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Introduction

About This Report

This report is for the Mid-Atlantic Fishery Management Council (MAFMC). The purpose of this report is to synthesize ecosystem information to allow the MAFMC to better meet fishery management objectives, and to update the MAFMC's Ecosystem Approach to Fishery Management (EAFM) risk assessment. The major messages of the report are synthesized on pages 1 and 2, with highlights of 2025 ecosystem events on page 3.

The information in this report is organized into two main sections; performance measured against ecosystem-level management objectives (Table 1), and potential risks to meeting fishery management objectives (Table 2: climate change and other ocean uses). A final section highlights notable 2025 ecosystem observations.

Report structure

A glossary of terms[1], detailed technical methods documentation[2], indicator data[3], and detailed indicator descriptions[4] are available online. We recommend new readers first review the details of standard figure formatting (Fig. 64a), categorization of fish and invertebrate species into feeding guilds (Table 7), and definitions of ecological production units (EPUs, including the Mid-Atlantic Bight, MAB; Fig. 64b) provided at the end of the document.

The two main sections contain subsections for each management objective or potential risk. Within each subsection, we first review observed trends for indicators representing each objective or risk, including the status of the most recent data year relative to a threshold (if available) or relative to the long-term average. Second, we identify potential drivers of observed trends, and synthesize results of indicators related to those drivers to outline potential implications for management. For example, if there are multiple drivers related to an indicator trend, do indicators associated with the drivers have similar trends, and can any drivers be affected by management action(s)? We emphasize that these implications are intended to represent testable hypotheses at present, rather than "answers," because the science behind these indicators and syntheses continues to develop.

Table 1: Ecosystem-scale fishery management objectives in the Mid-Atlantic Bight

Objective categories	Indicators reported
Objectives: Provisioning and Cultural Services	
Seafood Production	Landings; commercial total and by feeding guild; recreational harvest
Commercial Profits	Revenue decomposed to price and volume
Recreational Opportunities	Angler trips; recreational fleet diversity
Stability	Fishery and ecosystem volatility, adaptive capacity, and shifts from baseline
Social & Cultural	Community fishing engagement and social vulnerability status
Protected Species	Bycatch; population (adult and juvenile) numbers; mortalities
Potential Drivers: Supporting and Regulating Services	
Management	Stock status; catch compared with catch limits
Biomass	Biomass or abundance by feeding guild from surveys
Environment	Climate and ecosystem risk indicators listed in Table 2

[1] https://noaa-edab.github.io/tech-doc/glossary.html
[2] https://noaa-edab.github.io/tech-doc/
[3] https://noaa-edab.github.io/ecodata/
[4] https://noaa-edab.github.io/catalog/index.html

Table 2: Risks to meeting fishery management objectives in the Mid-Atlantic Bight

Risk categories	Observation indicators reported	Potential driver indicators reported
Climate and Ecosystem Risks		
Risks to Managing Spatially	Managed species (fish and cetacean) distribution shifts	Benthic and pelagic forage distribution; ocean temperature, changes in currents and cold pool
Risks to Managing Seasonally	Managed species spawning and migration timing changes	Habitat timing: Length of ocean summer, cold pool seasonal persistence
Risks to Setting Catch Limits	Managed species body condition and recruitment changes	Benthic and pelagic forage quality & abundance: ocean temperature & acidification
Other Ocean Uses Risks		
Offshore Wind Risks	Fishery revenue and landings from wind lease areas by species and port	Wind development speed; Protected species presence and hotspots

Performance Relative to Fishery Management Objectives

In this section, we examine indicators related to broad, ecosystem-level fishery management objectives. We also provide hypotheses on the implications of these trends—why we are seeing them, what's driving them, and potential or observed regime shifts or changes in ecosystem structure. Identifying multiple drivers, regime shifts, and potential changes to ecosystem structure, as well as identifying the most vulnerable resources, can help managers determine whether anything needs to be done differently to meet objectives and how to prioritize upcoming issues/risks.

Seafood Production

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Indicators: Landings; commercial and recreational

This year, we present updated indicators for total commercial landings, (includes seafood, bait, and industrial landings), U.S. seafood landings (excludes industrial and bait uses), and Council-managed U.S. seafood landings. Total commercial landings within the Mid-Atlantic have declined over the long term, and both total U.S. and Mid-Atlantic managed seafood landings are at their all time low in 2024 (Fig. 1).

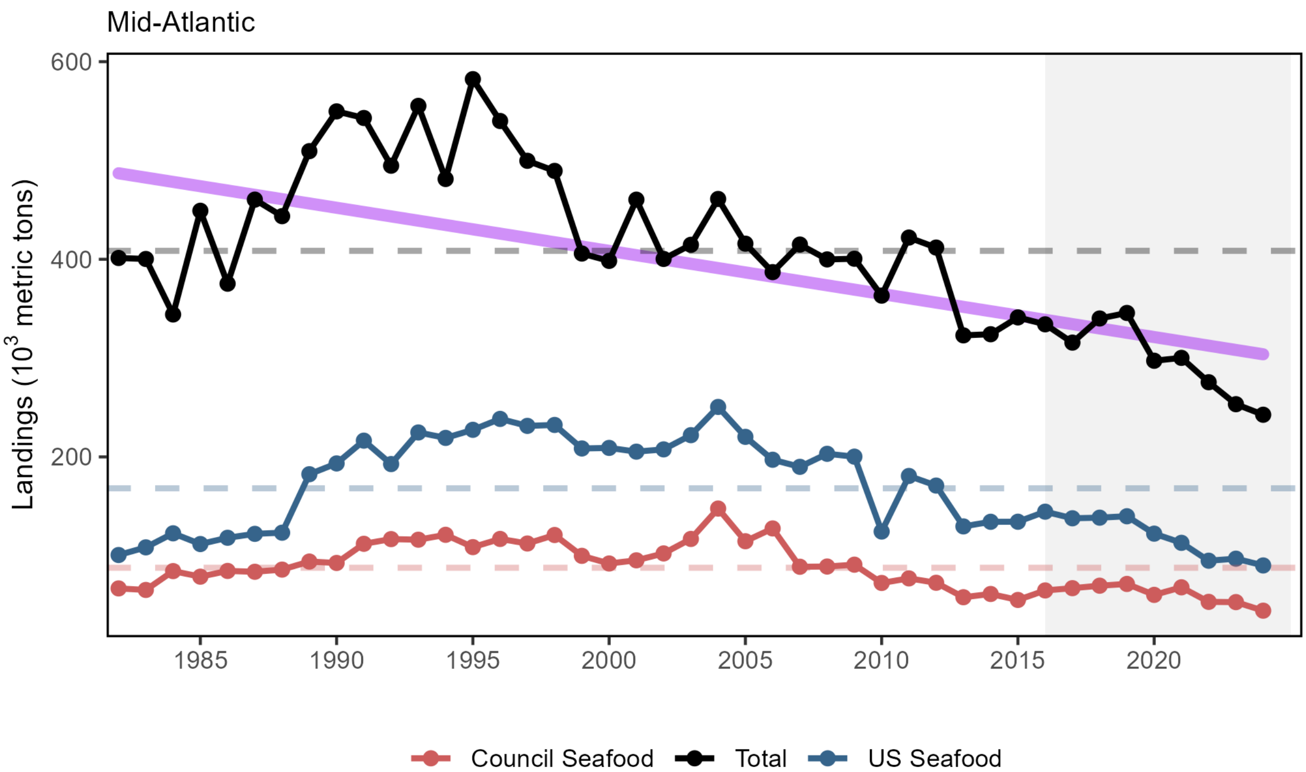

Figure 1: Total commercial landings (black), total U.S. seafood landings (blue), and Mid-Atlantic managed U.S. seafood landings (red), with significant decline (purple) in total landings.

Commercial landings by guild include all species and all uses, and are reported as total for the guild and the MAFMC managed species within the guild. Landings of benthos have been below the long term average since 2010, primarily driven by surf clam and ocean quahog, with scallops now contributing to the decline as well. Total landings of planktivores is presenting a significant downward trend, primarily due to decreases in species not managed by the MAFMC (Atlantic herring and Atlantic menhaden; Fig. 2).

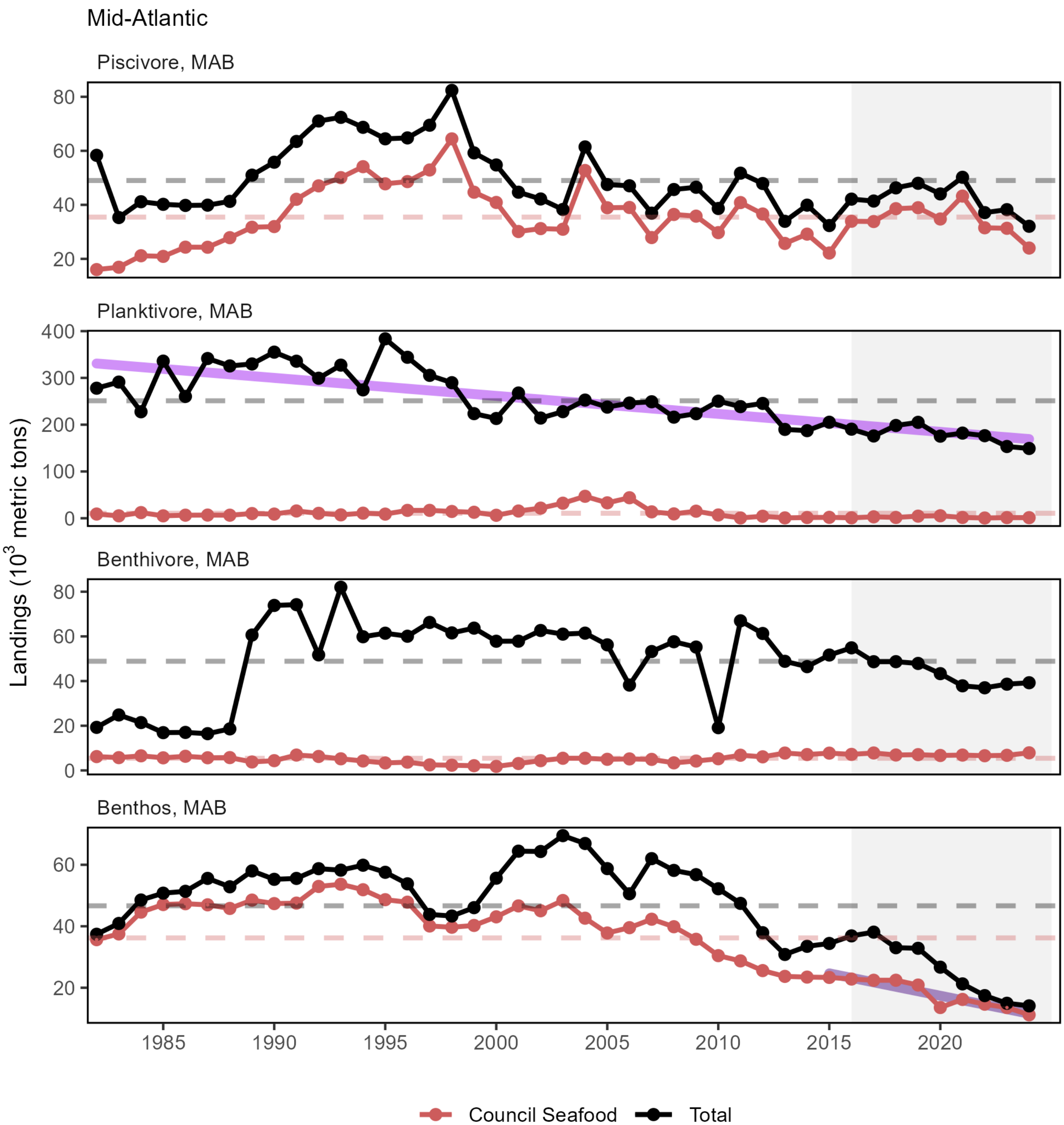

Figure 2: Total commercial landings in the Mid-Atlantic Bight (black) and MAFMC-managed U.S seafood landings (red) by feeding guild, with significant declines (purple) in total planktivore landings.

Community Environmental Variability Risk Indicators evaluate port level risk to environmental variability based on dependence on species and their respective bioenvironmental vulnerabilities as assessed by regional experts. Total Vulnerability measures how much a region's landings (or revenue) is dependent on species that are sensitive to different climate and environmental change factors including temperature and acidification. The total risk based on the Total Vulnerability indicator of Mid-Atlantic ports ranged between moderate and high (Fig. 3).

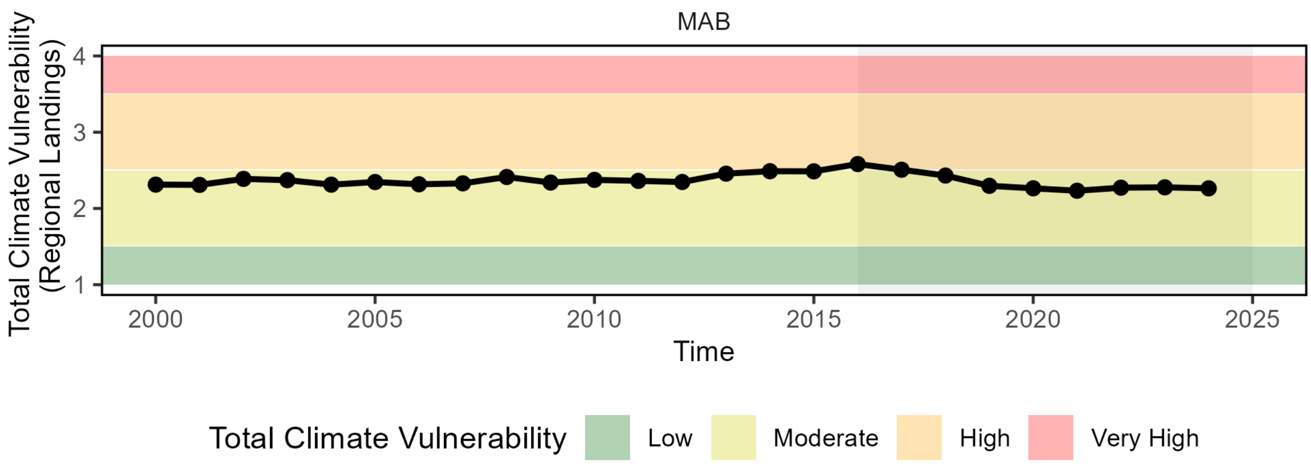

Figure 3: Mid-Atlantic region Total Vulnerability of commercial landings (sum of Mid-Atlantic port landings weighted by species climate vulnerability from Hare et al. 2016 and Loughran et al. 2025), with long-term increasing trend (orange). Horizontal colored bars show different environmental variability risk levels.

Total recreational harvest assesses the seafood production of the recreational fishery and doesn't include catch-and-release fishing. In the Mid-Atlantic (Fig. 4), recreational harvest shows a long-term decline. Recreational fishing may be shifting to catch-and-release strategies as opposed to catch for harvest.

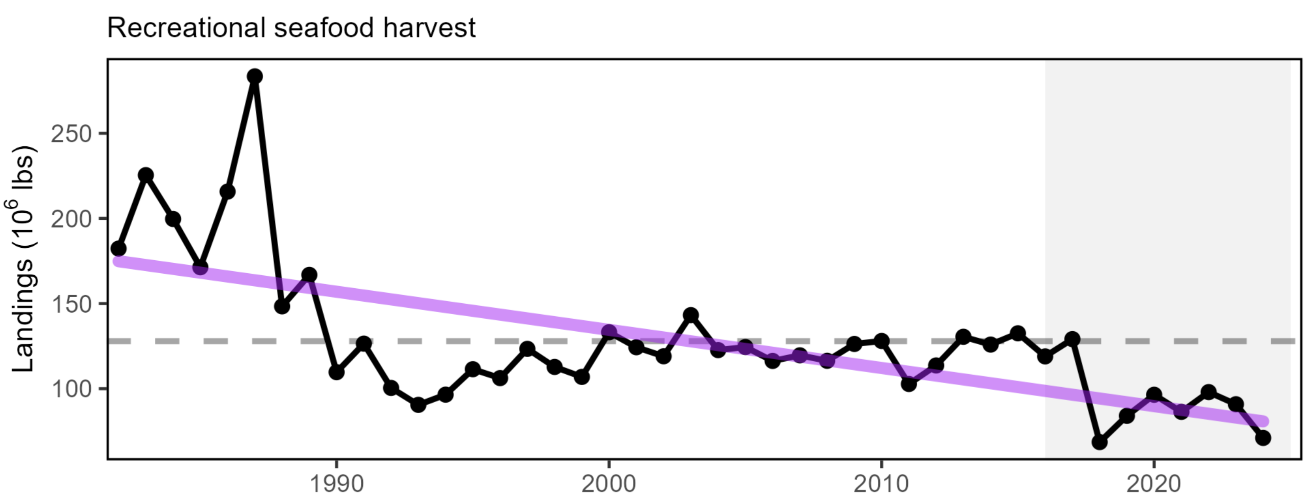

Figure 4: Total recreational seafood harvest (millions of pounds, black, significant decrease, purple) in the Mid-Atlantic region.

Recreational shark landings have generally decreased for most shark groups through 2024 (Fig 5). The recent low in pelagic shark landings is largely driven by regulatory changes implemented in 2018, followed by the closure of the shortfin mako fishery in 2022. These actions were intended to rebuild the North Atlantic shortfin mako stock and comply with binding recommendations by the International Commission for the Conservation of Atlantic Tunas (ICCAT).

