

Max Grezlik
Fishery Data Analyst with IBSS in support of NOAA Fisheries
maxwell.grezlik@noaa.gov

Outline

- Criteria for evaluating NEFSC products
- High-priority indicators
- Low-priority indicators
- Discussion Questions (time permitting)

Reviewing Resources

- Risk Policy Statement and Concept (2025)
  - Stock Status and Uncertainty
  - Climate and Ecosystem Considerations
  - Economic and Community Importance
- State of the Ecosystem Report (SOE)
- Ecosystem and Socioeconomic Profiles (ESPs)
- Research Track Assessment Term of Reference (ToR) 1

Climate and Ecosystem Considerations

Current indicators

- Climate Vulnerability
  - Hare et al. 2016
- Fish Condition
  - SOE

Potential improvements

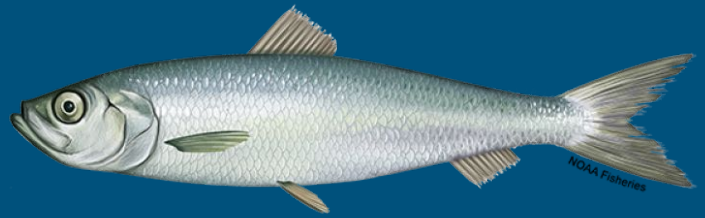
- Time dynamic indicators
- Mortality events
- Recruitment drivers

Evaluating NEFSC Products

Criteria for Indicators

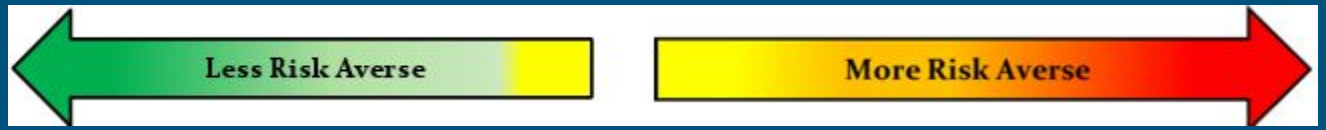
- Peer reviewed
- Collaboratively Developed
- Not used in the Stock Assessment
- Mechanistic connection to life history
- Time investment required to keep up to date

Atlantic Herring



Duration of optimal temperature from September to December

- Indicator of larval survival
- Gridded daily sea surface temperature NOAA OI SST V2 (Huang et al., 2021)
- Lethal threshold of 21°C (Moyano et al., 2020)
- # of days where none of the NEFSC herring strata above lethal threshold
- Assessment and support information available through the data portal



Increasing duration

No Trend

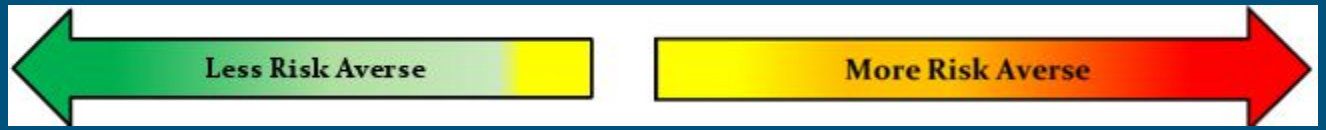
Decreasing duration

SNE Yellowtail Flounder

Mid Atlantic Bight cold pool persistence index

- Correlated with recruitment
- Generated from ROMS, GLORYS, PSY data
- Idex information available in the SOE catalog

Kittel, J., Cadrin, S.X., McManus, C., duPontavice, H., Hansell, A., Dolan, T., Legault, C., Adams, C., Kerr, L., Behan, J., Large, S., Tyrell, A., Alade, L. 2024. Yellowtail Flounder Environmental Effects. Yellowtail Flounder Research Track Working Paper.



Increasing persistence

No Trend

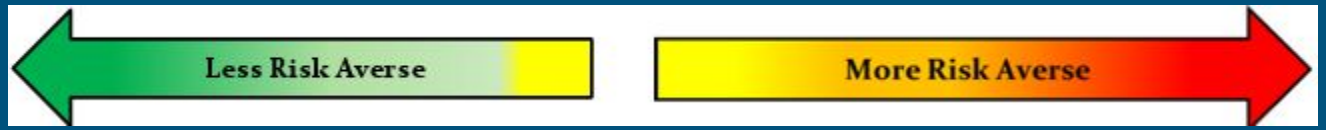
Decreasing persistence

GB Yellowtail Flounder

Bottom temperature

- Correlated with recruitment
- Generated from Bias-corrected ROMS-NWA (ROMScor) data
- Index information available in the SOE catalog

Kittel, J., Cadrin, S.X., McManus, C., duPontavice, H., Hansell, A., Dolan, T., Legault, C., Adams, C., Kerr, L., Behan, J., Large, S., Tyrell, A., Alade, L. 2024. Yellowtail Flounder Environmental Effects. Yellowtail Flounder Research Track Working Paper.



