NEFMC SSC Workshop on Dynamic Reference Points

June 1-2, 2026, Hampton Inn, Boston Seaport District
670 Summer Street; Boston, MA
Joseph T. O'Callahan Ballroom

Laura Taylor Singer - SAMBAS Consulting

Hannah MacDonald - Facilitator

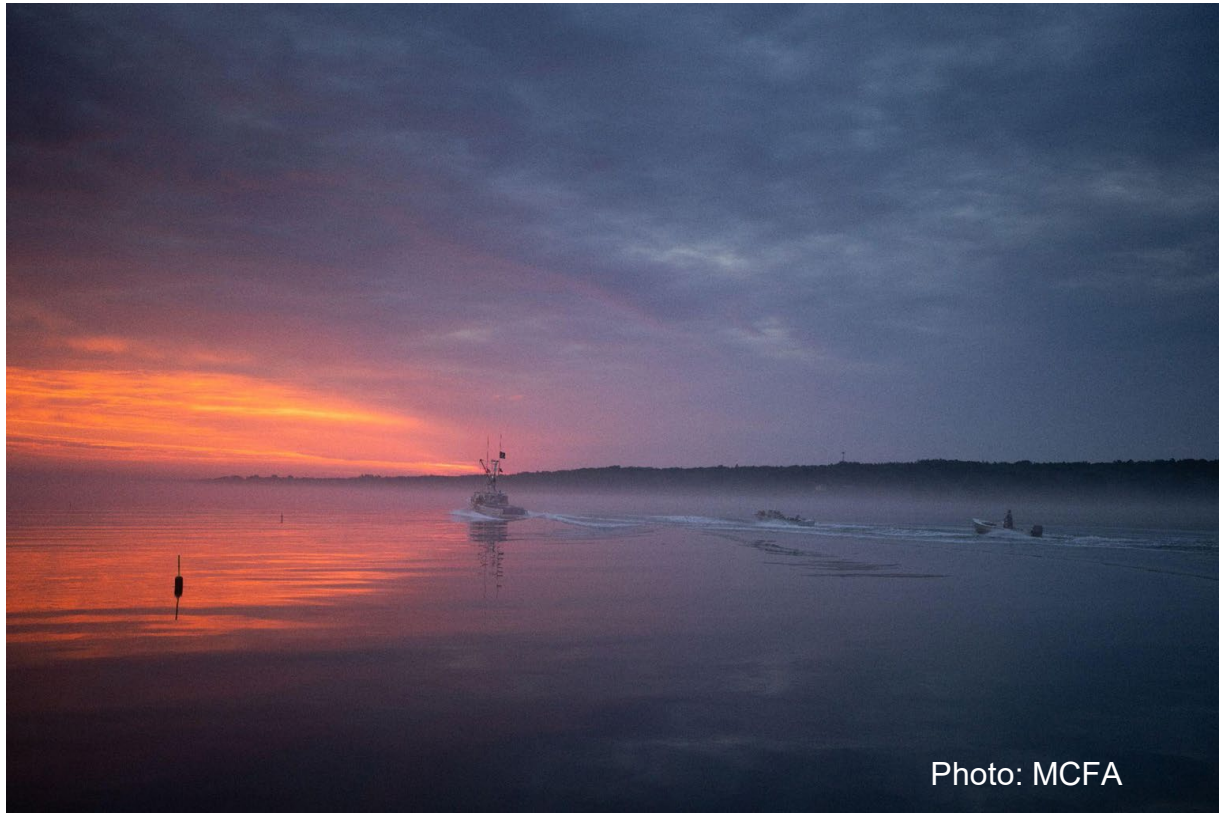
Willy Goldsmith - Pelagic Strategies

Day 1 Slides

NEFMC SSC Workshop on Dynamic Reference Points

Welcome and Opening Remarks

- Conor McManus, SSC Chair
- Dan Salerno, Council Chair
- Cate O'Keefe, Council Executive Director



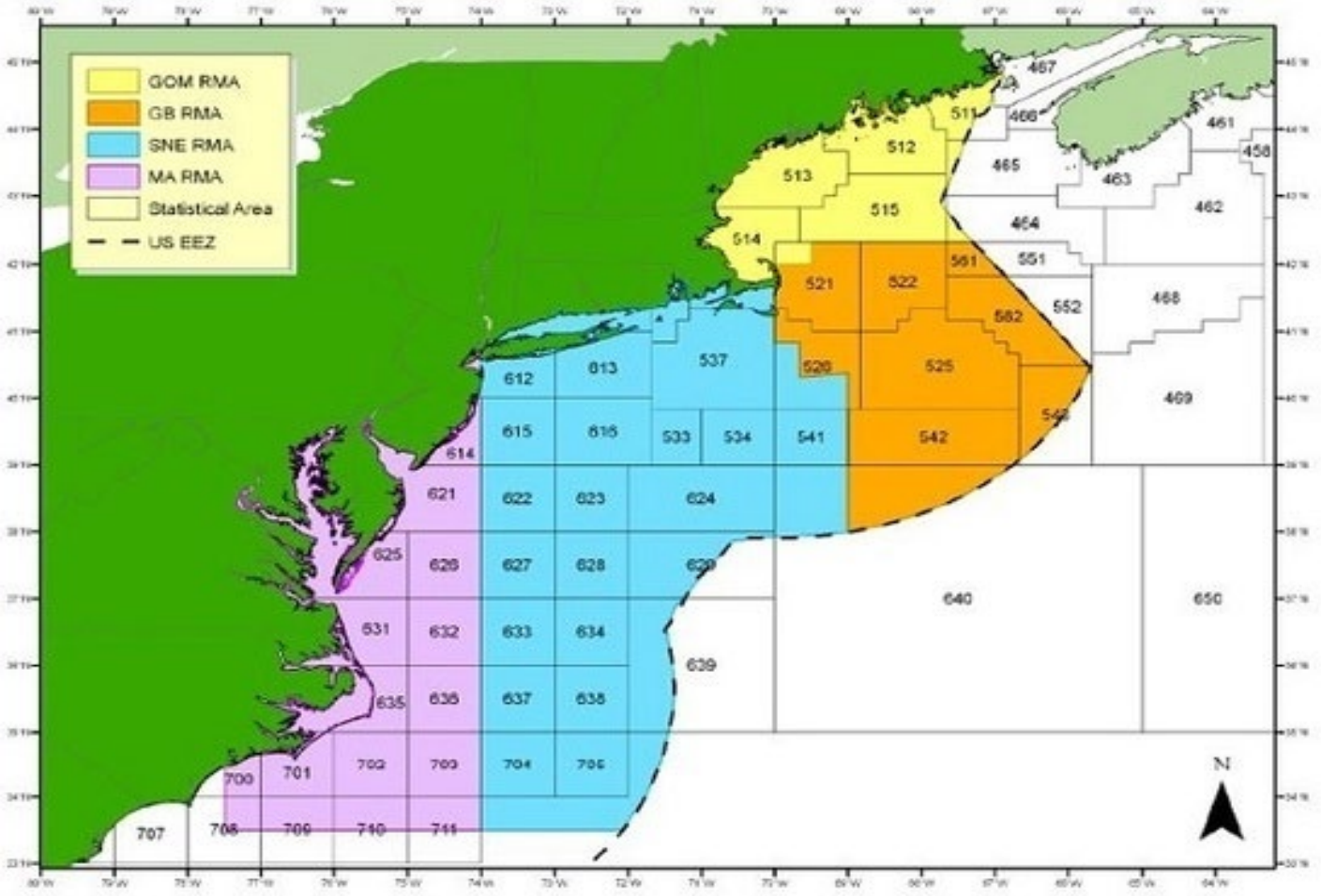
Management Implications of Dynamic Reference Points

Daniel Salerno, NEFMC Chair
Cate O'Keefe, NEFMC Executive Director

SSC Dynamic Reference Points Workshop

June 1-2, 2026

New England Fishery Management Council



- Ecosystem Units:
  - Gulf of Maine
  - Georges Bank
  - Mid-Atlantic Bight
- Biological Regions:
  - Eastern/Western Gulf of Maine
  - Great South Channel
  - Southern New England
  - New York Bight
- Management Boundaries:
  - Canada
  - Mid-Atlantic Council

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Northeast Multispecies (Groundfish)

22 Stocks – 3 Areas

Sea Scallop

1 Stock – 3 Areas

Monkfish

2 Stocks – 2 Areas

Atlantic Herring

1 Stock – 4 Areas

Habitat

All Stocks/Areas

Skates

7 Stocks – 3 Areas

Small-Mesh Multispecies (Whiting)

4 Stocks – 3 Areas

Red Crab

1 Stock – 1 Area

Spiny Dogfish

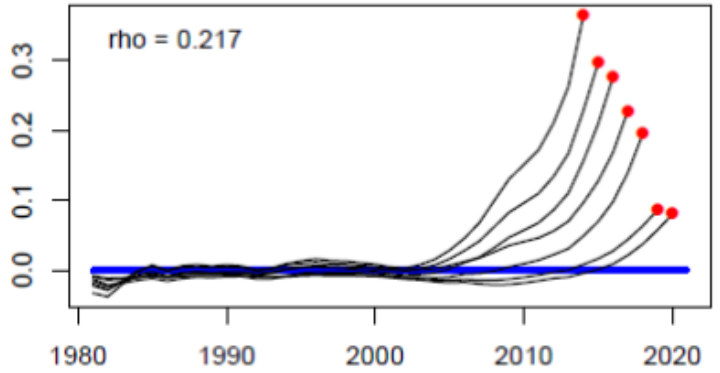
1 Stock – 1 Area

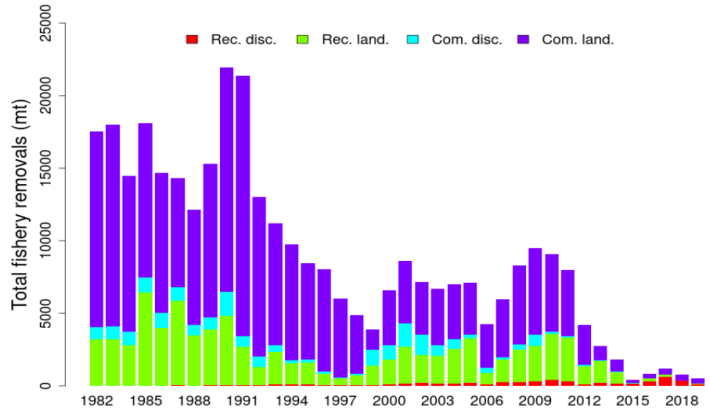
Atlantic Salmon

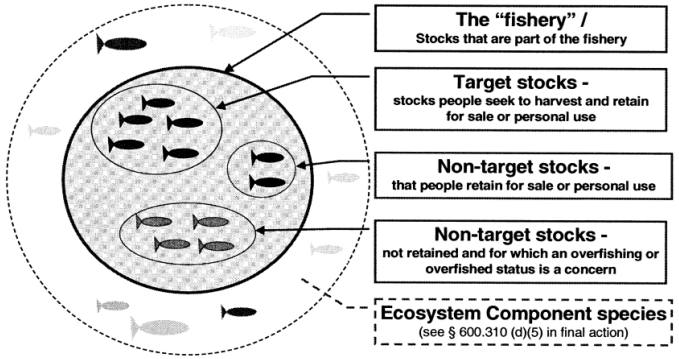
Aquaculture

Management Challenges: Stationary

- **Unknown Status**
  - Rejected analytical assessments
  - Managing around unknown targets and thresholds
  - Inconsistency in rationale for catch advice
- **Unrealistic Rebuilding Targets**
  - Continually extending rebuilding plans without progress
  - Substantial reductions in fishing effort
  - Inconsistency between reference points and projections
- **Constrain Ability to Target Healthy Stocks**
  - Low catch advice resulting in choke stocks
  - Inability to consider “Ecosystem Component” stocks
  - Socioeconomic impacts







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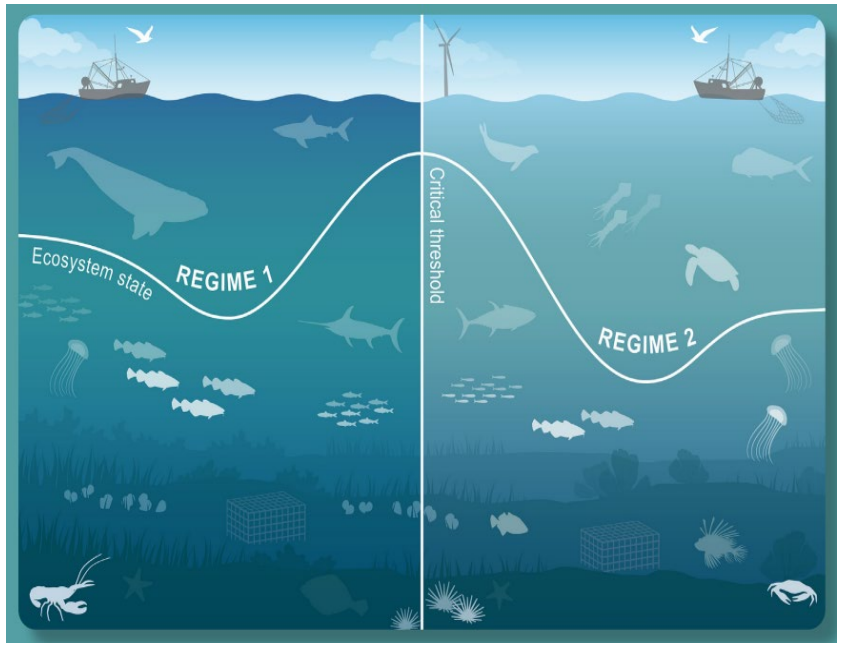
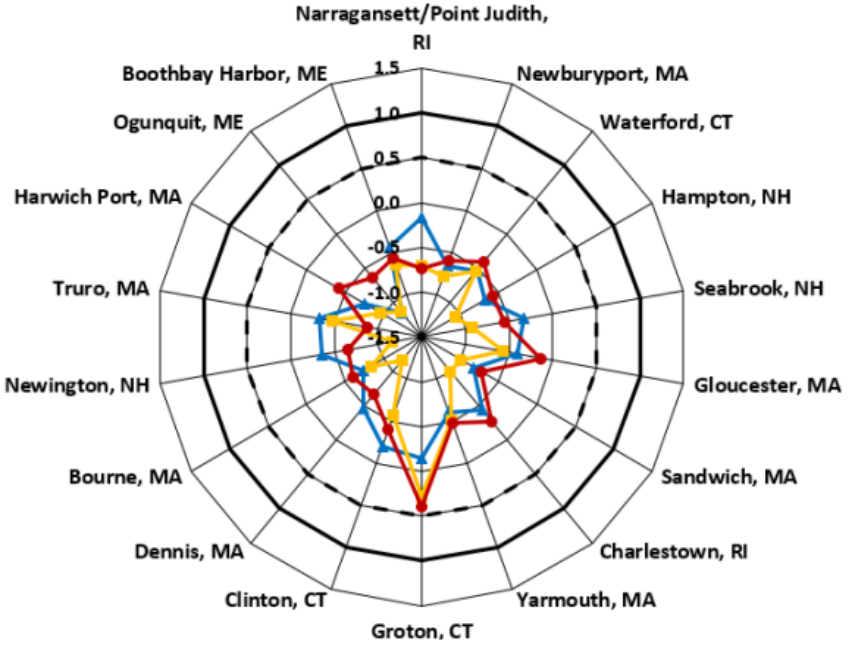
Management Challenges: Dynamic

- **Lack of Formal Guidance**
  - Need to revise Risk Policy and Harvest Control Rules
  - Need to develop consistent approaches and rationale
  - Need to operationalize scientific products
- **Reluctance to New Approaches**
  - Difficult to onboard new ideas in management arena
  - “Rebuilt” doesn’t necessarily result in increased catch
  - Climate governance challenges
- **Implications for Implementation**
  - Changes in individual or fleet allocations
  - Port and community reliance
  - Socioeconomic impacts





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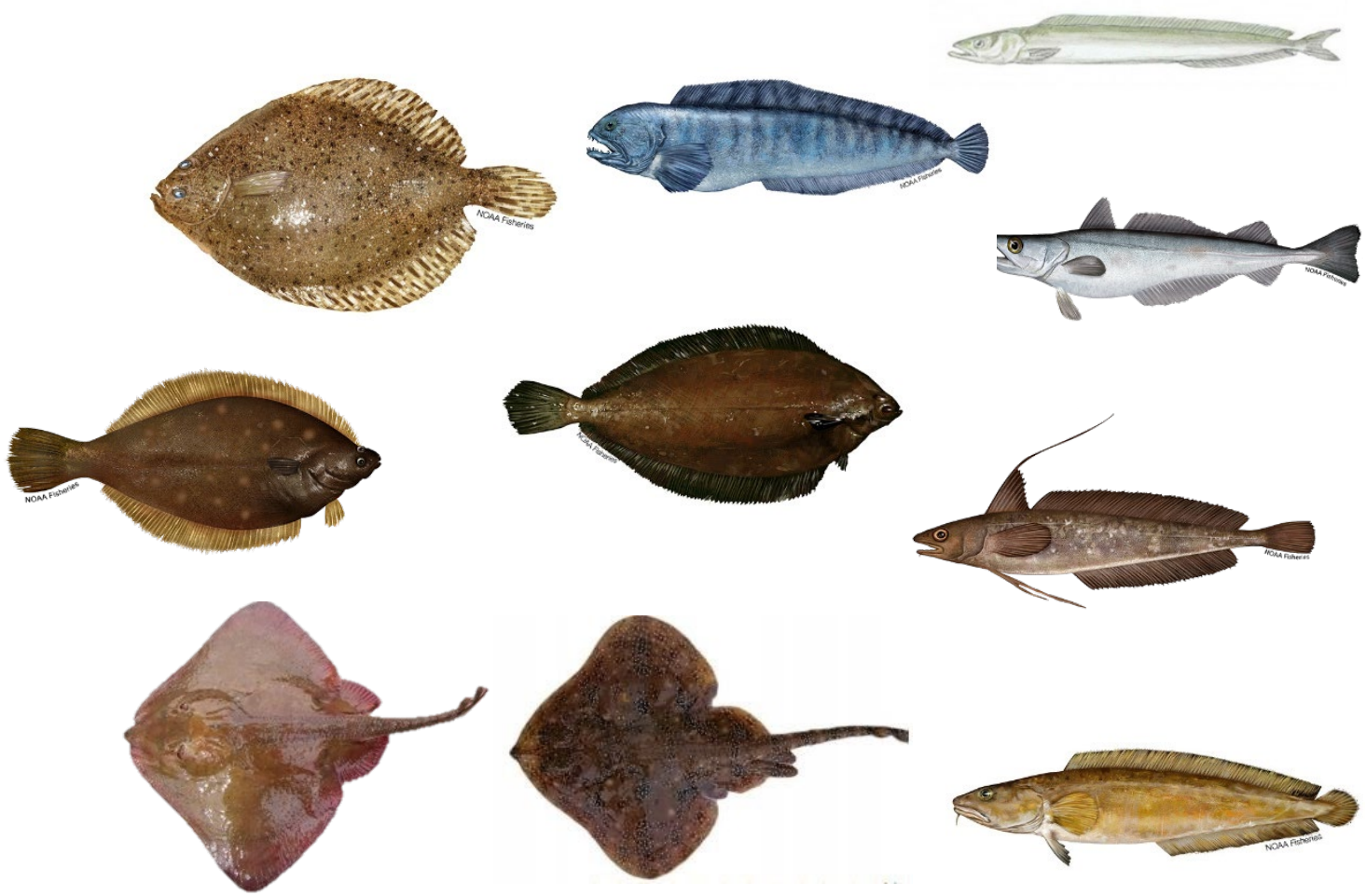
Moving Forward – Should we manage everything?

- Understanding our constraints
  - Growing consensus that fishing is likely not main driver for status of some stocks
  - Perpetuating failure to meet conservation and management objectives
  - Lack of ability for adaptation in fishing industry



Ecosystem Components

Goal:

- Establish a robust methodology and framework to evaluate candidate species/stocks for their potential as ecosystem components (EC)

Deliverable:

- A guidance document for NEFMC technical staff to apply to Council-identified EC candidates

Why are we doing this work?

- *Climate-driven changes in distribution, abundance, and productivity of Council-managed stocks*
- *Limited availability and rigid management of those stocks constrains fishery success*
- *Need new processes that allow for adaptation of management to ecosystem shifts and provide flexibility to the fishery, while maintaining data*

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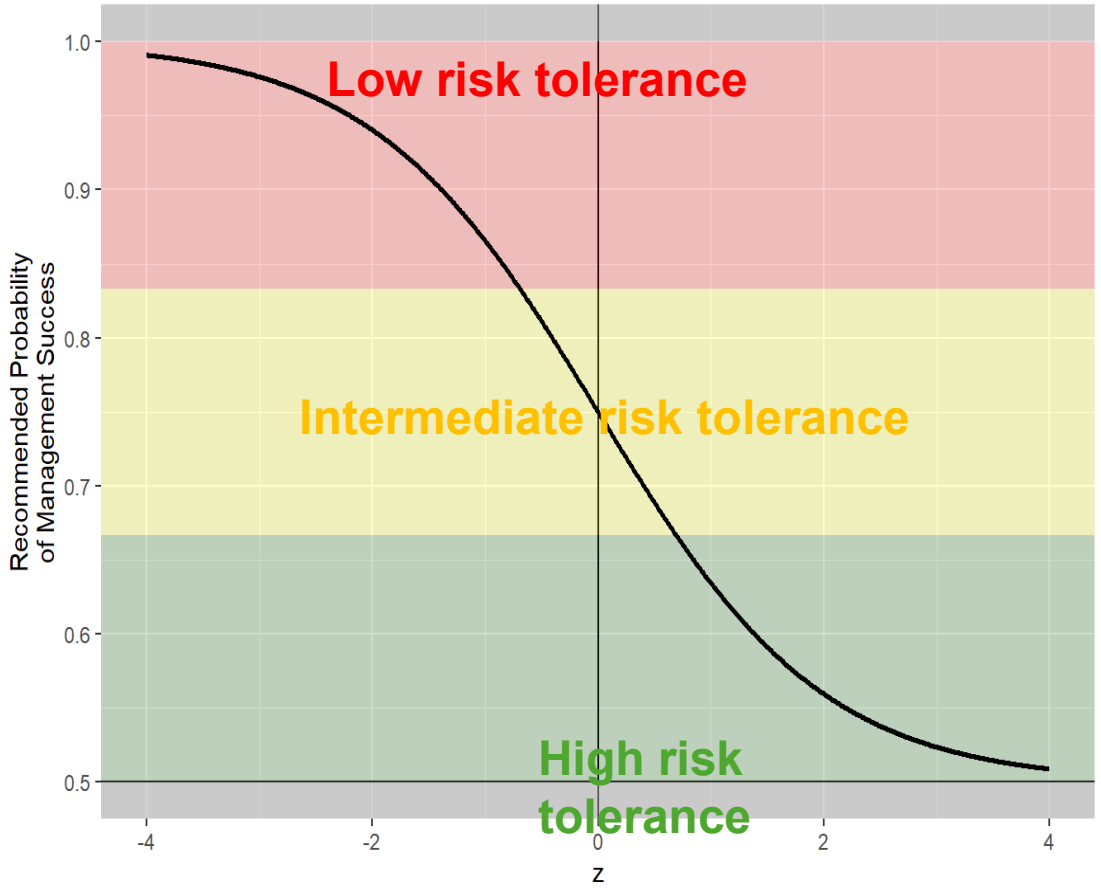
Moving Forward – What new approaches do we need?

- Developing guidance
  - Revising Council Risk Policy to include consideration of biological, environmental, and socioeconomic factors
  - Revising ABC Control Rules to integrate Risk Policy and specifically consider productivity regimes and changing climate
  - Evaluating tradeoffs between “risk” and “value” based on Council objectives and regional capacity



Risk Policy

Goal:

- Implement a process by which the Council accounts for the fact that all fishery management is based on uncertain information, fisheries and the surveys used to monitor marine resources are taking place in a changing environment, and that the decisions of the Council have social and economic impacts on fishing communities

Deliverable:

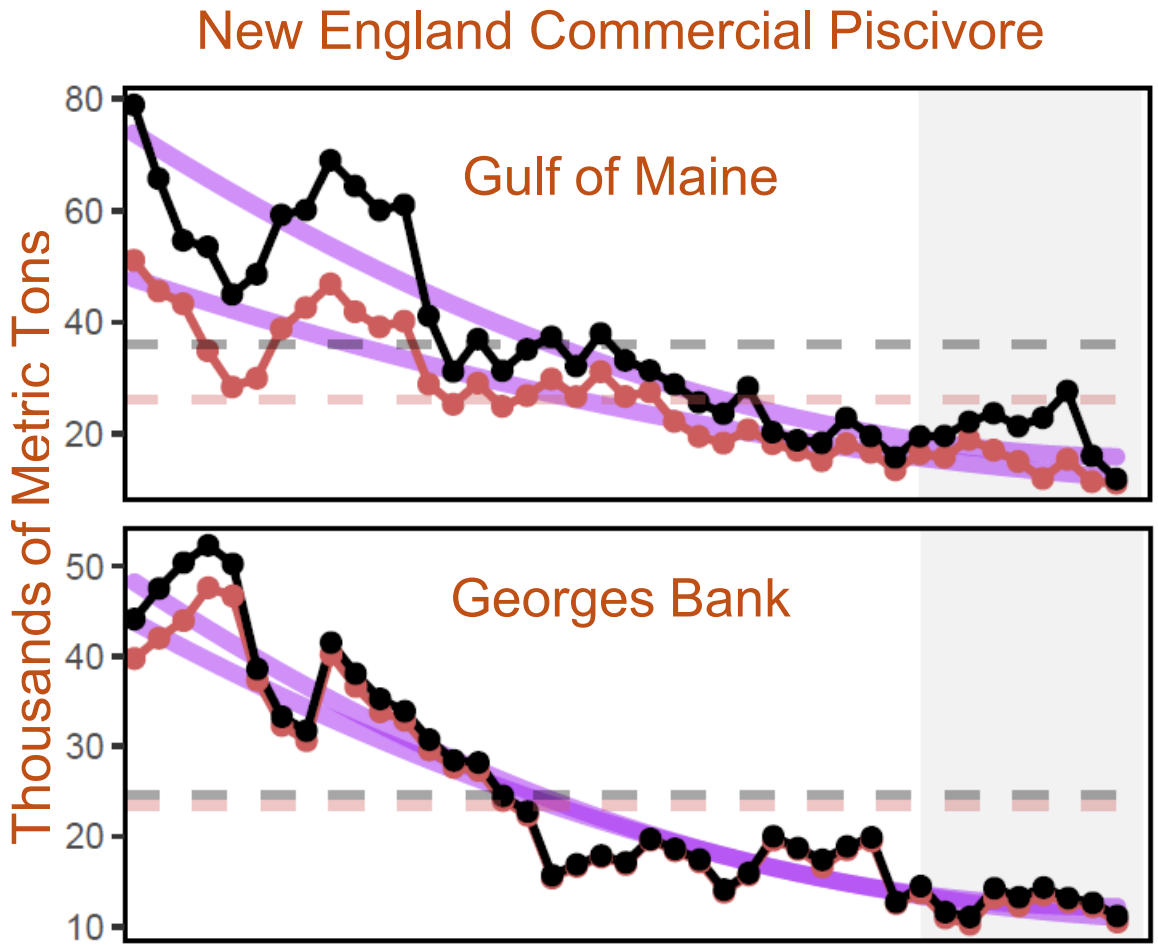
- Guidance on taking account of risk and uncertainty in Council decisions and clear communication of preferences regarding risk and uncertainty to a broad audience

Why are we doing this work?

