

Subgroup on ecosystem and climate informed fishing opportunities advice

MIACO, January 2026



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Objectives

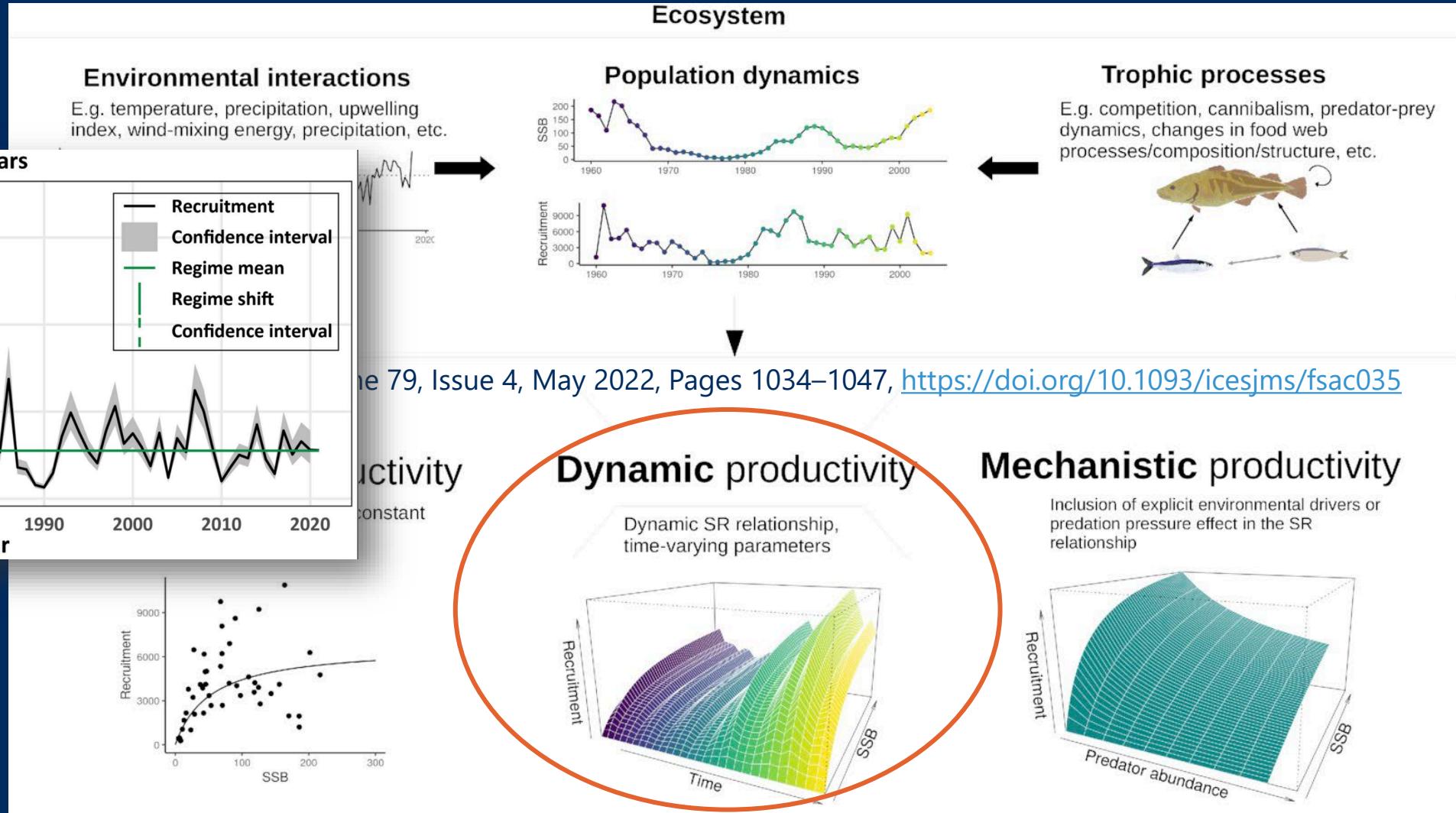
- Review a set of options for evolving our advice framework for fisheries to take account of ecosystem and climate change impacts
- Discuss and rank each option in terms of its relevance for, and alignment with, management needs
- Identify priority science and advisory next steps for the design and implementation of ecosystem and climate considerations in fishing opportunities advice