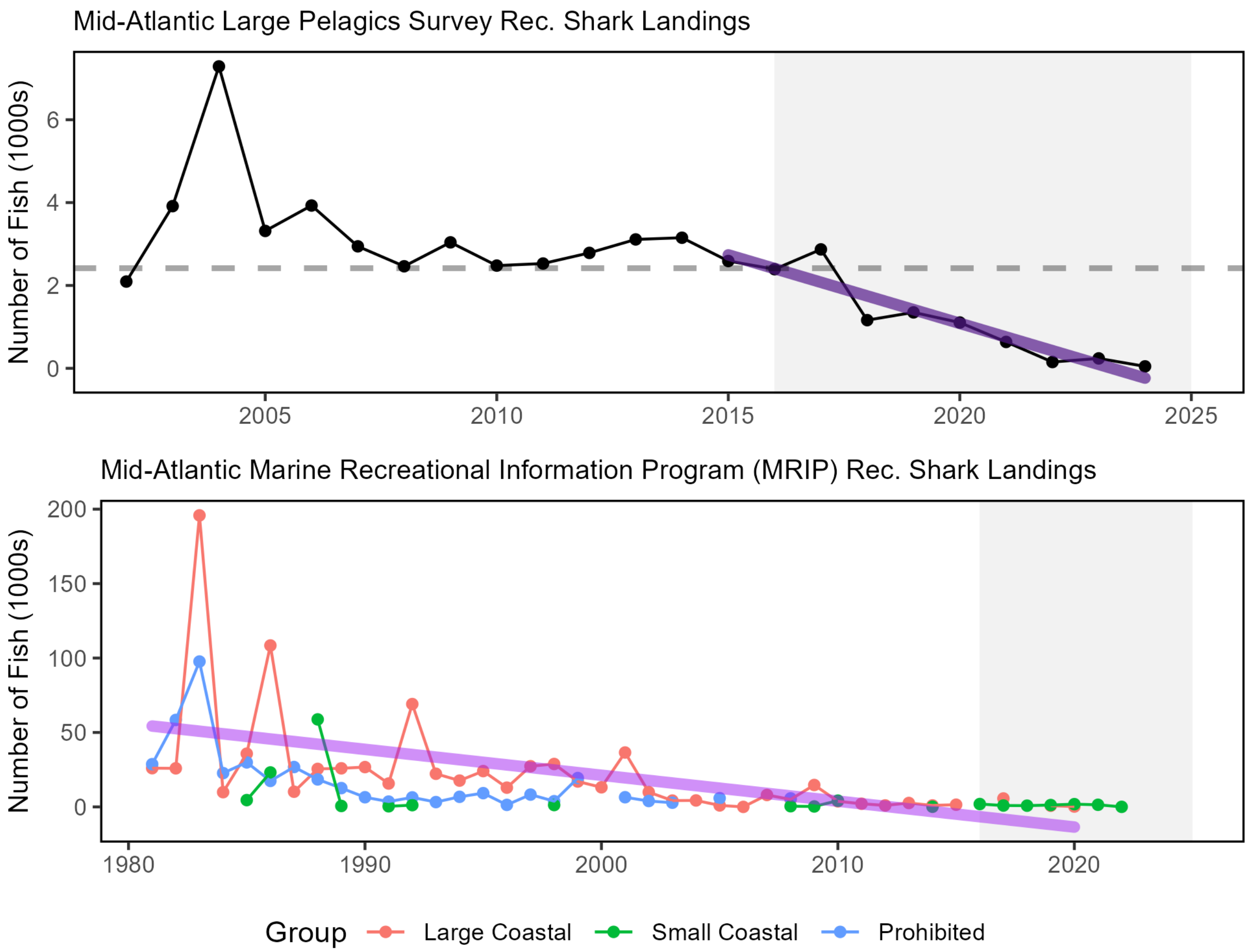

Figure 5: Recreational shark landings in the Mid-Atlantic region from NOAA Fisheries Large Pelagics Survey (top) and Marine Recreational Information Program (bottom) with declining trends (purple). Note that the trend line is associated with the Large Coastal group, which has had no reported MRIP landings after 2020.

Not all aquaculture production is included in total seafood landings. In 2022, the Northeast region produced approximately 6,300 metric tons of aquacultured shellfish, with revenue of $133 million (Fisheries of the United States, 2022).

Implications

Declining commercial landings (total and seafood) and recreational harvest can be attributed to many interacting factors, including combinations of ecosystem and stock production, management actions, market conditions, and environmental change. While we cannot evaluate all possible drivers at present, here we evaluate the extent to which stock status, management, and system biomass trends may play a role.

Stock Status and Catch Limits Single species management objectives (1. maintaining biomass above minimum thresholds and 2. maintaining fishing mortality below overfishing limits) are being met for all but two MAFMC-managed species (golden tilefish and Atlantic mackerel) (Fig. 6), though the status of 5 stocks (northern shortfin squid, goosefish GOM/GB, goosefish southern GB/MAB, blueline tilefish, and chub mackerel) is unknown (Table 3).

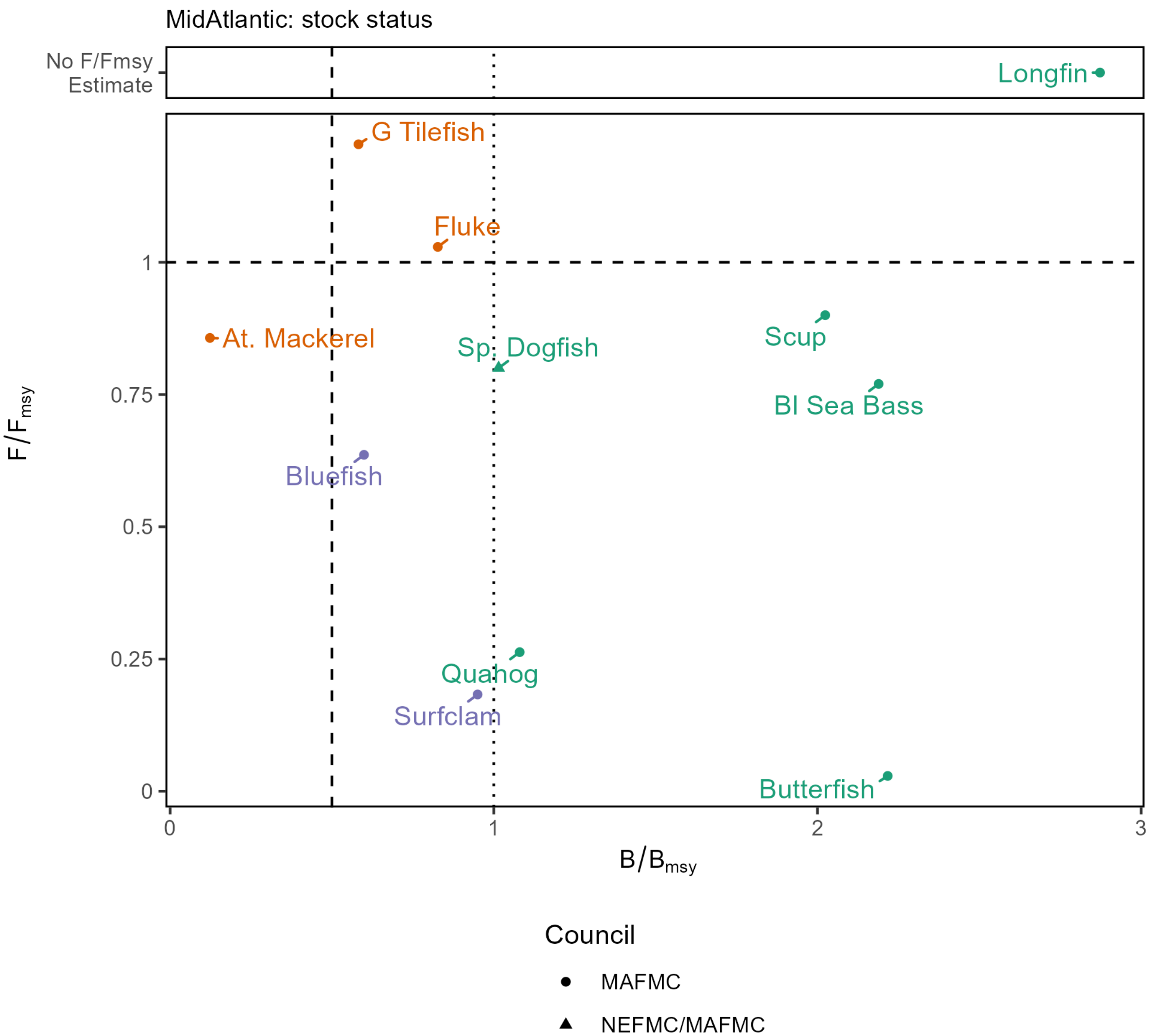

Figure 6: Summary of single species status for MAFMC and jointly federally managed stocks (Spiny dogfish and both Goosefish). The dotted vertical line is the target biomass reference point of B_{MSY}. The dashed lines are the management thresholds of one half B_{MSY} (vertical) or F_{MSY}. (horizontal). Stocks with a B/B_{MSY} estimate but without an F/F_{MSY} estimate are denoted in a separate box plot (top). Colors denote stocks with B/B_{MSY} < 0.5 or F/F_{MSY} (orange), stocks 0.5<B/B_{MSY}<1 (blue), and stocks B/B_{MSY}>1 (green).

Table 3: Unknown or partially known stock status for MAFMC and jointly managed species.

Stock	F/Fmsy	B/Bmsy
Northern shortfin squid - Northwestern Atlantic Coast	-	-
Goosefish - Gulf of Maine / Northern Georges Bank	-	-
Goosefish - Southern Georges Bank / Mid-Atlantic	-	-

Table 3: Unknown or partially known stock status for MAFMC and jointly managed species.

Stock	F/Fmsy	B/Bmsy
Blueline tilefish - Mid-Atlantic Coast	-	-
Chub mackerel - Atlantic	-	-

Stock status affects catch limits established by the Council, which in turn may affect landings trends. Summed across all MAFMC managed species, total Acceptable Biological Catch or Annual Catch Limits (ABC or ACL) have been relatively stable since 2012 (Fig. 7). The recent total ABC or ACL is lower relative to 2012-2013, even with the addition of blueline tilefish management contributing an additional ABC to the total post-2017, due to that fishery's small relative size.

The percentage of each stock's ABC or ACL that is caught (landings and discards) are generally below the 1/1 ratio (Fig. 8). Quahog, surfclam, and northern shortfin squid have the largest ABC or ACLs but have low catch ratios, with less than 24% of ABC or ACL caught in 2024. Stock status and associated management constraints are unlikely to be driving decreased landings for these species, and increased landings of quahog, surfclam, and northern shortfin squid could be supported by the ecosystem. All other species except chub mackerel and longfin squid have catch ratios over 80%, indicating that stock status and associated regulations are most likely constraining the landings of some species such as black sea bass, bluefish, and Atlantic mackerel. However, these management actions and regulations are enacted in response to biomass, such that less stringent regulations would not necessarily mean higher landings.

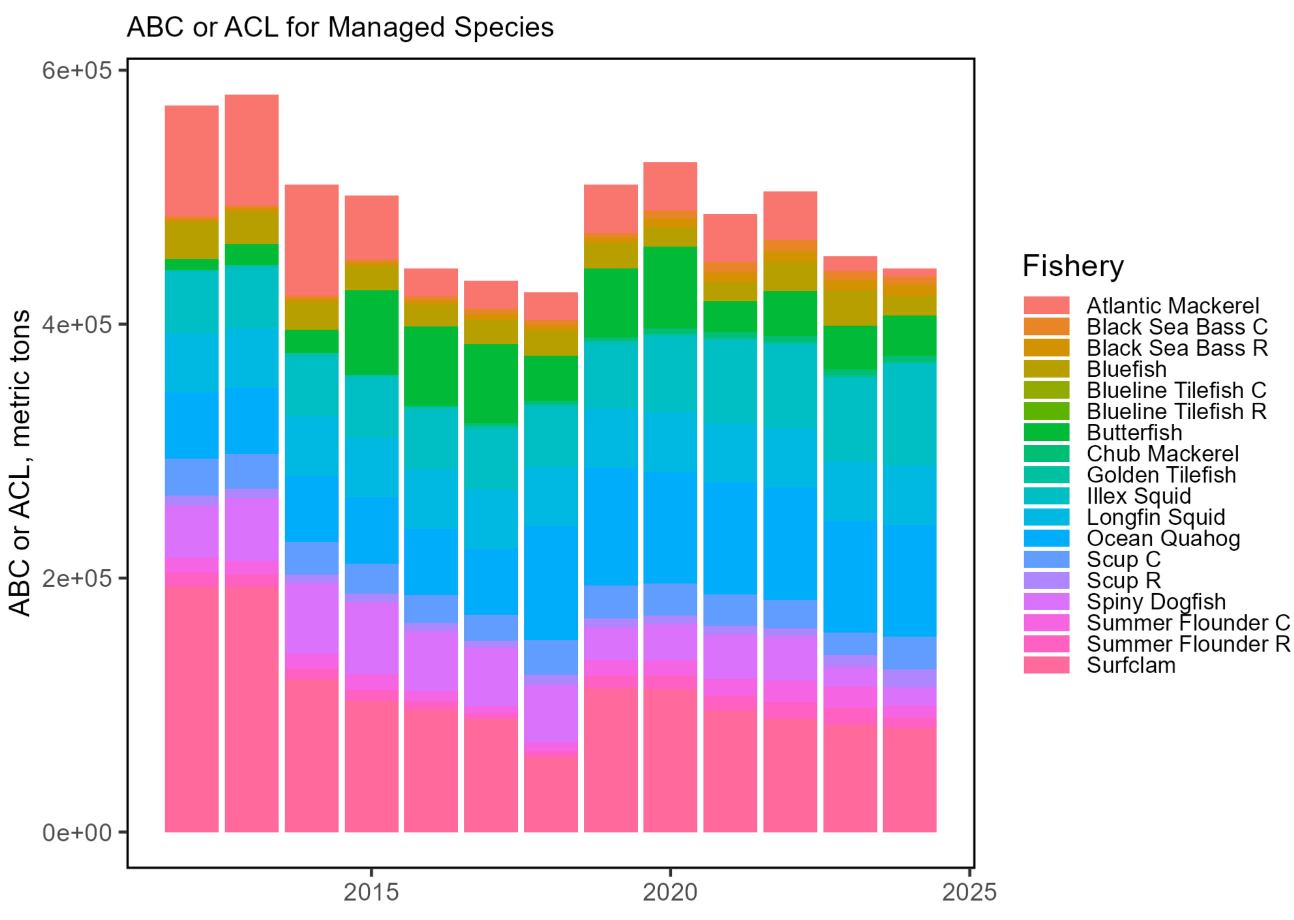

Figure 7: Sum of catch limits (in metric tons) across all MAFMC managed commercial (C) and recreational (R) fsheries

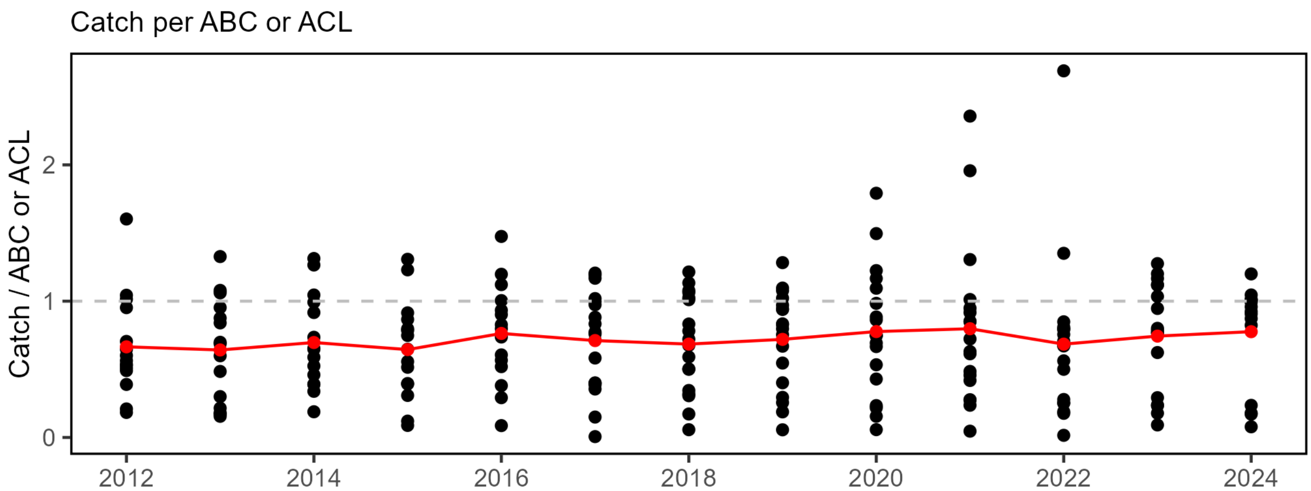

Figure 8: Total catch divided by ABC/ACL for MAFMC managed fisheries. High points are recreational black sea bass (2021) and scup (2022). Red line indicates the median ratio across all fisheries

System Biomass [Aggregate biomass](https://noaa-edab.github.io/catalog/aggregate_biomass.html trends derived from scientific resource surveys are mostly stable in the MAB, with long-term increases in spring piscivores, fall benthivores, and fall benthos (Fig. 9). While managed species make up varying proportions of aggregate biomass, trends in landings are not mirroring shifts in the overall trophic structure of survey-sampled fish and invertebrates. Therefore, major shifts in feeding guilds or ecosystem trophic structure are unlikely to be driving the decline in landings; however, future study should investigate whether shifts in the relative abundance of targeted species may be playing a role.

Effect on Seafood Production Stock status is above the minimum threshold for all but one stock, and aggregate biomass trends appear stable or increasing. For surfclams and ocean quahogs, this indicates that the decline in managed commercial seafood landings is most likely driven by market dynamics affecting landings, as the catch ratios have been relatively low for these species. The decrease in regional availability of scallops has contributed to the decline of benthos landings not managed by the MAFMC, with some of the most productive sea scallop fishing grounds closed through 2023 due to rotational management. The long-term declines in total and planktivore landings is driven in part by Atlantic menhaden fishery dynamics, including a consolidation of processors leading to reduced fishing capacity between the 1990s and mid-2000s. Reduced scallop landings in the MAB have also contributed to the long-term decline in total landings.

The spatial distribution of surfclams and ocean quahogs is changing, resulting in areas with overlapping distributions and increased mixed landings. Given the regulations prohibiting mixed landings, this could become problematic for harvesters. However, the MAFMC submitted an amendment in August 2025 to NOAA Fisheries to allow mixed surfclam and quahog trips; the amendment remains under review by NOAA as of February 2026. The decline in recreational seafood harvest is associated with a number of management and social factors. For example, the decline in recreational shark landings can be attributed to management actions intended to reduce fishing mortality on mako sharks. The lower than average landings since 2018 for species other than sharks could be driven by either changes in fishing behavior or a change in NOAA Fisheries' Marine Recreational Information Program survey methodology in 2018. The decline in recreational seafood harvest may also be linked to decreases in sustenance fishing. Ultimately, recreational harvest has been following a decreasing trend in the past three years relative to a slight increase around 2020.

Other environmental changes may become important drivers of commercial and recreational landings in the future and will require continuous monitoring. Overall, the majority of landings from Mid-Atlantic ports depend on species with moderate climate vulnerability. The proportion of landings with higher vulnerability has increased over time, but fluctuated in more recent years. Fisheries and communities rely on different combinations of stocks,and individual stocks will respond differently to these drivers. Some key drivers include :

- Climatological conditions are trending into uncharted territory. Globally, 2025 had the warmest ocean temperatures on record (see 2025 Highlights section). However, the 2025 Northwest Atlantic water temperatures were in line with the long-term average.
- Stocks are shifting their distributions, moving towards the northeast and into deeper waters throughout the Northeast US Large Marine Ecosystem (see Climate Risks section).
- Some ecosystem composition and production changes have been observed (see Stability section and Risks to Setting Catch Limits section).
- Some fishing communities are affected by Social and Community Risks (see Community Social and Climate Vulnerability section).

