

## Dynamic Reference Points State of Play

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 NS1G.

### 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 (NS1G).
- 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) conditions for revising BRPs<sup>1</sup> 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;
  - 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.

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<sup>1</sup> 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>

- 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).