



New England Fishery Management Council

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MEMORANDUM

DATE: March 25, 2026
TO: Scientific and Statistical Committee
FROM: Jamie Cournane, PhD and Rachel Feeney, PhD, Council Staff
SUBJECT: **Preparation for the Scientific and Statistical Committee Workshop on Dynamic Reference Points**

On behalf of the Steering Committee, we look forward to hosting your upcoming workshop on dynamic reference points on June 1-2, 2026 in Boston, MA. In preparation for the workshop, please review the preliminary set of meeting materials and background information prepared by the Steering Committee.

This memorandum includes: workshop goals and outcomes, dynamic reference points working definition, abbreviated agenda, background information, and a list of additional materials to be distributed prior to the workshop.

Background

Reference points in fisheries stock assessments and management are an essential tool for understanding the condition of a resource relative to a desired state. Dynamic reference points, unlike static ones, are allowed to change through time in response to non-stationarity in fish population dynamics. While scientific approaches to define dynamic biological reference points exist, the lack of a full understanding of their appropriate application and practical concerns about this change in key management targets and thresholds has presented challenges to adoption. This workshop aims to develop practical guidelines for integrating dynamic reference points into fisheries stock assessment and management.

1) Workshop goals and outcomes

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.

2) Dynamic reference points working definition

Biological Reference Points (BRPs) are the measures by which the status of a stock is determined. BRPs can be derived either empirically or analytically and are typically estimated under the assumption that population dynamics are constant and/or in equilibrium.

Examples of BRPs include: Maximum Sustainable Yield (MSY), B_{MSY} , F_{MSY} , Maximum Fishing Mortality Threshold (MFMT), Overfishing Limit (OLF), Minimum Stock Stock Size Threshold (MSST), and their proxies.

Empirical BRPs typically use stock biomass or exploitation levels during certain time periods as reference levels, with assumptions about the time periods to use to measure relative change. These assumptions vary across stocks, including a historical period where a stock is assumed responsive to management or had high, sustained productivity that may reflect MSY, or a contemporary period of sustained recent conditions. Analytical reference points, meanwhile, are defined through the stock assessment modeling process.

The traditional approach to BRP calculation has typically integrated strong assumptions of stationary population dynamics. While there is some updating that occurs in recalculating reference points with updated data on certain vital rates (e.g., a five-year average of weight-at-age and maturity-at-age), in the case of stocks with an analytical assessment, there are usually stationary assumptions regarding recruitment and natural mortality. In both cases, BRPs are used as benchmarks to set status determination,¹ to inform management decisions according to Acceptable Biological Catch (ABC) control rules, and to define stock rebuilding targets.

A challenge in characterizing MSY and other BRPs is complying with the requirements of National Standard 1 (NS1) of the Magnuson-Stevens Act as conditions change over time. The NS1 Guidelines define MSY as “the largest long-term average catch or yield that can be taken from a stock or stock complex under prevailing ecological, environmental conditions and fishery technological characteristics (e.g., gear selectivity), and the distribution of catch among fleets.” However, as changing ocean and fishery conditions impact a stock’s productivity, the assumption of “prevailing conditions” may no longer hold, thereby necessitating revisiting that stock’s BRPs.

Dynamic [Biological] Reference Points (DRPs) are time-varying targets and thresholds that adjust for non-stationarity in stock productivity. DRPs can enable more responsive management by accounting for the impacts of broad and persistent ecosystem change or regime shifts to better reflect recent past and projected future stock conditions. As with conventional BRPs, DRPs can be biomass- and/or fishing mortality-based and may use proxies depending on data availability (e.g., spawning potential ratio [SPR]). In some cases, DRPs may include linkages with an environmental driver and/or productivity but this is not required.

Numerous approaches for developing DRPs have been explored, including but not limited to those described in the following table.

¹ Some, not all, empirical BRPs inform status determination.