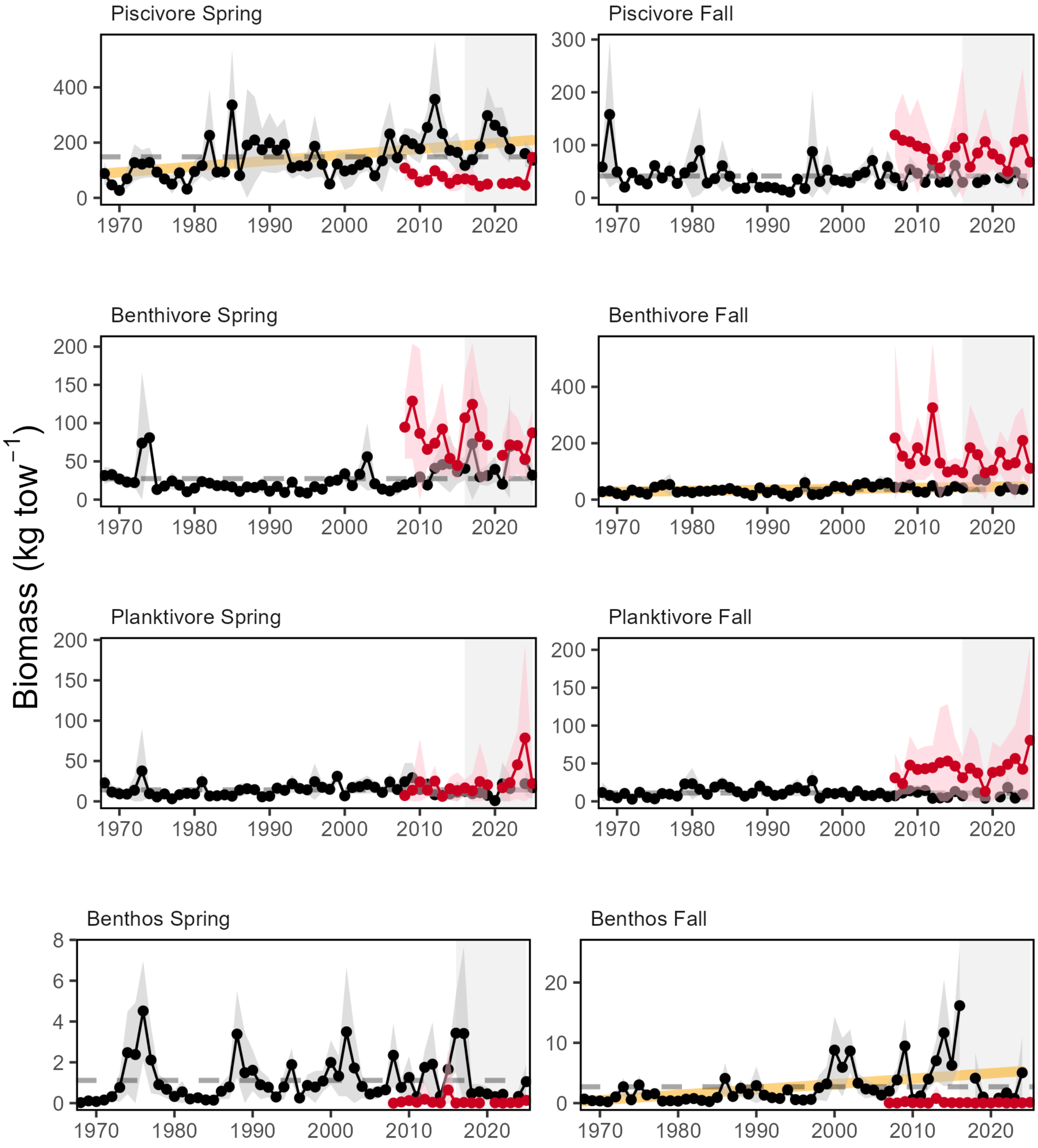

Figure 9: Spring (left) and fall (right) surveyed biomass in the Mid-Atlantic Bight. Data from the NEFSC Bottom Trawl Survey are shown in black, with the nearshore NEAMAP survey shown in red. Significant increases (orange lines) are present for spring piscivore and fall benthivore and benthos biomass. The shaded area around each annual mean represents 2 standard deviations from the mean.

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Commercial Profits

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Indicators: revenue (a proxy for profits)

Total commercial revenue and MAFMC managed species revenue (2024 USD) within the Mid-Atlantic Bight have declined over the past 20 years. In 2024, total revenue and MAFMC managed species revenue were both near an all-time low (Fig. 10).

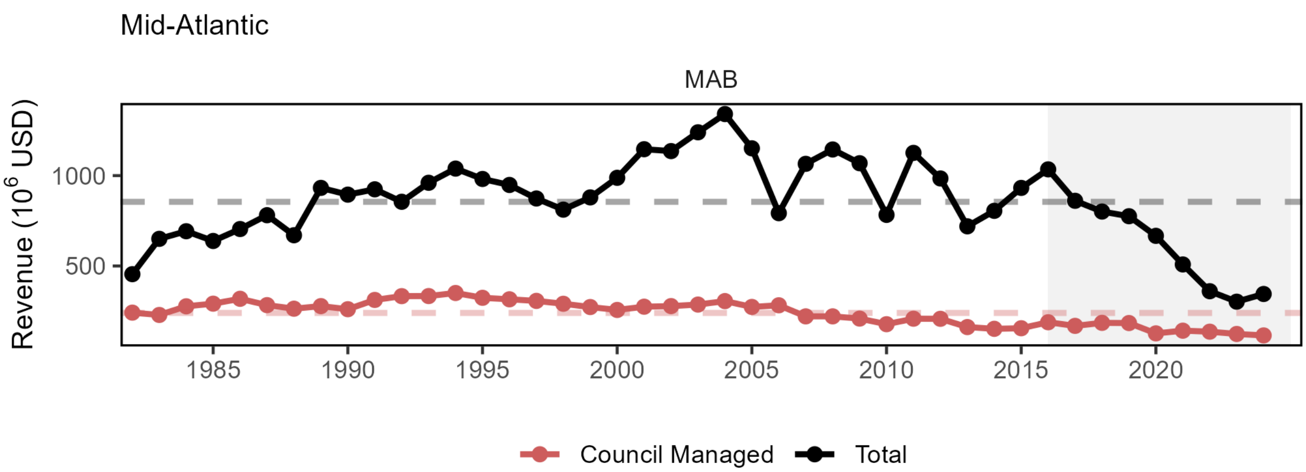

Figure 10: Commercial revenue (2024 USD) through 2024 for the Mid-Atlantic region: total (black) and from MAFMC managed species (red). Dashed lines represent the long-term annual mean.

Revenue earned by harvesting resources is a function of both the quantity landed of each species and the prices paid for landings. Therefore, total revenue patterns can be driven by harvest levels, the mix of species landed, price changes, or a combination of these. The Bennet Indicator (BI) decomposes revenue change into two parts, one driven by changing quantities (volumes), and a second driven by changing prices. All changes are in relation to a base year (1982). The 1982 base year was selected because that is the first year the relevant data is available and it allows for an extended period of time to evaluate market trends and dynamics. The BI results demonstrate that relatively high revenues in 2014-2016 were equally due to higher landings and prices (Fig. 11). In more recent years, both landings and prices have been closer to values from the reference year (1982). A low year for prices in 2024, coupled with low volumes landed, led to low revenue. Recent lower than average revenues are partially due to declining prices of benthivores. Benthos prices increased from 2023, but overall benthos revenue remained low due to low volumes landed (Fig. 12).

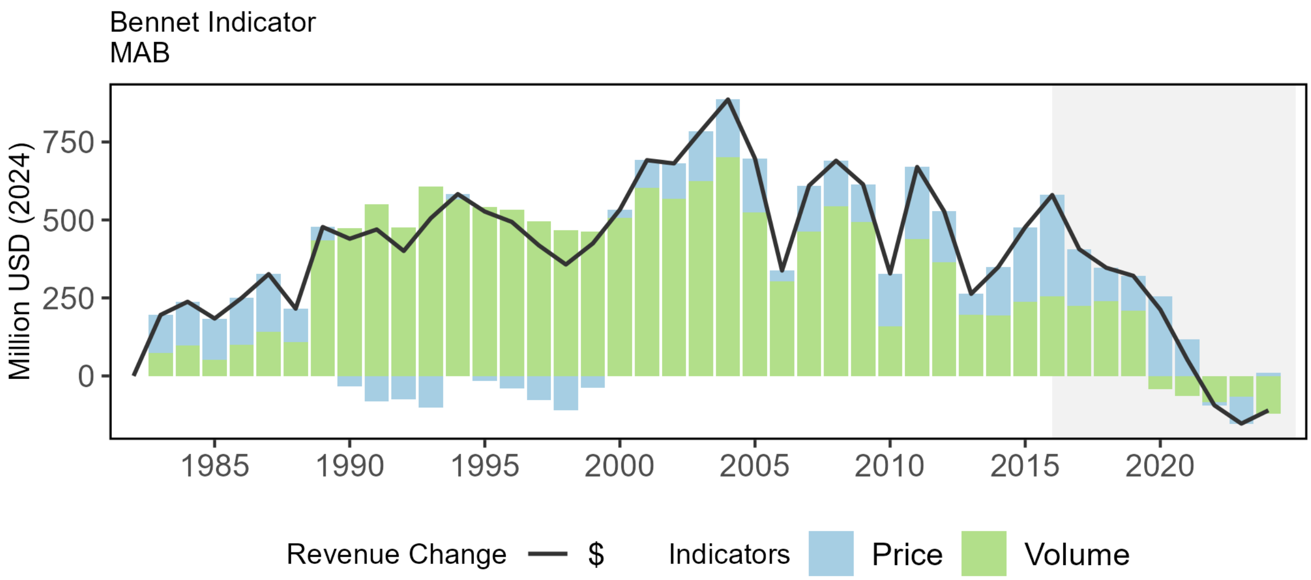

Figure 11: Revenue change from 1982 values in 2023 dollars (black); Price (blue), and Volume Indicators (green) for total commercial landings in the Mid-Atlantic Bight.

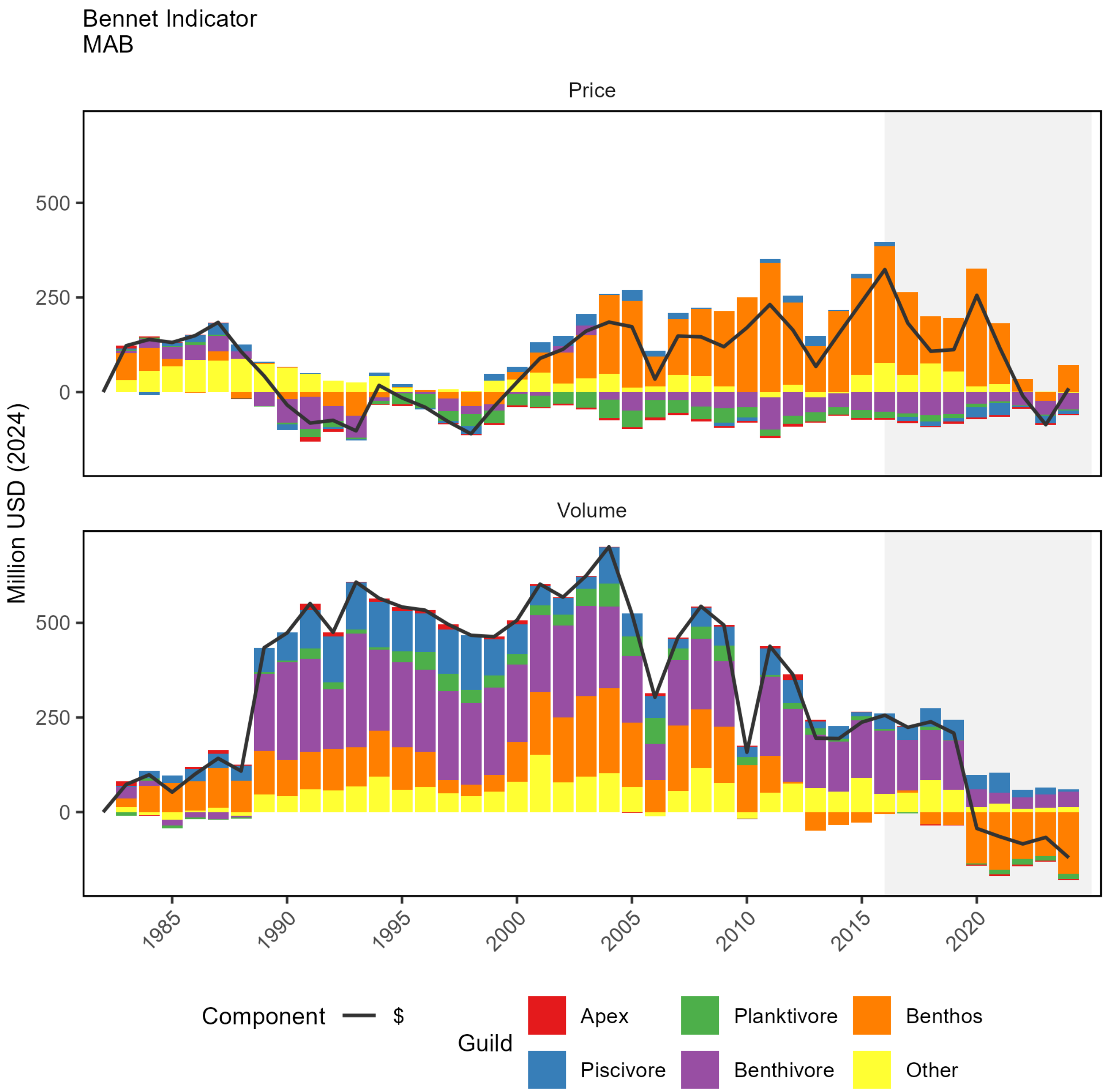

Figure 12: Total price (top) and volume (bottom) indicators in 2023 dollars (black) for commercial landings, and individual guild contributions to each indicator, in the Mid-Atlantic Bight.

This year, we present new indicators of profitability: indices of cost, revenue, and profit based on trips catching federally-managed species. In this index, costs pertain to trip costs, excluding labor, estimated for all federal trips in the region using methods described in Werner et al. (2020). The profit indicator is net-revenue, determined as the difference between trip revenue and trip costs. Trips were spatially allocated to compile regional indices. Indices are presented as values relative to 2000, the first year in the dataset. In the Mid-Atlantic, costs have fluctuated, but overall remain near the time series mean, despite some high costs in 2022, 2014 and 2008. Revenue, however, has declined steadily since 2019 and is driving an overall decline in profits (Fig. 13).

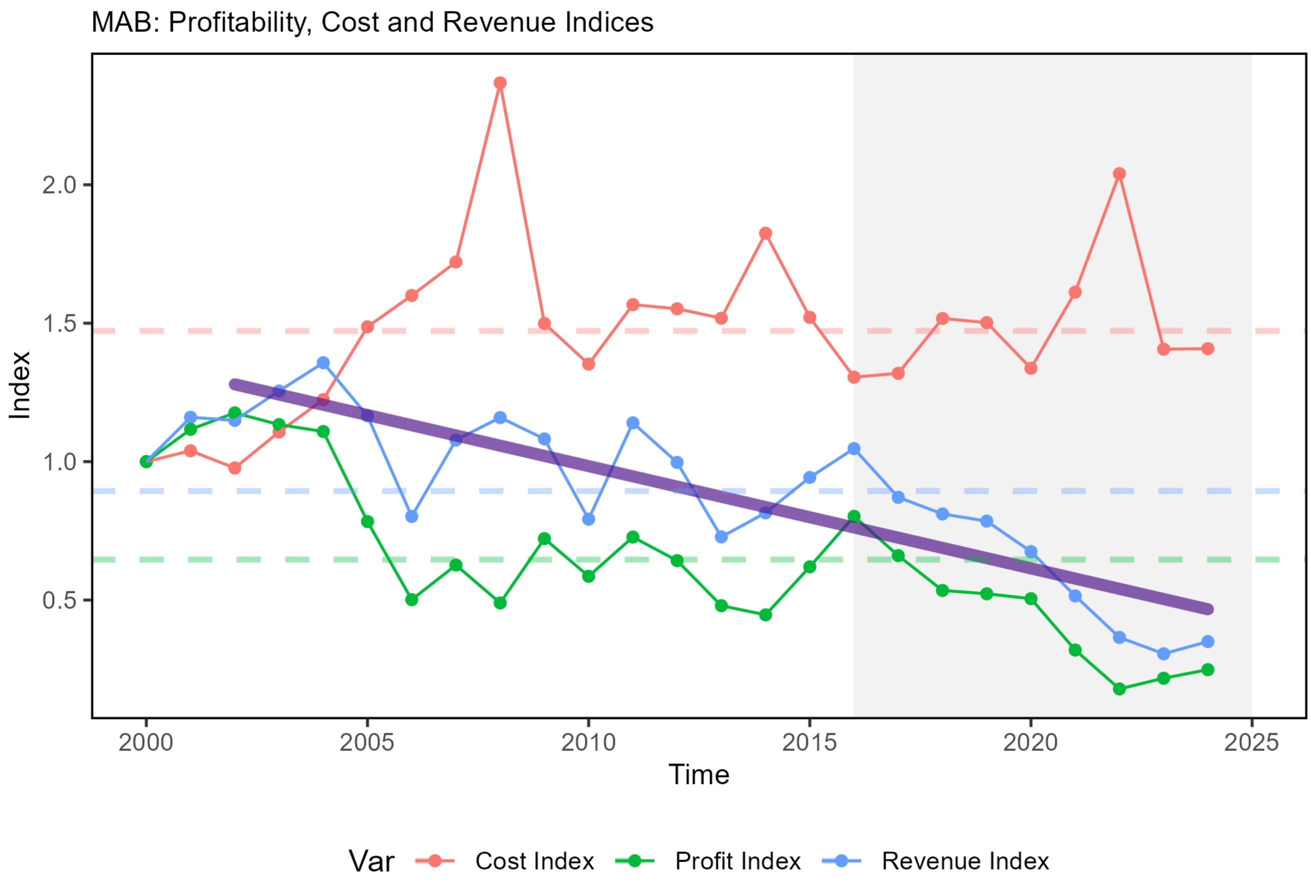

Figure 13: Profitability indices for Mid Atlantic federally managed species: cost index (red), profit index (green), and revenue index (blue). Dashed lines represent the long-term annual means for each index. Long-term declining trend associated with revenue index (blue).

For ports combined across Mid-Atlantic states, total climate vulnerability of revenue ranged from high to very high from 2000-2021, with no long-term trend. This suggests that Mid-Atlantic port commercial fishing revenue has been highly reliant on climate-sensitive species for most of the period since 2000 (Fig. 14).