- *Better integrate changing environmental conditions into the Council's assessment of risk*
- *Develop a clear path to incorporate social and economic considerations*
- *Focus on "stability" in the fishery-science-management enterprise, recognizing that the environment is inherently dynamic and abrupt shifts in catch/management advice*

Moving Forward – How do we implement change?

- Identifying implementation approaches
  - This workshop!
  - NRCC input to assessment priorities and TORs
  - Revisions to Regional Operating Agreements
  - Council understanding that change is challenge but the requirement is real



2024 New England State of the Ecosystem Report (NEFSC, 2025)

Thank You!

Workshop Goals

1. Establish a **shared understanding** of current approaches and recommendations from regional and national workshops on defining dynamic biological reference points, including the challenges of implementation and human dimensions.
2. Recommend ways to evaluate the effectiveness of existing reference points for NEFMC stocks to **determine when it may be more appropriate** to use dynamic reference points.
3. **Evaluate alternative approaches to defining reference points** that can account for non-stationarity, appropriateness of methods for NEFMC stocks (given data), and potential challenges in application.
4. **Identify tradeoffs, pathways and potential stocks** for implementing dynamic reference points within the current scientific process to inform management.

Workshop Outcomes

1. A preliminary **suite of indicators and guidelines** for evaluating whether to use dynamic BRPs and potentially candidate stocks.
2. Consensus on recommendations for developing, reviewing, and maintaining DRPs, building on existing CINAR, SSC8, and NS1 guidance (e.g., **evaluation standards, evidence thresholds**).
3. A stepwise **implementation roadmap** that aligns scientific advances with management, legal, and capacity constraints and identifies potential risks.
4. A prioritized **list of research recommendations** that could advance our understanding of DRPs and future development of best practices for implementation.

Agenda Overview

Monday, June 1
Morning: Setting the Stage – Where we are in 2026
Afternoon: Evaluating Reference Points and Considering Potential Guidelines

Tuesday, June 2
Morning: Management Applications, Challenges, and Opportunities of Implementation
Afternoon: Toward Operational Guidance and Next Steps

Photo: MCFA

Day 1 Agenda at a Glance

Monday, June 1		
Time	**Title**	**Presenter**
8:30 - 9:00	**Arrival and Coffee**	
9:00 – 9:15	**Welcome and Opening Remarks**	Conor McManus Cate O'Keefe
9:15 – 9:30	**Workshop Overview**	Hannah MacDonald Laura Taylor Singer Willy Goldsmith
MORNING SESSION: Setting the Stage – Where we are in 2026		
9:30 – 9:55	**Presentation: Current Approaches and Challenges to Implementing Dynamic Reference Points**	Lisa Kerr Jerelle Jesse
9:55 – 10:15	**Facilitated Discussion**	All
10:15 – 10:30	**Break**	
10:30 – 11:00	**Presentation: Evolving Approaches to Revise Biological Reference Points in New England**	Conor McManus
11:00 – 11:45	**Panel Discussion**	Lisa Kerr Jon Deroba Alex Hansell John Wiedenmann
11:45 – 12:15	**Facilitated Discussion: Opportunities and Unintended Consequences**	All
12:15 – 1:15	**Lunch**	

Day 1 Agenda at a Glance

AFTERNOON SESSION: Evaluating Reference Points and Considering Potential Guidelines		
1:15 – 1:30	Presentation: Considerations Regarding When to Change from Static to Dynamic Reference Points	Jon Deroba
1:30 – 2:15	Breakout group discussions	
2:15 – 2:30	Break and return to plenary	
2:30 – 3:00	Plenary: Report out and discussion	
3:00 – 3:15	Presentation: How to Change Dynamic Reference Points and What are the Practical Constraints	Jamie Cournane
3:15 – 4:00	Breakout group discussions	
4:00 – 4:45	Plenary: Report out and discussion	
4:45 – 5:00	Wrap Up and Preview of Day 2	Hannah MacDonald Laura Singer
5:00	Adjourn	

What are Biological Reference Points?

Biological Reference Points (BRPs) are the benchmarks used to:

- Determine stock status
- Inform management action (e.g., ABCs)
- Define rebuilding targets (SSB_{MSY} or proxies)

BRPs can be derived either analytically (model-based) or empirically

Traditional ("static") BRPs ***assume stationarity in stock productivity***

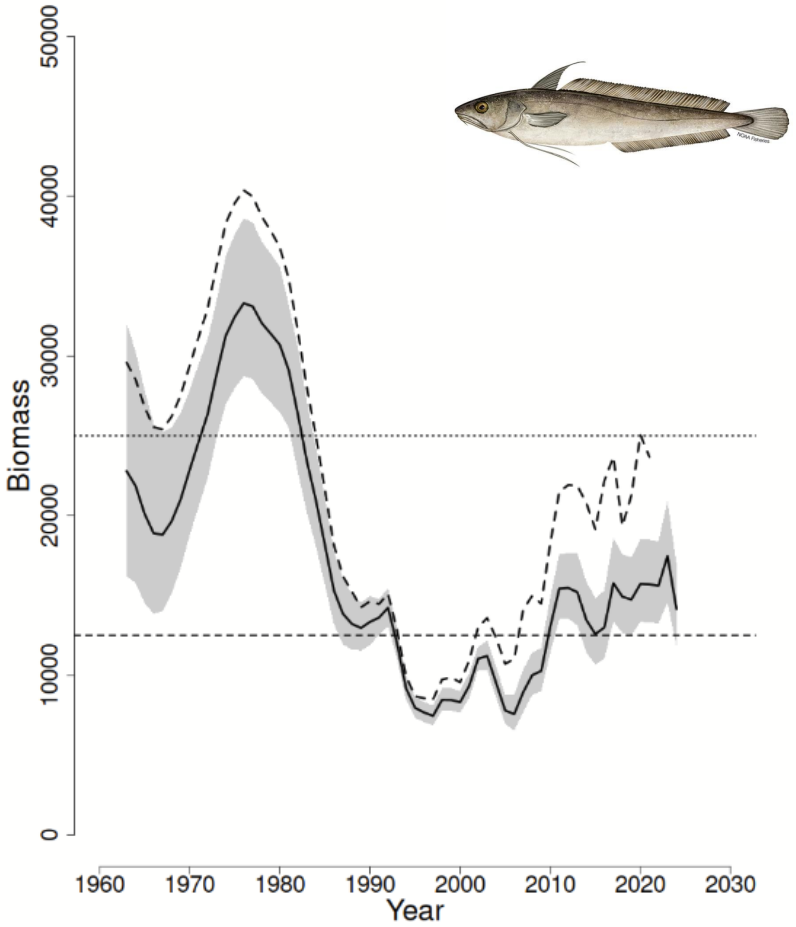


Figure 1: Trends in spawning stock biomass (SSB) of White Hake between 1963 and 2024 from the current (solid line) and previous (dashed line) assessment and the corresponding $SSB_{Threshold}$ ($\frac{1}{2}$ SSB_{MSY} *proxy*; horizontal dashed line) as well as SSB_{Target} (SSB_{MSY} *proxy*; horizontal dotted line) based on the 2025 assessment. The approximate 90% lognormal confidence intervals are shown.

What are *Dynamic* Reference Points?

Maximum Sustainable Yield: The largest long-term average catch/yield that can be taken "under prevailing ecological, environmental conditions and fishery technological characteristics (e.g., gear selectivity), and the distribution of catch among fleets."

But what if those conditions change?

Dynamic Reference Points (DRPs) are time-varying BRPs that adjust for changes in stock productivity

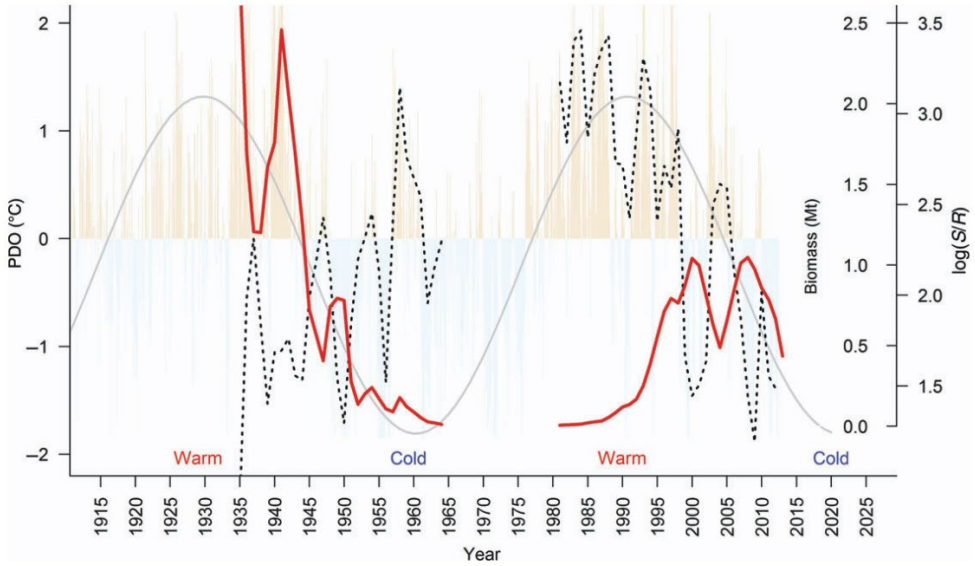


Figure 4. The PDO index indicating positive (pink) and negative (light blue) monthly values; the 60-year periodic component of the PDO projected to 2020 (grey line; Zwolinski and Demer, 2012); the assessment estimated sardine biomass (red); and the predicted logarithmic stock – recruitment ratio (dashed line).

Zwolinski, J. P., et al. (2014). *Environmental and parental control of Pacific sardine recruitment in the California Current ecosystem*. *ICES Journal of Marine Science*, 71(8), 2198–2207. https://doi.org/10.1093/icesjms/fst173

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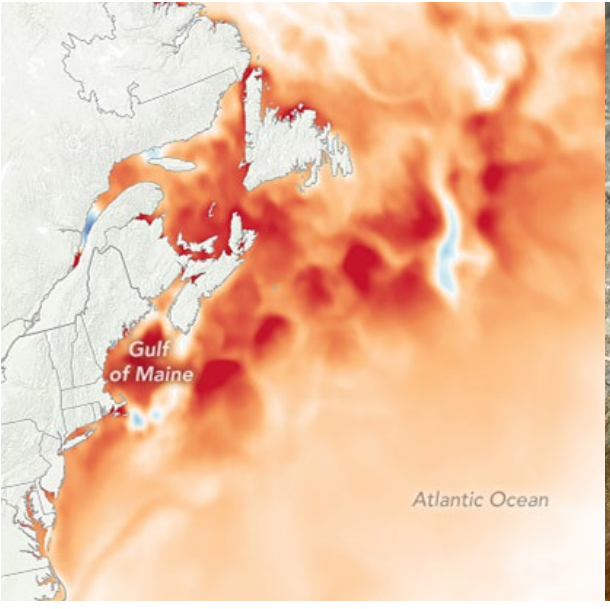
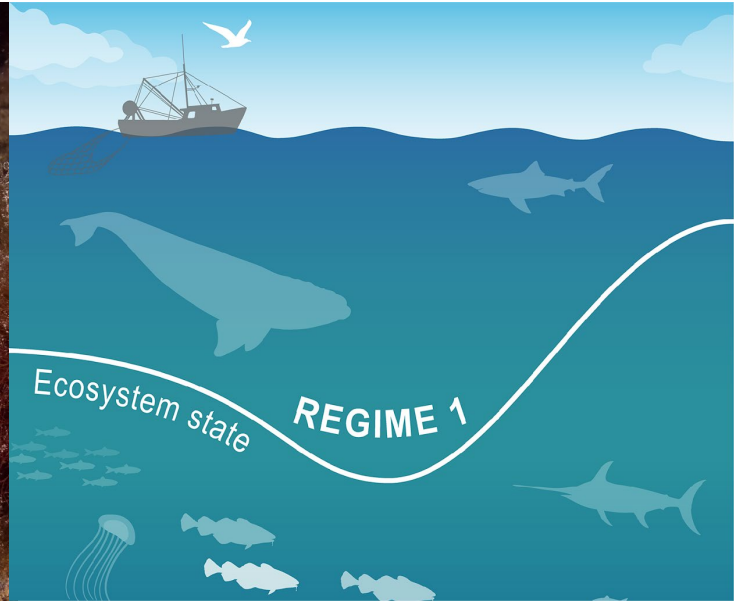
Current Approaches and Challenges to Defining Reference Points





Lisa A. Kerr, Jerelle Jesse

NEFMC SSC Workshop on Dynamic Reference Points

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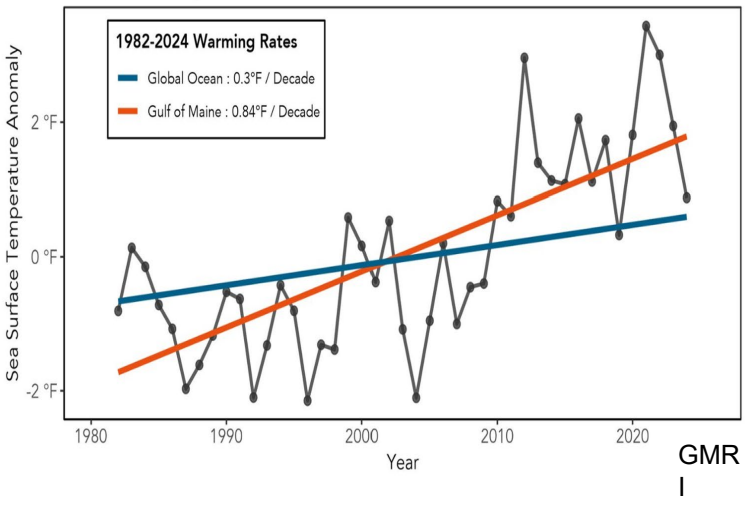
Outline

- Context setting
- How we currently define reference points for NEFMC stocks
- Outcomes of Regional Workshops
  - CINAR Workshop: Defining Biological Reference Points in a Dynamic Northeast Ecosystem – Jerelle Jesse
  - SCS8 Workshop: Applying Acceptable Biological Catch Control Rules in a Changing Environment – Lisa Kerr
- What has changed? What have we learned?

A Changing Northeast U.S. Shelf Ecosystem

Trends

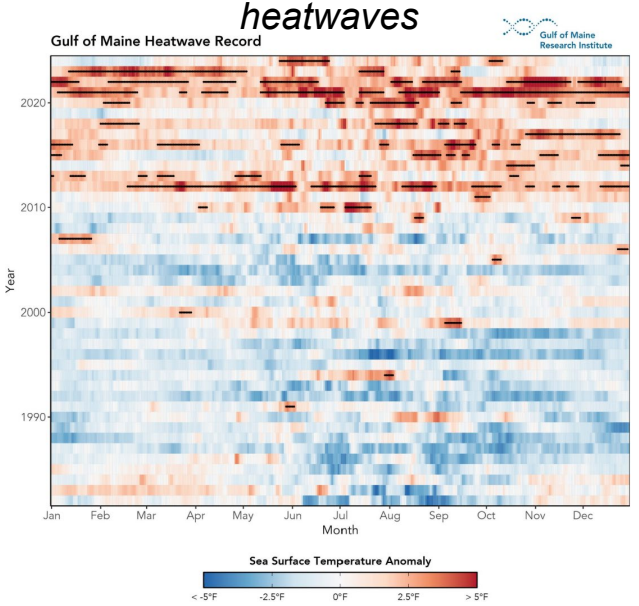
Rapidly warming waters



GMRI

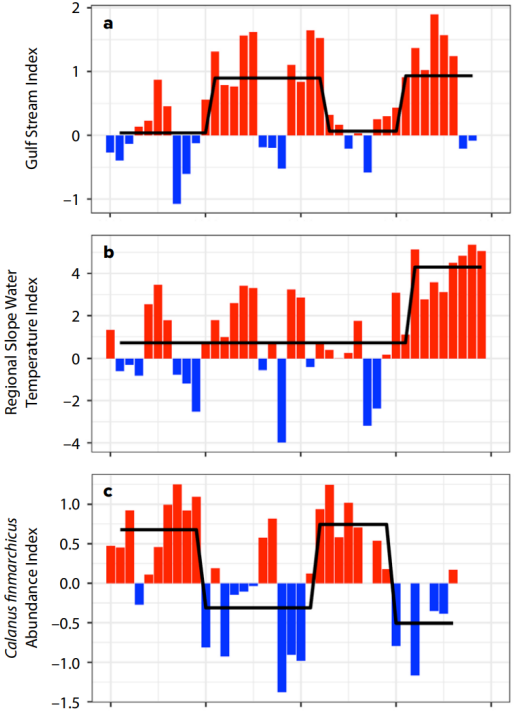
Spikes

Periodic to persistent heatwaves



Shifts

Climate-driven regime shift

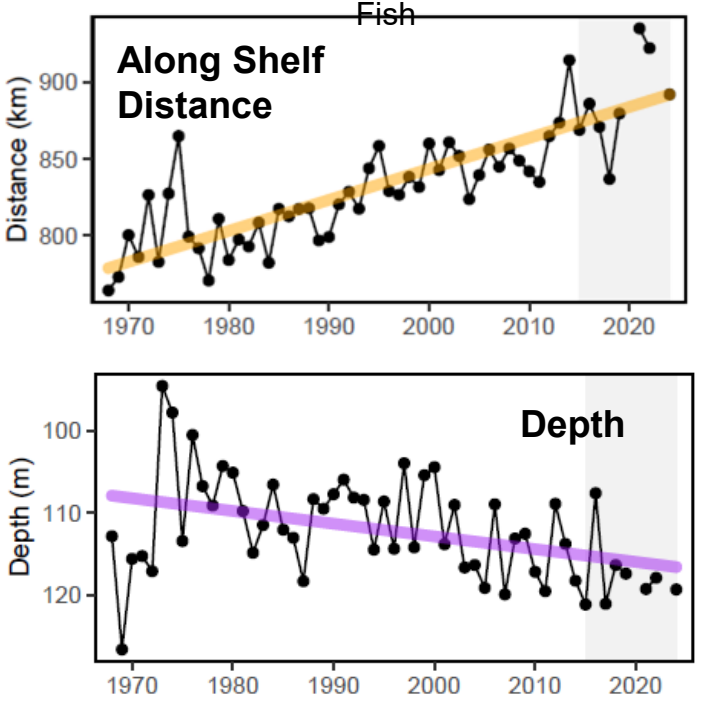


Meyer-Gutbrod et al 2021

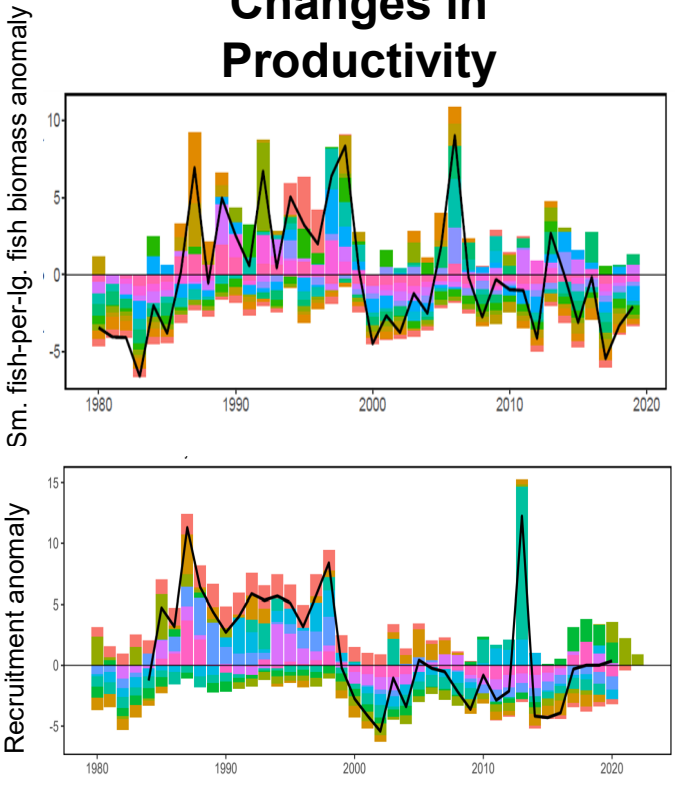
A Changing Northeast U.S. Shelf Ecosystem

Shifting Distributions

Distribution Metrics for Northeast U.S. Fish

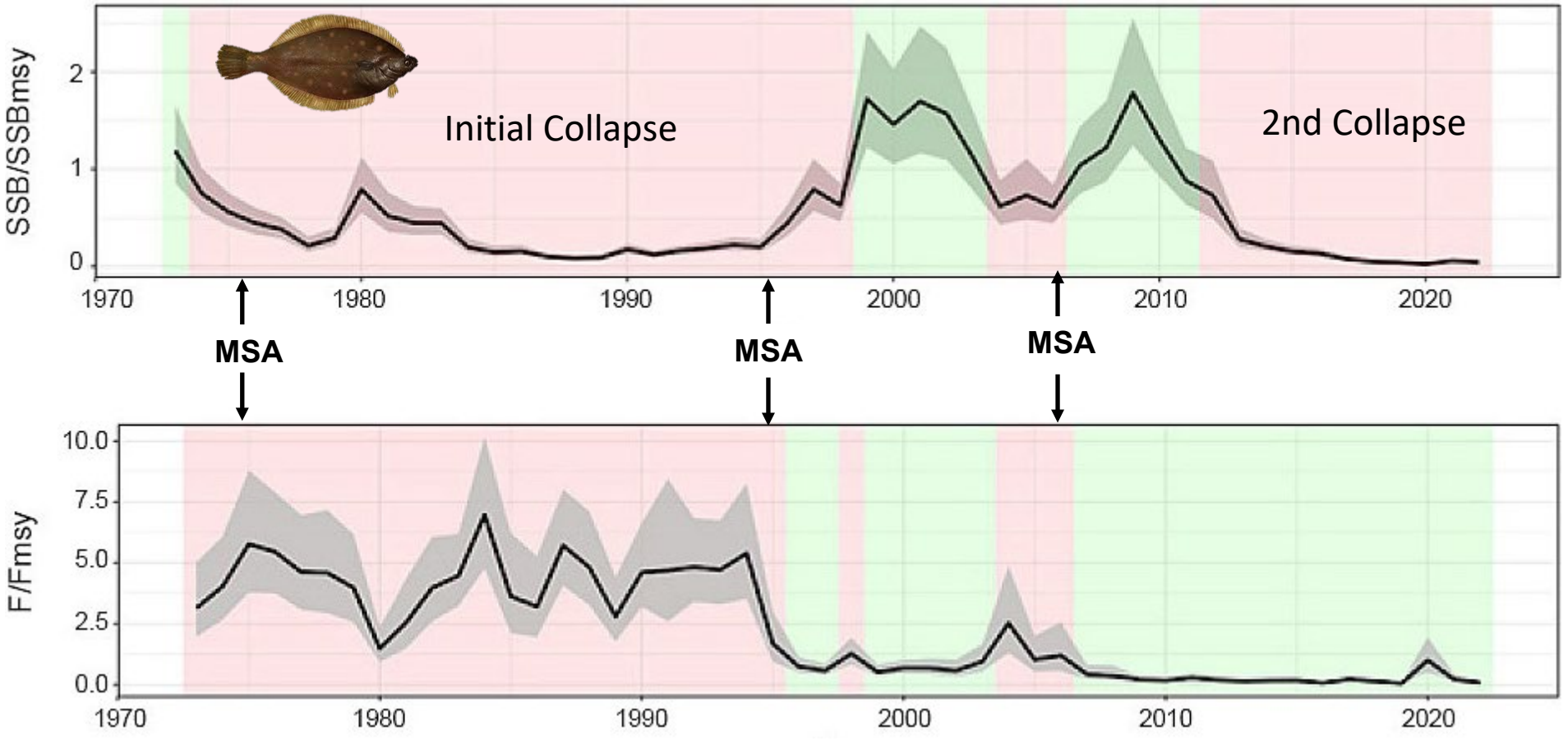


Changes in Productivity



NOAA 2025

Challenges to Fisheries Management: Unrealized Stock Rebuilding

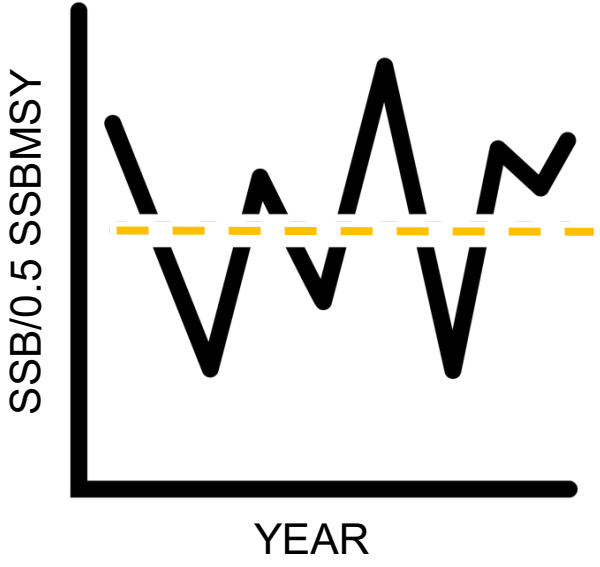


Hansell et al. 2025

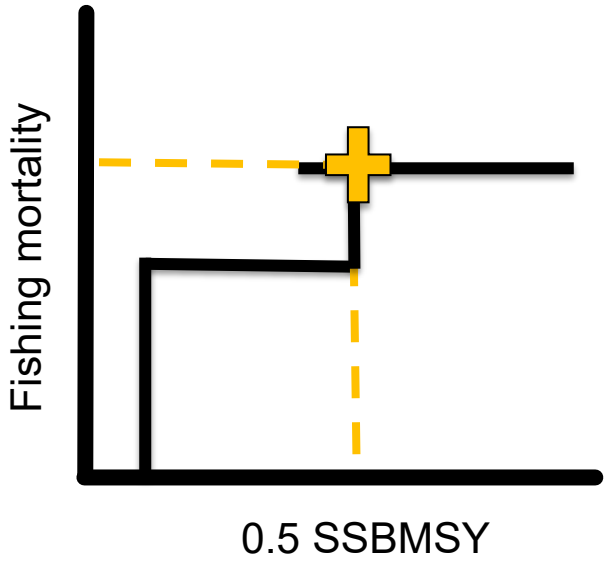
Defining Reference Points

Reference points are the benchmarks by which we determine **stock status,** they serve as triggers for management actions in the context of **ABC control rules**, and define targets for **rebuilding.**