Dynamic Reference Point Approach	Description	Citation/NEFMC Example
Time-Varying MSY Reference Points	Calculating reference points such as MSY, SSB_{MSY} , and F_{MSY} as a function of a time-varying stock-recruitment relationship	Collie, J. 2023. White hake recruitment assumptions: effects on biological reference points and rebuilding projections for white hake (white paper and presentation). (Not yet adopted by the NEFMC)
Dynamic B_0	Determines unfished biomass by predicting the abundance of the stock in the absence of fishing using the stock assessment estimated-parameters (non-equilibrium approach)	Bessell-Browne, P., A. E. Punt, G. N. Tuck, J. Day, N. Klaer, and A. Penney. 2022. The effects of implementing a “dynamic B_0 ” harvest control rule in Australia’s Southern and Eastern Scalefish and Shark Fishery. <i>Fisheries Research</i> 252: 106306. https://doi.org/10.1016/j.fishres.2022.106306 .
Environmental Covariate-Informed Dynamic Reference Points	State-space models can propagate environmental covariates into biological reference points by linking environmental variables to key biological processes (e.g., recruitment or mortality). These environmentally driven processes determine population dynamics, and reference points derived from those dynamics such as MSY, B_{MSY} , and F_{MSY} become functions of environmental conditions.	
Truncated Productivity or Moving Window Approach	Calculated using a truncated productivity (e.g., recruitment) time series or a moving average over a window of time	Adopted in the 2022 management track assessments for Atlantic herring and Southern New England/Mid-Atlantic winter flounder.
Regime-Based Reference Points	Regime or state-dependent reference points defined for a particular ecosystem regime or productivity state (i.e., separate reference points for high/low states)	Are examples of re-estimating reference points to account for a change in productivity—for instance, for the Bering Sea/Aleutian Islands Tanner Crab stock (see p. 63-64).
Environmentally Conditioned Reference Points	Ecosystem-based fishing mortality: reference point that adjusts fishing mortality based on ecosystem conditions (e.g., lower when conditions are poor, higher when good).	Bentley, J. W., M. G. Lundy, D. Howell, S. E. Beggs, A. Bundy, F. de Castro, C. J. Fox, J. J. Heymans, C. P. Lynam, D. Pedreschi, P. Schuchert, N. Serpetti, J. Woodlock, and D. G. Reid. 2021. Refining fisheries advice with stock-specific ecosystem information. <i>Frontiers in Marine Science</i> 8: 602072. https://doi.org/10.3389/fmars.2021.602072 .

3) Abbreviated Agenda

NEFMC SSC Workshop on Dynamic Reference Points **DRAFT AGENDA**

MONDAY, JUNE 1

MORNING SESSION (9:00 am - 12:15 pm)

SETTING THE STAGE: WHERE WE ARE IN 2026

- Welcome and Opening Remarks (30 mins)
 - PRESENTATION: What are we doing now? What are the challenges? (40 mins presentation + 20 Q+A)
 - BREAK at 10:30 am - 10:45 am
 - PRESENTATION: Evolving Approaches to Revise Biological Reference Points in New England (30 mins presentation + 15 mins Q+A)
 - DISCUSSION: Unintended Consequences and Opportunities (45 mins discussion)
 - LUNCH at 12:15 - 1:15
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AFTERNOON SESSION (1:15 pm - 4:45 pm)

EVALUATING REFERENCE POINTS AND CONSIDERING POTENTIAL GUIDELINES

- Presentation/Breakout: When to change to DRPs (15 min presentation + 45 min breakout + 15 mins report out)
 - BREAK at 2:30pm - 3:00 pm
 - Presentation/Breakout: How to Change to DRPs and What are the Practical constraints (15 min presentation + 45 min breakout + 15 mins report out)
 - SUMMARIZE AND WRAP UP (30 min)
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TUESDAY, JUNE 2

MORNING SESSION (9:00 am - 12:00 pm)

MANAGEMENT APPLICATIONS, CHALLENGES & OPPORTUNITIES OF IMPLEMENTATION

- Day 2 Welcome: Goal Setting / Agenda Overview (15 mins)
 - PANEL: Policy and Legal Implications (45 mins + 15 mins Q+A)
 - BREAKOUT: Practical Implications for SSC and Council Workflows (45 mins breakout + 20 min report out + 30 min discussion)
 - LUNCH: 12:00 - 1:00 pm
-

AFTERNOON SESSION (1:00 pm - 4:45 pm)

TOWARD OPERATIONAL GUIDANCE AND NEXT STEPS

- DISCUSSION: Developing Operational Guidance for Dynamic BRPs (90 mins)
- BREAK from 2:30 - 2:45
- DISCUSSION: Identification of Future Work and Research Priorities (30 mins)
- DISCUSSION: Developing Clear, Implementable Next Steps (45 mins)
- Summary, Reflections, and Path Forward (30 mins)
- Closing Remarks from SSC Leadership (15 min)

4) **Background information**

State of Play Regarding Development and Implementation of Dynamic Reference Points [DRAFT]

Recent workshops, along with technical guidance from NOAA Fisheries, have highlighted the need to consider revising biological reference points (BRPs) to account for changing ocean conditions. This document is intended to prompt discussion at the June 2026 workshop and summarizes recent challenges, opportunities, and recommendations regarding the implementation of Dynamic Reference Points (DRPs) in federally managed U.S. fisheries, as identified by three key sources:

1. The Cooperative Institute for the North Atlantic Region (CINAR) hosted a two-day workshop in January 2024 in New Bedford, MA, entitled [*Defining Biological Reference Points in a Dynamic Northeast Marine Environment*](#).
2. The Eighth National Meeting of the Scientific Coordination Subcommittee of the Council Coordination Committee (SCS8) was held in Boston, MA in August 2024 and entitled [*Applying Acceptable Biological Catch \(ABC\) Control Rules in a Changing Environment*](#).
3. In November 2025, NOAA Fisheries published Technical Memorandum NMFS-F/SPO-261, entitled [*Technical Guidance for Estimating Reference Points Used for Stock Status Determination in Accordance with the National Standard 1 Guidelines*](#).