Options for ecosystem and climate informed fishing opportunities advice

1. Implementation of **ecosystem-informed single-stock reference points**
2. Inclusion of **qualitative, risk- and objectives-based statements** in advice
3. Provision of **single, multispecies or mixed fisheries catch scenarios conditioned for observed, anticipated, or projected climate change or ecosystem effects.**
4. **Forecast of long-term impacts of climate change** in fisheriesXplorer





Examples: Option 2

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Performance Relative to Fishery Management Objectives

Trends and status of indicators related to broad ecosystem-level fishery management objectives, with implications for the Mid-Atlantic Fishery Management Council (MAFMC)

OBJECTIVE (Indicator)	TREND	CURRENT STATUS	IMPLICATIONS
Seafood production (Total and MAFMC managed landings)	 Decline	 Below long-term average	Commercial landings were at a historic low in 2023, driven by menhaden fishery consolidation. MAFMC landings have declined since the mid-2000s. This is driven by surfclam and ocean quahog, and possibly by market conditions. Port landings combined across Mid-Atlantic states have moderate to high total climate vulnerability. Recreational harvest is declining due to multiple drivers.
Commercial profits (Total and managed revenue)	 No trend	 Below long-term average	Total revenue reached an all time low in 2022–2023, driven by both declining price and volume. Recent declining revenue is driven in part by managed clam species volume. Even when adjusting for inflation, falling prices are almost universal and due to market dynamics. Combined Mid-Atlantic port revenue has had high to very high total climate vulnerability for most of the period since 2000.
Recreational opportunities (Effort and fleet diversity)	 Increase	 Above long-term average	EFFORT Recreational effort shows an increasing long-term trend and is above average, but fleet diversity is decreasing because of a shift away from party/charter to shore-based fishing. This shift results in a decreased range of recreational fishing opportunities. Shore-based anglers have access to different species/sizes of fish than vessel-based anglers.
Stability (Fishery and ecosystem diversity maintained over time)	 Decline	 Below long-term average	FISHERY Not stable ECOSYSTEM Not stable Commercial: Indicators suggest changing commercial fleet composition but similar species revenue diversity, for those fleets continuing to fish. Recreational: Species catch diversity has been maintained by a different set of species over time and continues to be above the long-term mean. Ecosystem: Multiple ecosystem indicators suggest instability. While fish species richness is stable, zooplankton diversity has been increasing, and changes in biological traits of the fish community have been observed.
Social and cultural (Community fishery engagement, social and climate vulnerability)	 No trend	 Below long-term average	Community total climate vulnerability trend Four Mid-Atlantic communities ranked among the top most engaged in both commercial and recreational fishing. Community social and climate vulnerability status varies by community. Many of the top highly engaged fishing communities throughout the Mid-Atlantic region ranked medium-high or above for one or more of the social vulnerability indicators, including 4 commercial and 3 recreational communities, suggesting potential challenges for these communities adapting to change. A majority of Mid-Atlantic commercial fishing communities have high to very high revenue total climate vulnerability.
Protected species (Coastwide bycatch, population numbers, mortalities)	 Mixed trends	 Meeting objectives	BYCATCH Mixed trends POPULATION NARW Decline Below recovery objective Mixed bycatch trends through 2022 are related to fishery management, low observer coverage, shifts in population distribution combined with fishery shifts, and population increase for seals. Population drivers for North Atlantic Right Whales (NARW) include combined fishery interactions/vessel strikes and distribution shifts related to prey abundance and quality. Management measures to reduce adult mortality are reflected in more stable population numbers. Unusual mortality events continue for 3 large whale species.