Decreasing bottom temp

No Trend

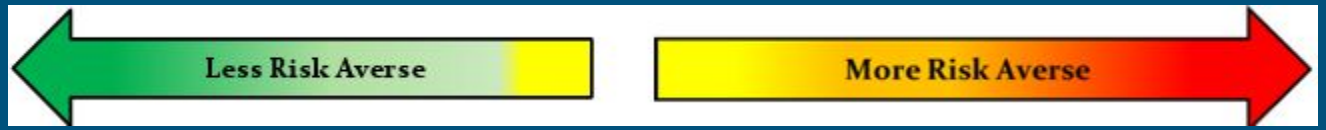
Increasing bottom temp

American Plaice

Annual bottom temperature anomaly

- Bottom temperature anomaly has significant positive influence on the center of gravity in both fall and spring
- Bottom temperature from Finite-Volume Community Ocean Model (FVCOM, Chen et al., 2006)

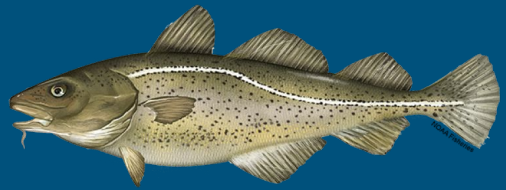
Behan, J., Kerr, L., 2022. Environmental Influences on American Plaice Stock Dynamics. https://repository.library.noaa.gov/view/noaa/66452



No Trend

Increasing bottom temp

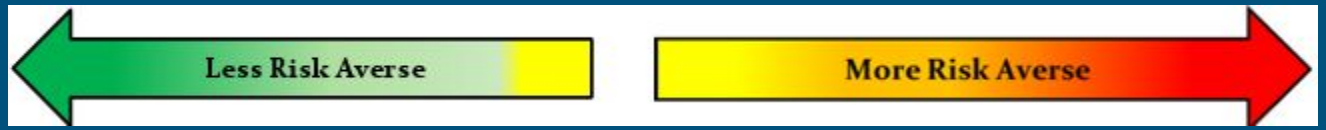
Atlantic cod



Cumulative Heatwave

- Term of Reference 1 WG recommended index for Distribution, Recruitment, and Growth
- Considers both the intensity (water temp.) and duration (cumulative degree days)
- Generated from NOAA high-res OISST (daily, 25-km, 1982-2019) data

Behan, J., Kerr, L., 2023. Environmental Influences on Atlantic Cod (*Gadus morhua*) Stock Dynamics. https://repository.library.noaa.gov/view/noaa/70578/noaa_70578_DS1.pdf

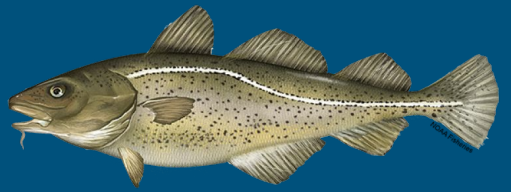


Decreasing heatwave

No Trend

Increasing heatwave

Atlantic cod



Calanus abundance anomalies

- Term of Reference 1 WG recommended index for Distribution, Recruitment, and Growth
- Generated from NERACOOS-MBON Wilkinson Basin Time Series (WBTS) station between 2005-2023 data

Behan, J., Kerr, L., 2023. Environmental Influences on Atlantic Cod (*Gadus morhua*) Stock Dynamics. https://repository.library.noaa.gov/view/noaa/70578/noaa_70578_DS1.pdf

Increasing Calanus abundance

No Trend

Decreasing Calanus abundance

Commercial Fishery Characterization

Is revenue concentrated in ports with low catch diversity?

Effective Shannon index

- Could be modified from the SOE report
- Data from dealer database, vessel trip reports, clam logbooks, permit database, WPU series producer price index

Increasing Shannon index

No Trend

Decreasing Shannon index

Commercial Fishery Characterization

Is the market value decreasing (i.e. price per pound)?