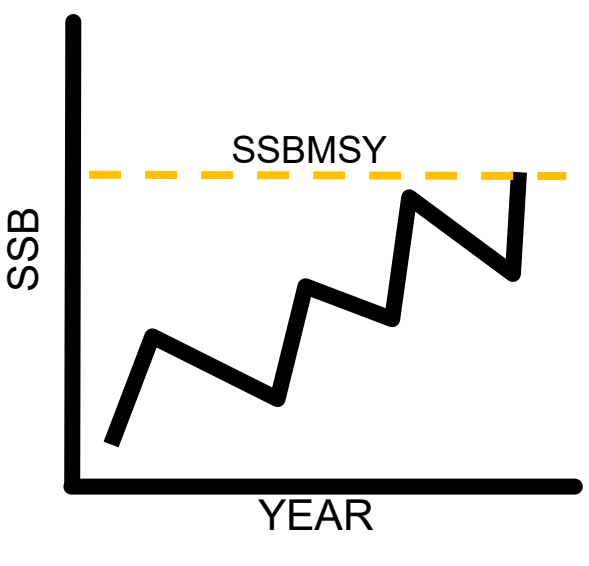
Stock Status



ABC Control Rules

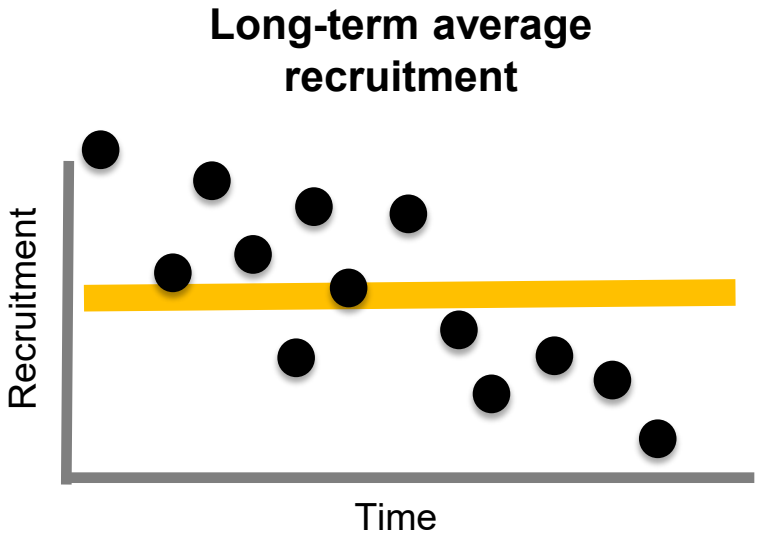


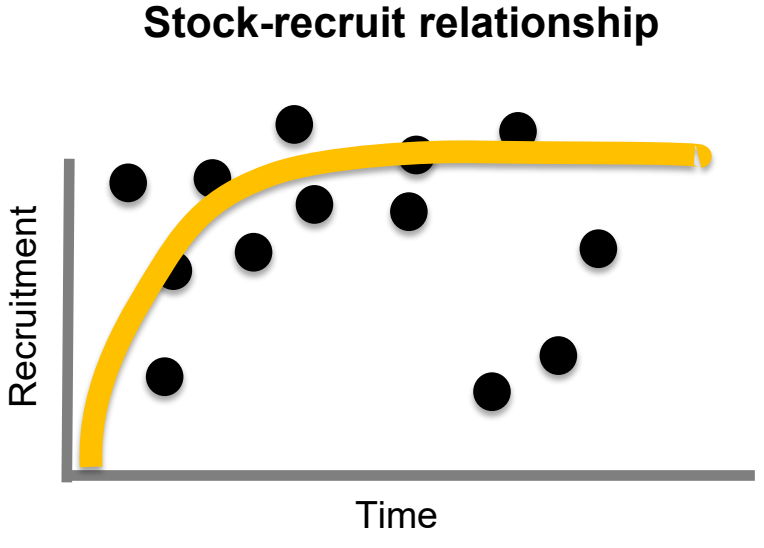
Rebuilding



Defining Reference Points

Stationarity Assumption: Reference points are often linked to historical productivity. Harvest control rules operate independent of the prevailing environmental state.

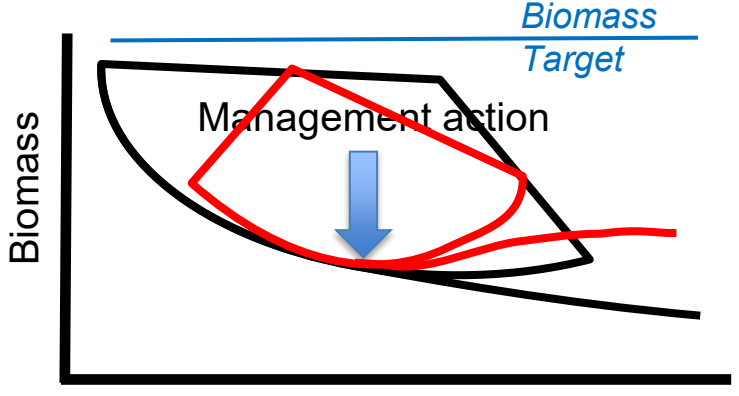




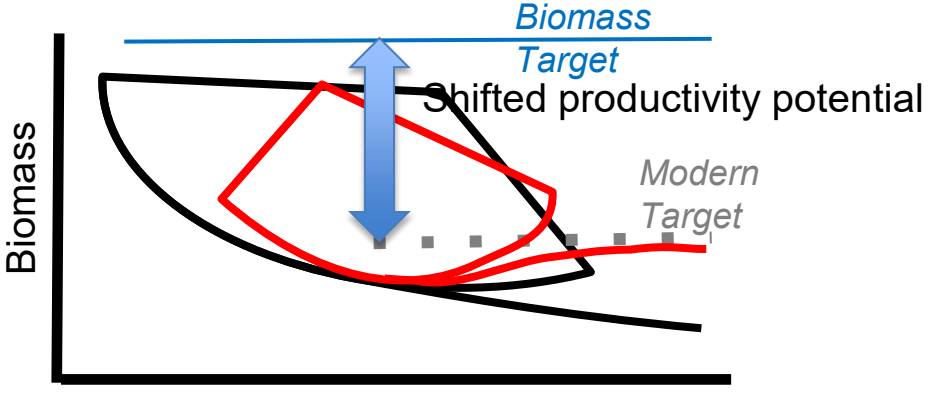
Defining Reference Points in a Dynamic System

- Realization that some fishery resources may no longer have the capacity to meet rebuilding targets, even with extreme reductions of fishing.
- Perpetual rebuilding cycles can have economic consequences (choke species).
- Need to consider redefining baselines for stocks where ocean changes are a critical driver of resource productivity.

Rebuilding toward Historic Baselines

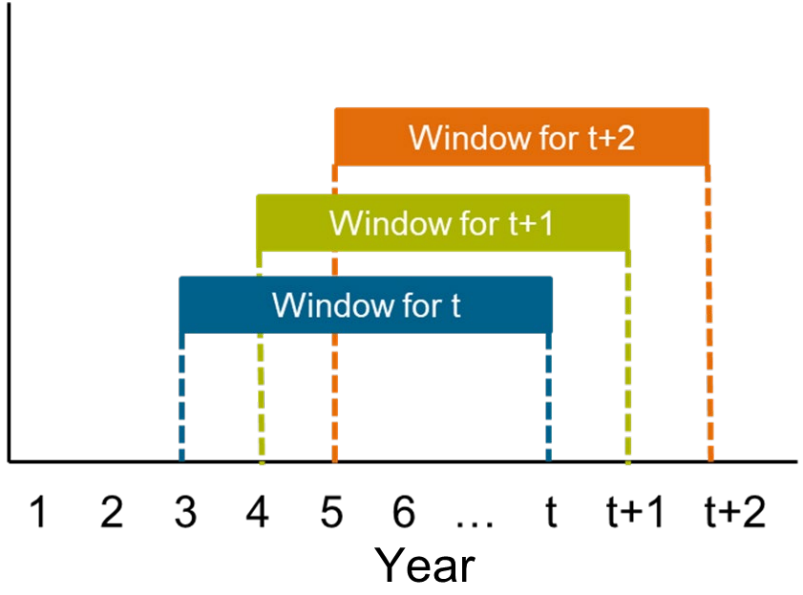


Management toward a Modern Baseline



Dynamic Reference Points

- Dynamics reference points can acknowledge changes in underlying stock productivity



Alternative Approaches

- Test for regime shifts
- Apply moving windows
- Allow for time-varying productivity
- Use dynamic stock-recruit relationship
- Use dynamic unfished biomass (B0)
- Model linkage with environmental driver (temp)
- Model linkage with ecosystem models

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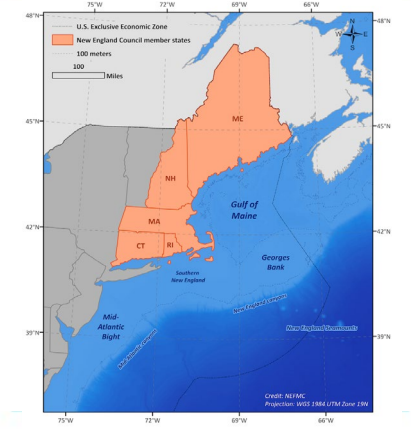
Current Approaches to Defining Reference Points

New England Fishery Management Council

New England Fishery Management Council

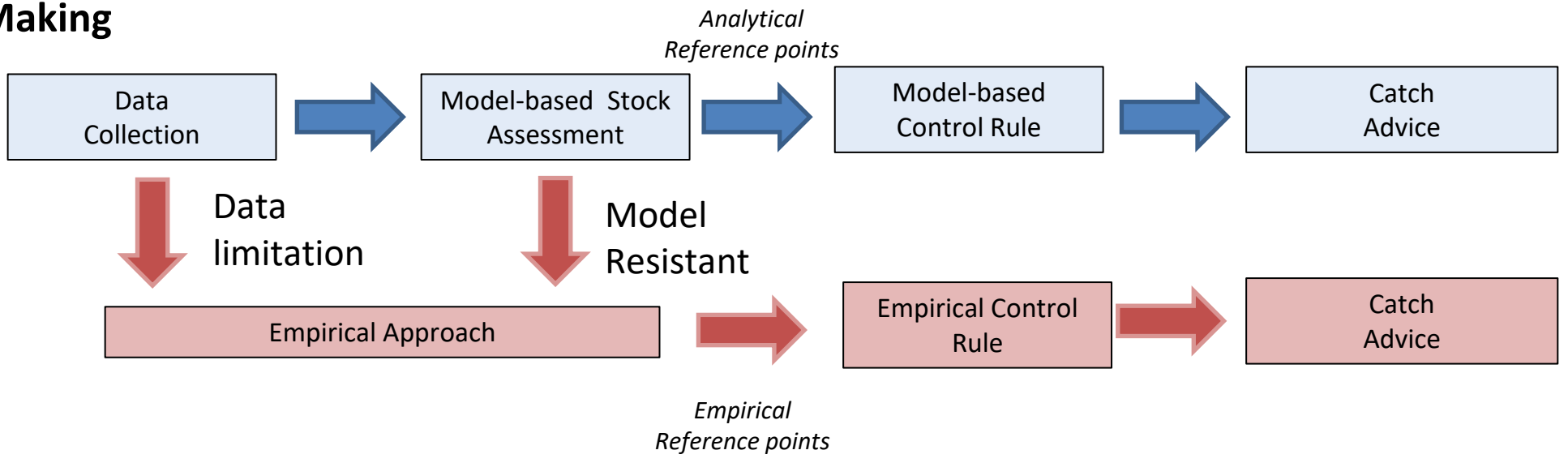
SSC sets catch advice for 39 stocks under 7 fishery management plans encompassing 26 species.



Pathways to Setting Catch Advice

- Frequent analytical age structured assessment **models** are considered the desired assessment product for catch advice setting.
- **Empirical** approaches have been viewed as a “Plan B” and used when age structured assessments have failed or when data is limited.

Pathways to Tactical Decision Making



Stock Assessment Approach

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Model-based Assessments (18 stocks)

- Model types vary in capacity to integrate time-varying stock dynamics or environmental covariates.
- Many analytical assessments with retrospective patterns are shifting to **WHAM** to address these issues.

Empirical Assessments (21 stocks)

- Diversity of index-based methods (IBM) are used to assess model-resistant & data-limited stocks.
- Analytical models are rejected due to retrospective patterns-but we do not expect an IBM to perform better.

Challenge: Climate impacts on stocks are broadly recognized but not yet broadly accounted for in assessments of all NEFMC stocks.

Advances: Increased adoption of flexible model frameworks (WHAM) that allow for time-varying stock dynamics and linkage to environmental drivers.

Definition of Reference Points

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Analytical Approaches (n = 18)

- Future productivity typically assumes = time series average.
- Recent examples of revisions to recruitment assumptions.

Empirical Approaches (n = 13)

- Relies on reference time periods for defining targets and threshold.
- Inconsistency in definitions of reference time periods.

Unknown Status (n = 8)

- Inconsistent use of empirical reference point vs unknown status.
- More ad hoc control rule application.

Challenge: Static characterizations of a stock's productivity can lead to unrealistic reference points and rebuilding timelines. Unclear on optimal approach to revise.

Advances: Recent examples of revisions to recruitment assumptions that inform reference points. Further guidance is needed.

ABC Control Rules Applied to NEFMC Stocks

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Model-based Control Rules (18 stocks)

- Probability-based Control Rule
  - Atlantic Sea Scallop (P*)
- Tiered Control Rule
  - Northeast multispecies complex (based on stock status)
- Ramped Control Rule
  - Atlantic herring (MSE derived)

Empirical Control Rules (21 stocks)

- Catch-based Control Rules
  - Monkfish, Atlantic halibut, skate complex
- Constant Exploitation Rate
  - Silver & red hake, windowpane, witch flounder
- Constant Catch
  - Red crab, ocean pout

Challenge: Performance of current ABC control rules are not fully vetted with respect to their robustness to changing climate/ecosystem conditions.

Advances: Ongoing revision to NEFMC Risk Policy and ABC control rules.

Proxy Reference Points

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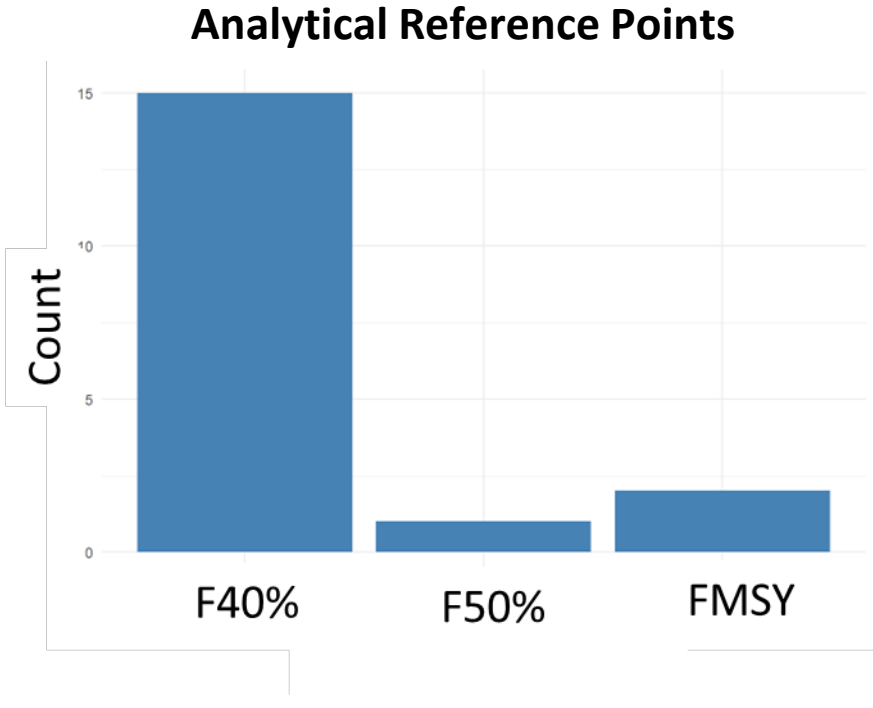
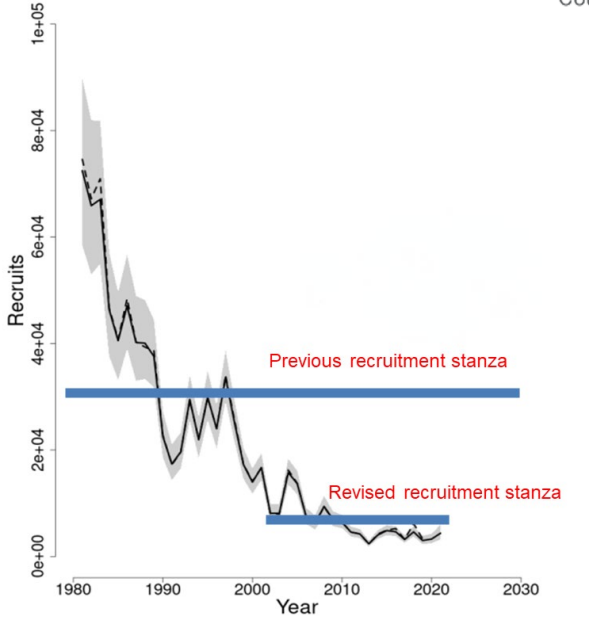
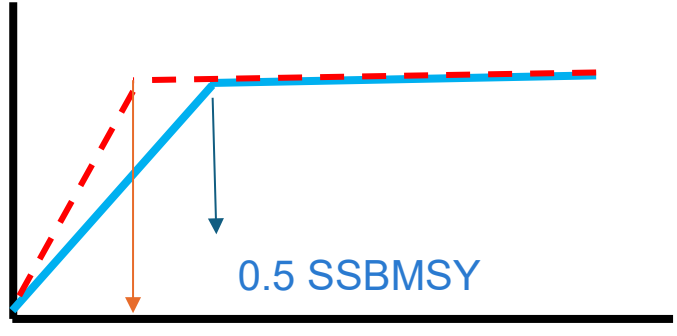
- NEFMC stocks predominatly use F40% based reference points
- FX% is the fishing mortality rate that results in x% spawning potential ratio.
  - F40% is commonly used but higher values (50 to 60 %) have been suggested for some species
- For many fish stocks, the time-series of data used in stock assessments do not provide sufficient contrast to estimate stock–recruitment curve.
- Proxy reference points are often used in this case.



Perils of Proxies

- Calculation of Fmsy proxy based on F40% does not reflect productivity changes.
- Assumptions of productivity that inform associated SSBmsy proxy can be adjusted.
- Adjustment of management targets to reflect decreased productivity can have the inadvertent result of higher exploitation rates on populations under stress.





Revised 0.5 SSBMSY

Workshop Overviews

Outcomes of Regional Workshops on Reference Points

Workshop on Defining Biological Reference Points in a Dynamic Northeast Ecosystem

Organizers: Lisa Kerr, Jerelle Jesse, Steve Cadrin

Workshop Objectives

The specific objectives of the workshop were to:

1. Identify the need to redefine biological reference points (BRPs) in a changing ecosystem,
2. Review existing approaches and challenges in defining BRPs in the region,
3. Evaluate alternative approaches to defining BRPs in other areas of the US and globally, and
4. Synthesize recommendations for estimating reference points for stocks in our changing ecosystem.

Workshop Details

- Two day workshop focused on defining BRPs in a changing ecosystem for New England and Mid-Atlantic scientists and managers
- Targeted expert presentations on existing and alternative approaches for BRPs
- Discussion focused on synthesis of the state of knowledge and recommendations for continued research and applications

Workshop held January 8-9, 2024, New Bedford, MA

Workshop Report: Kerr et al. 2024

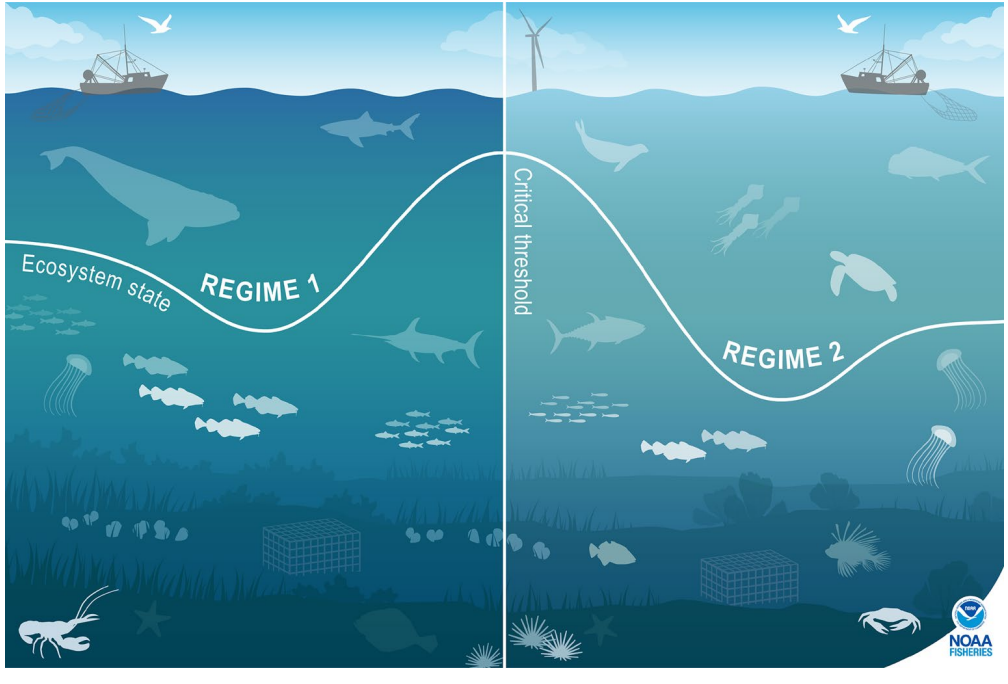
Recommendations

Recommendations: When to revise reference points

Consider both ecosystem-wide and stock-specific indicators of change to assess whether it is appropriate to revise reference points.