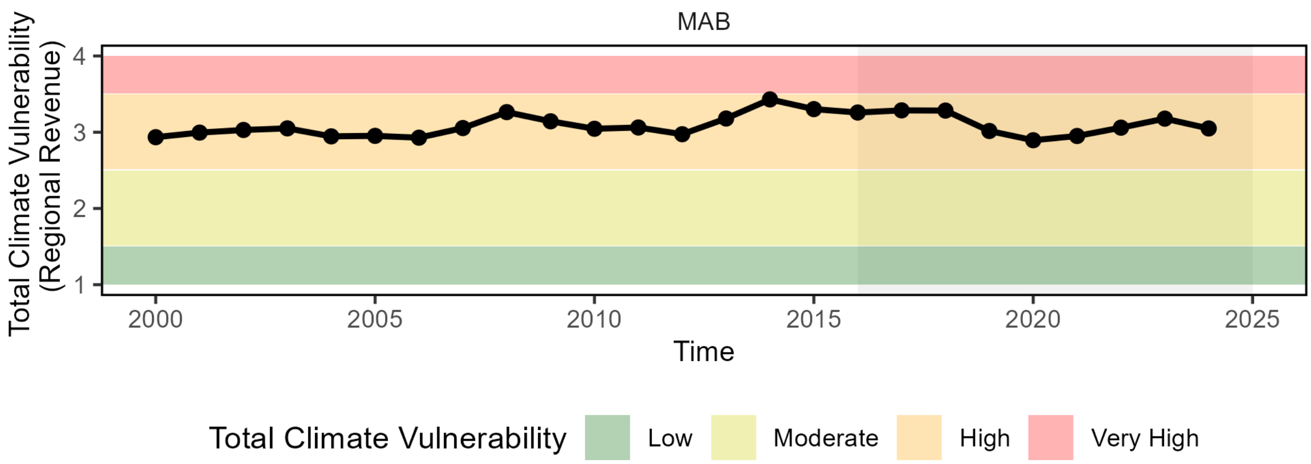

Figure 14: Mid-Atlantic region total climate vulnerability of commercial revenue (sum of Mid-Atlantic port revenue weighted by species climate vulnerability from Hare et al. 2016). Horizontal colored bars show different climate risk levels.

Implications

Although the Mid-Atlantic region shows declining revenue since 2016, inflation-adjusted revenue from harvested species was still greater than 1982 levels until the past two years (Fig. 11). However, revenue from MAFMC-managed species has been below 2000 levels in several of the past 24 years (Fig. 13). The BI demonstrates that this decline is driven by lower volumes and no inverse price effects to offset the decreases in volume. Declines in landings of surfclams and ocean quahogs since 2012 are a result of decreased landings per unit effort over the same period, which may reflect changes in surfclam and quahog aggregation or distribution patterns. Changes in other indicators, particularly those driving landings and those related to climate change, require monitoring as they may become important drivers of revenue in the future; for example:

- Surfclams, ocean quahogs, and scallops are sensitive to warming ocean temperatures and ocean acidification, as reflected in the high climate vulnerability of total landings from from Mid-Atlantic ports.
- Multiple stressors including warming and ocean acidification are interacting in Mid-Atlantic shellfish habitats.

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Recreational Opportunities

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Indicators: Angler trips, fleet diversity

Recreational effort (angler trips) in 2023 continues to be above the long-term average (Fig. 15). in the MAB. MAB. However, there is a long-term declining trend in recreational fleet diversity (i.e., effort by shoreside, private boat, and for-hire anglers) (Fig. 16). Billfish landings were notably high in 2025 (See 2025 Highlights Section), but long-term time series are in development.

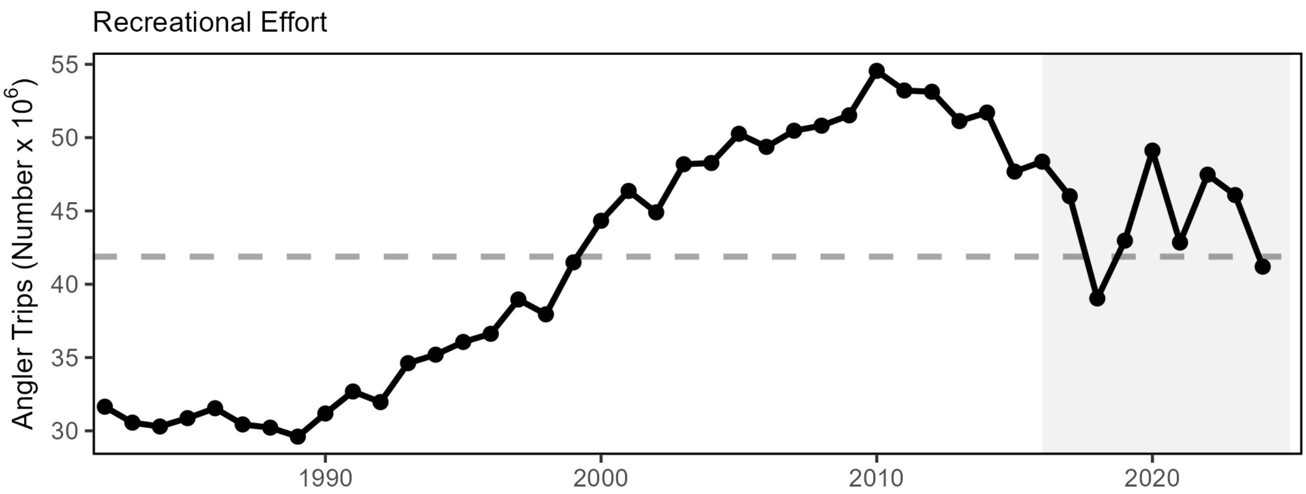

Figure 15: Recreational effort (total number of recreational angler trips from 1980-2023, black) in the Mid-Atlantic. Derived from MRIP's Effort Time Series Query.

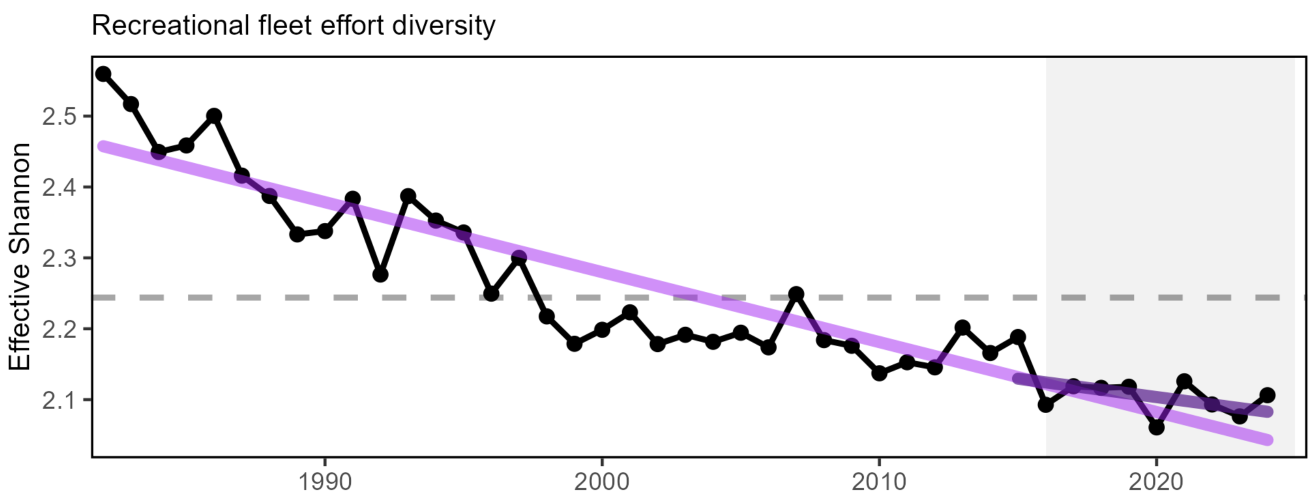

Figure 16: Recreational fleet effort diversity from 1980-2023 (black) in the Mid-Atlantic, with significant decrease in long-term (light purple) and short-term (dark purple) trends.

Implications

While the overall number of recreational trips in the MAB is above the long-term average, the continuing decline in recreational fleet effort diversity suggests, at least in part, changes in angler behavior. Future study is required to determine whether and to what extent the range and availability of recreational fishing options may drive these changes as well.

The downward effort diversity trend is driven by party/charter contraction (down from 2.2% in 2021 to 1.3% of trips in 2023), and a shift toward shorebased angling, which currently makes up 60% of all angler trips. Private boat effort has remained relatively stable compared to 2022 values.

Shore anglers will have access to different species than vessel-based anglers, and when the same species is accessible both from shore and from a vessel, fish size differs by location, with some species using inshore regions as nursery grounds while other species only come inshore as adults. Many states have developed shore-based regulations where the minimum size is lower than in other areas and sectors to maintain opportunities in the shore angling sector.

MAFMC is currently considering recreational sector separation which might establish different options for managing the for-hire sector from other modes.

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Community Social and Climate Vulnerability

Fisheries management seeks to provide for sustained participation of fishing communities and to avoid adverse economic impacts to fishing communities. A new composite indicator (Port Commercial Fishing Activity Indicator or PCFA) utilizes NOAA data on dealers, fish landings, and commercial permits to explore trends in commercial fishing activity over time in top ports. This information can be used to understand how changes in fish stocks, regulations, and other social-ecological factors may have disparately impacted ports throughout the Greater Atlantic region.

The recreational engagement index has not been updated from last year and will be updated with similar methods as PCFAI in future reports. The recreational engagement index demonstrates participation levels in recreational fishing in a given community relative to other coastal communities in a region.

The Community Social Vulnerability Indicators (CSVI) utilize U.S. Census American Community Survey data to describe social characteristics at the municipality level (i.e., not just the fishing community) and provide context for the municipalities utilized by commercial fishing industry participants. Fishing industry participants that live in and/or utilize resources in municipalities with relatively concerning socio-demographic conditions may be more vulnerable to changes. The personal disruption index addresses factors that reduce adaptability to change such as unemployment or educational level. The poverty index is a composite index that indicates a community's financial standing relative to other communities. The population composition index characterizes groups within communities that may be more vulnerable to change. CSVI information for communities highlighted in the PCFA and recreational engagement index have been updated with the most recent census data.

Coastal fishing communities worldwide have or are likely to experience social, economic, and cultural impacts from climate change, both negative (e.g., loss of infrastructure, fish stock decline) and positive (e.g., increased abundance of valuable species). Changes in marine fisheries as a consequence of climate change will require adaptation by coastal fishing communities and fisheries managers alike. The Community Environmental Variability Risk Indicators (CEVRI) were developed to help examine trends in risk related to dependence on species vulnerable to climate and environmental changes.

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Indicators: Port Commercial Fishing Activity and Community Social Vulnerability

Six of the top 2024 communities experienced declines of 15-35% in the Port Commercial Fishing Activity Indicator compared to their average scores from 2007-2011: Point Pleasant Beach, NJ; Ocean City, MD; Bronx, NY; Barnegat Light, NJ; Newport News, VA; Cape May, NJ. Of particular concern, Atlantic City, NJ and Newport News, VA both rank medium or higher for all three socio-demographic CSVIs, suggesting that fishing industry participants associated with this municipality may be more vulnerable to change. The other four top communities showed positive growth since 2007-2011; most notably Hampton Bays/Shinnecock, NY with an increase of 84%. Currently North Carolina communities are not presented due to data limitations.

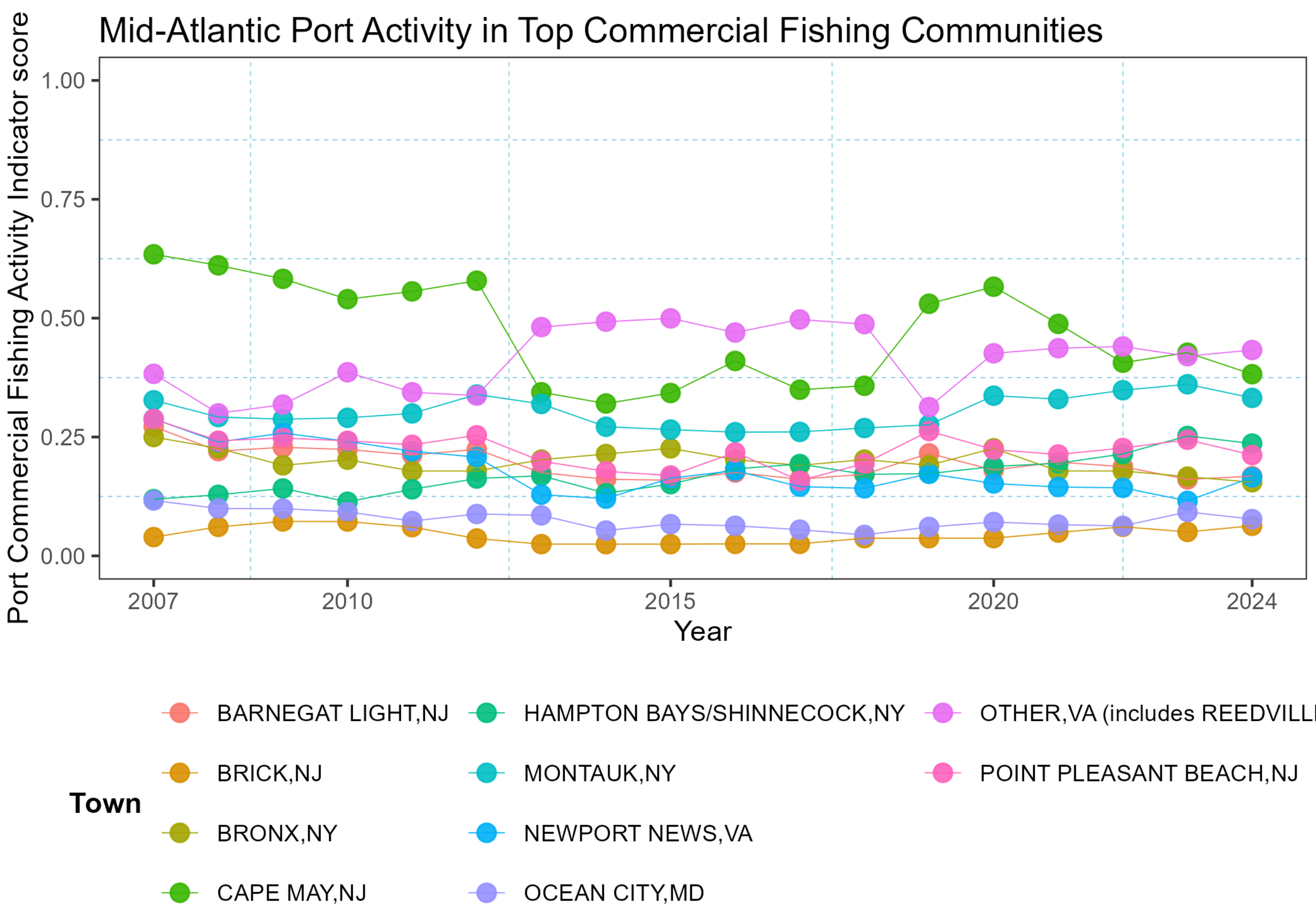

Figure 17: Port Commercial Fishing Activity Indicator scores over time with labels for the top commercially active fishing ports in the Mid-Atlantic.

Table 4: Socio-demographic indicator rankings (ranging from low = low vulnerability to high = high vulnerability) for Mid-Atlantic communities most engaged in commercial fishing, 2022. Blank spaces indicate no data available.

Community	Personal Disruption	Population Composition	Poverty
Newport News, VA	med	med high	med
Hampton Bays/Shinnecock, NY	low	med high	low
Ocean City, MD	med	low	low
Barnegat Light, NJ	low	low	low
Cape May, NJ	low	low	low
Point Pleasant Beach, NJ	low	low	low
Brick, NJ	low	low	low
Montauk, NY	low	low	low

Of those included in the top-ranked recreational communities, both Morehead City, NC and Virginia Beach, VA had medium or higher ranks for at least one socio-demographic indicator (Table 5). This suggests that future changes to recreational fishing conditions may disproportionately impact these places.

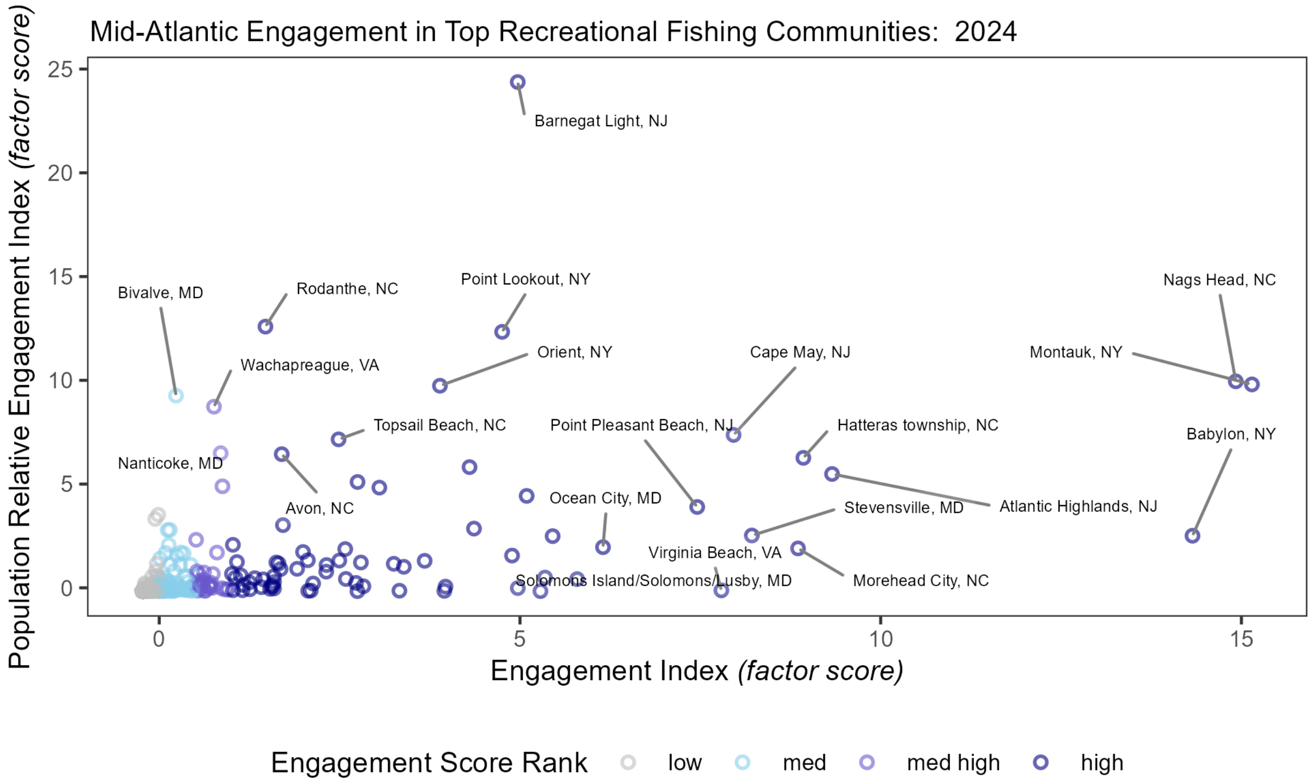

Figure 18: Recreational engagement and population relative engagement with labels for the top recreationally engaged fishing communities in the Mid-Atlantic (last updated 2023).