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Risks to Meeting Fishery Management Objectives

Environmental Change and Ecosystem Risks

Climate and ecosystem change can directly and indirectly create risks to meeting fisheries management objectives by affecting the distribution, seasonal timing, productivity, and physiology of marine species.



Risks to Managing Spatially

- **Observations:** Species distributions for many fish and marine mammals are trending to the northeast along the continental shelf and into deeper water.
- **Potential Impacts:** Spatial misallocation of quotas within and across jurisdictions, leading to unmet quotas and/or increased discards. Specification of gear management areas may not utilize quotas and minimize bycatch.

Risks to Managing Seasonally

- **Observations:** Seasonal timing of spawning has changed for some managed species. Migration timing of some tunas and large whales has changed.
- **Potential Impacts:** Spawning closures are less effective if peak spawning occurs outside the seasonal closure. Seasonal openings of exemption areas may be inconsistent with species presence. Seasonal quota allocations may be misaligned with availability.



Risks to Setting Catch Limits

- **Observations:** Productivity and fish condition has changed for multiple fish species.
- **Potential Impacts:** Changes in environmental conditions can affect stock reference points and short-term stock projections. When productivity changes are not accounted for, they can lead to misspecified quotas and rebuilding plans.



Ecosystem and Environmental Conditions

- **Recruitment:** Recent strong recruitment is considered under the assessment data inputs. [Not Scored]

- **Habitat:** The center of gravity for sablefish biomass has shifted approximately 2° northward in recent years. [Unknown]

- **Prey:** Increased euphausiid and juvenile hake biomass suggest adequate prey availability for sablefish in recent years. [Favorable]

- **Predators:** Sablefish consumption (by California sea lions, sperm whales, porpoises, skates, and fur seals) is unlikely to have changed in recent years, but there have been long-term increases in the abundance of some groups like sea lions. [Neutral]

- **Competition:** There is potential for competition between sablefish and Pacific hake (e.g., for euphausiids). Changes in competitive interactions are highly uncertain given limited information about prey availability and spatiotemporal overlap with potential competitors. Recent large recruitments increase the likelihood of intraspecific, density-dependent, competition. [Unfavorable]

Assessment Data Inputs

- Catch reconstructions (landings and discards) date back to the early 1900s for hook-and-line and trawl fisheries. Foreign landings records began in the 1960s. [Neutral]

- There is high confidence in the primary fishery-independent survey (WCGBTS). Sablefish also occur deeper than the survey samples. [Favorable]

- An informative but highly uncertain environmentally driven recruitment index was incorporated into the assessment for the most recent 5 years. [Neutral]

- Age data have been relatively well sampled. The WCGBTS provides coastwide age data and ages are available from the fishery for the last 40 years but lack coastwide sampling in recent years. Data to inform recent recruitment is well represented. There are known challenges and uncertainty in ageing. [Favorable]

- Time-varying growth relies on empirical weight-at-age and is integrated across latitudes according to survey biomass. [Favorable]

- Spatially explicit estimates of functional maturity account for latitudinal differences in productivity. [Favorable]

Assessment Model Fits and Structural Uncertainty

- Length data were available but not used in the model [Neutral]

- Age data generally fit well with realistic selectivity assumptions. Estimates of recent large cohorts were robust across sensitivity runs. The model estimates recent recruitments based on age data and the recruitment index. [Favorable]

- Natural mortality was estimated but assumed to be constant for all life stages and across time and space. Natural mortality was set to be equal by sex based upon similar model estimates. [Neutral]

- Steepness was fixed ($h = 0.75$) given life history and management (reference point) objectives. Available data are not informative of absolute stock size or productivity at small stock sizes. [Neutral]