Ecosystem wide:

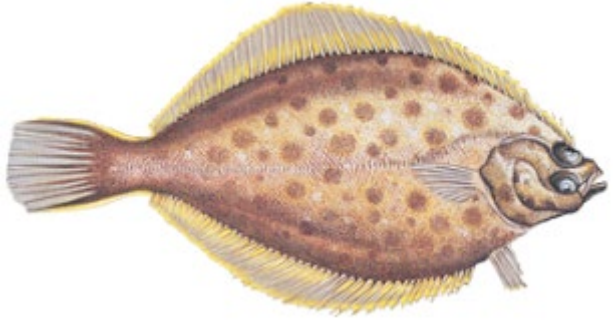
- Identify regime shifts in the region using multiple system components and indicators
- Characterize stability of prevailing ocean conditions and expectations of future change

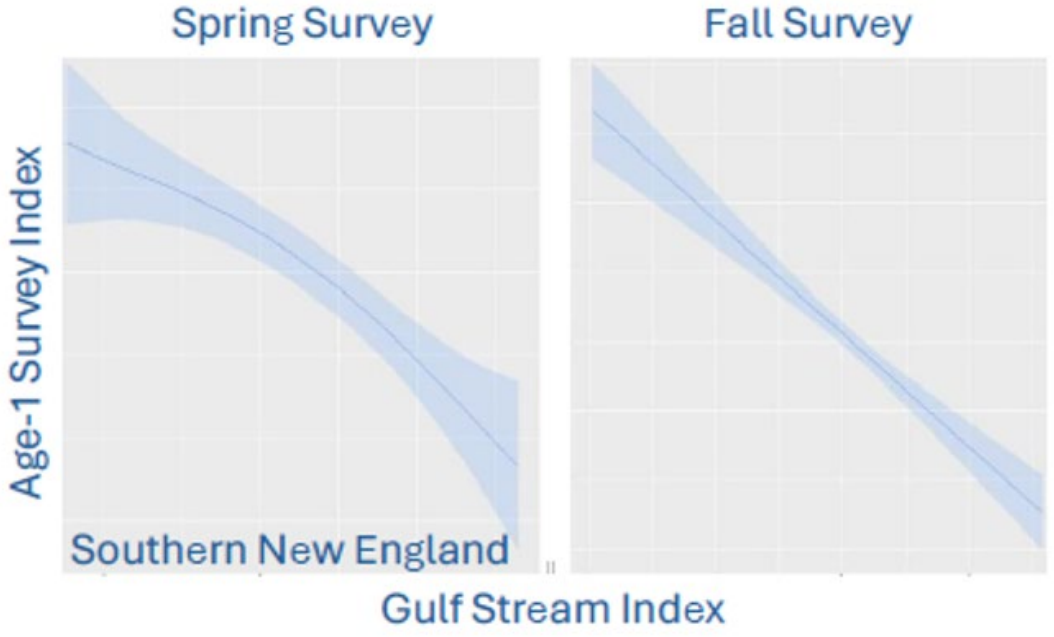


Recommendations: When to revise reference points

Stock-specific:

- Characterize non-stationarity in stock dynamics and linkages to environmental drivers





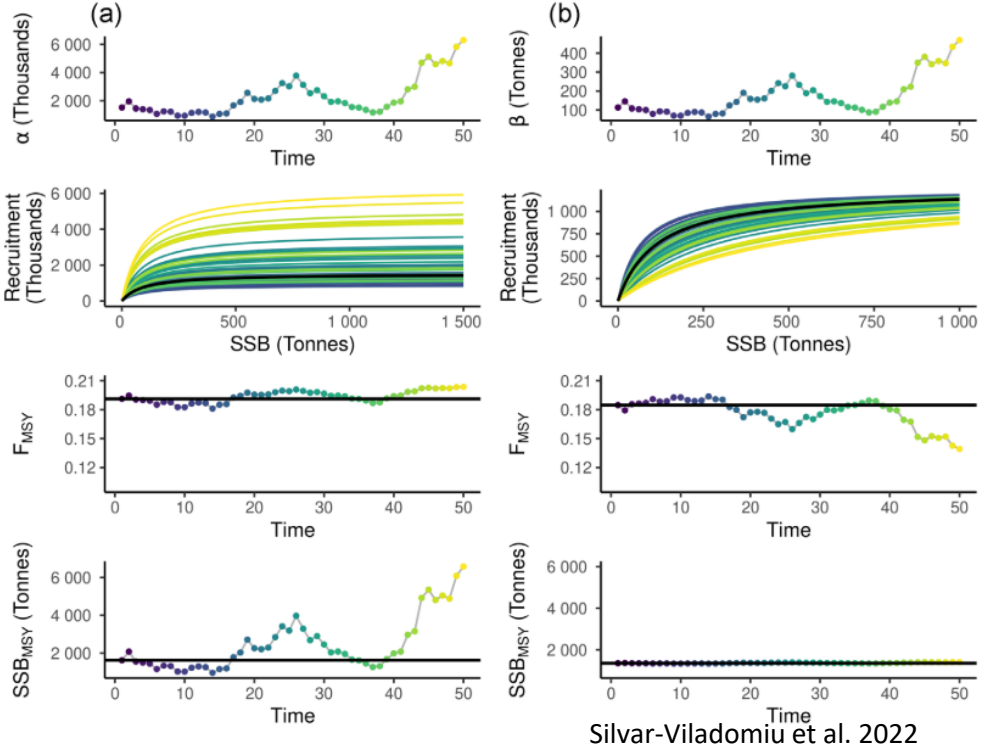
Kittel et al. 2024

Recommendations: How to revise reference points

Consider both short-term and long-term solutions to inform how to revise reference points

Short-term:

- Prioritize focus on characterizing non-stationarity in recruitment and influence of environmental drivers
- Stock recruitment functions should be routinely examined



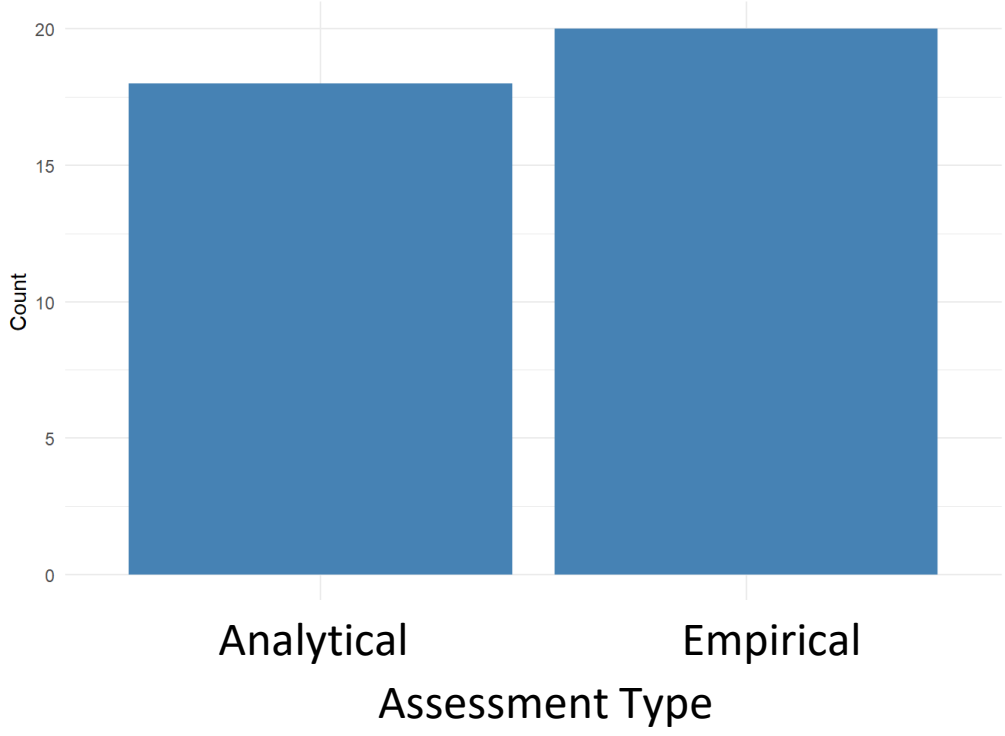
Silvar-Viladomiu et al. 2022

Recommendations: How to revise reference points

Short-term:

- For stocks using **analytical approaches**, re-examine assumptions and specifications of status quo reference points.

- For stocks using **empirical approaches**, characterize the responsiveness of alternative approaches to environmental change.

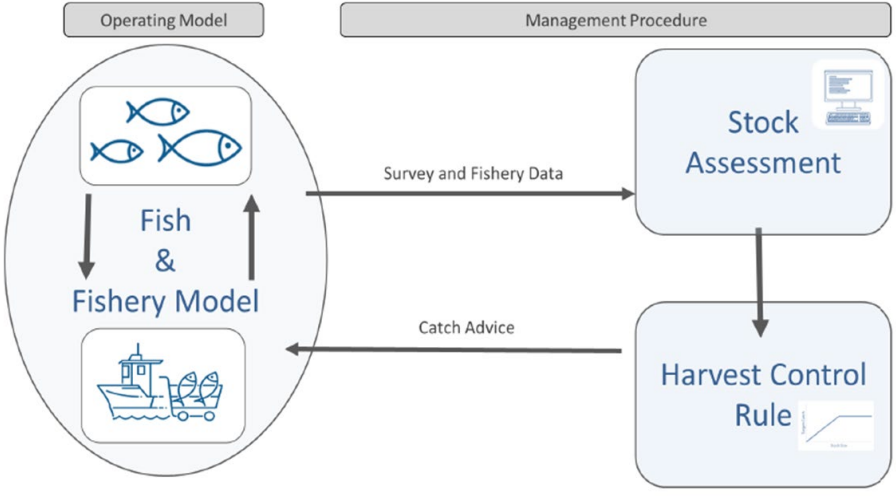


Recommendations: How to revise reference points

Long-term:

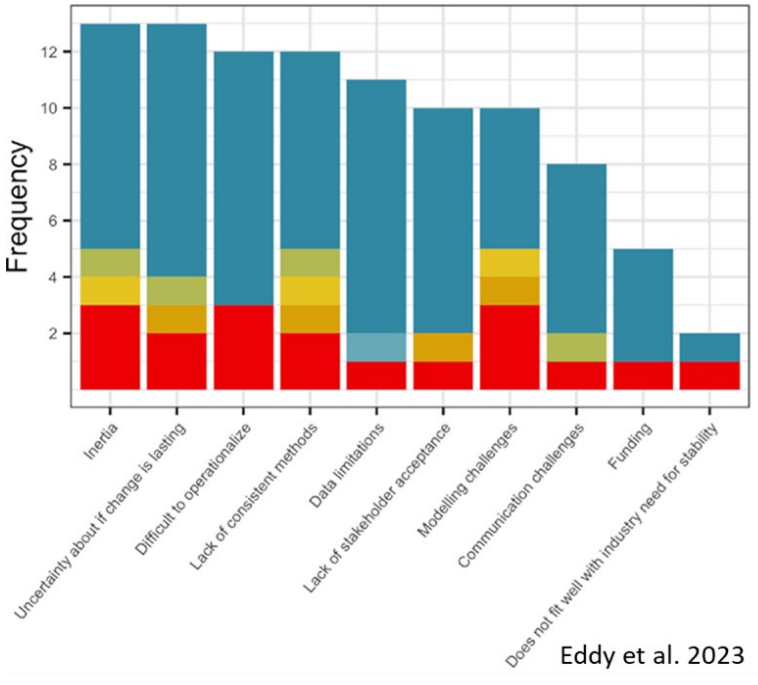
- Adopt assessment models that can account for time-varying stock dynamics and can integrate environmental covariates and can propagate uncertainty into projections
- Consider alternative methods for defining reference points that are more responsive to a changing environment.
- Evaluate risks of current and alternative approaches to define reference points

The WHAM
oods ole ssessment odel

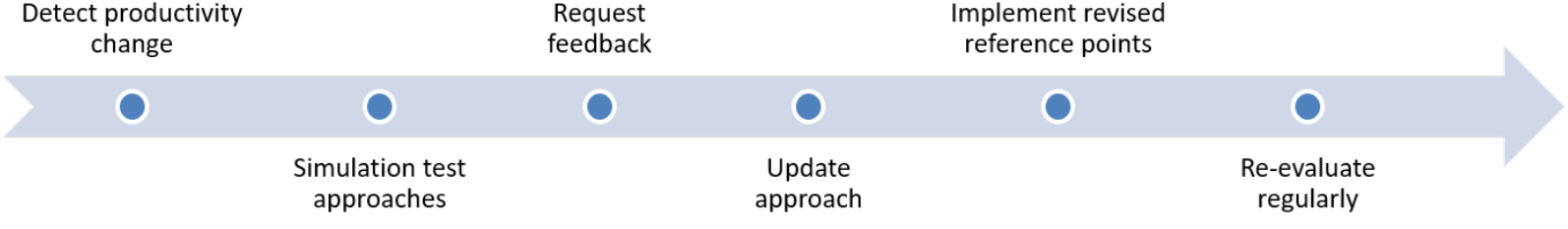


Practical Limitations & Opportunities

- Address key questions regarding who, how, and when to redefine reference points within the fishery management process.
- Consider fundamental shifts in use of reference points in the region
- Collaboration between science and management is needed to find meaningful solutions
- There is a lot of relevant research that can be done outside of formal stock assessment process.



Eddy et al. 2023



8th National Workshop of the Scientific Coordination Subcommittee

Dr. Lisa Kerr, Chair of SCS8 Committee

New England Fishery Management Council

Applying Acceptable Biological Catch (ABC) Control Rules in a Changing Environment

Goal: Provide actionable guidance on how to best support Councils in the management of fisheries, specifically the application of ABC control rules, in a changing environment.

Representatives from 8 Fishery Management Councils SSC's and staff hosted by the NEFMC in Boston, MA (2024)

Sub-theme 3: Adaptation of Reference Points, Control Rules, and Rebuilding Plans to a Changing Environment

New England Fishery Management Council

- Keynote:
  - Dr. Jeremy Collie, URI - Harvest Strategies for Climate-Resilient Fisheries
- Review of case studies across Councils
- Discussion:
  - If and how Councils have adapted reference points, control rules, and rebuilding plans to changing environment
  - Reasons and barriers why not

Case Study 8: *Paul Spencer* - Temperature-dependent recruitment and dynamic harvest-control rules for Bering Sea walleye pollock

Case Study 9: *Conor McManus* - Southern New England/Mid-Atlantic winter flounder reference point revisions and ABC outcomes

Case Study 10: *Desiree Tommasi* - Sardine harvest control rules under climate change (Future Seas)

Case Study 11: *Matt Damiano* - Non-stationarity in recruitment: Stock assessments in the South Atlantic Region

Case Study 12: *Cassidy Peterson* - The role of Management Strategy Evaluation (MSE) in turning climate science into climate informed management advice.

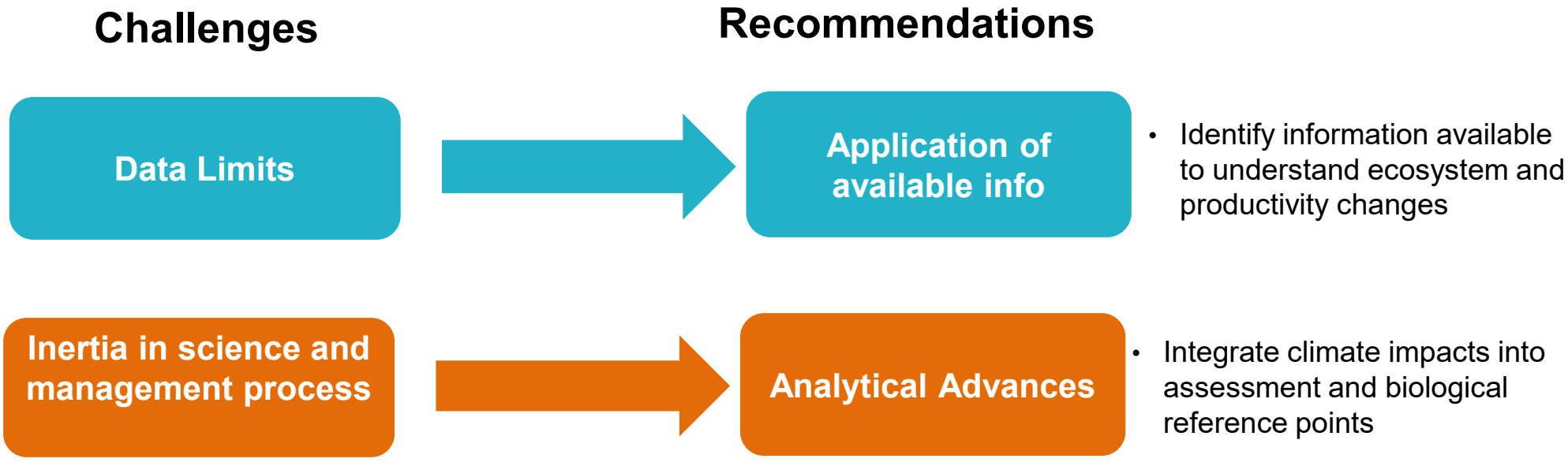
Challenges: Adapting reference points, control rules, and rebuilding plans to environmental change

New England Fishery Management Council

- Reference points are being adjusted but best practices and processes are still emerging in many regions.
- Some of the variation in regional adaptations may be driven by the fact that climate impacts are not uniform in all ecosystems and for all fisheries.
- Other limitations include data scarcity, incomplete understanding of when and how ecosystems change and how those changes impact stocks,
- Performance testing of control rules was identified as useful in some regions and lacking in others.
- Uncertainty surrounding the role of SSCs in the decision-making process, and inflexible procedures that create barriers to making changes.

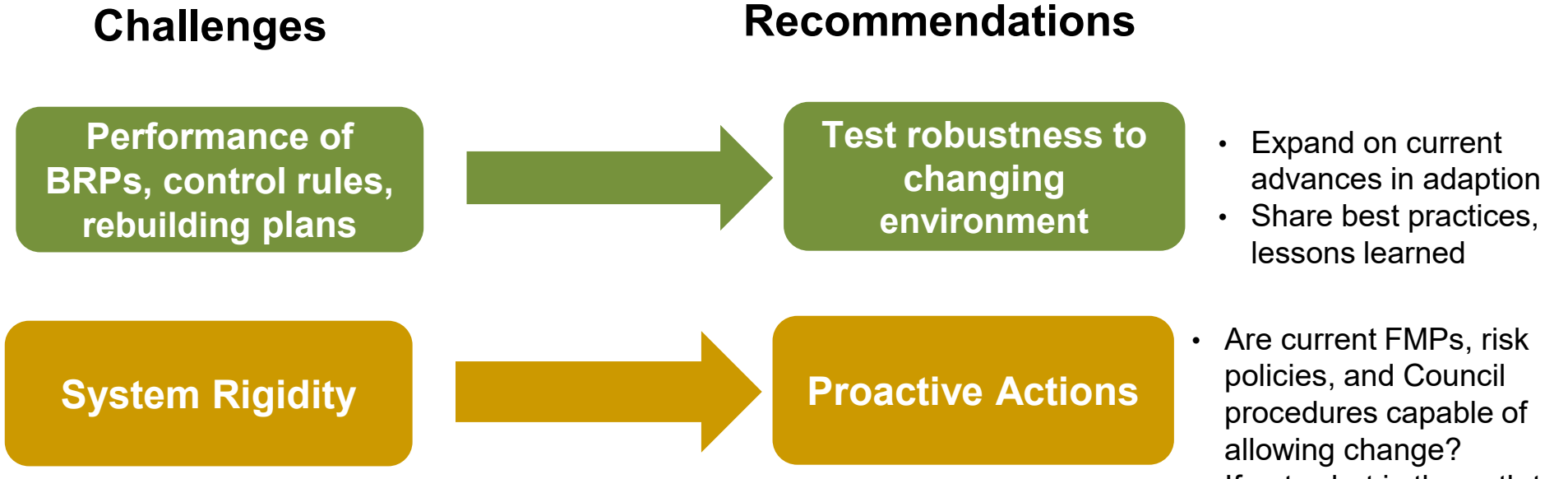
Recommendations: Adapting reference points, control rules, and rebuilding plans to environmental change

New England Fishery Management Council



Recommendations: Adapting reference points, control rules, and rebuilding plans to environmental change

New England Fishery Management Council



SCS8 Goal: Provide Actionable Guidance

New England Fishery Management Council

- Given **very real limitations** in data, capacity, our understanding of ecosystem change and fish and fishery impacts, and funding:
  - How can we do more with what we have right now?
  - What action can we take in our specific regions?
  - Are there national level policy changes that need to be made to enable these actions?

NEFMC Action Item 1: Develop a working group on reference points that spans management and science and supports goals to redefine reference points in a dynamic environment.

NEFMC Evolving Fisheries Management

What has changed? What have we learned?

Synthesis

Stock Assessment Performance:

- Adoption of models that have flexibility to incorporate time varying or climate impacts (WHAM) has improved assessment performance for some stocks.
- Performance of index-based approaches is uncertain.

Reference Point Estimation:

- Reference points based on historical productivity regimes may not reflect a stock's current productivity.
- Thoughtful revision of future productivity assumptions is paramount.
- Need to address challenges for both analytical and empirical approaches.

Rebuilding Plans:

- Challenged with timelines and targets that are likely unrealistic.

Unknown Stock Status:

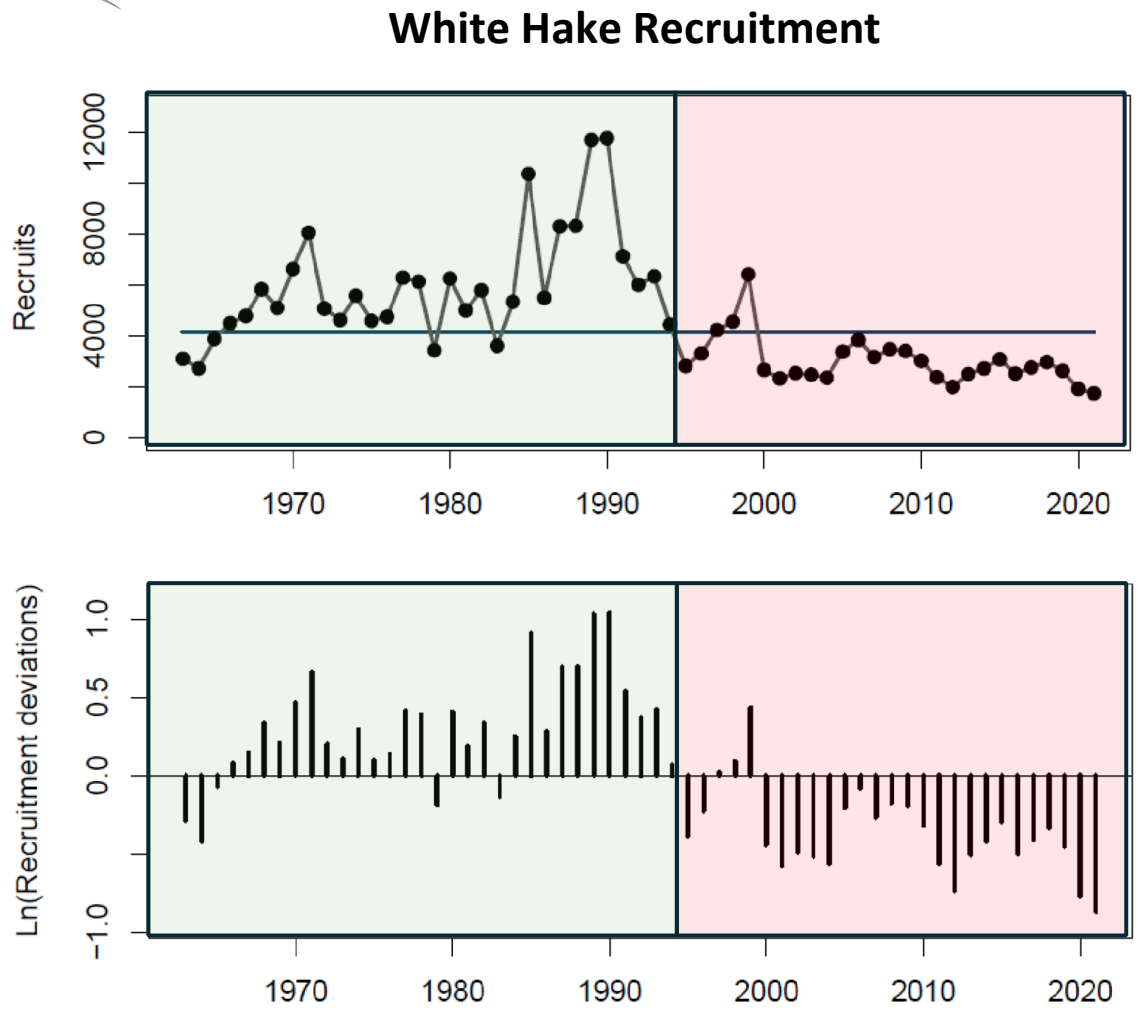
- Challenges for determination of catch advice associated with unknown stock status.

White Hake

- **Assessment:** Statistical catch-at-age model (ASAP)
- **Stock status:** Not overfished, no overfishing. Currently in a rebuilding plan.
- **Reference points:**

  FMSYproxy = F40%; SSBMSYproxy = SSBF40%

  - Fishery selectivity, maturity and weights at age from most recent 5-year averages
  - Recruitment sampled from a cumulative distribution function of recruitment estimates for 1963–2022
- **Short-term Projections:**
  - Fishery selectivity, maturity and weights at age from most recent 5-year averages
  - Recruitment sampled from a cumulative distribution function of recruitment estimates for 1995–2022

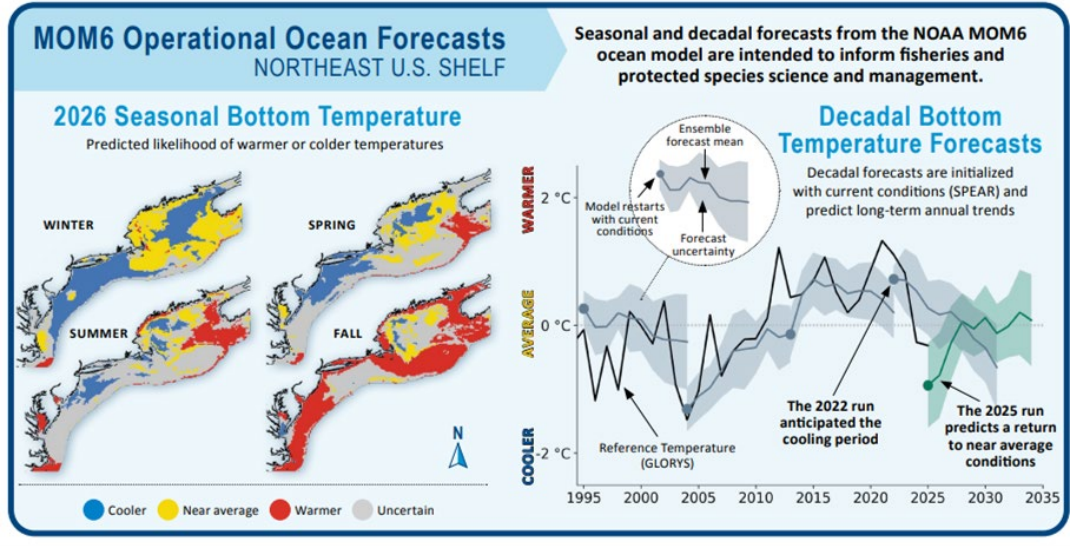


NEFSC 2022

Evolving Fisheries Management

Status Quo → Responsive → Proactive

- Recognized need to move away from **status quo** assumptions of stationarity
- Increasingly **responsive** management, adjusting to changes based on new data and direct linkage to climate drivers
- Not yet **proactive,** progress toward anticipating future conditions.



Building trust in ocean forecasts for potential integration into decision making.

Northeast U.S. Regional Changes

- Things have changed….
  - Pause of Research Track Stock Assessments – challenge for climate integrated stock assessment and redefinition of reference points
  - Change in level of information to inform catch advice with capacity changes (less assessments and more data updates).
- Given these changes, what are the current pathways to making progress ?