Price component of the Bennett index

- From the SOE report
- Data from the Commercial Fisheries Database System (CFDBS)

Decreasing Bennett index

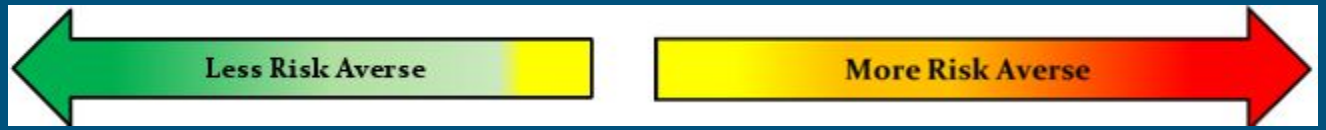
No Trend

Increasing Bennett index

Commercial Fishery Characterization

Net Revenue

- SOE indicator
- Commercial Fisheries Database System



Decreasing Net Revenue

No Trend

Increasing Net Revenue

Recreational Fishery Characterization

Is recreational fleet diversity from the SOE report declining over last five years?

Recreational Fleet Diversity

- SOE indicator
- Data from MRIP

Increasing Diversity

No Trend

Decreasing Diversity

Low Priority Indicators - Climate and Ecosystem Considerations

Failed to meet one or more of our criteria but still peer reviewed and statistically sound

- Collaboratively Developed
- Mechanistic connection to life history
- Not used in the Stock Assessment
- Time investment required to keep up to date

Low Priority Indicators - Climate and Ecosystem Considerations

Species/Stock	Indicator	Life History Impacted	Low Priority Explanation
Atlantic herring	Estimated consumption of Atlantic herring	All	Output by VAST models created by researchers outside of EDAB
	Haddock predation index	Recruitment	Used in stock assessment as justification for constant predation mortality rate
	Large copepods in spring	growth of herring postlarvae and juveniles	Output by VAST model of a researcher who is no longer with EDAB.
	small copepods in fall	survival of herring larvae over winter	
	small copepods in high herring larval density area	small copepods from Sept-Feb	

Low Priority Indicators - Climate and Ecosystem Considerations

Species/Stock	Indicator	Life History Impacted	Low Priority Explanation
Spiny dogfish	COG	all	Output from VAST model which may not be kept up to date
SNE Yellowtail flounder	Gulf Stream Index	Recruitment	Less mechanistic connection than the cold pool persistence index
GB Yellowtail flounder	Atlantic Multidecadal Oscillation	Recruitment	Less mechanistic connection than bottom temperature
CCGOM Yellowtail flounder	Atlantic Multidecadal Oscillation	Recruitment	Less mechanistic connection than bottom temperature

Low Priority Indicators - Climate and Ecosystem Considerations

Species/Stock	Indicator	Life History Impacted	Low Priority Explanation
WGOM Atlantic cod	Bottom temperature anomaly	Recruitment	Redundant with cumulative heatwave as an indicator for all stocks
	SST anomaly		
	Heatwave index		
EGOM Atlantic cod	SST anomaly		
	Calanus abundance anomaly		Redundant with same indicator as an indicator for all stocks

Low Priority Indicators - Climate and Ecosystem Considerations

Species/Stock	Indicator	Life History Impacted	Low Priority Explanation
EGOM Atlantic cod	Bottom temperature anomaly	Growth and Maturity	Used as justification for annual age-length key or time-varying growth model, and time-varying maturity-at-age for WGOM, GB, and EGOM stocks
GB Atlantic cod	Calanus abundance anomaly		
	Heatwave index		
	SST anomaly		
WGOM Atlantic cod	Heatwave index		
	Gulf Stream Index		
	Pseudocalanus Abundance Anomaly		

Links from this presentation

Data Portal: https://apps-nefsc.fisheries.noaa.gov/saw/sasi.php

SOE Catalog: https://noaa-edab.github.io/catalog/

Maxwell.Grezlik@noaa.gov

Discussion Questions

- What level of specificity is appropriate for environmental effects (in situations when more granular indicators are available)
  - Metric(s) for all species
  - Species-specific indicators
  - Stock-specific indicators
  - E.g. SST is important for herring larval survival but may be less important for other species
- What indicator(s) to use in absence of species-specific indicators?
- What types of ecosystem effects should be considered in the scoring? (Habitat, growth, mortality, recruitment…)