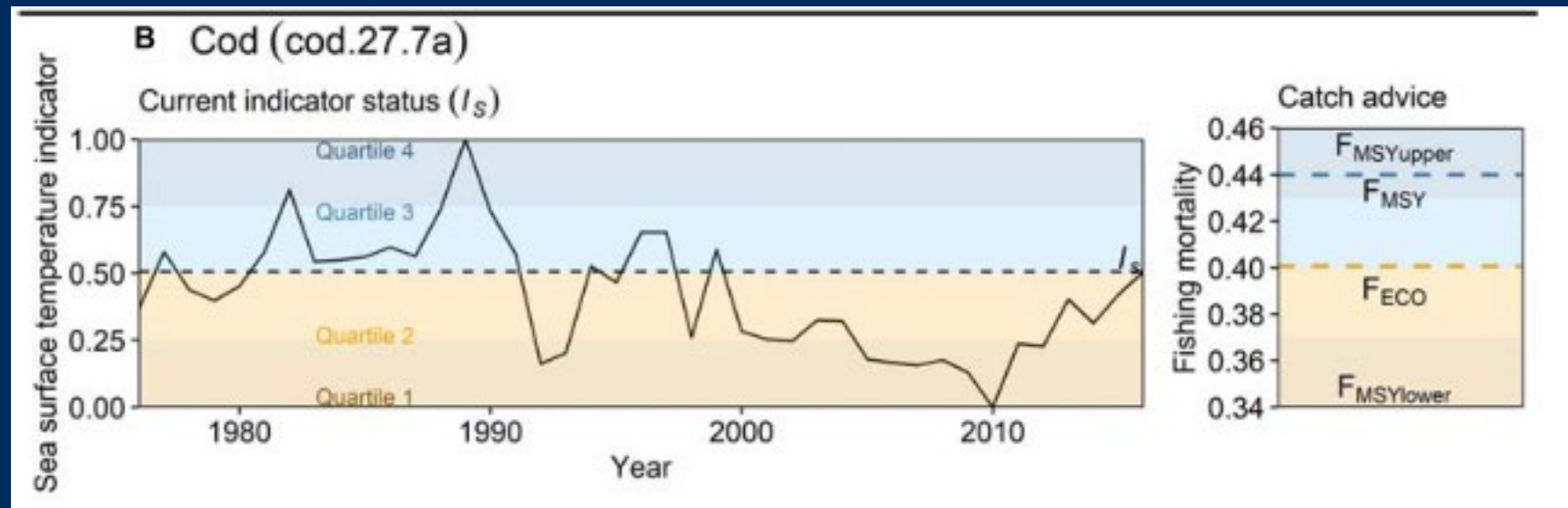
- There is variation in maturity, growth, and potentially other biological processes across the latitudinal range that is partially captured in the model. [Neutral]

- There is uncertainty with respect to biological stock boundaries, including movement across the Northeast Pacific. [Unfavorable]

- Extensive sensitivity runs produced reasonable results and changes were generally similar relative to base model results. There were little to no retrospective patterns or other diagnostic issues. The model produces stable jitters and parameter estimates that did not considerably vary by data source or as a result of structural changes. [Favorable]