Acknowledgements

CAFA
Climate and Fisheries Adaptation

New England Fishery Management Council

CINAR
Cooperative Institute for the North Atlantic Region

Break 10:15 - 10:30

Photo: MCFA

Evolving Approaches to Revise Biological Reference Points in New England

Conor McManus
June 1, 2026
NEFMC SSC DRP Workshop

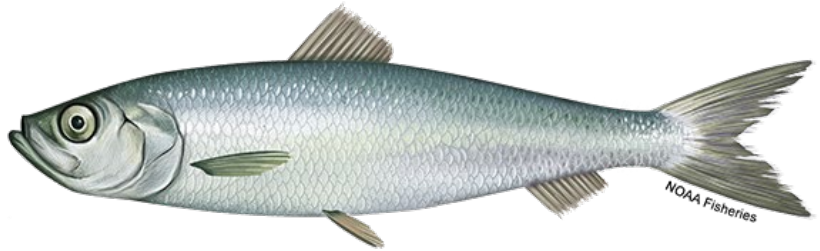
Special thanks to Lisa Kerr, Jon Deroba, Alex Hansell, John Wiedenmann

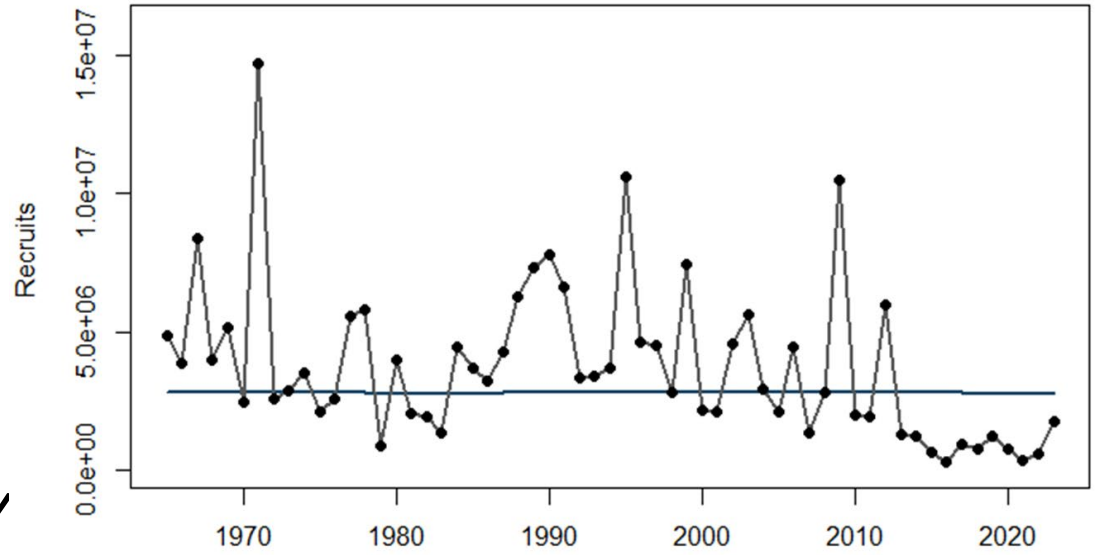
Introduction - Setting the Stage

- We have seen several examples of stocks where environmental conditions are believed to be influencing population dynamics, in particular stock productivity.
  - Lack of positive response under reduced harvest.
  - Signaling a change in (i.e. non-stationary) stock productivity.
- Historical productivity regimes (often recruitment assumptions) may no longer be applicable given changes in the ecosystem.
- Changes in productivity have been addressed in different ways. These themes span many stocks, but for today, 4 case studies are presented:
  - Atlantic Herring
  - GB & SNEMA Yellowtail Flounder
  - SNE Winter Flounder
  - White Hake

Atlantic Herring

- SSC has previously noted the low recruitment, and the importance for understanding changes in predation and survival for context on productivity.
- PDT has explored projections using average time series recruitment and autocorrelated recruitment.
- SSC has recommended exploring dynamic linear modeling and other techniques to acknowledge change changes in productivity.
- SSC has suggested revisiting F40%MSY proxy if in low productivity regime.

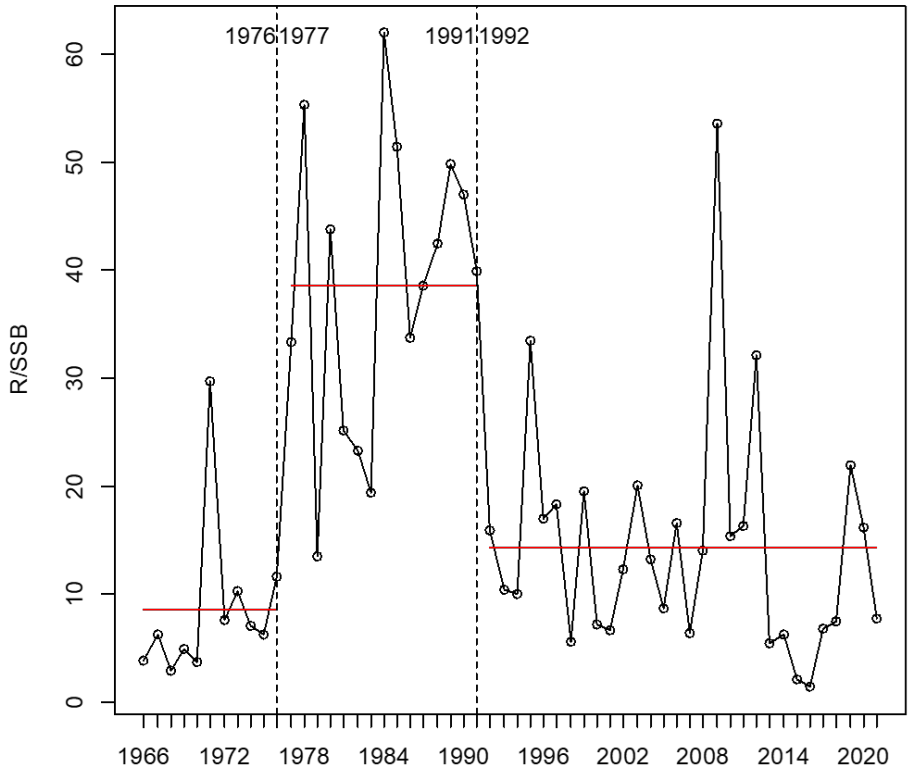




Atlantic Herring

2024 MTA in ASAP

- Continued poor recruitment in terminal years.
- Evaluated stanzas in R/SSB.
- Time series analyses identified multiple change points over time in R/SSB.
- Supported notion for change in productivity over time due to ecosystem. Used recruitments from 1992-2021 in calculating BRPs.



BRPs using entire time series (2022):

F40% = 0.5, SSBproxy = 266,140mt

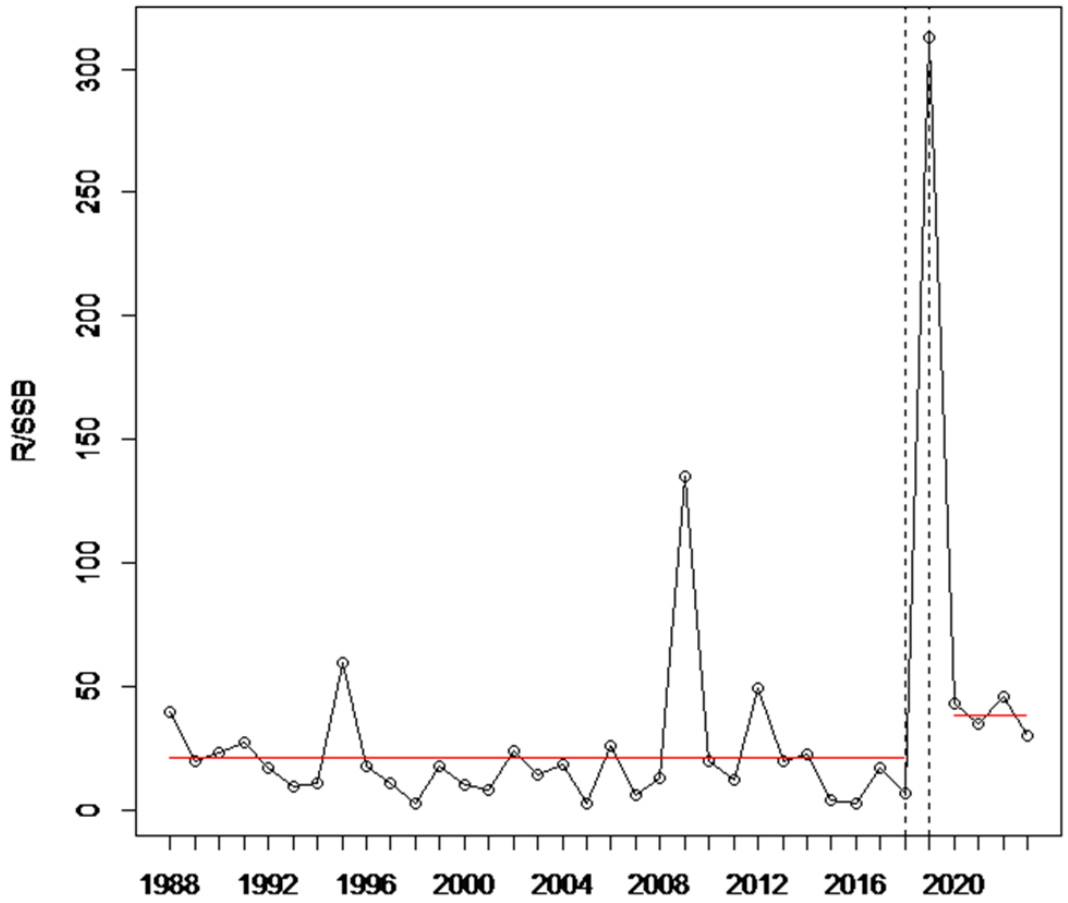
BRPs using truncated series (2024):

F40% = 0.45, SSBproxy = 186,367mt

Atlantic Herring

2025 RTA in WHAM

- With movement to WHAM, no longer support for truncated time series.
- Model now began in 1987, and not 1965 as previously used in ASAP.
- WHAM adopted mean of the recruitment process random effects.
- New reference points: F40%=0.349, SSBproxy = 233,176mt

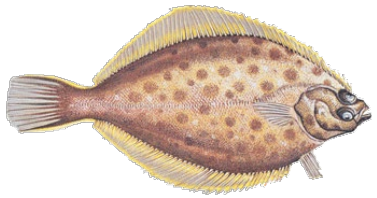


Atlantic Herring

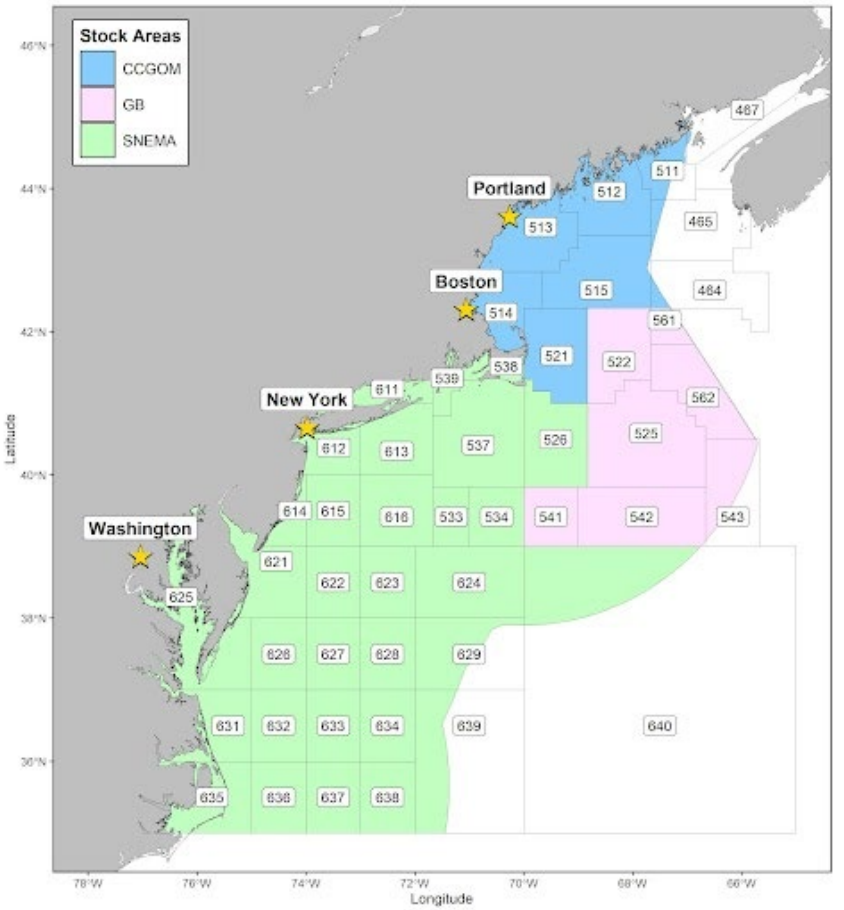
Conclusions

- Poor recruitment can have multiple causes (e.g., environment, low SSB), and low recruitment alone may be insufficient to justify using a truncated recruitment stanza for BRPs.
- R/SSB stanzas can be helpful, but must be interpreted with caution:
  - R/SSB can shift/trend just due to changes in SSB unrelated to environment.
  - Are shifts in R/SSB inconsistent with compensatory dynamics?
- State-space models may alter the evidence (e.g., change trends in R/SSB)

SNEMA and GB Yellowtail flounder



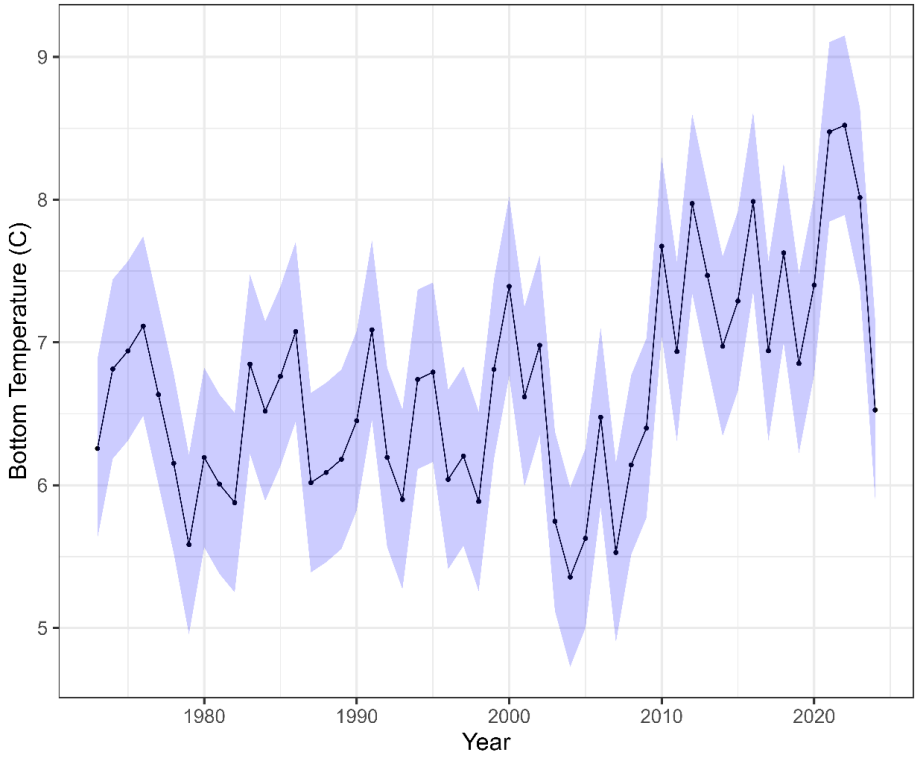
- Abundance has consistently been low for GB and SNEMA Yellowtail Flounder in recent years.
- With significant declines in harvest, fishing mortality does not appear to be the primary driver of stock dynamics.
- Increasing evidence that bottom temperature and larger climate signals (e.g., Cold Pool) may be strong determinant for the stocks' recruitment.



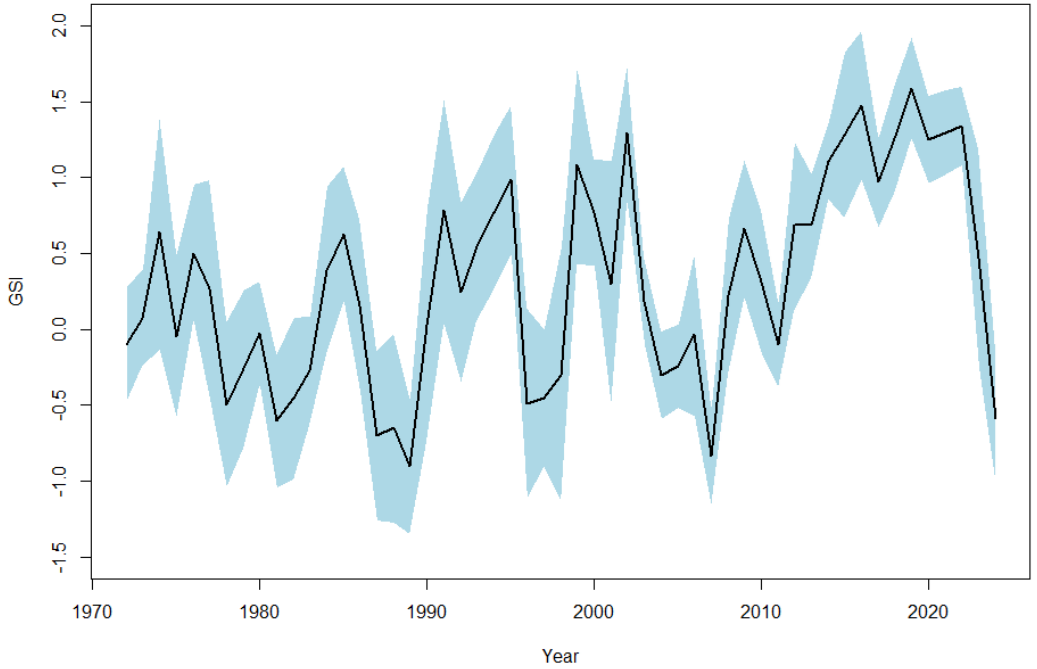
SNEMA and GB Yellowtail flounder

2024 RTA: Exploration of environmental influences on recruitment

GB: Bottom water temperature



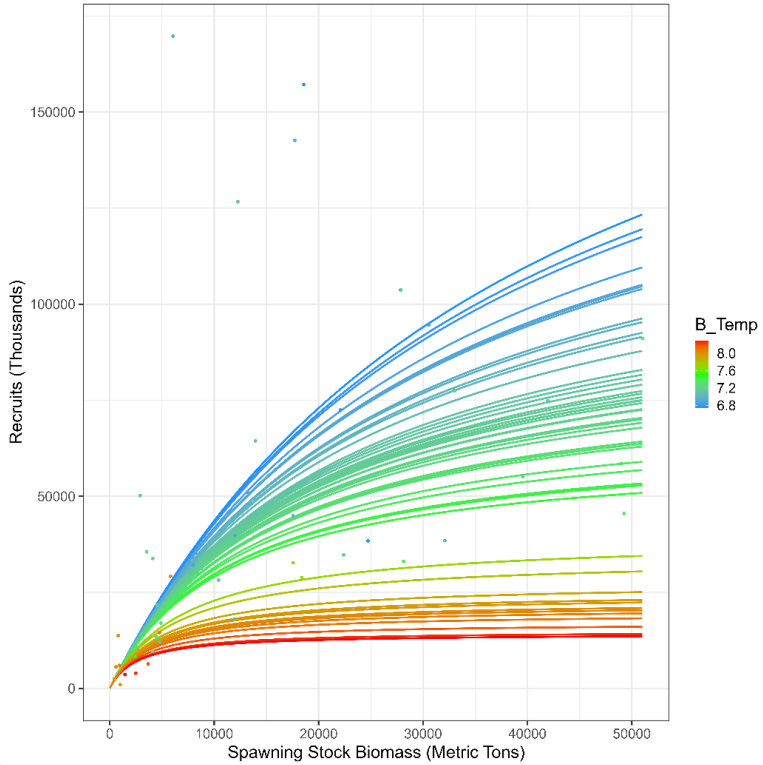
SNEMA: Gulf Stream Index



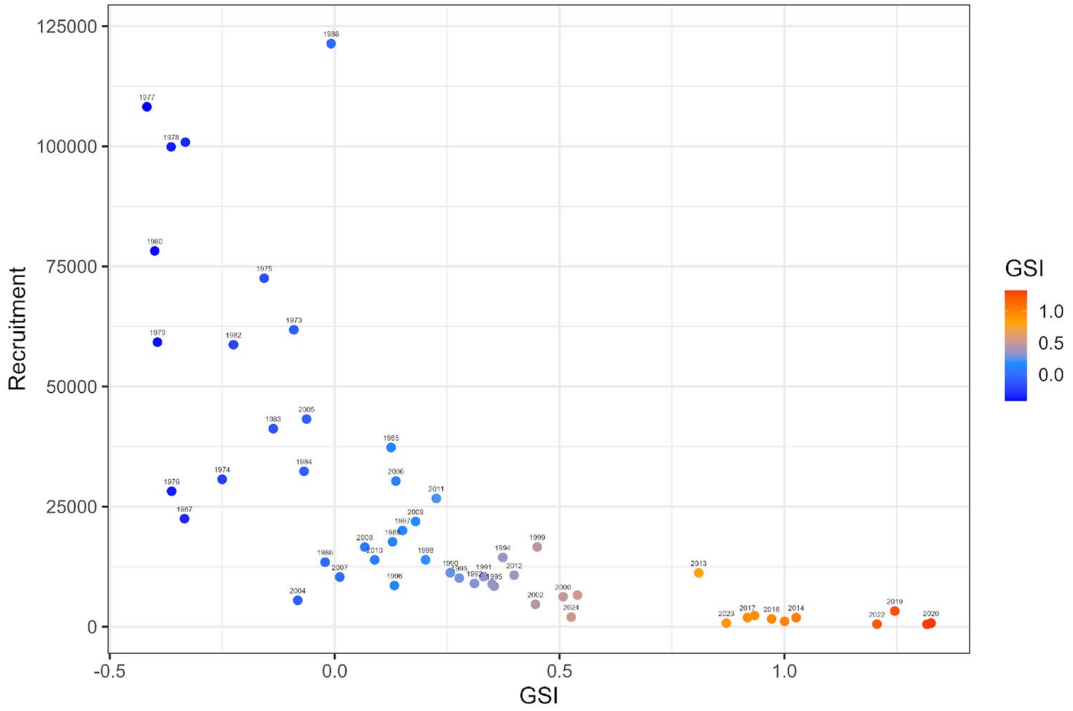
SNEMA and GB Yellowtail flounder

2024 RTA: Exploration of environmental influences on recruitment

GB: Bottom water temperature



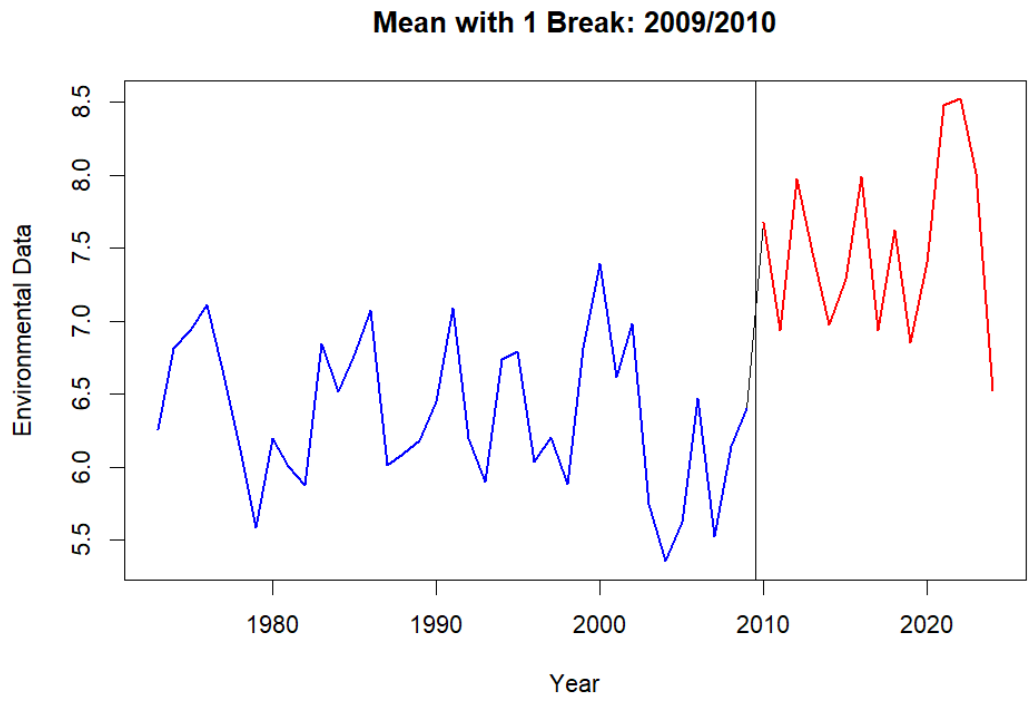
SNEMA: Gulf Stream Index



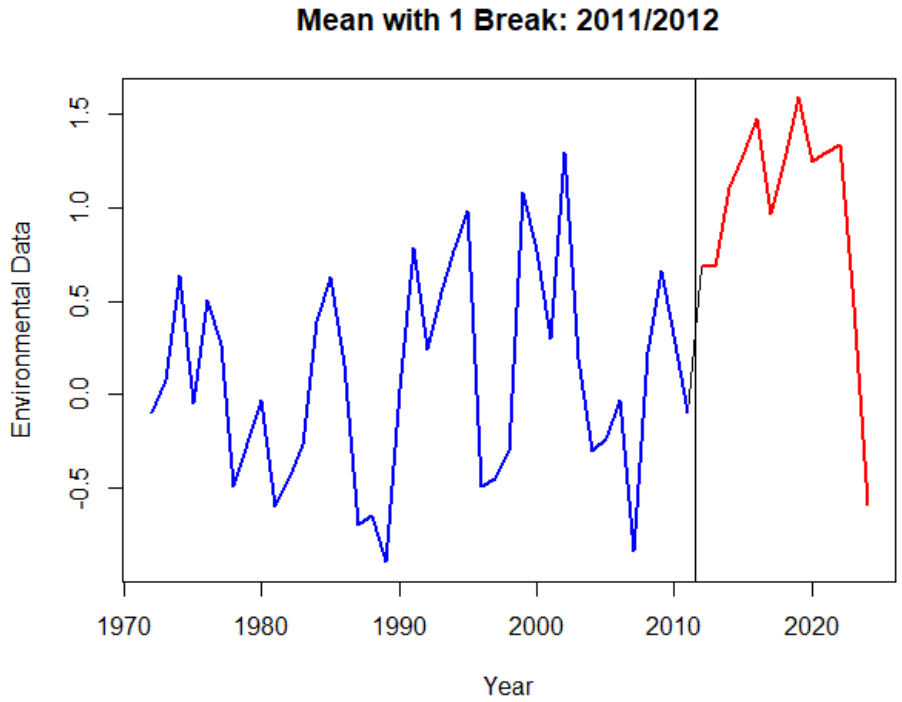
SNEMA and GB Yellowtail flounder

2024 RTA: Exploration of environmental influences on recruitment

GB: Bottom water temperature



SNEMA: Gulf Stream Index



SNEMA and GB Yellowtail flounder

GB Stock

FMSY

- Natural mortality: age-based, constant
- Maturity: constant
- Selectivity: terminal 2-year average
- Weights at age: terminal 2-year average
- Recruitment: Beverton-Holt

Table 2: Comparison of reference points estimated in the last management track and from the current management track assessment. The previous management track assessment was an empirical approach so biological reference points could not bet estimated. FMSY was used for the overfishing threshold.