Table 5: Socio-demographic indicator rankings (ranging from low = low vulnerability to high = high vulnerability) for Mid-Atlantic communities most engaged in recreational fishing, 2022. Blank spaces indicate no data available.

Community	Personal Disruption	Population Composition	Poverty
Morehead City, NC	med	low	med high
Virginia Beach, VA	low	med	low
Stevensville, MD	low	low	low
Nags Head, NC	low	low	low
Hatteras Township, NC	low	low	low
Atlantic Highlands, NJ	low	low	low
Cape May, NJ	low	low	low
Point Pleasant Beach, NJ	low	low	low
Babylon, NY	low	low	low
Montauk, NY	low	low	low

Indicators: Community Environmental Variability Risk in the Mid-Atlantic

Community Environmental Variability Risk Indicators (CEVRI) measure risk by linking commercial landings and revenue to specific climate sensitivity factors, including temperature, ocean acidification, and stock status using the Climate Vulnerability Assessment (CVA) scores. These indicators calculate total sensitivity and vulnerability scores based on a community's dependence on species vulnerable to climate change. Risk scores range from low (1) to high (4), increasing as a community relies more heavily on species at higher risk from environmental shifts.While long-term risk trends across the Mid-Atlantic remain stable, most individual fishing communities currently rank as high or very high risk. This high ranking demonstrates that a majority of regional communities depend on species that are highly vulnerable to changing ocean conditions for their commercial revenue. Strategies for management should account for this widespread reliance on climate-sensitive stocks.

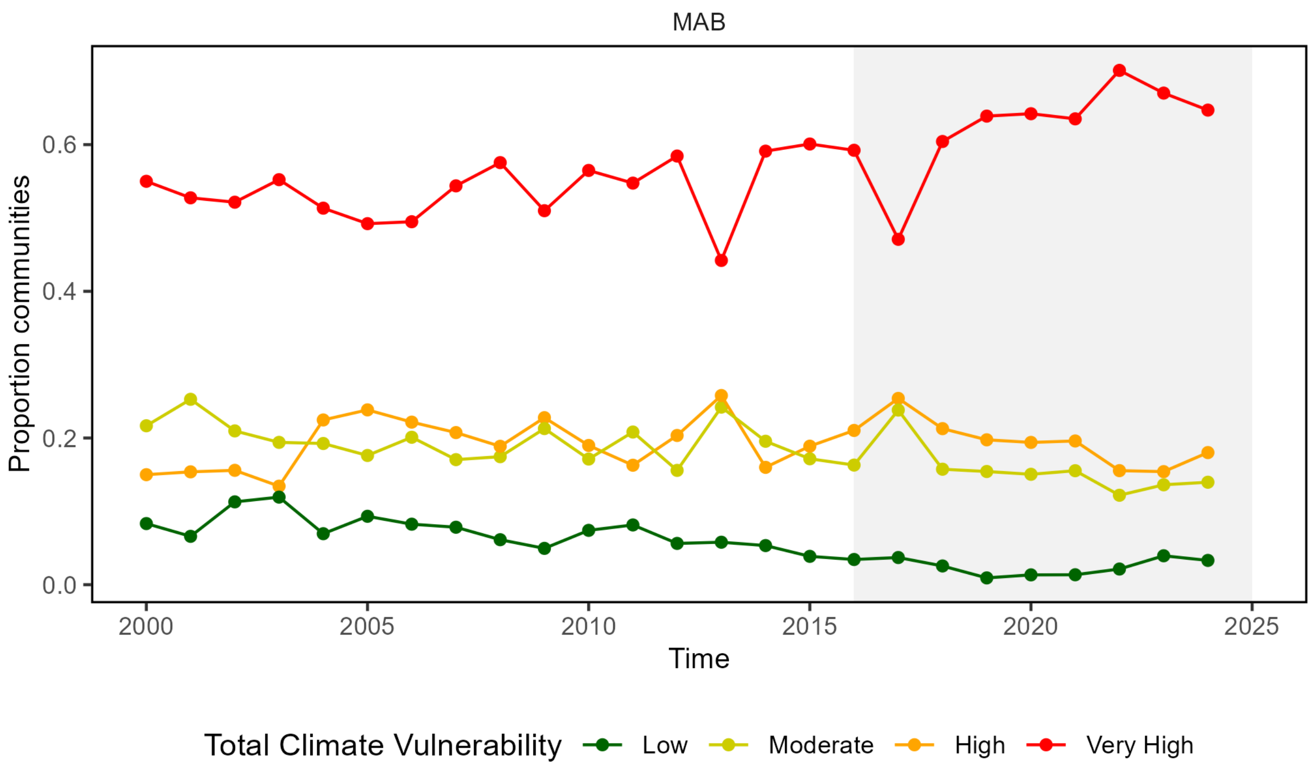

Figure 19: Proportion of Mid-Atlantic communities at each revenue climate vulnerability level over time. Total climate vulnerability ranges from low (green), moderate (yellow), high (orange), to very high (red).

Implications

A range of socioeconomic and environmental variability risk concerns are found throughout Mid-Atlantic fishing communities, and the CSVI and CEVRI indicate socio-demographic concerns in the most highly active commercial Mid-Atlantic fishing ports. Fishing industry participants that utilize more vulnerable ports may be at increased relative risk to changes in fishing patterns due to regulations and/or ecosystem changes.

A majority of Mid-Atlantic communities have high to very high total environmental variability risk based on revenue. Coastal fishing communities are greatly affected by environmental change, both because of their physical location and because of their frequent social, cultural, and economic dependence on fishing. These impacts are expected to become more pressing as changes become more extensive. Changes in ocean temperature and acidification affecting marine life have the potential to directly impact fisheries and fishery dependent livelihoods.

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Protected Species

Fishery management objectives for protected species generally focus on reducing threats and on habitat conservation/restoration. Protected species include marine mammals protected under the Marine Mammal Protection Act, endangered and threatened species protected under the Endangered Species Act, and migratory birds protected under the Migratory Bird Treaty Act. In the Northeast U.S., endangered/threatened species include Atlantic salmon, Atlantic and shortnose sturgeon, all sea turtle species, giant manta ray, oceanic whitetip shark, and five baleen whales. Protected species objectives include managing bycatch to remain below potential biological removal (PBR) thresholds, recovering endangered populations, and monitoring unusual mortality events (UMEs). Here we report on performance relative to these objectives with available indicator data, as well as indicating the potential for future interactions driven by observed and predicted ecosystem changes in the Northeast U.S.

Indicators: bycatch, population (adult and juvenile) numbers, mortalities

The management objective for harbor porpoise has been met, as the average index (Fig. 20) remains below the current PBR threshold.

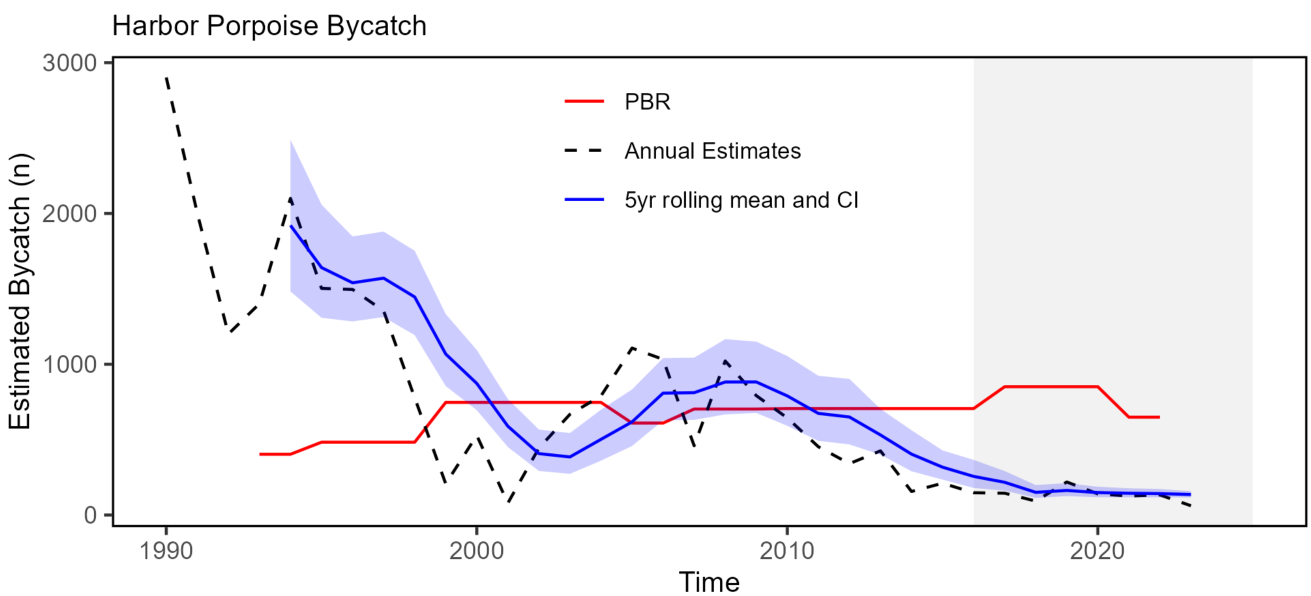

Figure 20: Harbor porpoise average bycatch estimate for Mid-Atlantic and New England gillnet fisheries (blue, confidence interval shaded) and the potential biological removal (red). The dashed line (black) represents the annual estimated bycatch.

The annual estimate for gray seal bycatch, most of which occurs in New England, has generally declined since 2019, in part driven by declining gillnet landings. In addition, estimates since 2019 have greater uncertainty stemming from low observer coverage in some times and areas. The U.S. and Canadian range-wide PBR for gray seals is 12,052. Despite the PBR for the portion of this stock in U.S. waters being reduced to 756 animals bycatch (Fig. 21) due to incomplete data on anthropogenic mortality and serious injury, the range-wide mortality and serious injuries are still considered unlikely to exceed the range-wide PBR and thus the management objective has been met.

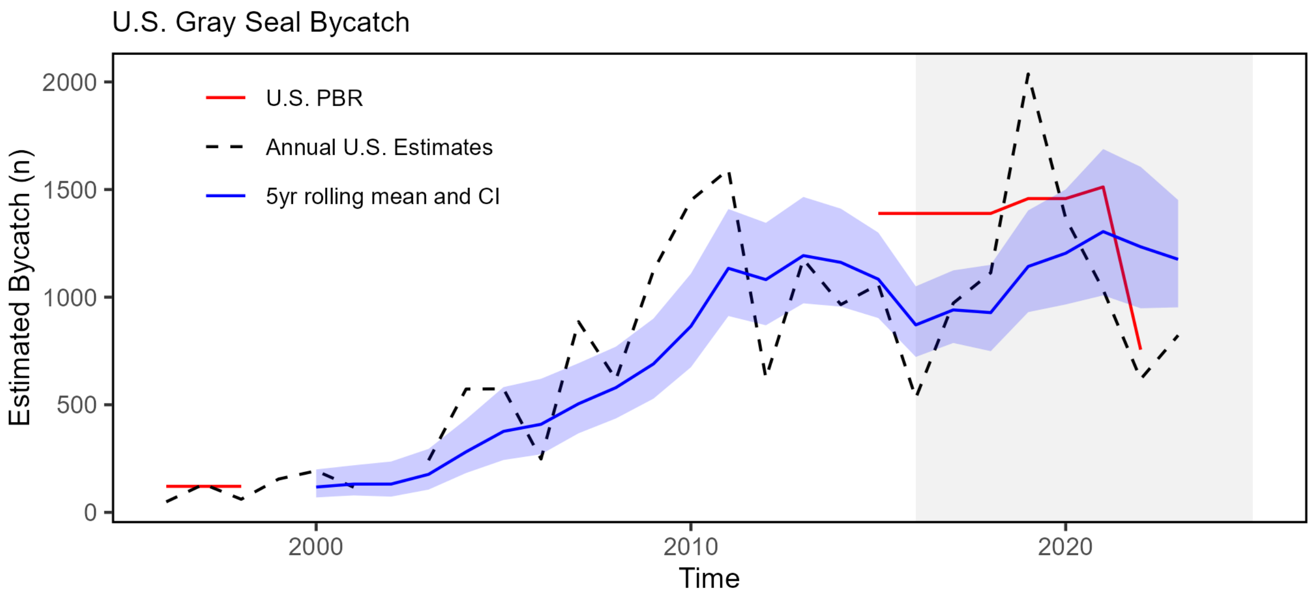

Figure 21: Gray seal five-year average bycatch estimate for New England and Mid-Atlantic U.S. gillnet fisheries (blue, with confidence interval shaded) and the potential U.S. biological removal (red). The range-wide PBR, including both U.S. and Canadian portions of the population, is 12,052 in the draft 2024 SAR.The dashed line (black) represents the annual estimated bycatch.

The North Atlantic right whale population was on a recovery trajectory until 2010, but has since declined (Fig. 22). The sharp decline observed from 2015-2020 appears to have slowed, although the right whale population continues to experience annual mortalities above recovery thresholds. Reduced survival rates of adult females lead to diverging abundance trends between sexes. It is estimated that there are fewer than 70 adult females remaining in the population.

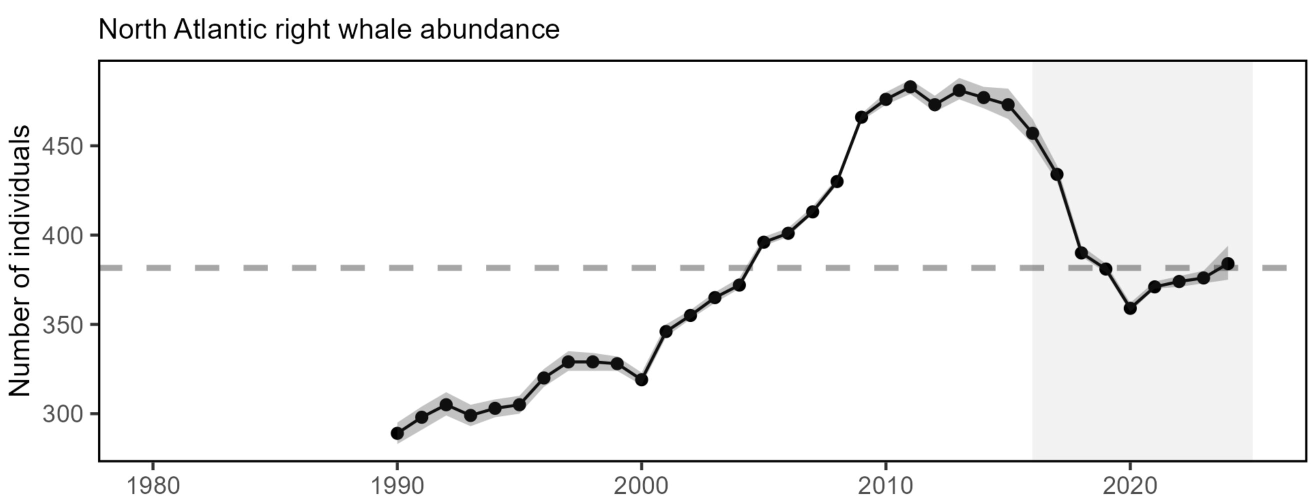

Figure 22: Estimated North Atlantic right whale abundance on the Northeast Shelf. 95% confidence interval shaded in gray around the line. Analysis is based on methods by Pace, Corkeron, and Kraus (2017), as documented most recently by Linden (2025).

North Atlantic right whale calf counts have generally declined after 2009 to the point of having zero new calves observed in 2018 (Fig. 23). However, since 2020, calf births have been closer to the long-term average, with 11 calves born in 2025.

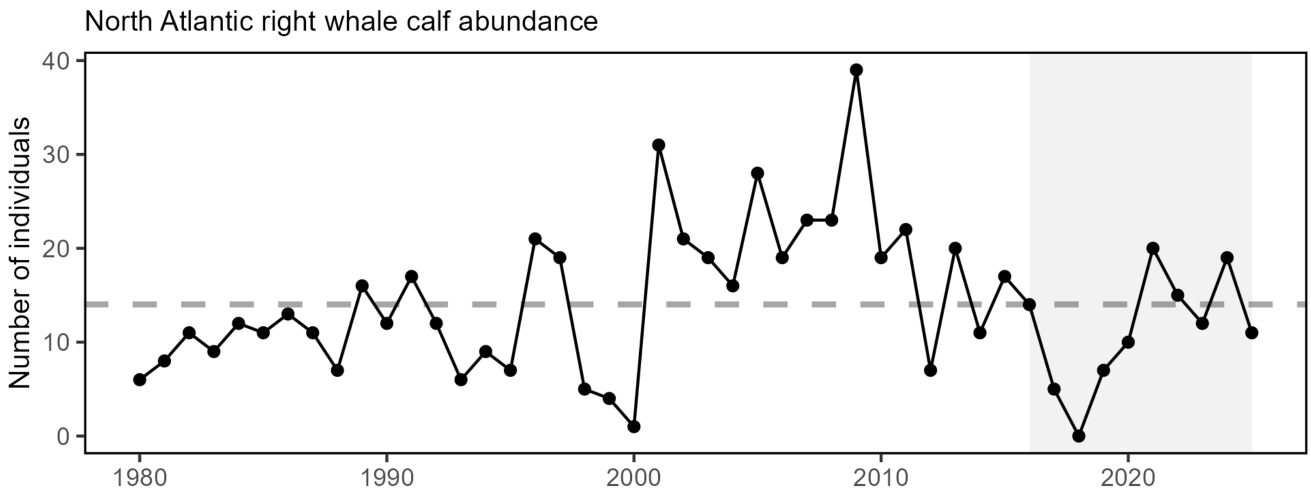

Figure 23: Number of North Atlantic right whale calf births since 1980. Calf birth estimates are available in Linden (2025).

This year, the Unusual Mortality Event (UME) for North Atlantic right whales continued. From 2017 through 5 January 2026, the total UME right whale mortalities includes 41 dead stranded whales, 19 in the US and 22 in Canada. When alive but seriously injured whales (40) and sublethal injuries or ill whales (87) are taken into account, 168 individual whales are included in the UME. Recent research suggests that many mortalities go unobserved and the true number of mortalities are about three times the count of the observed mortalities. The primary cause of death is "human interaction" from entanglements or vessel strikes.

A UME continues from previous years for humpback whales (2016-present) and Atlantic minke whales (2018-present); suspected causes include human interactions. A UME for Northeast pinnipeds that began in 2018 for infectious disease is non-active pending closure as of February 2026.

Implications

Bycatch management measures have been implemented to maintain bycatch below PBR thresholds. The downward trend in harbor porpoise bycatch could also be due to a decrease in harbor porpoise abundance in U.S. waters, reducing their overlap with fisheries, and a decrease in gillnet effort. The increasing trend in 5-year average gray seal bycatch may be related to an increase in the gray seal population (U.S. pup counts), supported by the dramatic rise over the last three decades in observed numbers of gray seal pups born at U.S. breeding sites plus an increase in adult seals at the breeding sites, some of which are supplemented by Canadian adults.