Examples: Option 3

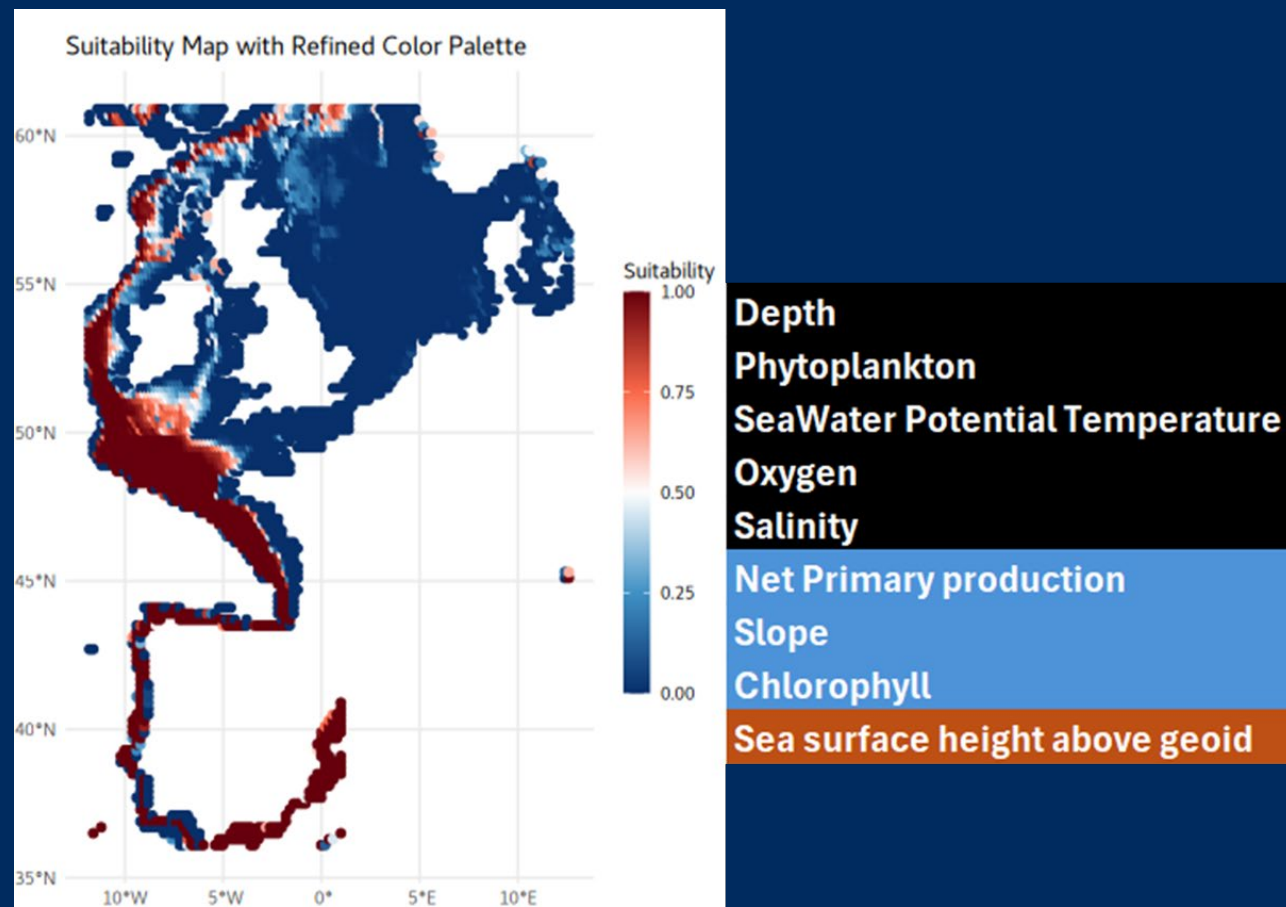
- Feco approach.
- Multi-species F_{msy} .
- Short term forecast including environmental variables or predator-prey considerations in the forecast of: recruitment, biological parameters



Examples: Option 4



Stock abundance and catch forecast under climate change: NS Cod



Spatial suitability model under climate change: Northern Hake

Subgroup tasks

1. Score each option against utility criteria:
 - i. Relevance to short term (2026-2030) and longer-term (>2030) management needs
 - ii. Alignment with existing management, legal, institutional frameworks
2. Identify other options and/or utility criteria that should be considered
3. Discuss cases where the delivery of ecosystem/climate information in advice is most pressing/required



Options/utility criteria	Option 1: Ecosystem-informed single-stock reference points (dynamic B0)	Option 2: Qualitative, risk-based statement in advice (risk table and overviews)	Option 3: Catch options conditioned for climate or ecosystem effects (Feco)	Option 4: Forecast of long-term impacts of climate change in FisheriesXplorer (SEAWise tool)	Other options? (e.g. multispecies Fmsy, other MSE-tested harvest strategies)
Relevance to short-term management needs (2026-2030)					
Relevance to longer-term management needs (> 2030)					
Alignment with existing legal, management and/or institutional frameworks					
Other criteria?					

Scoring: 1=Low, 2=Moderate, or 3=High

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Other criteria?					



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