Citations in this document are abbreviated to CINAR, SCS8, and NSIG.

Background and Rationale

- Traditionally, BRPs are estimated with the assumption of stable stock productivity over time. However, environmental changes may affect stock productivity and challenge this assumption of stationarity. There is a need to develop non-stationary BRPs that can account for changing stock dynamics such as recruitment.
- While Maximum Sustainable Yield (MSY) is defined as the largest long-term average catch for a stock under prevailing ecological and environmental conditions and fishery technical characteristics, MSY should be re-estimated as those conditions change (NSIG).
- Failing to revisit reference points as productivity changes can impact both the stocks themselves and the social systems that have developed around them, while also affecting managers' abilities to adhere to (or adjust) rebuilding and other legal requirements (CINAR).
- At SCS8, Dr. Jeremy Collie described his research testing the ability of harvest control rules to respond to climate-driven changes in stock productivity. He found that over half of 84 stocks examined across five regions of the U.S. exhibited time-varying recruitment productivity; for those stocks, a dynamic stock-recruit model could improve recruitment forecasts for up to three years due to the estimates' being based on current versus long-term average conditions. Simulations suggested that time-varying harvest control rules based on DRPs were more effective at maintaining biomass near the target level by adjusting fishing levels as productivity changed. Harvest policies that did not change over time produced similar average catch but were not able to maintain biomass at the target level when productivity was low.

Key Challenges for Developing and Implementing DRPs

Scientific Challenges

- Determining whether environmental changes constitute a long-term regime shift that warrants changing BRPs versus short-term variability can be difficult (CINAR, SCS8).
- Explicitly linking changes in productivity to environmental drivers can prove elusive, as fishing mortality, density dependence, and other factors can also impact stock dynamics (CINAR, SCS8).

- While some councils have found ways to account for non-stationarity in productivity when setting BRPs and control rules (e.g., by shortening the time series of recruitment to reflect recent conditions), only Pacific sardine (managed by the Pacific Fishery Management Council) is managed with an explicitly climate-linked control rule based on a predictable relationship between temperature and productivity (SCS8).

Management/Implementation Challenges

- There is a risk in revising BRPs to reflect changing conditions when doing so is unwarranted. Adjusting them downward can lead to a comparatively positive view of stock status and ensuing catch levels that risk further driving down a depleted stock. Conversely, adjusting them upward can decrease stock status and result in an overly conservative approach (e.g., implementation of an unnecessary rebuilding plan) (CINAR, SCS8, NS1G).
- Given the potential for significant socioeconomic impacts from changing BRPs (e.g., lowering catch limits for a choke species in a multi-species fishery that constrains access to other species), there can be inertia in the management process (SCS8).
- Depending on the stock, BRPs are currently defined at multiple steps of the assessment/management process (e.g., research track assessments, management track assessments, through council Scientific and Statistical Committees, or within council fishery management plans), which can impede the ability to make timely adjustments (CINAR).

When to Consider Revising BRPs

- There are three main types of “prevailing conditions” which can impact MSY as they change and thus potentially warrant re-estimating BRPs:
 1. Changes to fishery/fleet characteristics, such as regulations, market conditions, or stock availability, can affect fishing mortality patterns.
 2. Stock life-history characteristics such as growth, maturity, and fecundity can be affected by environmental shifts, although those characteristics can be density-dependent and thus could be affected by fishing as well as the environment.
 3. Changing conditions can impact a stock’s recruitment and thereby affect productivity (NS1G).
- Key criteria for determining whether a regime shift has occurred that may warrant revising BRPs include:
 - Consistent environmental change;
 - Responses across multiple stocks;
 - Lack of stock response to changes in fishing effort (or stock size is strongly correlated with changing conditions); and
 - Evidence that prior conditions are unlikely to return (NS1G).
- The Northwest Atlantic Fisheries Organization’s (NAFO)² conditions for revising BRPs also specify that there should be strong evidence that a regime shift has occurred. Other conditions provided by NAFO include:
 - The mechanism driving the shift in productivity is understood;