Strong evidence exists to suggest that interactions between right whales and both the fixed gear fisheries in the U.S. and Canada and vessel strikes in the U.S. are contributing substantially to the decline of the species. Further, right whale distribution has changed since 2010. Recent research suggests that recent climate driven changes in ocean circulation have resulted in right whale distribution changes driven by increased warm water influx through the Northeast Channel, which has reduced the primary right whale prey (the copepod *Calanus finmarchicus*) in the central and eastern portions of the Gulf of Maine. Additional potential stressors include offshore wind development, which overlaps with important habitat areas used year-round by right whales, including mother and calf migration corridors and foraging habitat. Additional information can be found in the offshore wind risks section.

The UMEs are under investigation and are likely the result of multiple drivers. For all large whale UMEs, human interaction appears to have contributed to increased mortalities, although investigations are not complete.

A climate vulnerability assessment is published for Atlantic and Gulf marine mammal populations.

Stability

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This year, we have updated the definition of stability for fisheries and ecosystems as a measure of how consistent we expect the system to be over time. Three components of stability are considered for the purpose of this report: volatility, adaptive capacity, and a shift from baseline. Volatility is a measure of predictability, where volatile conditions indicate that future years are more likely to be different than the recent past. Adaptive capacity refers to a system's ability to respond to changes without fundamentally changing its composition or structure. A shift from baseline refers to a systemic shift in a system towards a new status, where prior conditions may no longer be the norm. Measures of volatility are currently being developed. Therefore, we assess fisheries and ecosystem stability as "stable" if there is no notable change in adaptive capacity or shifts from a historic baseline, and "not stable" if there are changes in either of these components.

Fishery Stability Indicators suggest that Mid-Atlantic fisheries have broadly shifted from the historic baseline. Commercial fishery fleet count has declined while fleet revenue diversity has been stable over time in the MAB, but current values are above the long-term average (Fig. 24). Revenue per unit effort remains steady or increasing over time for most gear types, indicating financial viability of current fishing operations. This indicates that the commercial fleet composition has changed, but the portfolio of species targeted is similar over time (Fig. 25). Target species such as Atlantic mackerel and quahog have had reduced catch limits in recent years, resulting in reduced landings in these fisheries, and a decline in scallop catch within the MAB has severely reduced the total revenue generated in the region. Because non-MAFMC managed landings and revenue have declined, a larger share of the regional landings and revenue come from Council-managed fisheries.

The Crew Survey shows that specific aspects pertaining to sustainability and resilience of the fishing lifestyle are declining: predictability of earnings, the amount of time away from home, the physical fatigue of the job, and the personal health impacts have all been cited as dissatisfaction rates increase. Overall job satisfaction remains relatively stable over time, but unveils vulnerability as additional survey results show an aging population, particularly an increase in the 55+ crew cohort, and fewer individuals entering the fishery. This suggests a reduced capacity for Mid-Atlantic commercial fisheries to adapt to future uncertainties and change.

Despite reduced recreational landings (Fig. 4), the number of recreational trips is near average (Fig. 15), suggesting a shift to catch-and-release fishing. Billfish (i.e., white marlin) catch-and-release was especially high, possibly due to shifting effort due to the closure of the recreational bluefin tuna fishery in August 2025. Shark and large sport fish regulations, the right environmental conditions, and other circumstances may also contribute to reduced recreational landings. As noted above, recreational fleet effort diversity is declining (Fig. 16), suggesting a shift in recreational fishing opportunities. The Mid-Atlantic has experienced a contraction of the party and charter sectors, with more recreational angling occurring from shore. Recreational species catch diversity has no long-term trend and has been at or above the long-term average since 2016 (Fig. 26), indicating that anglers continue to catch a mix of species.

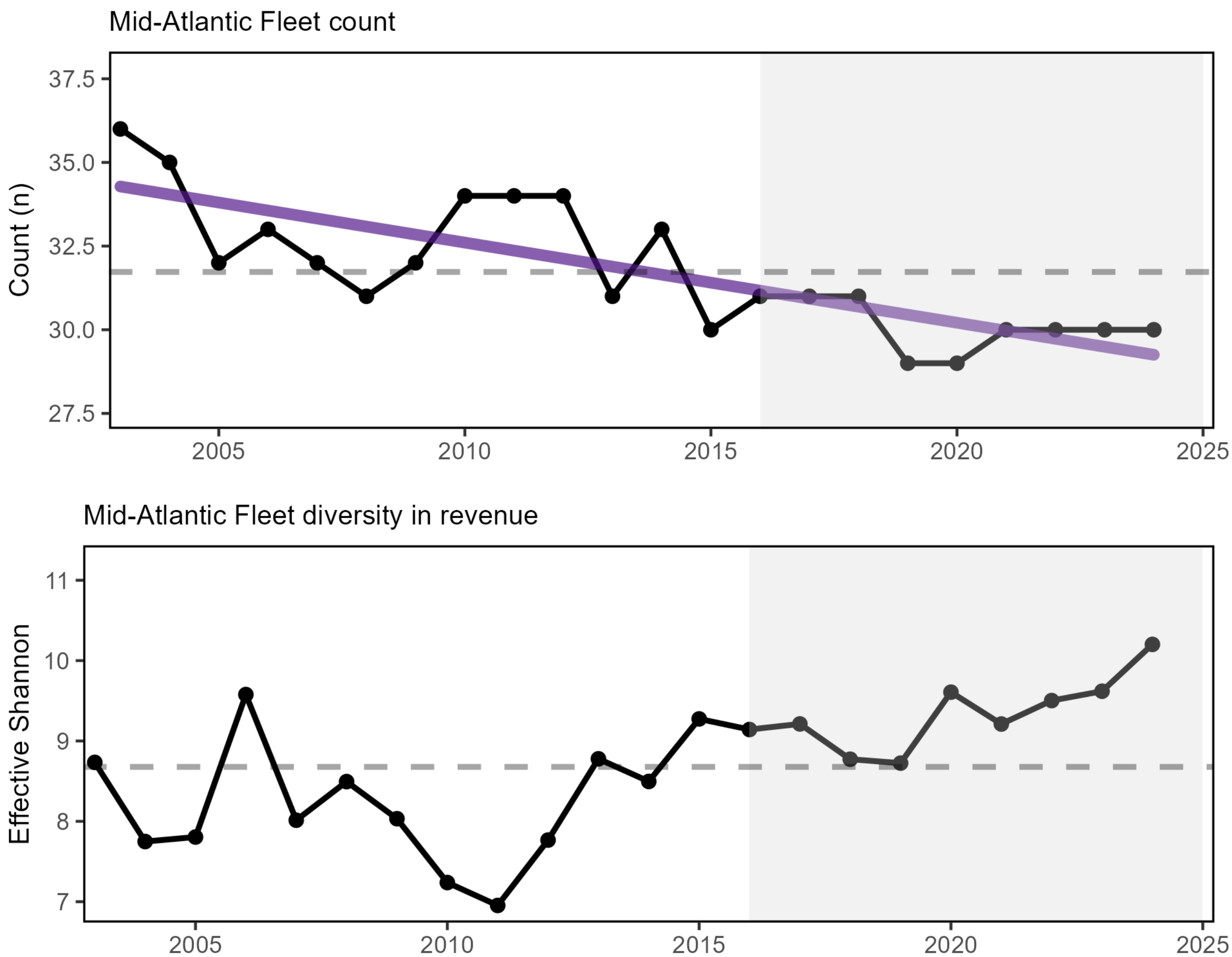

Figure 24: Commercial fleet count (top) and fleet diversity in revenue (bottom) in the Mid-Atlantic (black) with significant decline in fleet count (purple line).

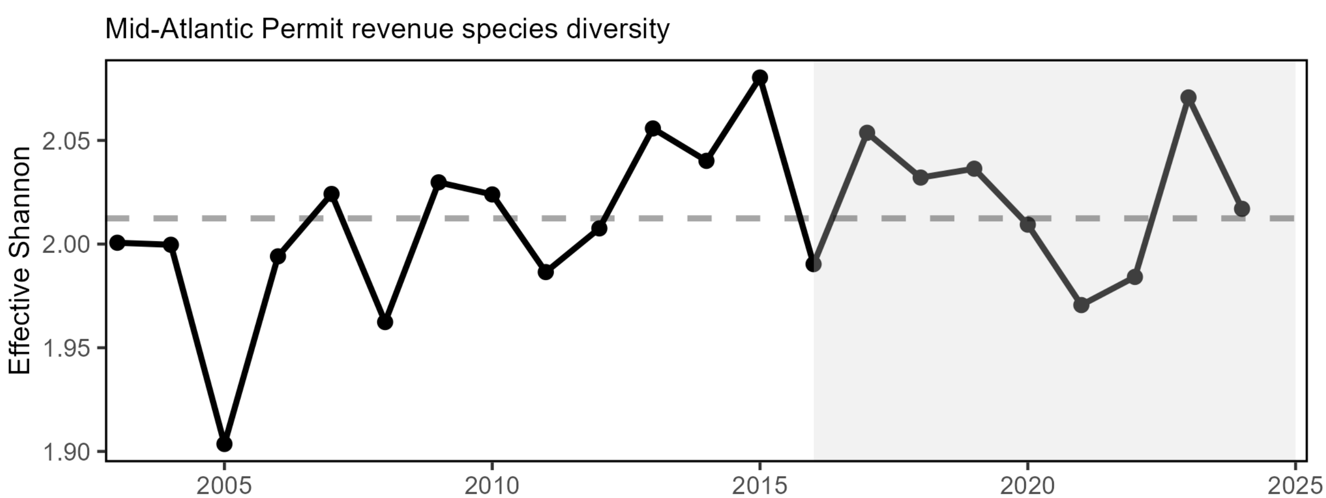

Figure 25: Species revenue diversity (permit-level species effective Shannon index) in the Mid Atlantic.

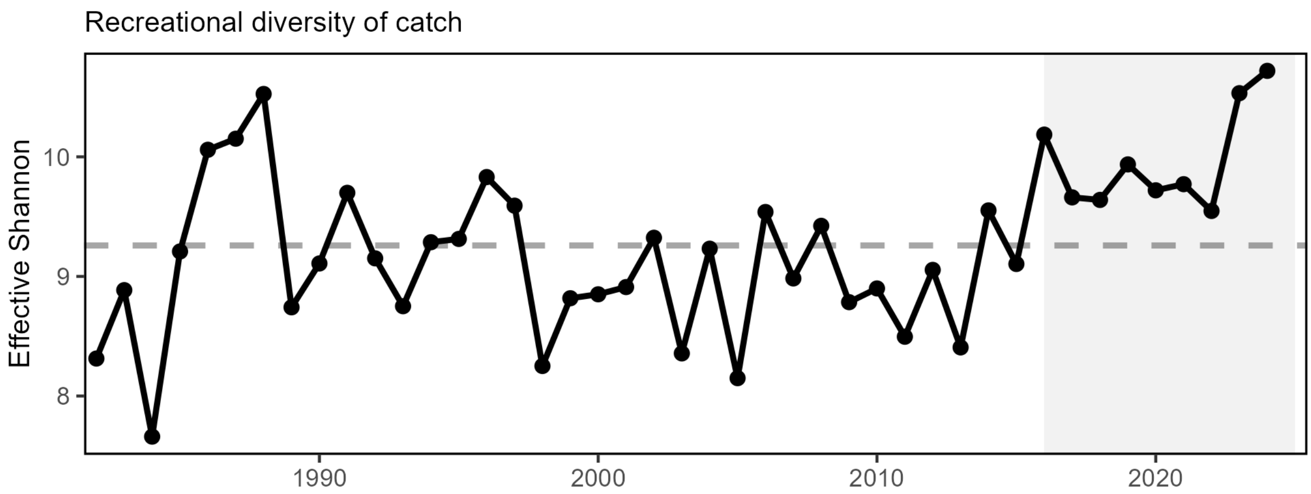

Figure 26: Diversity of recreational catch in the Mid Atlantic. Derived from MRIP's Catch Time Series Query.

Ecological Stability Long-term changes in biological processes suggest the Mid-Atlantic ecosystem is experiencing a systemic shift. Total annual primary production, a measure of the total amount of carbon (i.e., energy) produced by phytoplankton per year, has no clear trend (Fig. 27), suggesting stability in energy at the base of the food web. However, we are monitoring for shifts in the phytoplankton community, which can affect the amount of primary production available to higher trophic levels. Zooplankton diversity is increasing in the MAB, and measures of zooplankton community composition also indicate a long-term shift in zooplankton communities. Together, these indicators show a gradual but systemic change in lower trophic levels towards a community with a higher proportion of euphausiids and less dominated by copepods, which would not be expected in a stable ecosystem.

There are long-term increases in the biomass of the euphausid, benthivore, and benthos guilds. These lower trophic groups have similar roles within the ecosystem and these changes indicate a shift towards an ecosystem with a higher representation of those functional groups. Adult fish diversity, the expected number of species in a standard number of individuals sampled from the NEFSC bottom trawl survey, appears stable over time, with current values within one standard deviation from most historic estimates (Fig. 28). This suggests that biomass increases in some guilds is due to an overall productivity increase rather than an influx of new species.

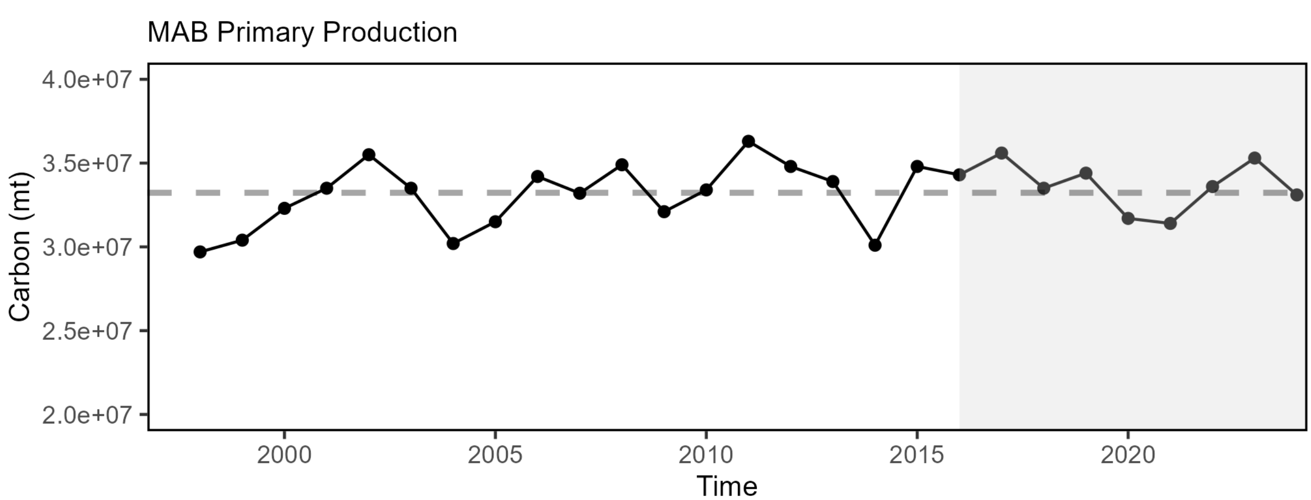

Figure 27: Total areal annual primary production for the MAB. The dashed line represents the long-term (1998-2024) annual mean.

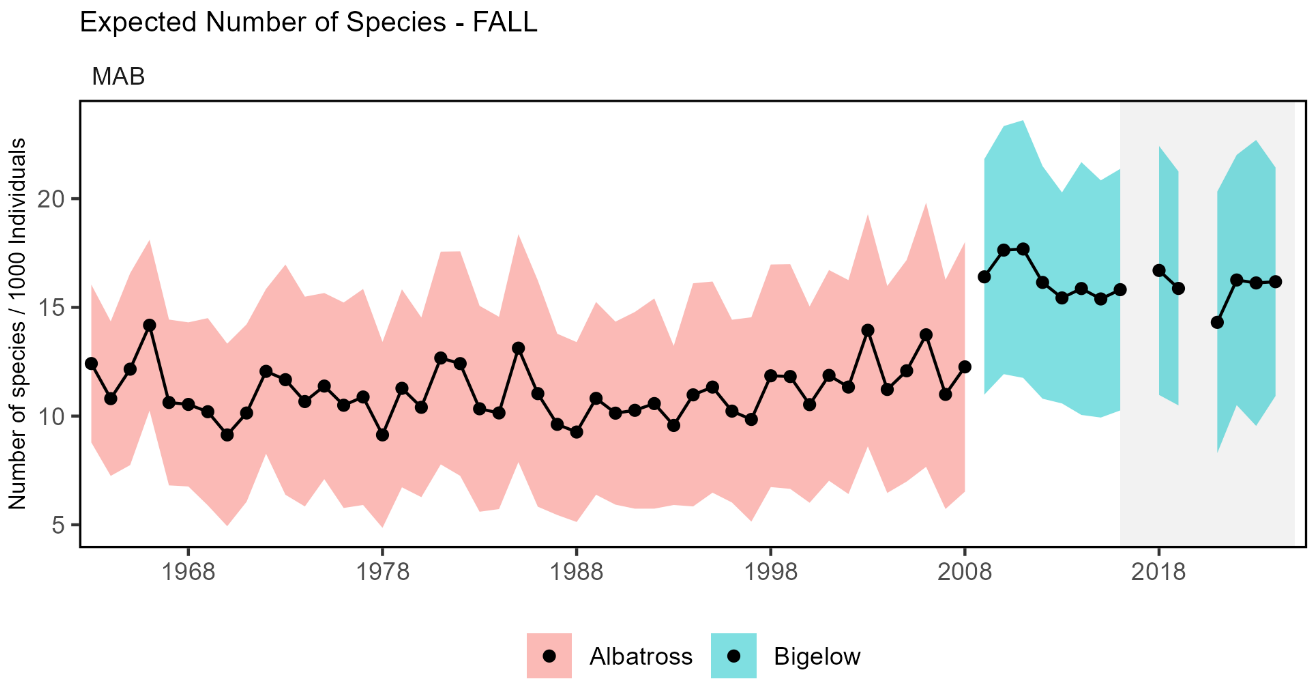

Figure 28: Adult fish diversity in the Mid-Atlantic Bight, based on expected number of species in a standard number of individuals. Results from survey vessels Albatross (red) and Bigelow (blue) are reported separately due to catchability differences.