	2024	2025
F_{MSY}		0.09
SSB_{MSY} (mt)		7,072 (2,700 - 18,521)
MSY (mt)		597 (23 - 2,440)
Mean recruits (age 1) (000s)		31,190
Overfishing	Unknown	No
Overfished	Unknown	Yes

SNEMA Stock

F40

- Natural Mortality: age-based, constant
- Maturity: constant
- Selectivity: terminal 2-year average
- Weight-at-age: terminal 2-year average
- Recruitment: mean

Table 2: Reference points estimated in the current management track assessment compared with reference points estimated in the previous management track assessment (NEFSC 2022). An $F_{40\%}$ proxy was used for the overfishing threshold. Intervals shown reflect 95% lognormal confidence intervals.

	2022	2025
F_{MSY} *proxy*	0.349	0.374 (0.346-0.404)
SSB_{MSY} (mt)	1715	270 (42-1720)
MSY (mt)	461	94 (15-595)
Mean recruits (age 1) (000s)	22375	25778
Overfishing	No	No
Overfished	Yes	Yes

SNEMA and GB Yellowtail flounder

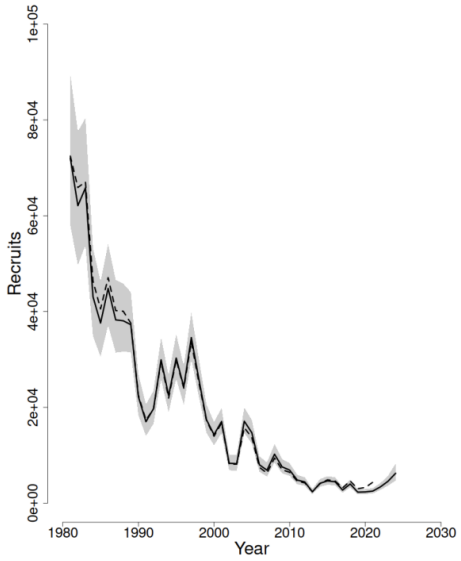
SSC comments regarding 2025 MTA changes in reference points:

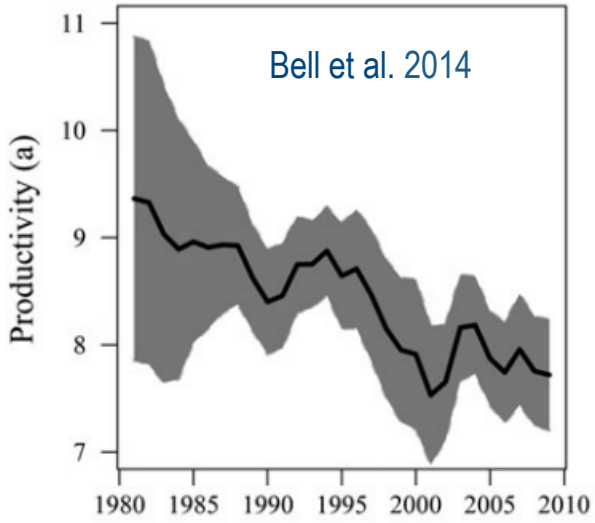
- GB - uncertainties with the assessment included:
  - The WHAM model may make it difficult to parse environmental versus fishery effects on the stock.
  - Environmental forecasting could be developed and potentially integrated into future recruitment estimates.
- SNEMA - SSC struggled to understand the concurrent decrease in the biomass-based BRP proxy and increase in the F proxy, both based on a SPR proxy estimate assuming a target SPR 40%. The SSC suggested investigating whether yield per recruit has changed, which could necessitate revisiting the 40% SPR proxy.

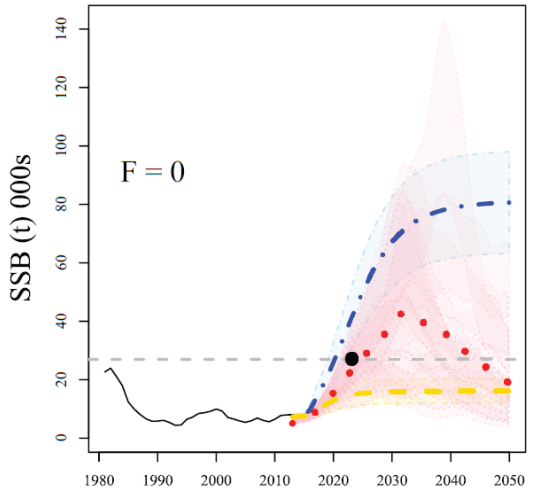
SNEMA Winter Flounder

Several lines of evidence for environmental forcings on SNEMA winter flounder population dynamics.

- Inc temp, dec in abundance.
- Thermal-predation WF mortality studies.
- Fitting environmentally-explicit stock-recruit curves for SNEMA winter flounder.
- Under future warming scenarios, projections that incorporate temperature indicate rebuilding the stock is highly unlikely.





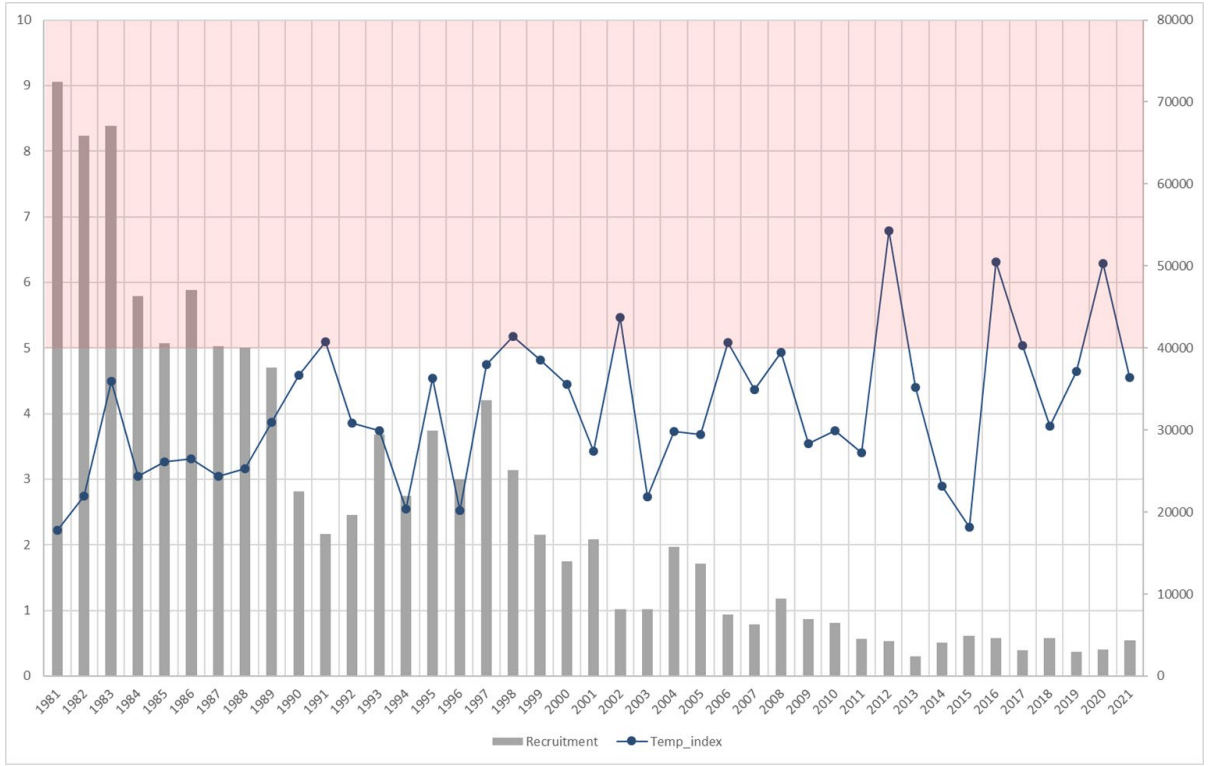


Bell et al. 2018

SNEMA Winter Flounder

2022 MTA

- For more realistic projections reflective of the current stock productivity, SSBMSY projection methodology moved from using recruitment from the entire time-series (1981-2021) to a more recent period.
- Qualitative assessment of temperature time series data from Bell et al. (2014).
- Regression tree models suggested a split in recruitment time-series at 1990 and 2002.

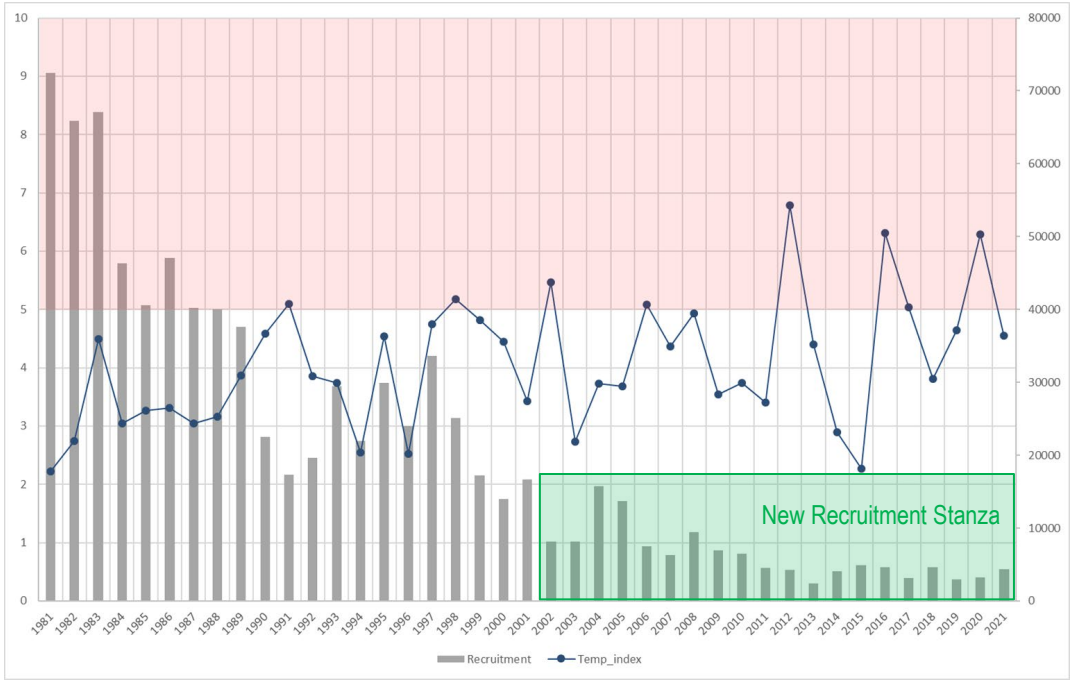


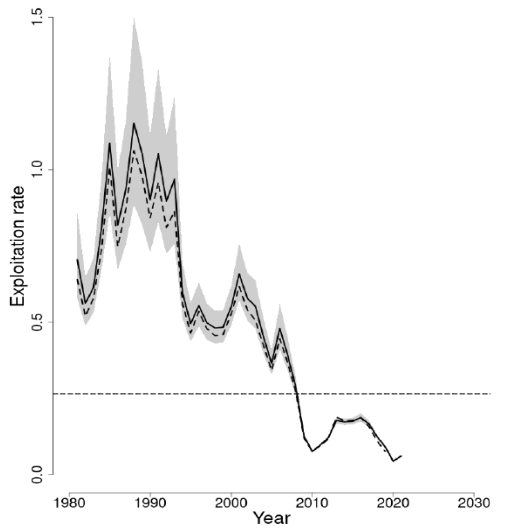
SNEMA Winter Flounder

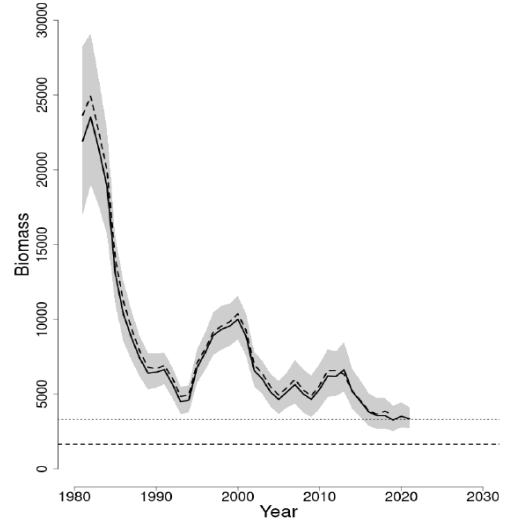
2022 MTA

- The last 20 years of recruitment was used to inform projections (twenty year moving window).

- Revised reference points resulted in the stock not overfished, overfishing not occurring, and considered rebuilt.



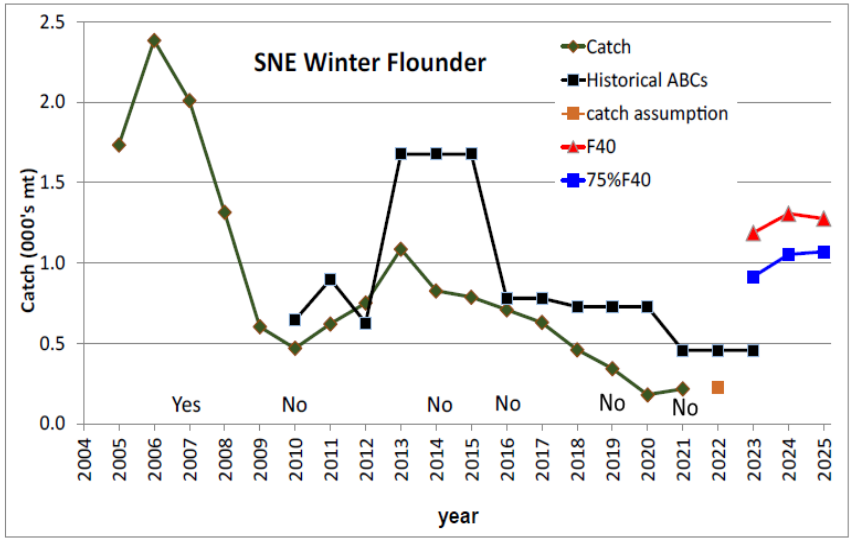




SNEMA Winter Flounder

SSC Deliberations

- In Fall 2022, SSC met to recommend ABC and OFL limits for SNEMA Winter Flounder.
- Projections using new recruitment stanza resulted in catch advice up to over four times current catch.
- Given our perspective of the stock's condition had not changed and productivity remained low, the SSC recommended a more precautionary approach (50%FMSY held constant), instead of recommending control rule (75%FMSY).



Control Rule Specifications

Year	OFL	ABC
2023	1,186	914
2024	1,365	1,052
2025	1,387	1,069

SSC Recommendation

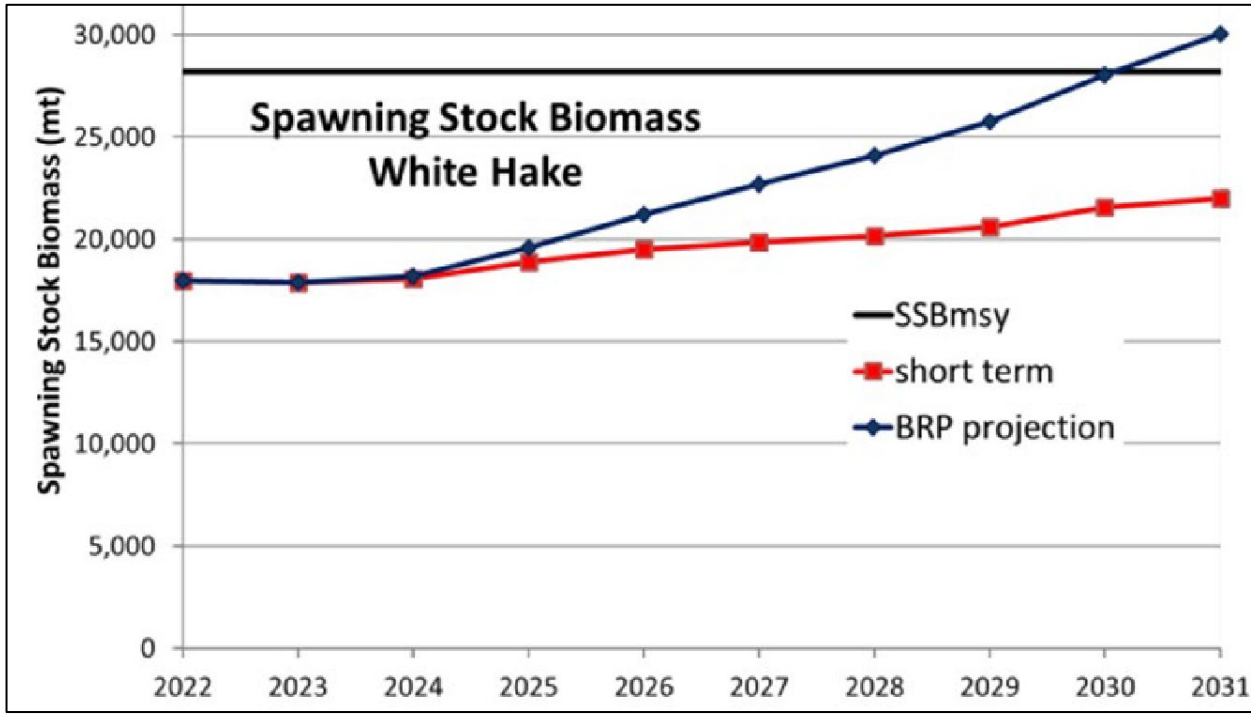
Year	OFL	ABC
2023	1,186	627
2024	1,365	627
2025	1,387	627

White Hake

Rebuilding

- PDT provided short-term catch advice using projections assuming recruitment estimates from 1995-2019, and rebuilding projections using recruitment from 1963-2019.

- Results indicated stock could rebuild by 2031 if the full time series of recruitment is assumed, but would not rebuild by the target date under the projection assumption of recent lower recruitment.



NEFSC 2022

White Hake

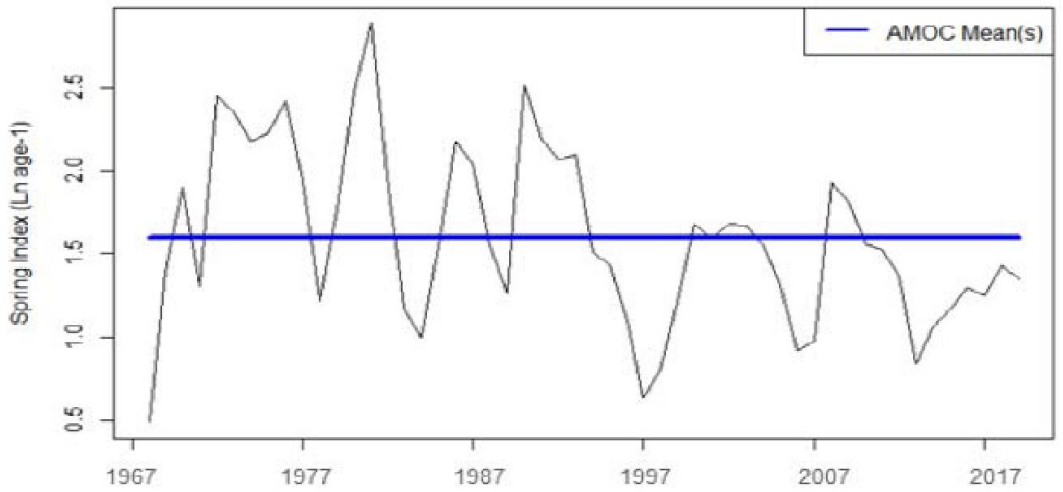
Motivation for Examining Reference Points

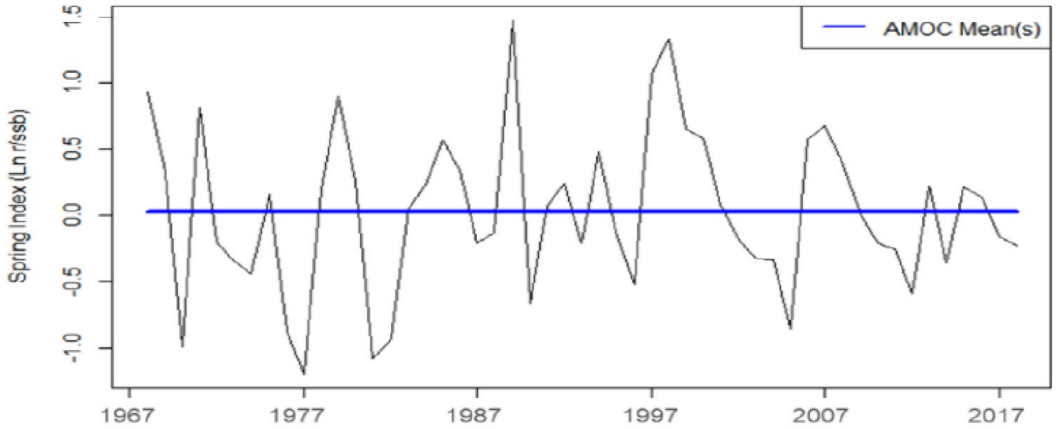
- 2022 MTA Peer Review Panel accepted the projection approach, but noted:
  - Using a recruitment time series extending back to 1995 may be inappropriate and asked whether there is a more appropriate recruitment stanza for the stock. A change point analysis might be helpful.
- SSC recommended exploration of internal consistency between biological reference points and projections, and considering change point analyses or recruit-per-spawner analyses to inform recruitment time stanzas and productivity.
- SSC was concerned about potentially optimistic projections given the continued low recruitment.

White Hake

Recruitment Assumptions (Dr. Steve Cadrin)

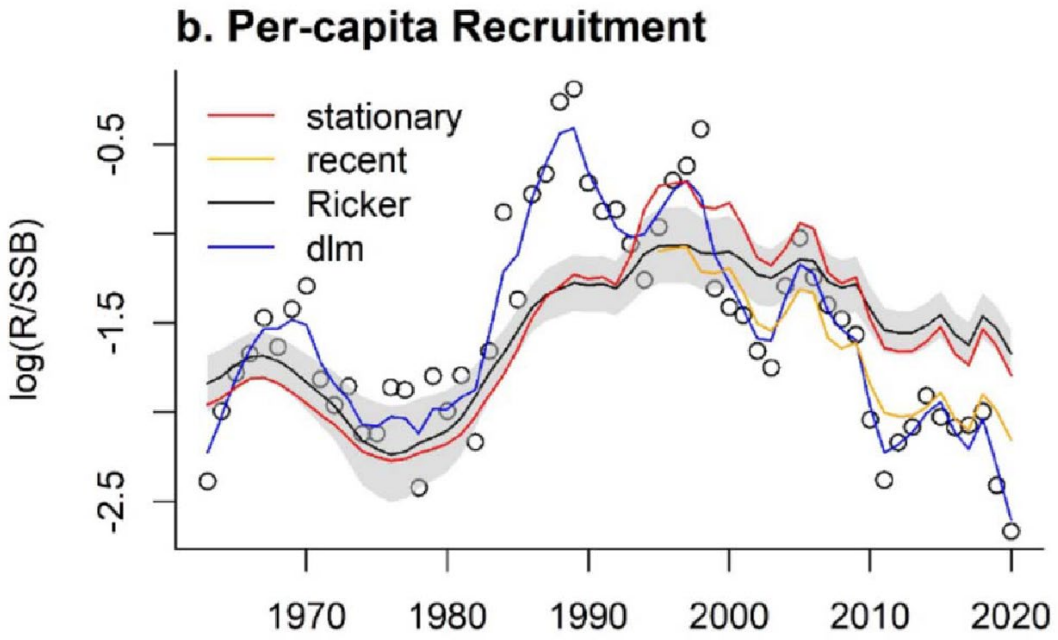
- Goal: Test for changes in white hake recruitment and recruitment rate using change point analysis.
- No significant and consistent change points were identified.
- Recruitment and recruitment rate were strongly autocorrelated.
- Recommendation: short-term catch projections assume autocorrelated long-term recruitment to be more consistent with management reference points.





White Hake
Dynamic Stock-Recruit Relationship (Dr. Jeremy Collie and Dr. Samuel Collie)

- Goal: Use dynamic linear modeling to describe productivity and recruitment dynamics of white hake.
- Use models to calculate reference points, short term projections, and rebuilding projections.
- Support for time-varying stock-recruit models for white hake which indicate a decline in productivity since 1990.
- Recommended use of dynamic stock-recruitment relationship in calculation of reference points, short-term projections, and rebuilding projections for white hake.



White Hake

SSC Review of Studies (2023)

- The SSC found these two studies both could be useful in informing white hake rebuilding plans and setting ABCs.
- SSC noted that these analyses would be most useful for incorporation into a future research track assessment or management track assessment.
- SSC recommendation:
  - Run short-term projections that include a scenario that assumes the long-term distribution of recruitment with autocorrelation for SSC deliberations on catch advice (Sept 8, 2023).
  - Have catch advice based on projections using two bridge years, autocorrelated long-term recruitment for short-term projections, and 75%Fmsy.
  - Dynamic stock-recruit analyses are helpful in providing insight on projections and rebuilding plans, and should be considered further in the next management track stock assessment.

White Hake

SSC in Recent Years (2026)

- Concern remains regarding continued low recruitment under historically-low harvest. Recruitment still remains a major uncertainties for the assessment.
- Continued interest in moving assessment from ASAP to WHAM.
- During the 2025 MTA Peer Review, the SAW56 recruitment methods for the projections was approved. The SSC has supported the use of these methods for use in projections for guiding catch advice.
  - Autocorrelated recruitment was deemed a plausible basis for projections and still supported by SSC for continued evaluation and estimation.
  - No biologically meaningful difference between two methods in short-term projections.

Conclusions

- Common themes noted by SSC:
  - Lack of population / abundance response when lowering harvest dramatically has signaled non-fishing mortality factor prohibiting stocks rebuilding (i.e., ecosystem and productivity change).
  - Fear of overly-optimistic projections when assuming productivity has been constant (i.e., assuming recruitment can reach previously high levels).
  - Interest in more realistic recruitment (e.g., autocorrelation, recent years.)
  - Interest in exploring environmental drivers for identifying and justifying changes in productivity, and methods in calculating BRPs.
  - Biomass-based and F-based reference points must both be considered to fully respond to changes in productivity.

Conclusions

- Revisions to reference points have been made using multiple approaches.
  - Primarily have focused on how to treat recruitment (stanzas, autocorrelation, stock-recruit curves).
- These efforts have largely recognized changes in productivity through management or research track assessment processes, and then have subsequently been used for management.
    - Occasional ad-hoc SSC decisions.
- Revisions in reference points have led to changes in stock status without changing the perceptions of the stocks' historical trends.
- Potential interactions with changes in control rules and risk policy.