² NAFO (Northwest Atlantic Fisheries Organization). 2021. *Achieving NAFO Convention Objectives with a Precautionary Approach Framework*. NAFO SCS Doc. 22/02. Available at: <https://www.nafo.int/Portals/0/PDFs/sc/2022/scs22-02.pdf>

- The stock would be viable if managed with the revised BRPs; and
- Sufficient information is available to revise BRPs (NAFO, as described in CINAR).
- It is important to detect evidence of a regime shift/ecosystem change across multiple ecosystem components (e.g., indicators in the State of the Ecosystem Reports for the Northeast U.S. Shelf) before considering changes to stock-specific BRPs. At the same time, there is a need for stock-specific approaches to updating BRPs as ecosystem conditions change (CINAR).

Understanding the driver(s) of shifting productivity not required

- While mechanistically linking environmental changes to stock productivity is preferable, establishing those relationships remains a challenge. (NS1G).
- To consider changing BRPs, it is preferable but not required to understand the exact mechanism behind environmental drivers of changes in stock productivity, as long as such changes are driven by environmental factors rather than stock size (CINAR; note that this is contrary to NAFO's guidance).
- At the same time, adaptations can be more easily made when the linkage between the environment and stock productivity is better understood, as was seen with the adoption of more conservative BRPs for gag grouper by the Gulf Council following red tide events (SCS8).

Approaches for defining DRPs

- There are three broad approaches for updating BRPs:
 1. Maintaining use of the entire time series of data when there is no obvious trend.
 2. Adopting a trailing average to reflect recent sustained changes in conditions.
 3. Truncating the time series due to detection of a regime shift (NS1G).
- Truncating the time series used to set BRPs to reflect changing productivity has been done for several stocks, including southern New England yellowtail and winter flounder, Atlantic mackerel in the mid-Atlantic, and Sacramento River Fall Chinook salmon (SCS8).
- There are numerous methods to consider for adapting BRPs under changing conditions, including:
 - Dynamic B_0 , which determines a stock's unfished biomass under prevailing conditions to account for changing productivity.
 - Dynamic stock-recruitment models, which allow the stock-recruitment relationship to vary over time.
 - Updating assumptions for proxy-based BRPs such as Spawning Potential Ratio.
 - Transitioning assessments to model platforms such as the Woods Hole Assessment Model (WHAM) that can incorporate environmental covariates and account for time-varying stock dynamics.
 - Shifting away from biomass-based BRPs in favor of solely fishing mortality-based BRPs (CINAR).

Key Recommendations and Next Steps

Research and Analysis

- There is broad recognition of the need to expand research on environmental drivers of stock dynamics, which can also be influenced by other factors such as fishing mortality or population density (CINAR, SCS8, NS1G).

- There is a need for clearer guidance on when there is sufficient evidence of environmental change to revise BRPs or control rules (SCS8).
- Identifying a suite of indicators of broad ecosystem change (i.e., a regime shift), along with performance indicators for individual stocks, could be helpful for determining whether revisiting BRPs is warranted. A review of such indicators could be integrated into the stock assessment process (CINAR, SCS8).
- Regardless of the specific DRP approach, there is a need to test the performance of changing BRPs across a range of scenarios using Management Strategy Evaluation (CINAR, SCS8, NS1G).
- The South Atlantic Fishery Management Council is investigating the use of dynamic harvest controls and DRPs in the region (SCS8).

Implementation

- There is a key need for guidance on how and where in the assessment/management process changes to BRPs should be considered (CINAR).
- Councils should write flexibility into fishery management plans that allows for rapidly adjusting a stock's BRPs and control rules as conditions change (SCS8). By the same token, councils should explore pathways that enable them to quickly adopt new reference levels (i.e., Status Determination Criteria) that reflect the Best Scientific Information Available without developing a full Fishery Management Plan Amendment (NS1G).
- It is important to consider the consistency in assumptions about stock productivity between BRPs and short-term projections (CINAR). At the same time, while maintaining BRPs based on the full time series may make sense in some cases, using shorter time horizons for control rule projections may be a better predictor of near-future conditions (NS1G).

5) **List of additional materials to be distributed prior to the workshop**

- Review of past 10 years of SSC discussions and synthesize where there have been past challenges with static reference points, underscoring the need for DRPs
- Overview: What's changed since SCS8 in 2024
- Updated NEFSC stock-by-stock table re. reference point methods (originally prepared for SCS8)
- Background materials about management system constraints that might prevent NEFMC from nimbly implementing DRPs
- Illustration of the pathways for adjusting SDCs given the NEFMC's recent Management Flexibility Omnibus