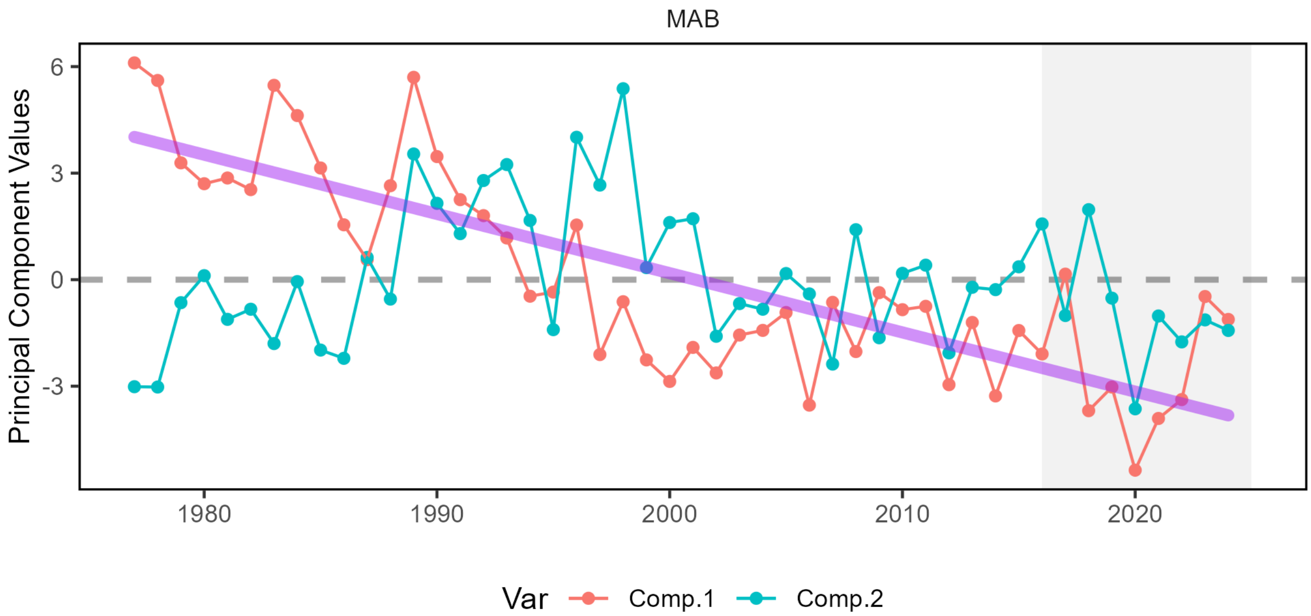

Figure 29: Principal component analysis of zooplankton community composition in the MAB. Lines show the first two principal components (colors). The declining trendline is associated with the first principal component. This trend is driven by an increasing abundance of sea butterflies, hyperiid amphipods, echinoderm larvae, arrow worms, and the copepod Calanus minor, and a decreasing abundance of the copepods Pseudocalanus spp., Centropages hamatus, Acartia spp., and Temora longicornis.

Functional traits, such as length at maturity, maximum body size, or fecundity, serve to synthesize change in complex, diverse communities by looking beyond species-specific trends. Furthermore, shifts in functional trait distributions for the fish community can indicate changes in ecosystem-scale resilience. There is evidence of long-term change in trait distributions in the MAB, particularly in the fall season (Fig. 30) (Fig. 31). The fall finfish community in the MAB is showing long-term shifts towards faster life history strategies with lower trophic levels, smaller offspring, younger age and shorter length at maturity, and faster growth rates. This indicates shifts in a system increasingly composed of smaller, fast-growing species. The long-term trends in the spring season are, however, more equivocal, with some evidence in shifts towards slower life history strategies, including larger length-at-maturity and offspring size. The lack of trend in finfish diversity suggests that these changes in fish communities are not due to a change in the total number of species.

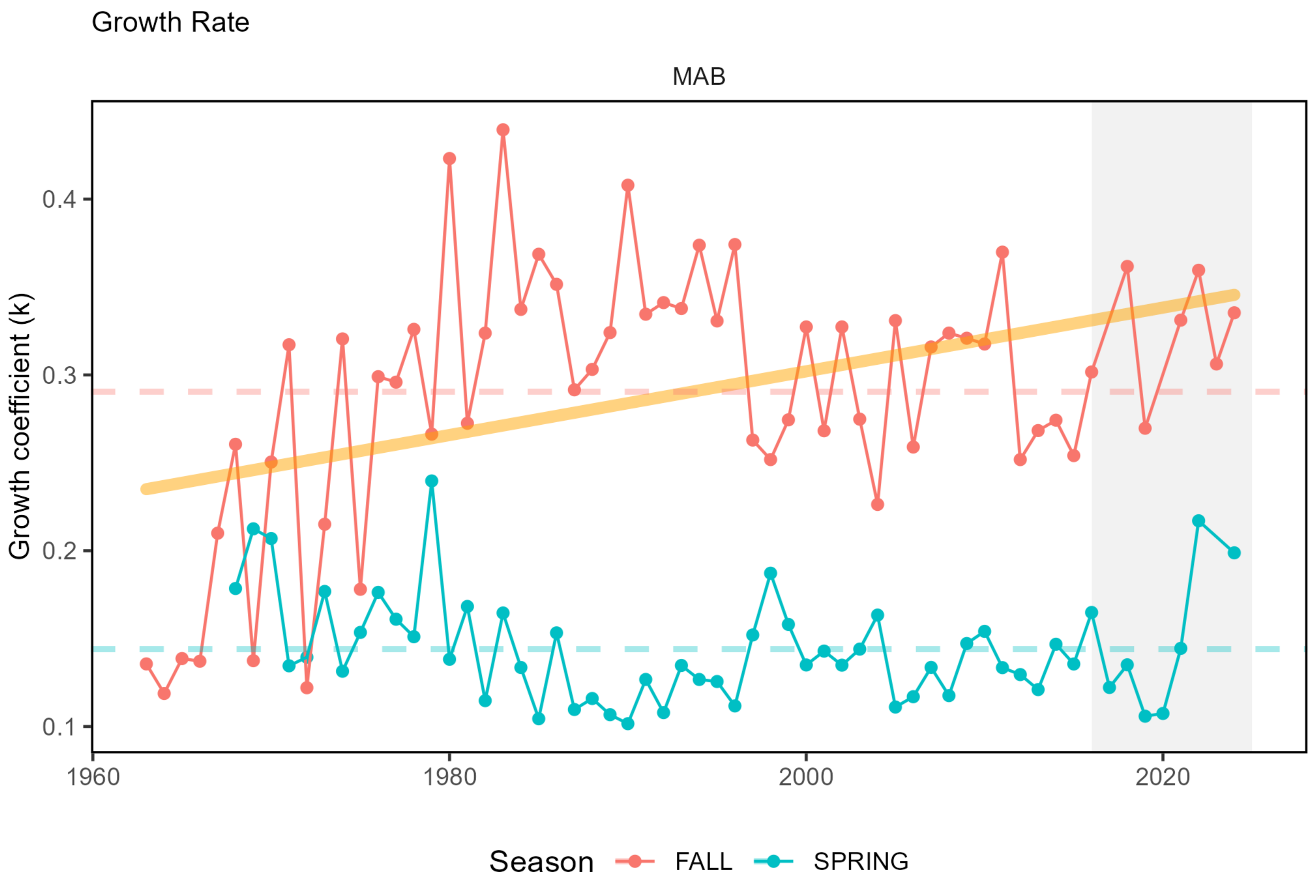

Figure 30: Fish community functional traits (growth rate) in the Mid Atlantic Bight based on Fall (red) and Spring (blue) survey data.

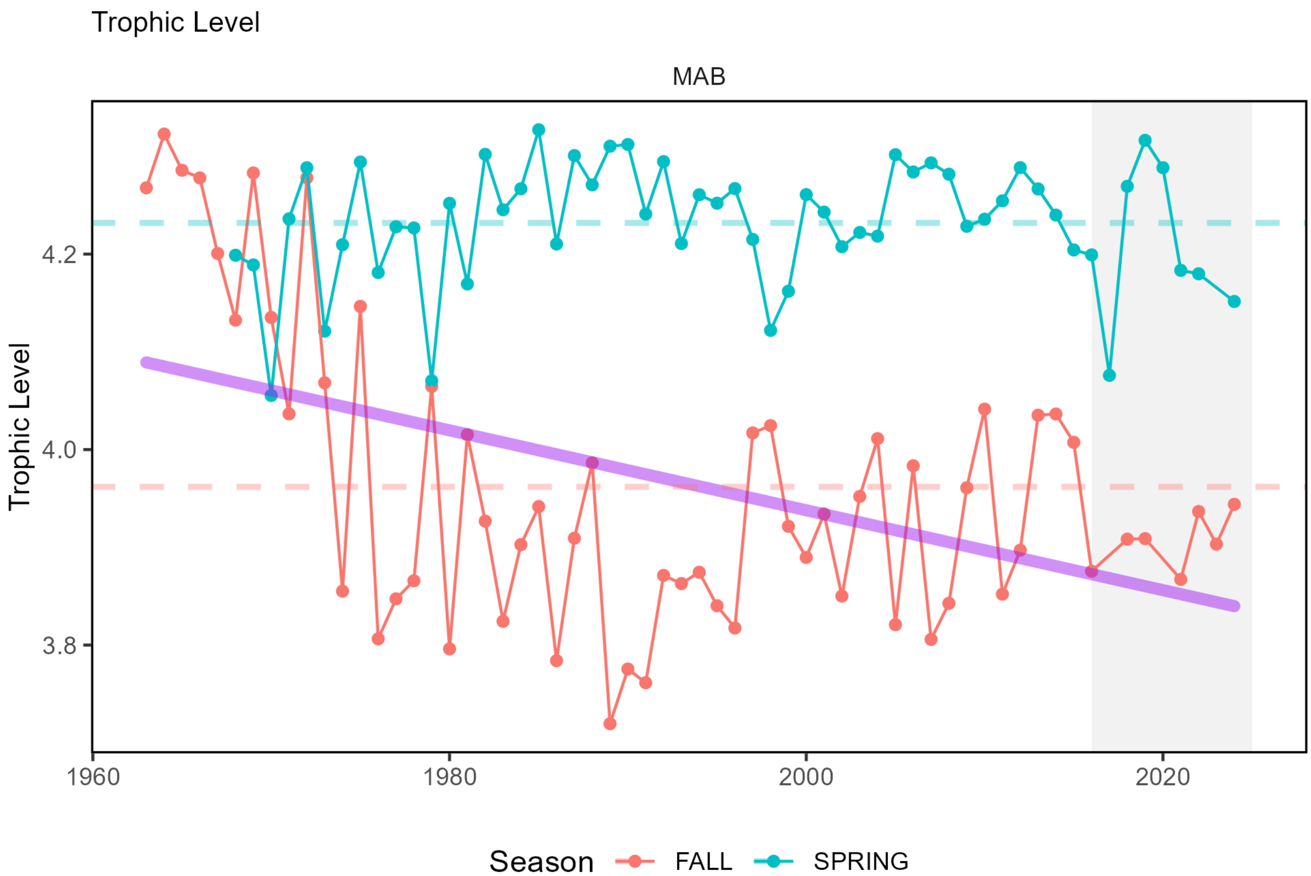

Figure 31: Fish community functional traits (trophic level) in the Mid Atlantic Bight based on Fall (red) and Spring (blue) survey data.

Implications

Fleet diversity indices are used by the MAFMC in their EAFM risk assessment to evaluate stability objectives, as well as risks to fishery resilience and maintaining equity in access to fishery resources. Instability in the commercial fleet count metric suggests lower capacity to respond to the current range of fishing opportunities. Commercial species permit revenue diversity is relatively stable but comparisons are limited by missing historical (pre-2003) clam fishery data.

Declining recreational fleet effort diversity indicates that the party/charter boat sector continues to contract, with shoreside angling becoming a greater percentage of recreational angler trips. Stability in recreational species catch diversity has been maintained by a different set of species over time. A recent increase in Atlantic States Marine Fisheries Commission (ASMFC) and South Atlantic Fishery Management Council (SAFMC) managed species in recreational catch is helping to maintain diversity in the same range that MAFMC and New England Fishery Management Council (NEFMC) managed species supported in the 1990s. These changes in effort and species trends may necessitate new or changing management considerations to ensure effective tools and opportunities are in place to support recreational fisheries.

Production at the base of the food web is variable, but stable over time. Mid-Atlantic species composition is changing, shifting towards a higher proportion of benthic and demersal fish. Stable adult fish diversity indicates the same overall number and evenness over time, but doesn't rule out species substitutions (e.g., warm-water species replacing cold-water species). There is evidence for long-term change in finfish trait distributions in the Mid-Atlantic.

In the MAB, both the fisheries and ecosystem are exhibiting long-term systemic shifts away from historical norms.

While these changes don't appear abrupt like one would expect during a regime shift, they do indicate a potential change in baseline conditions.

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Risks to Meeting Fishery Management Objectives

Climate and Ecosystem Change

Risks to managing spatially

Shifting species distributions, or (changes in spatial extent or center of distribution), alter both species and fishery interactions. In particular, shifting species distributions can affect expected management outcomes when spatial allocations and bycatch measures are based on historical fish and protected species distributions. Species availability to surveys can also change as distributions shift within survey footprints, complicating the interpretation of survey trends.

Coastwide indicators are reviewed in this section to evaluate spatial change throughout the Northeast US shelf. Indicators are identical between the Mid-Atlantic and New England reports.

Indicators: Fish and protected species distribution shifts As noted in the Seafood Production Implications section, the combined center of distribution for 48 Northeast Shelf commercially or ecologically important fish species continues to show movement towards the northeast and generally into deeper water (Fig. 32). An analysis of recreational landings data from 2002 to 2019 found evidence of distribution shifts for several highly migratory species, including sharks, billfish and tunas.

Habitat model-based species richness suggests shifts of both cooler and warmer water species to the northeast. Similar patterns have been found for marine mammals, with multiple species shifting northeast between 2010 and 2017 in most seasons (Fig. 33).

Megabenthos center of gravity shows a short-term northward and eastward trend in spring (Fig. **??**). Megabenthos are large, non-federally-managed benthic invertebrates sampled by scallop dredge, otter trawl, and the Campbell grab. These include crabs, decapods, and sea stars, which are often prey for many managed species.

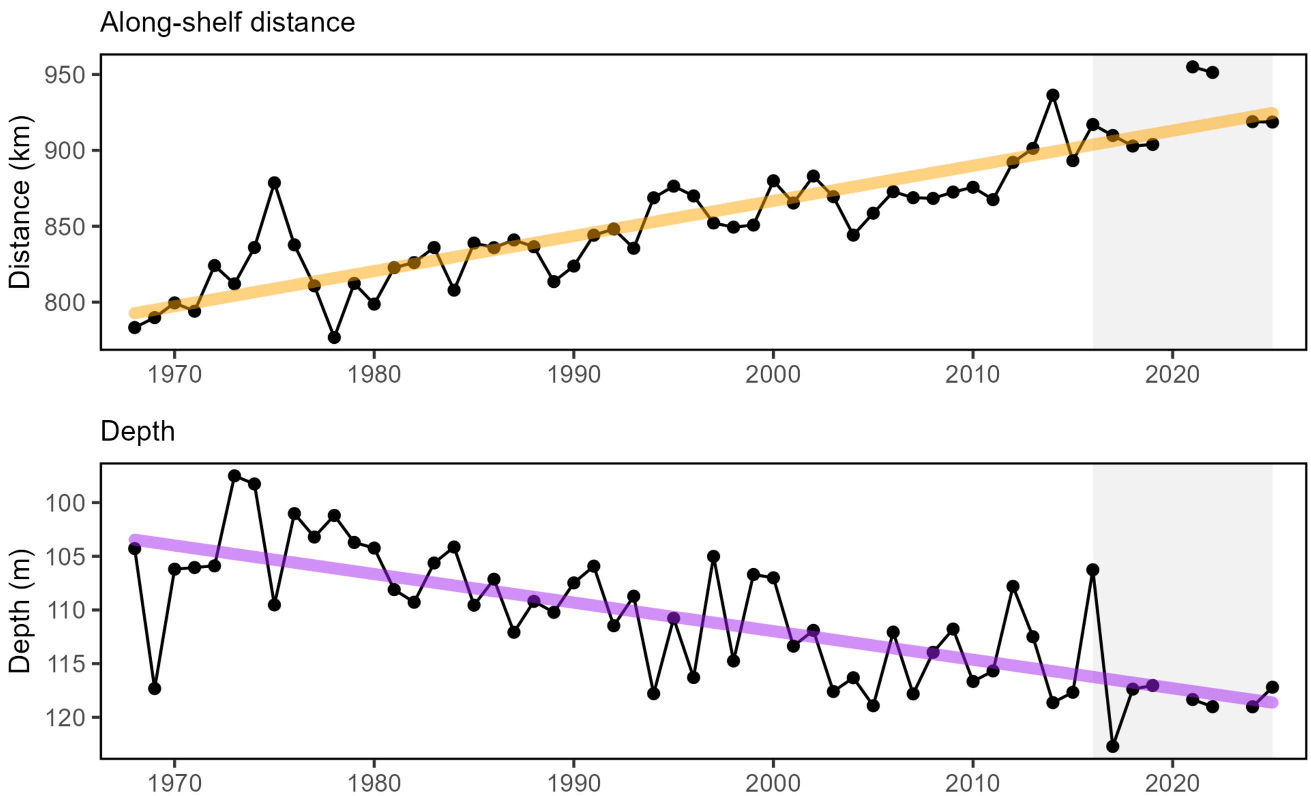


Figure 32: Aggregate species distribution metrics for species in the Northeast Large Marine Ecosystem: along shelf distance with increasing trend (orange), and depth with decreasing trend indicating deeper water (purple).