Closing Questions

- Much of the work on BRPs and DRPs have focused on recruitment.
  - Are there other life history traits or rates that should be further considered?
- Our conversations for reference points have been based in biology.
  - Are there reference point options that can consider additional considerations, such as socioeconomics?
- Much of our discussions have focused on analytical assessments?
  - What about empirical assessments?
- Current processes for revising reference points involve MTA or RTA.
  - How do we recognize changes in productivity timely if assessment periodicity is more infrequent?

Lunch 12:15 - 1:15

Look for Stanzas (e.g., in R/SSB)

- Be careful!
- Look at multiple relationships and time series
- R/SSB decreasing (increasing) as SSB decreases (increases) is more informative as that is counter to compensation
- Similarly, deviations in the R/SSB versus SSB plot that deviate from expected inverse relationship might be indicative of change

- Credit: Chris Legault

Breakout Group: When to Change to DRPs

Considering the signals that have arisen when reference points have been a challenge

1. What indicators or diagnostics should flag the need to review the RP approach and consider a dynamic approach?

1. What proposed guidance do you have to evaluate whether or not to use DRPs?

1. How should indicators be monitored and reviewed? (Research Track, SSC review, Ad-hoc trigger-based review)?

No webinar audio broadcast at this time.

Breakout Group
1:30 - 2:15

Break 2:15 - 2:30

Return to Discussion

Photo: NEFMC

New England Fishery Management Council

Considerations regarding when to change from static to dynamic BRPs

Jonathan J. Deroba

NOAA Fisheries – NEFSC

June 1, 2026

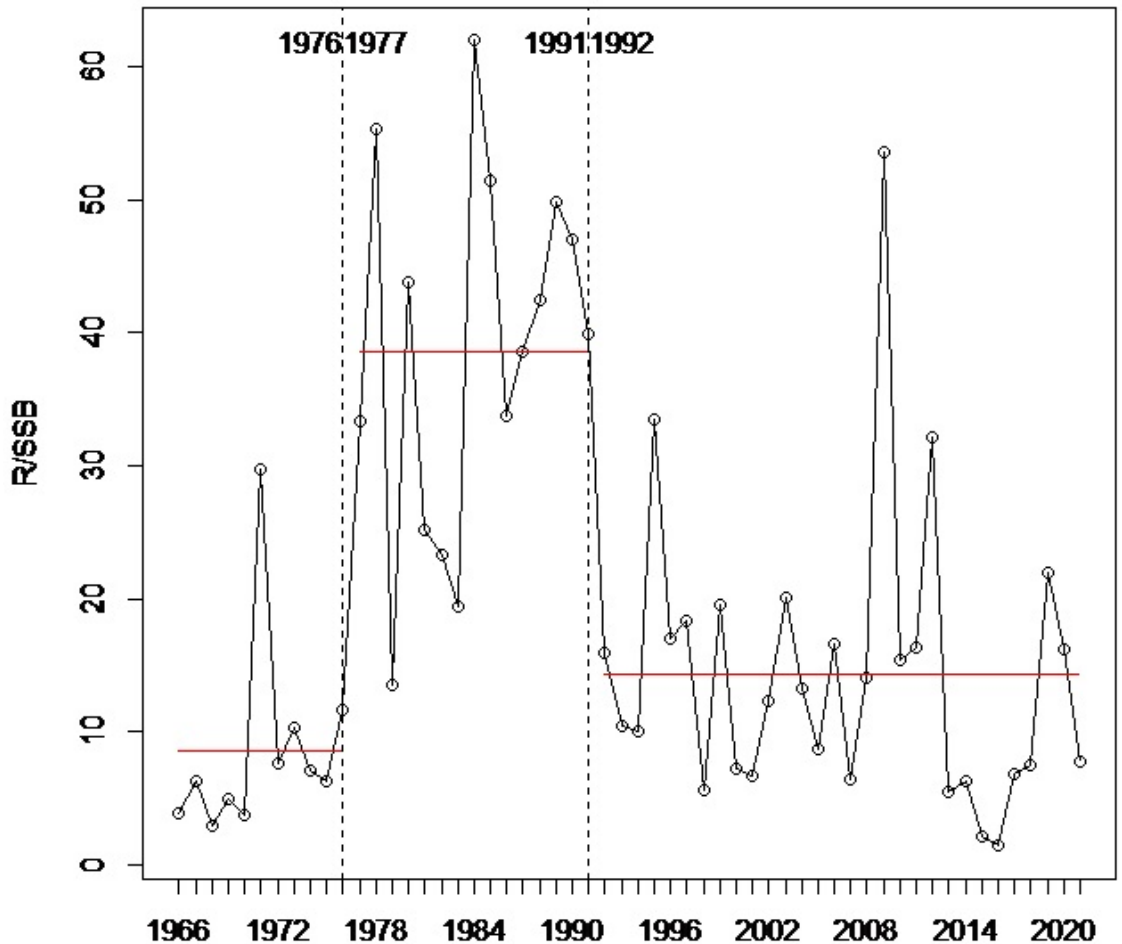
NEFMC SSC Workshop on Dynamic BRPs

When to change BRPs

- I do not know and there is no clear answer
- But there are things we can consider
  - Look for stanzas, for example, in R/SSB
  - Strength of evidence considerations
  - Dynamic B_{zero} or similar
  - Stock-recruit relationships informed by covariates
  - The complications caused by random effects
- Should we be worrying about BRPs so much?

Look for Stanzas (e.g., in R/SSB)

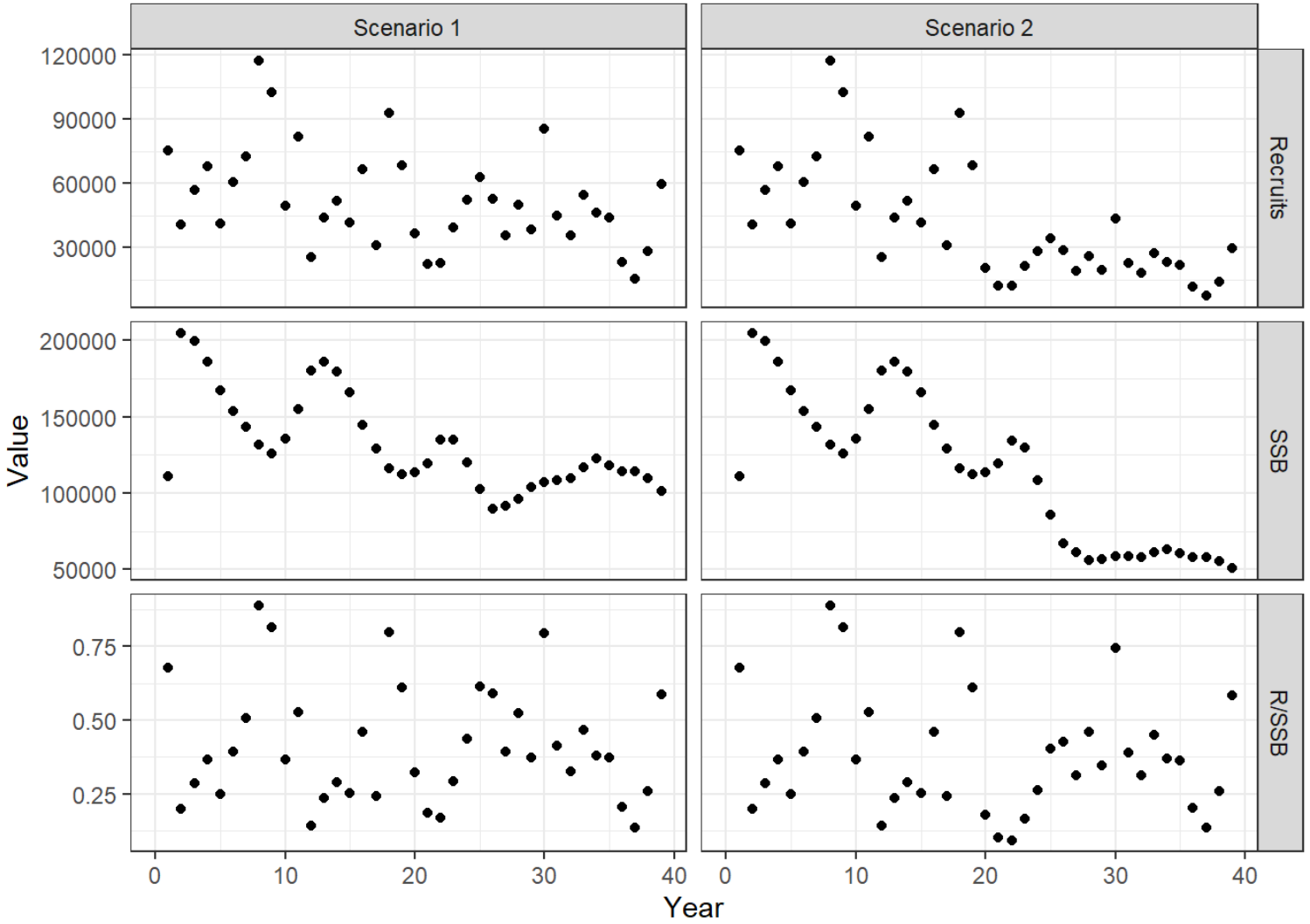
- As in Atlantic herring
- This shift was counter to compensatory dynamics
- Assumed as support for an environmental shift
- Is it that simple?



Look for Stanzas (e.g., in R/SSB)

- In which scenario is R_{zero} half as big in the last 20 years?
- Patterns in R/SSB are insufficient

- Credit: Chris Legault



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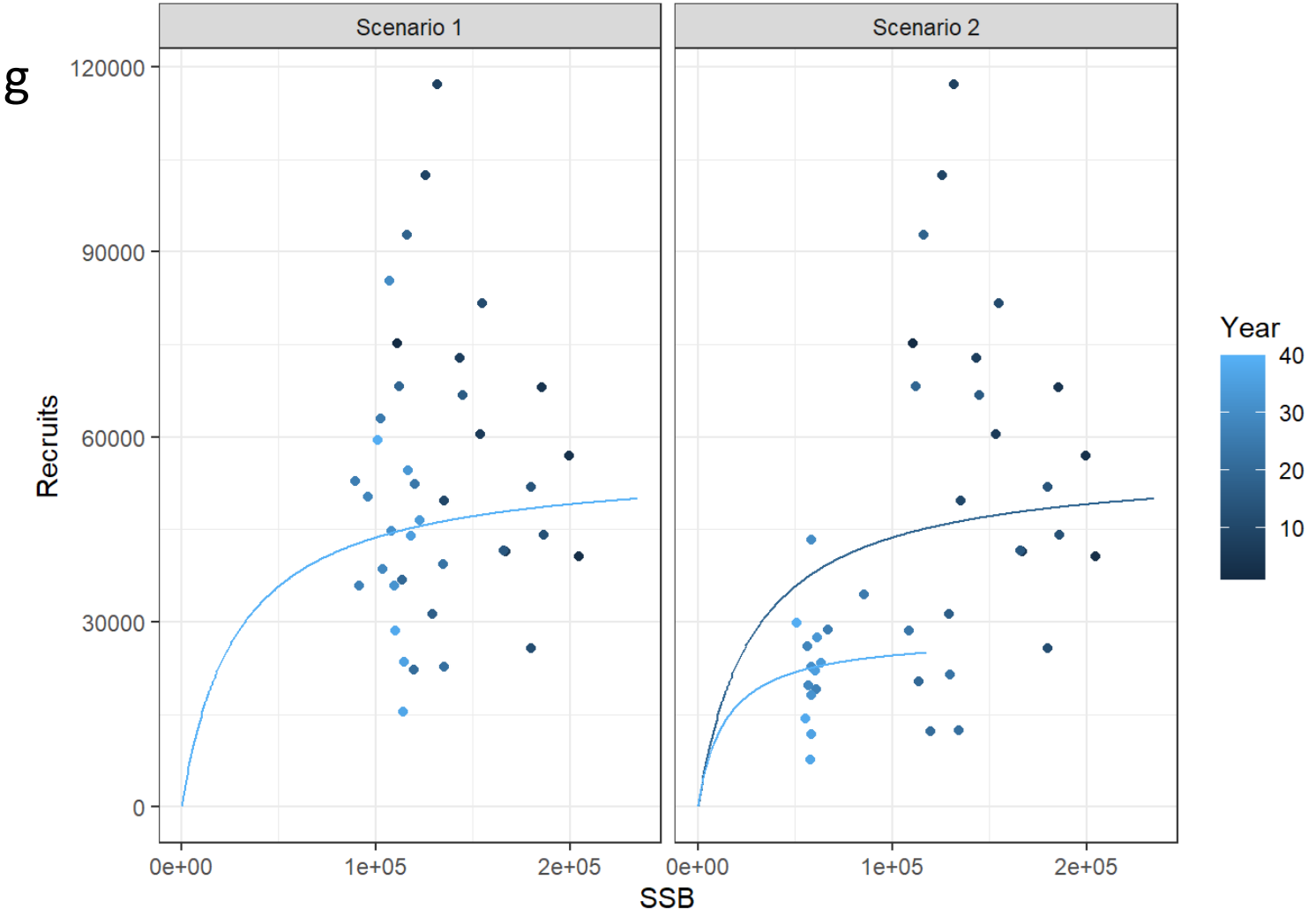
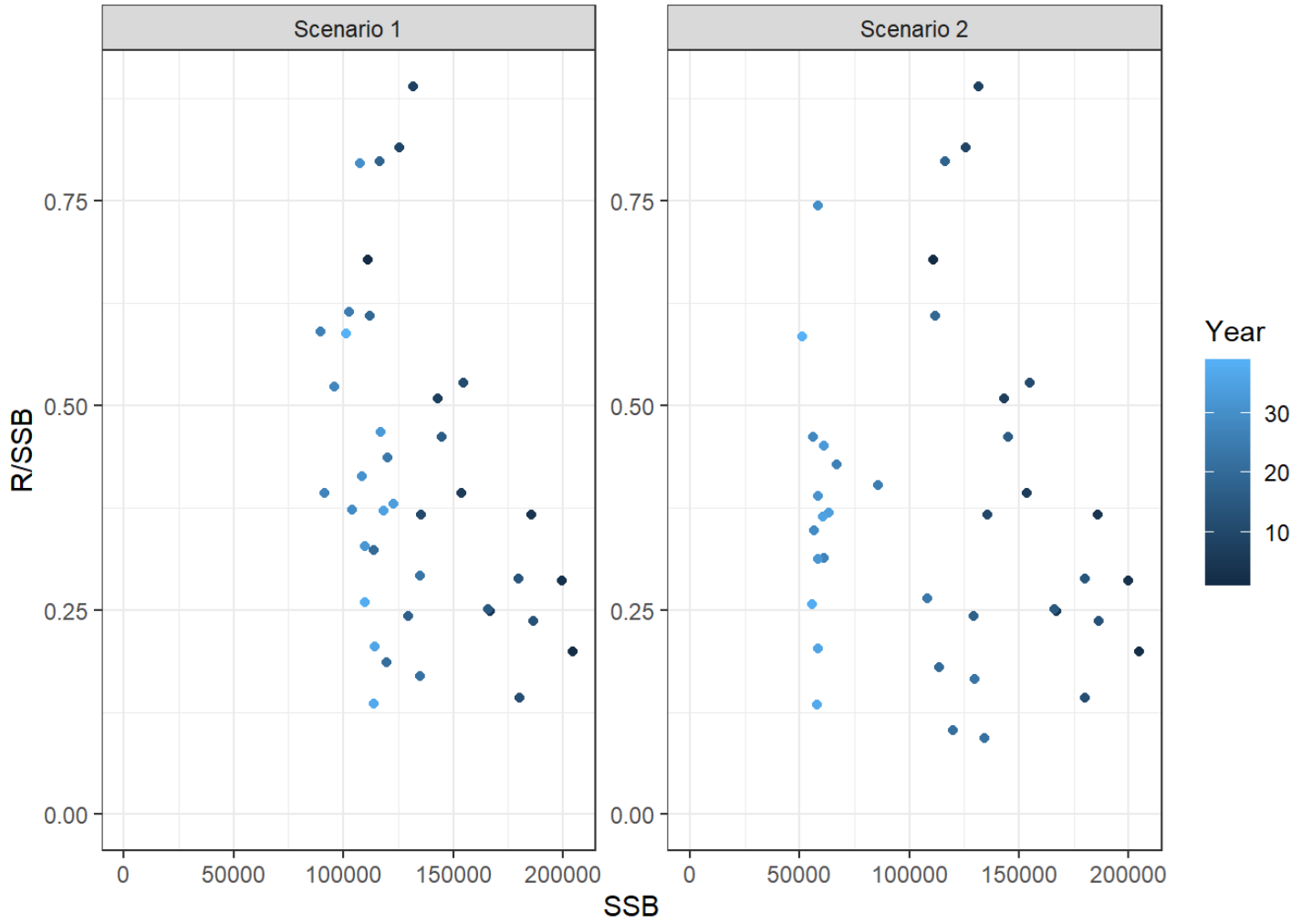


Look for Stanzas (e.g., in R/SSB)

- In which scenario is Rzero half as big in the last 20 years?
- Patterns in R/SSB are insufficient
- Can also examine R/SSB versus SSB

- Credit: Chris Legault



Strength of evidence

- Assuming a regime shift has occurred comes with risks
- Most conversations and decisions were case by case and ad hoc
- Klaer et al. (2015; and I am sure others) proposed a strength of evidence rubric
- A score ≥ 7 was considered "strong" evidence

Score	Observed change in a productivity indicator	Understanding of assessment model input data	Understanding of assessment model structural assumptions	Explanatory hypothesis
0	Short period less than one generation	Model input uncertainties are unknown	Key population parameters affected have not been identified	The mechanism is unknown
1	More than one generation	A number of model inputs are uncertain and the extent of uncertainty has not been characterised	Modeled changes in one or more key population parameters have fitted with observed biomass changes	A plausible mechanism for productivity shift has been developed from general knowledge of biophysical processes
2	Multiple generations and across several assessment/management cycles	Uncertain model inputs have been characterised and plausible ranges for those uncertainties have been investigated	Modeled changes in key production parameters have been somewhat validated by investigation of alternative model structures and/or improved model behaviour such as the removal of retrospective patterns	Output from a limited biophysical or multispecies model is consistent with observed patterns of change in productivity
3	Multiple generations and across many regular assessment/management cycles in the same timeframe	The character of model inputs is well understood and uncertainty has largely been eliminated or well estimated statistically	Validated modeled changes are consistent with output from a biophysical or multispecies model	Output from a comprehensive biophysical multispecies model is consistent with observed patterns of change in productivity

Strength of evidence

- Assuming a regime shift has occurred comes with risks
- Most conversations and decisions were case by case and ad hoc
- Klaer et al. (2015; and I am sure others) proposed a strength of evidence rubric
- A score $\geq$ 7 was considered “strong” evidence

- Structured conversations are likely better than ad hoc debate
- Still subjective and dependent on who is doing scores

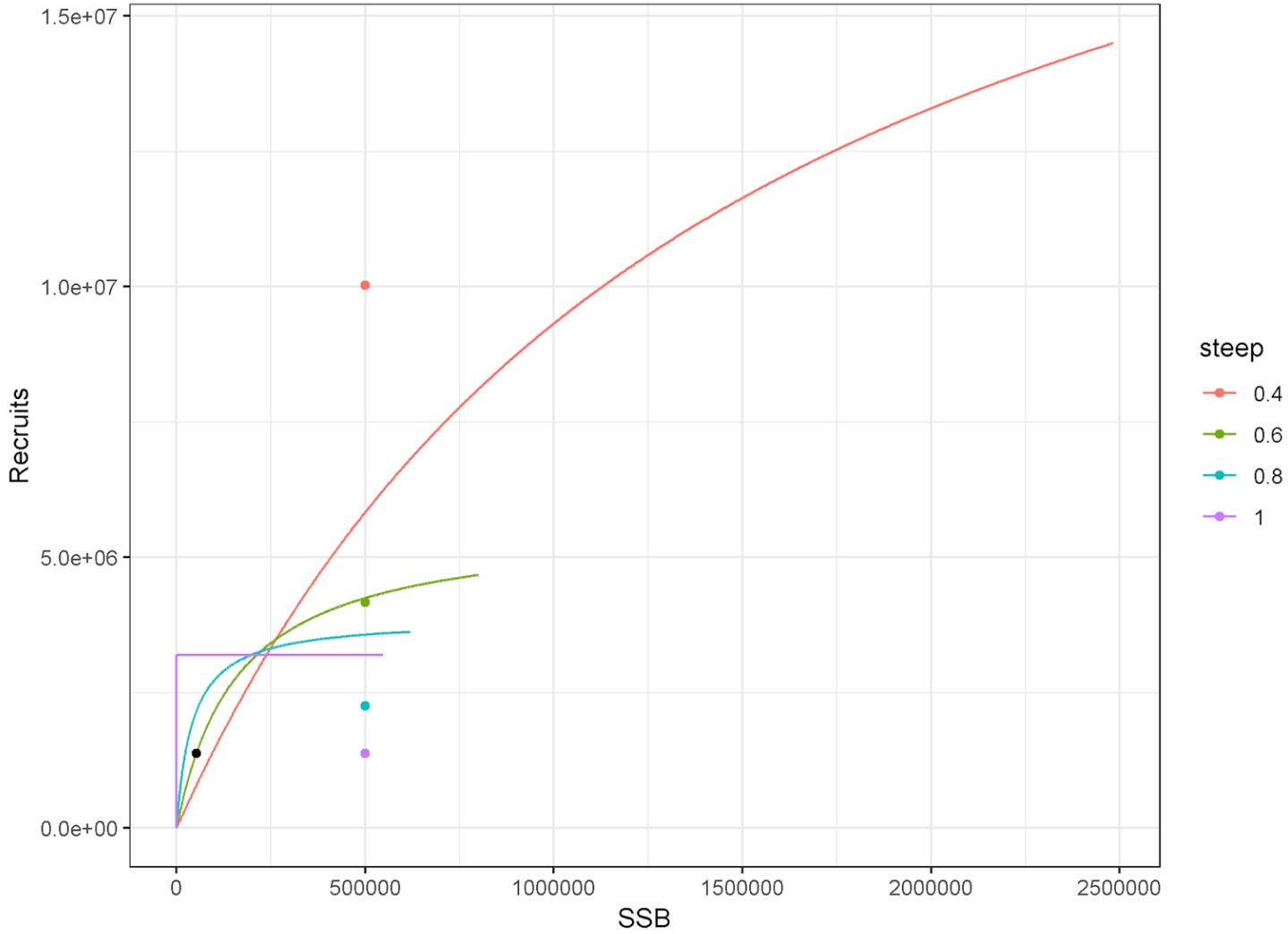
Dynamic B_{zero}

- Projects the population from year 1 of the assessment in the absence of fishing, and the annual SSB equate to B_{zero}
  - Very dynamic in that it changes annually
- The annual recruitment deviations are assumed to equal the values estimated by the assessment
  - Note, the deviations are the same, not the recruitment values themselves
  - Also assumes that fishing has no bearing on the recruitment deviations
- Provides a direct evaluation of the effect of fishing on the population, which is good and bad because it relies on a well determined stock-recruit curve

Dynamic Bzero

- Projected recruitment (and Bzero) depends heavily on the underlying stock-recruit relationship

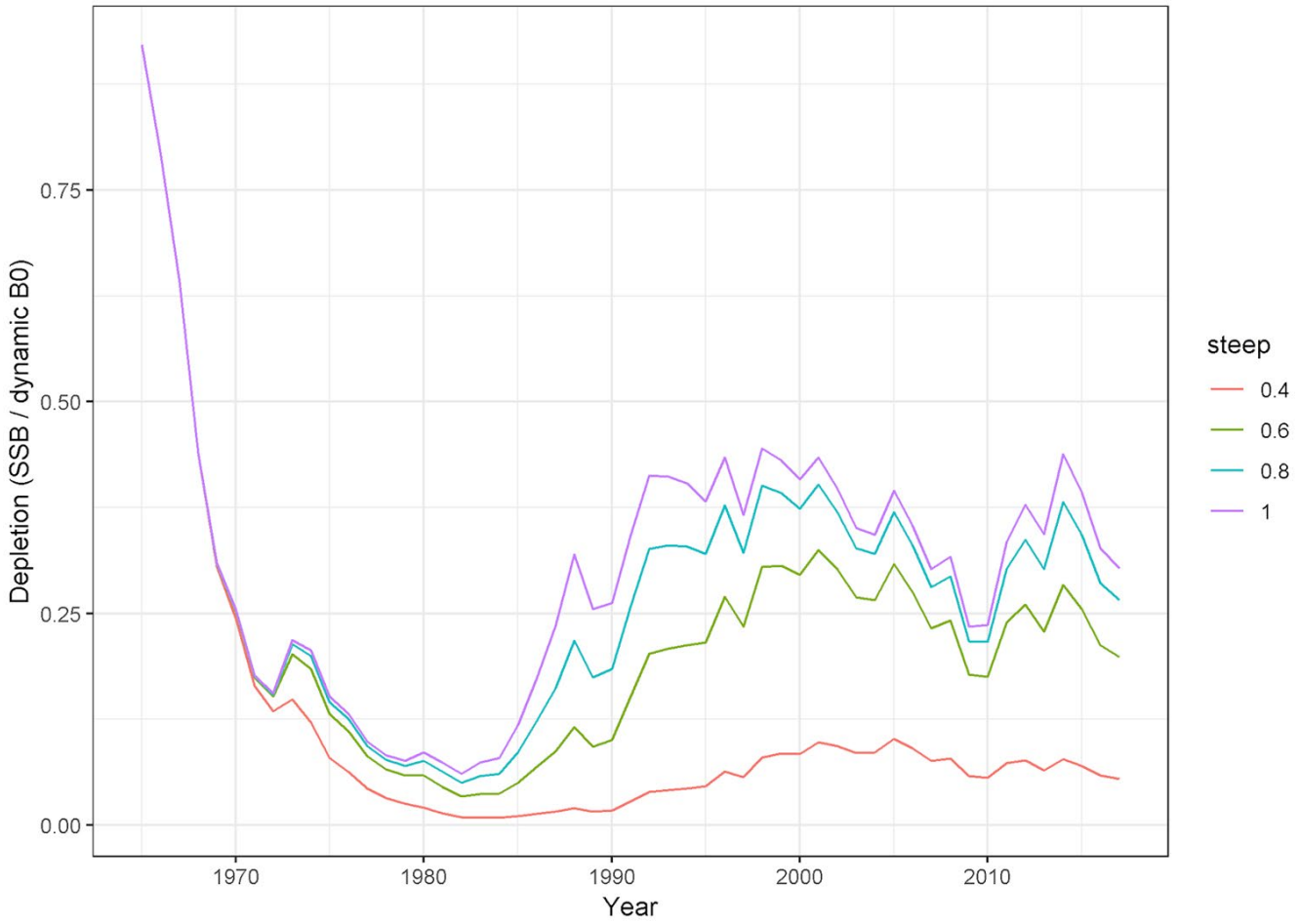
- Credit: Chris Legault



Dynamic Bzero

- Projected recruitment (and Bzero) depends heavily on the underlying stock-recruit relationship
- Relative stock status varies widely

- Credit: Chris Legault

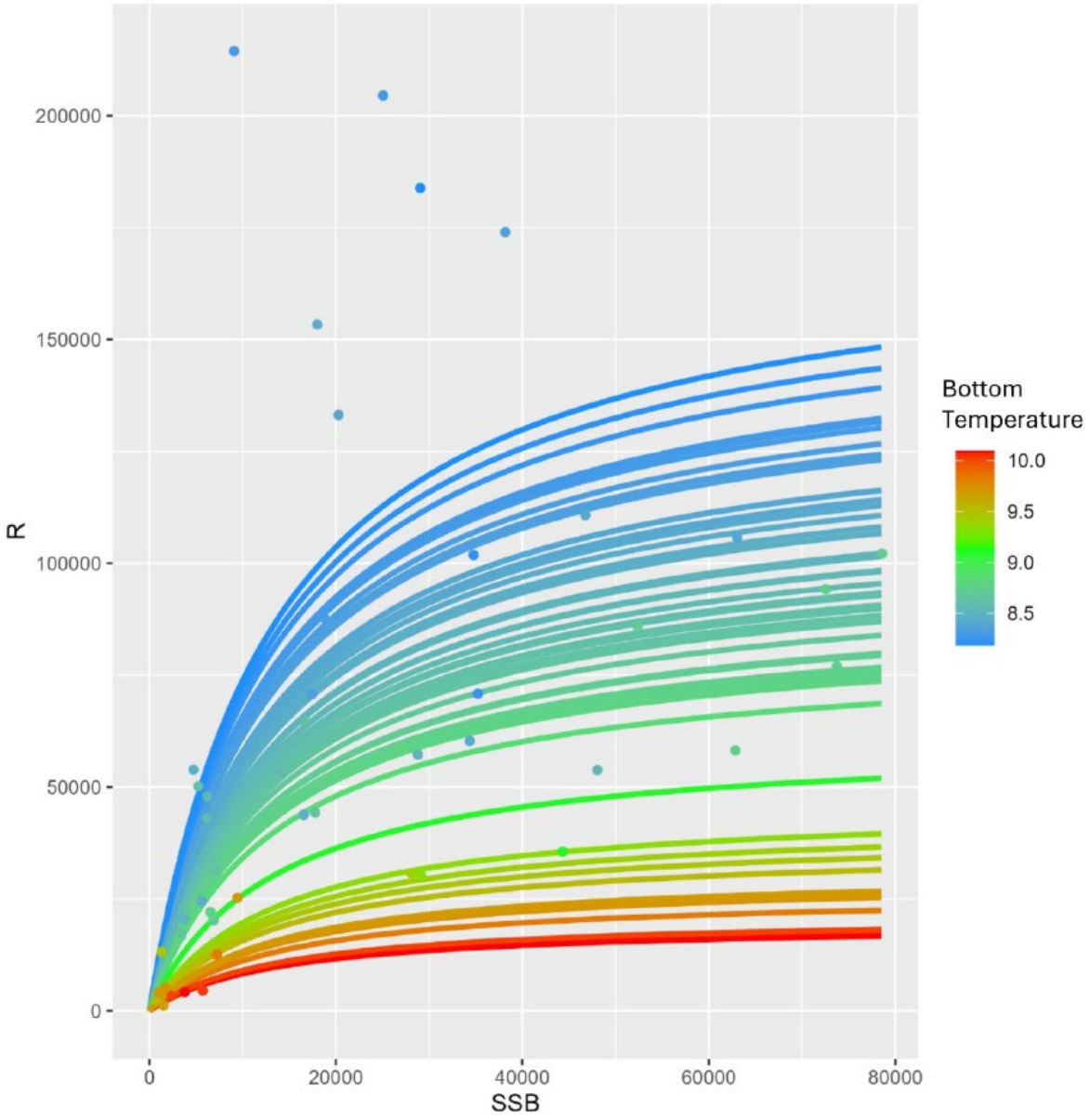


Dynamic B_{zero}

- Best in situations where the underlying stock-recruit curve is well determined (Credit: Chris Legault)
  - But if we are concerned about being dynamic then we are probably also worried about non-stationarity in the stock-recruit relationship; meaning we may also need a stock-recruit curve that is well determined for each year
- Performs better than static B_{zero} when changes in productivity shift directionally among years (Berger 2019)

Stock-recruit relationships informed by covariate

- GB Yellowtail
- Gets us back to similar conversations as when to use a shortened recruitment stanza
- As with B_{zero} it probably makes sense to be dynamic when the covariate trends among years
  - In this case, a break point analysis was done on the covariate to determine what curves to use for BRPs



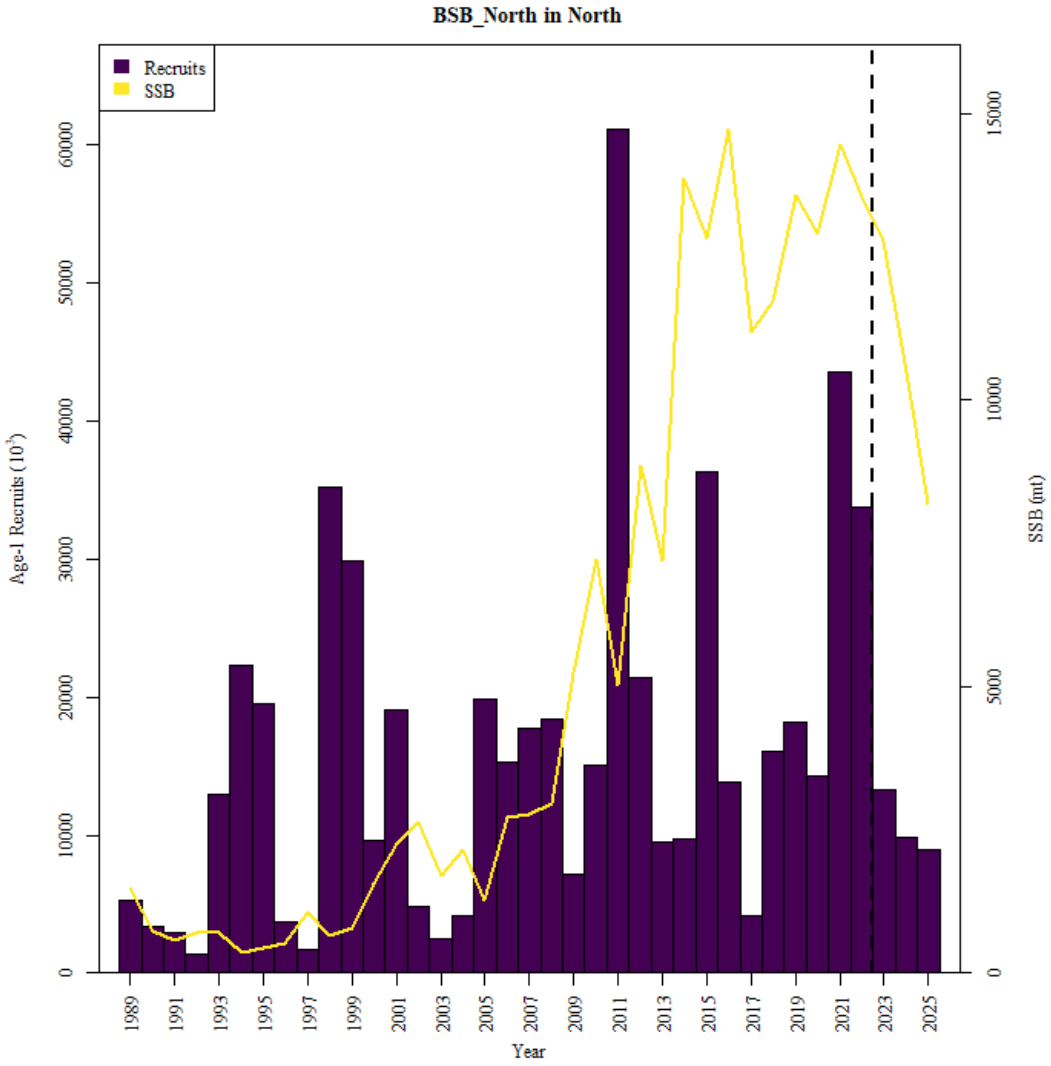
Complications caused by random effects

- Are NAA random effects obscuring covariate effects on recruitment, and therefore information about the need for dynamic BRPs?
  - See the 2025 Atlantic herring research track
  - Gaichas, S., Dean, M., and Deroba, J.J. 2025. Fit for the future? Environmental covariates and random effects in stock assessment. In: Theme Session M – Swimming against the tide –Controversial opinions in stock assessment and fisheries management. ICES Annual Science Conference 2025, Klaipeda, Lithuania.
- Are these random effects emergent properties that need to be discussed in the context of being dynamic?

Complications caused by random effects

- Including NAA random effects implies that cohort strength is not simply defined by recruitment
  - How do we interpret R/SSB in these contexts?
  - R and SSB can be different with and without NAA random effects (e.g., Atlantic herring)

	Without Random Effects	With Random Effects
Age-1 Abundance	67,184	43,544
Age-2 Abundance	40,457 (36% decrease)	11,851 (73% decrease)



Should we be worrying about BRPs so much?

- Hilborn, R. 2002. The dark side of reference points. Bulletin of Marine Science 70: 403-408.
- Assessment and BRP issues
  - Even “good” assessments have scale issues (e.g., historical and internal retrospectives)
  - We cannot reliably estimate Bzero (or Bmsy for that matter)
  - We cannot reliably estimate F reference points either (e.g., without an SR curve we borrow proxies)
  - BRPs are not transparent because they depend on judgement choices (e.g., data weighting), the logic is often irreproducible, and the methods not approachable for most
- We should spend more time evaluating the impact of key uncertainties and alternate catch policies and procedures
- “Overfishing is Overrated and Other Problems are More Pressing”
  - Waste from discarding
  - Bycatch
  - Overcapitalization
- Advocates for data based rules (e.g., an index must increase x% in so much time)
  - Use complex assessments for testing and simulation
  - Admittedly, success will depend on data quality (but also true of assessment)
- He sprinkles in some criticism of the US council approach too

Summary

- There is no “easy” way to decide when to use dynamic BRPs
- Examining a variety of tools is likely a good idea
- Trends and relationships in R/SSB can be informative, but requires caution
- Structured discussions about strength of evidence are likely better than ad hoc approaches
- Given the regions general inability to estimate stock-recruit relationships, maybe B_{zero} does not make sense (more of a when not to use a dynamic BRP)
- Covariate informed stock-recruit relationships are nice and offer an opportunity at a clear way to use dynamic BRPs, but do not get us away from all the challenges (e.g., stanzas)
- Continued research on how to evaluate when dynamic BRPs should be used in the presence of NAA random effects is warranted
- Is it time to avoid most of this and do something completely different?

How to change and what are the potential logistical challenges

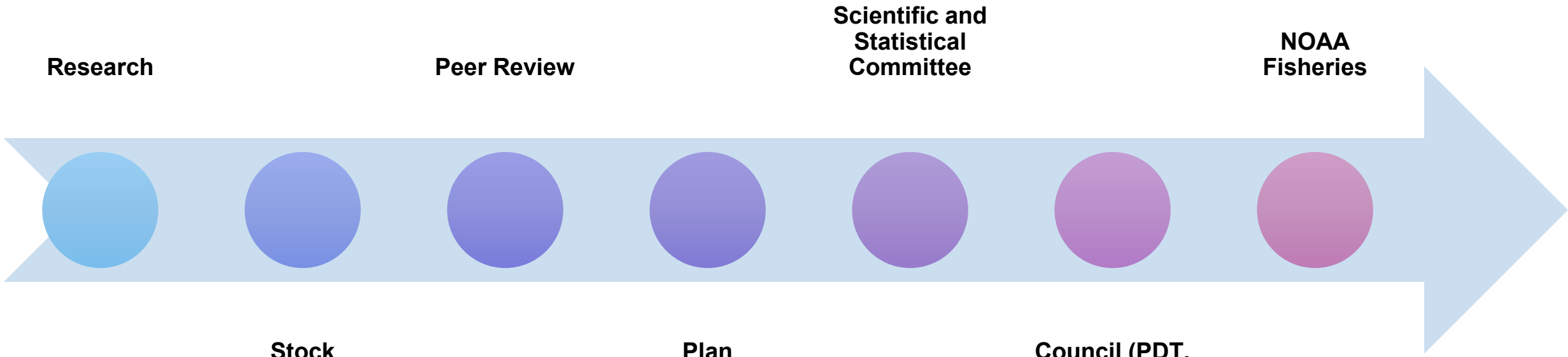
Jamie Cournane

SSC WORKSHOP

BOSTON, MA

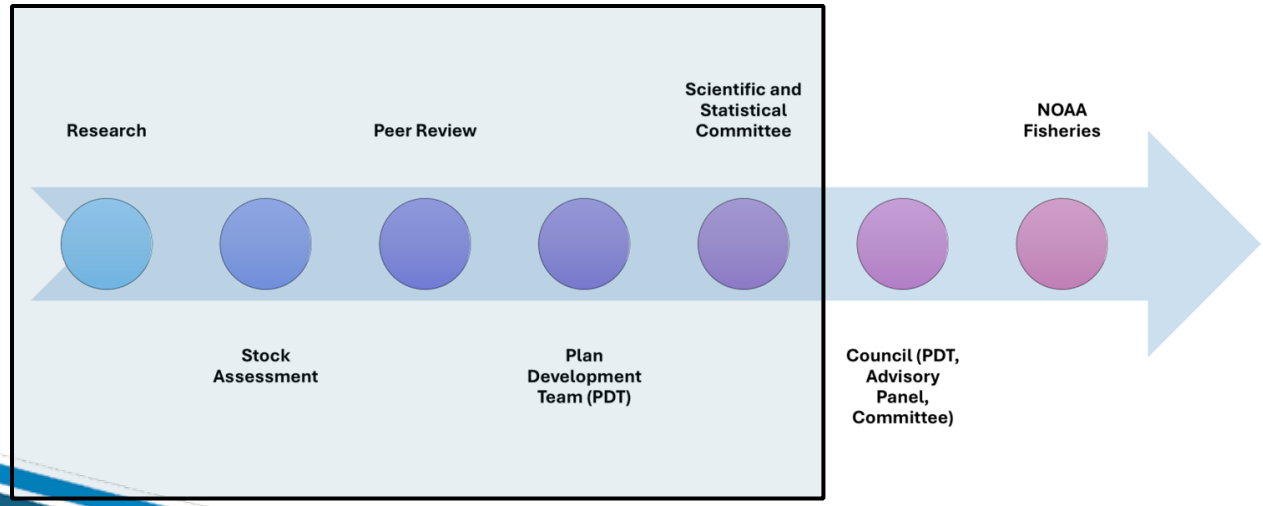
JUNE 1, 2026

PROCESS OVERVIEW



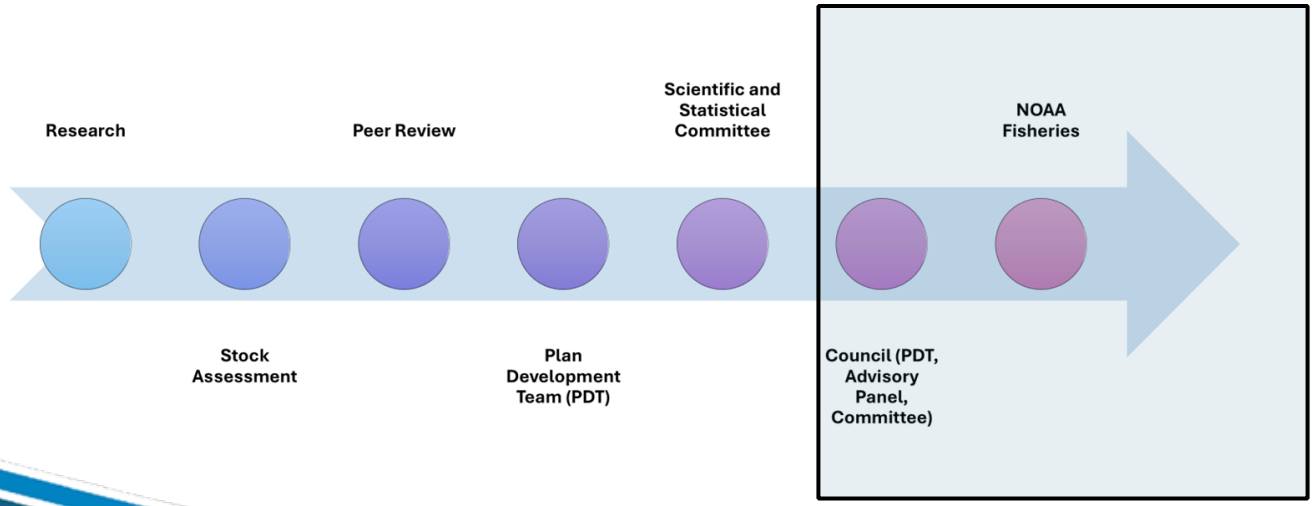
RESEARCH TO SSC

- Research occurs to inform a potential change in biological reference points
- Research Track Stock Assessment or Management Track Stock Assessment
- Peer Review of the Stock Assessment
- Plan Development Team may conduct additional analysis
- Scientific and Statistical Committee – Best Scientific Information Available



COUNCIL & NOAA FISHERIES

- Council
  - Does the Council want to adopt the new (dynamic) approach to biological reference points as its basis for stock status determination criteria in place of its old (static) approach?
- NOAA Fisheries
  - Determines if Best Scientific Information Available and implementation



COUNCIL ACTION - STATUS DETERMINATION CRITERIA

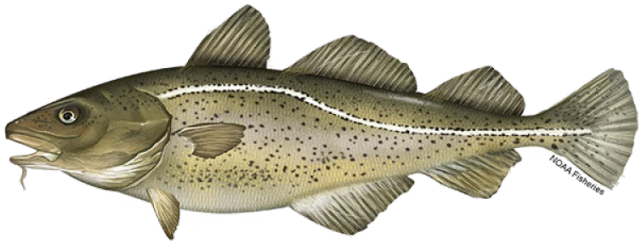
- Council recommends changes to status determination criteria to NOAA Fisheries through an action to modify a Fishery Management Plan:
  - Specifications*
  - Framework Adjustment or
  - Amendment
- Public process including involvement of Plan Development Teams, Advisory Panels, and Committees of the Council

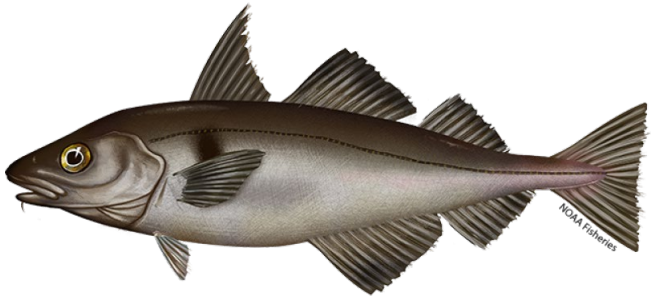
**Upon approval of the Council's Omnibus Management Flexibility Amendment all FMPs will have this type of action available for changes to SDCs.*

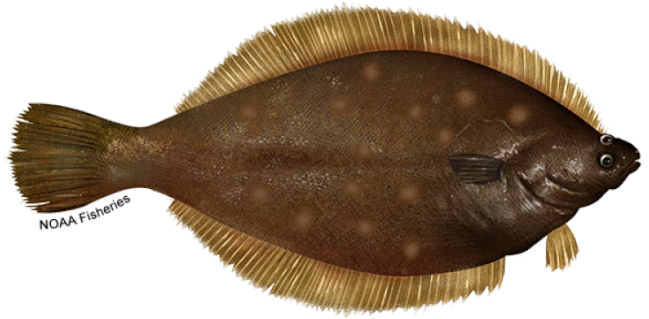
HOW LONG DOES THE COUNCIL PROCESS TAKE?

Typical Groundfish Specifications (Framework Adjustment) Timeline

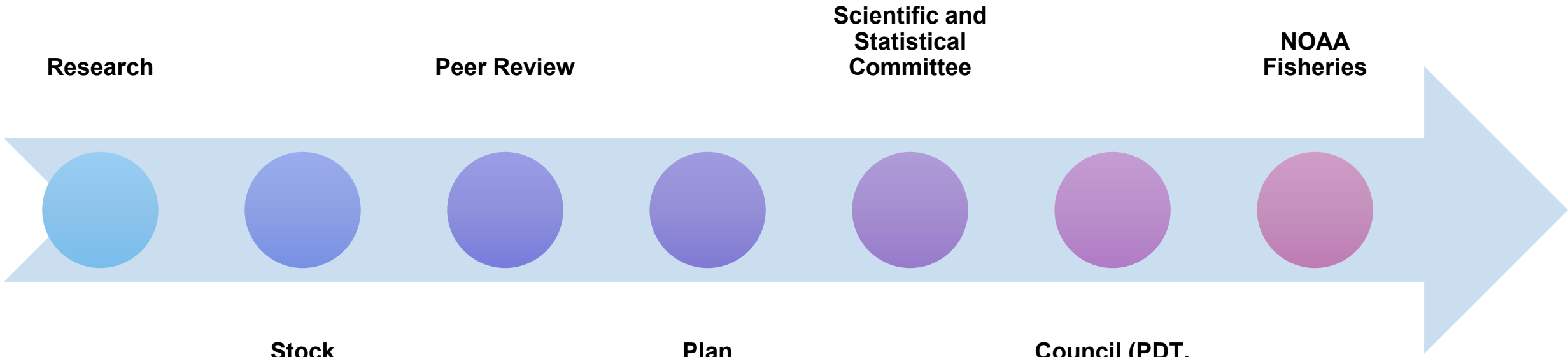
- Assessment schedule set in advance
- June – Council initiates action
- September – Management Track Stock Assessments Peer Review
- September – Council update
- September/October – PDT prep work
- October/November – SSC recommends ABCs
- November – additional PDT work
- November – APs and Committee meet
- December – Council – final action
- May – NOAA – target implementation







PROCESS OVERVIEW

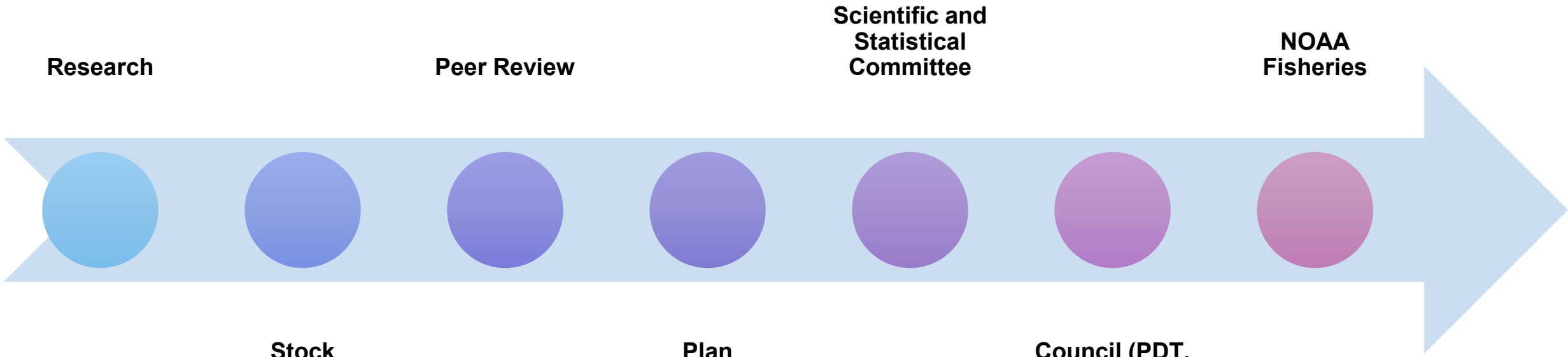


SOME INITIAL QUESTIONS

- Will there be a way to compare the old (static) approach and the new (dynamic) approach to biological reference points?
- Will simulation studies be needed to inform the SSC and Council?
- How will this approach work when setting specifications for longer periods of time (up to 5 years*)?

**Upon approval of the Council's Omnibus Management Flexibility Amendment all FMPs will allow specifications for 1 year to up to 5 years.*

PROCESS OVERVIEW



Breakout Group: How to Change to DRPs and What are the Practical Constraints

1. What are the management on ramps for implementing? What are the opportunities/barriers?

1. What pathways are available and what are the logistics? (assessment TORs, FMP amendments, ABC control rule changes, general SSC guidance)

1. What are practical and technical constraints? (acquiring data, limited data, frequency, resources, scientific consensus)

No webinar audio broadcast at this time.

Breakout Group Assignments - How to Change DRPs

	Table 1	Table 2	Table 3
Facilitator	Hannah MacDonald	Willy Goldsmith	Laura Singer
	Jerelle Jesse	Rachel Feeney	Jamie Cournane
SSC Members	Ed Camp	Lisa Kerr	Conor McManus
	Adam Delargy	Sam Truesdell	John Wiedenmann
	Michelle Staudinger	Gareth Lawson	Lauran Brewster
	Alex Hansell	Hirotsugu Uchida	Jason McNamee
	Kevin St. Martin	Kai Lorenzen	Mateja Nenadovic
Floaters	Jeff Kipp	Mike Wilberg	Jon Deroba
	Liz Sullivan	Kristan Blackhart	Wendy Morrison
	Tara Dolan	Dan Salerno	Cate O'Keefe

Plenary: Report Out and Discussion

1. When, how and what do we need to set up operational guidance?

1. Prioritizing stocks that need to be addressed
    a. How do we decide which NEFMC stocks may be better suited to DRPs in the future?
    b. What is the appropriateness of DRPs for NEFMC stocks given available data?

Wrap Up and Preview of Day 2

Tuesday, June 2

8:30 - Coffee and Breakfast Snacks

Morning: Management Applications, Challenges, and Opportunities of Implementation

Afternoon: Toward Operational Guidance and Next Steps

Photo: MCFA