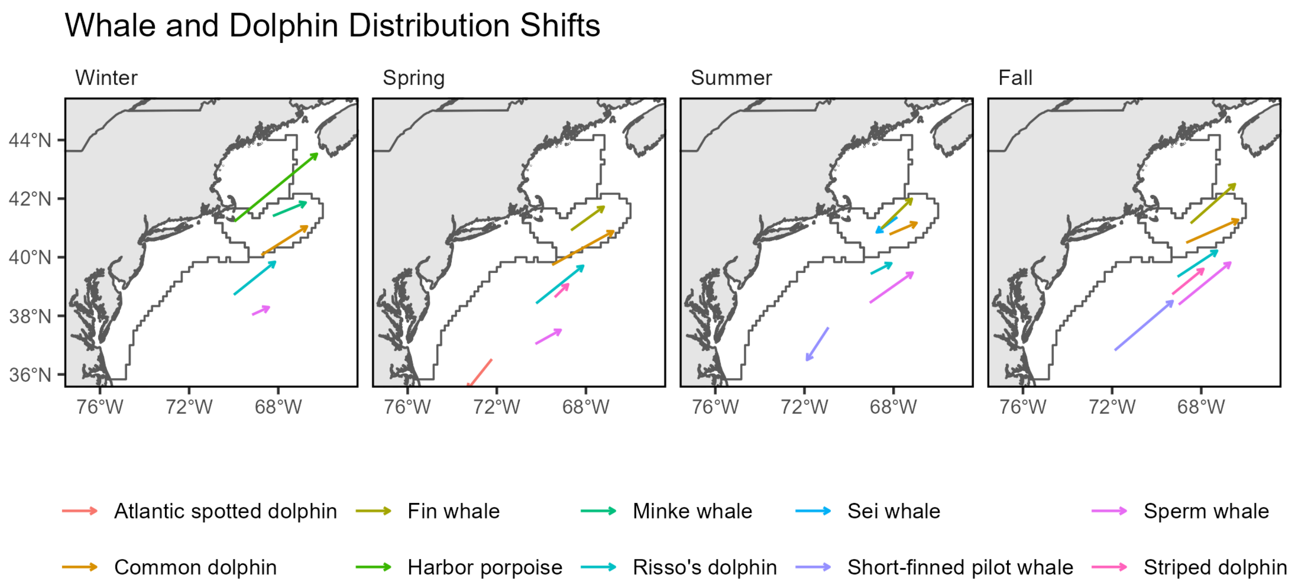
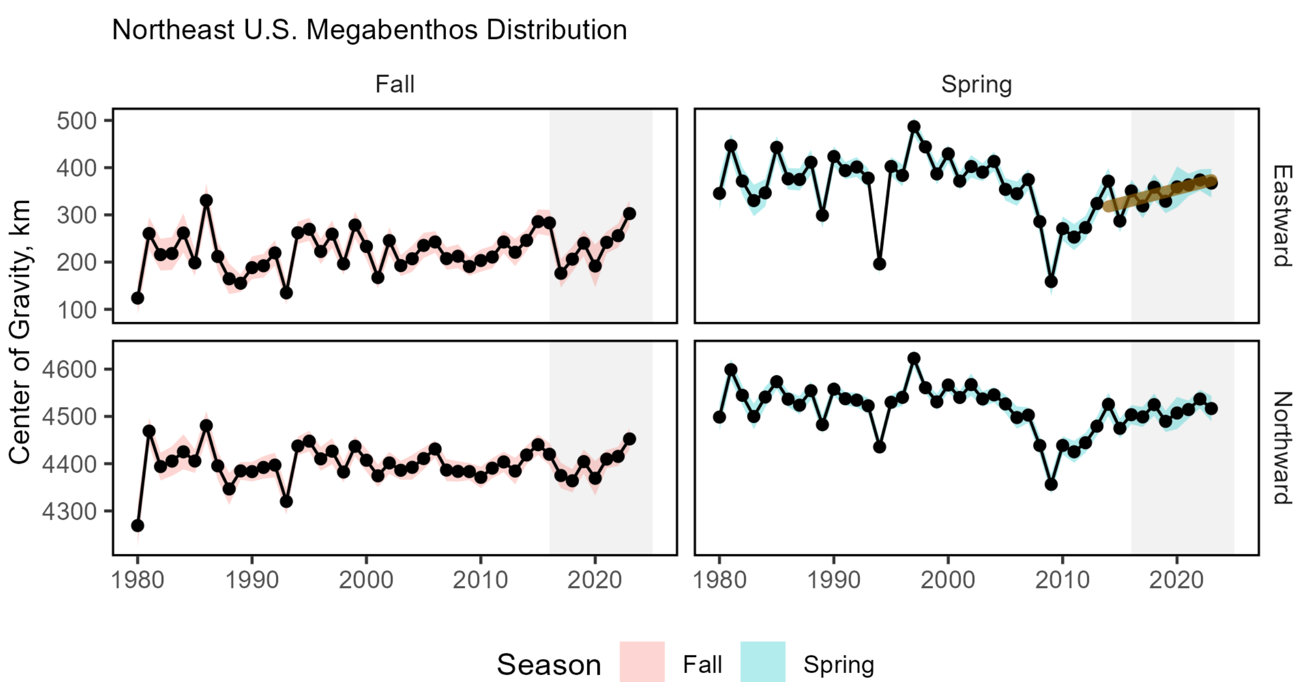


Figure 33: Direction and magnitude of core habitat shifts, represented by the length of the line of the seasonal weighted centroid for species with more than 70 km difference between 2010 and 2017 (tip of arrow).



Drivers: Mobile populations shift distributions to maintain suitable habitat and prey fields, possibly expanding ranges if new suitable habitat exists. Changes in managed species distribution is partially related to the distribution of forage biomass. Since 1982, the fall center of gravity of forage fish (20 species combined) has moved to the north and east (Fig. 34). Spring forage fish center of gravity has moved northward but without an eastward trend. Some of the whale and dolphin distribution shifts (Fig. 33) are likely in response to these forage fish shifts. Small copepods, widespread prey of many larval and juvenile fish, show a similar shift in center of gravity as forage fish, to the north and east in the fall, as well as northward in spring.

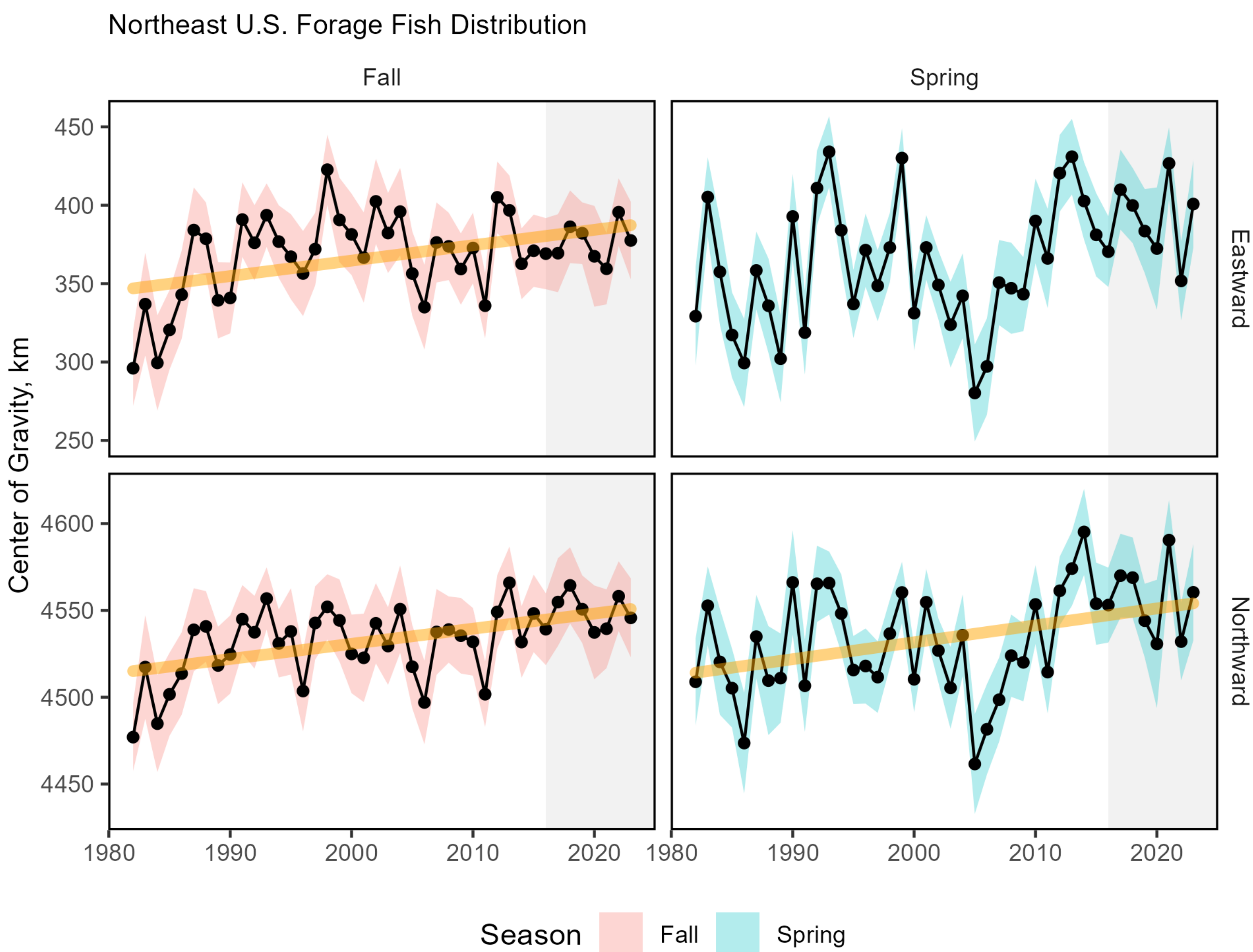


Figure 34: Eastward (top) and northward (bottom) shifts in the center of gravity for 20 forage fish species on the Northeast U.S. Shelf in fall (left) and spring (right), with increasing trend (orange) for fall eastward and northward and spring northward center of gravity.

In contrast, macrobenthos center of gravity has shifted west and south in the spring (Fig. 35). Macrobenthos are small bottom-dwelling invertebrates including polychaete worms, small crustaceans, bivalves (non-commercial), gastropods, nemerteans, tunicates, cnidarians, brittle stars, sea cucumbers, and sand dollars, and are prey for many managed species. Large copepods (including *Calanus finmarchicus*) and euphausiids do not have long-term trends in their centers of gravity (Fig. XX), but small copepods show shifts eastward and northward. Some targeted species distributions may shift in response to these shifts in forage, copepod, and macrobenthos distributions.

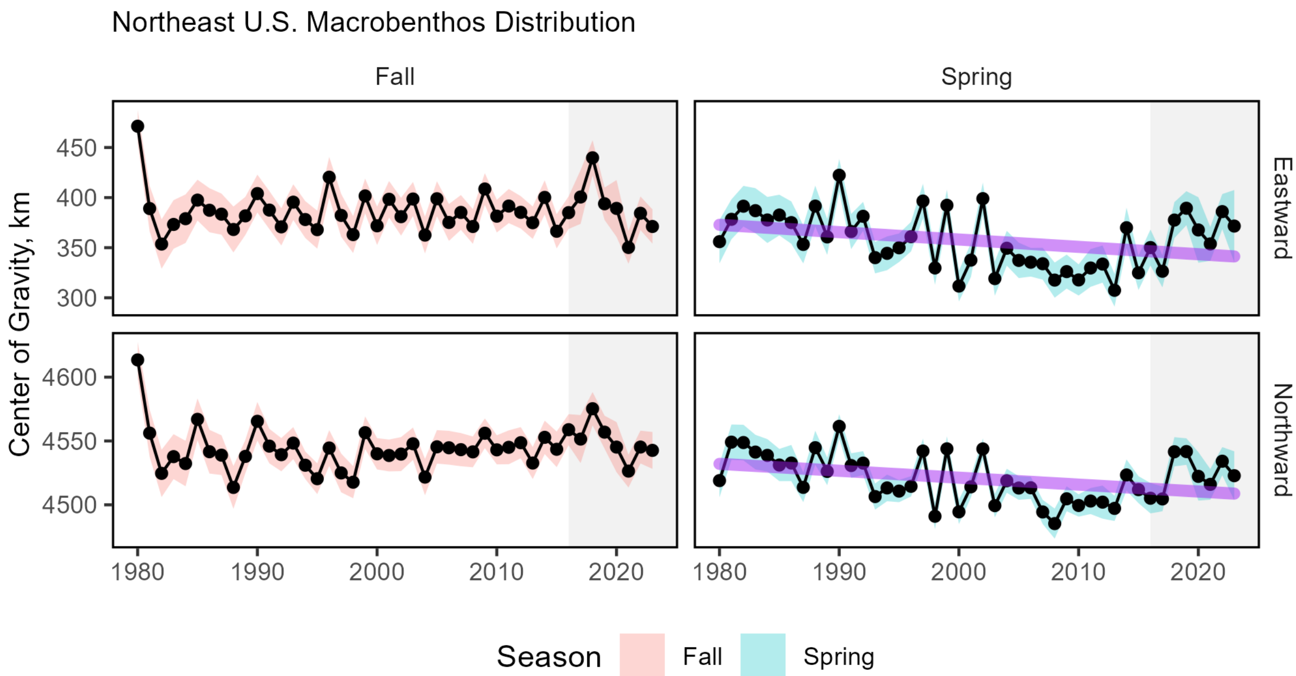
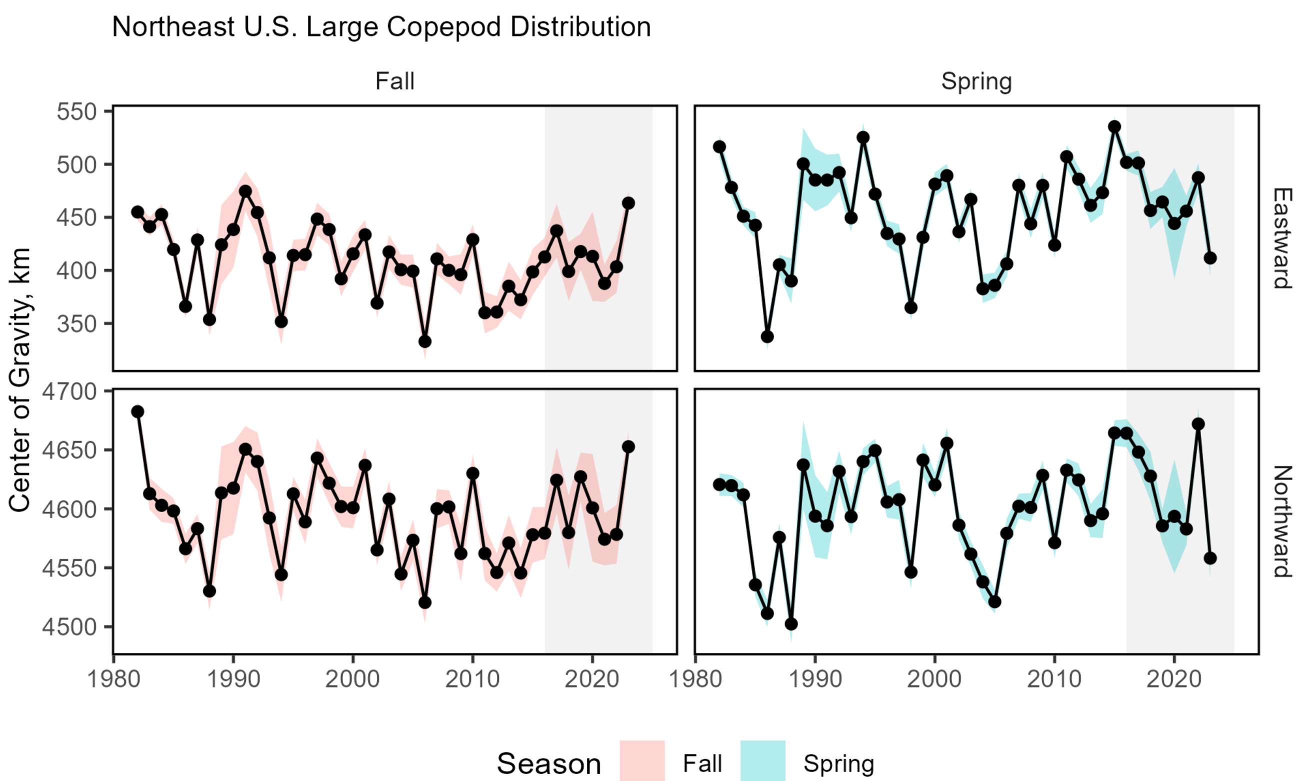
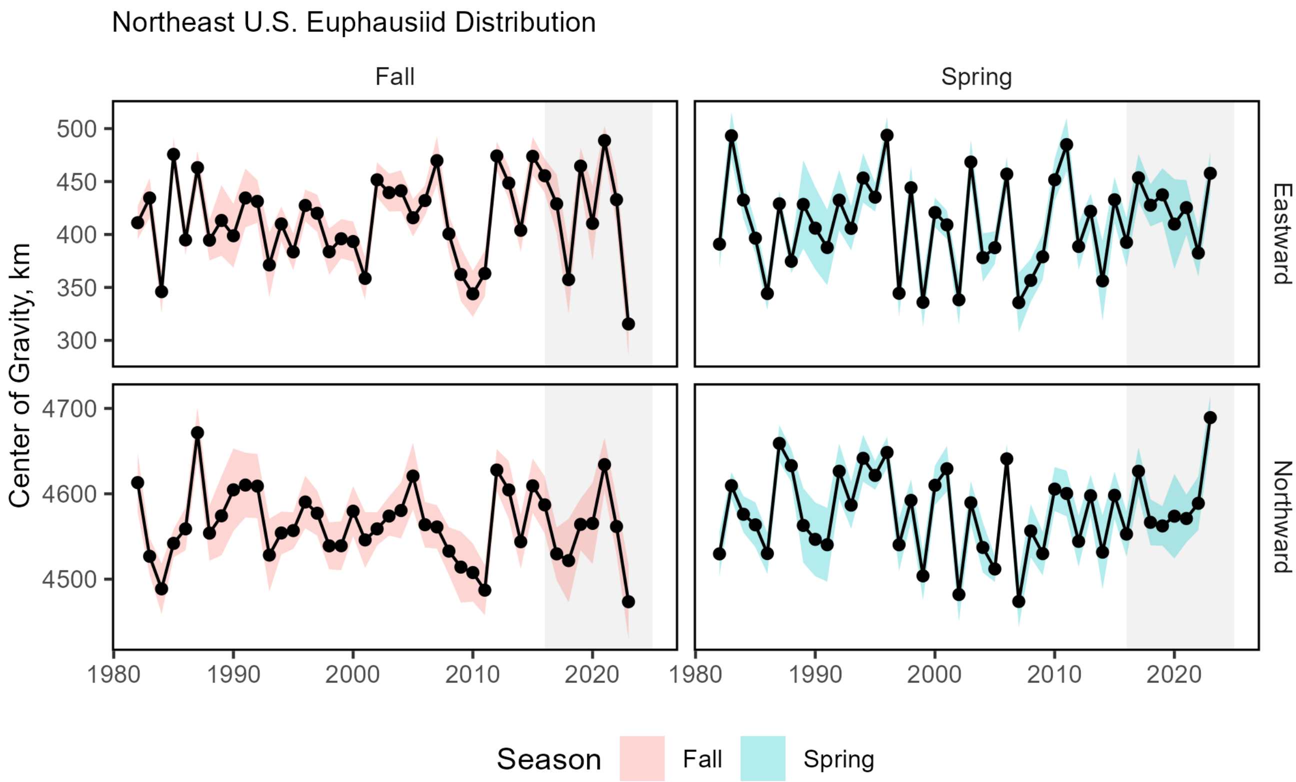


Figure 35: Eastward (top) and northward (bottom) shifts in the center of gravity for macrobenthos species on the Northeast U.S. Shelf in fall (left) and spring (right), with decreasing trend (purple) for spring eastward and northward center of gravity.





Ocean temperatures influence the distribution, seasonal timing, and productivity of managed species (see sections below). The Northeast US shelf, including the Mid-Atlantic, has experienced a continued warming trend for both the long term annual sea surface (Fig. 38) and seasonal surface and bottom temperature. However, 2025 surface and bottom temperatures were near normal to cooler than normal conditions in all seasons in the MAB (see also the 2025 Highlights section).

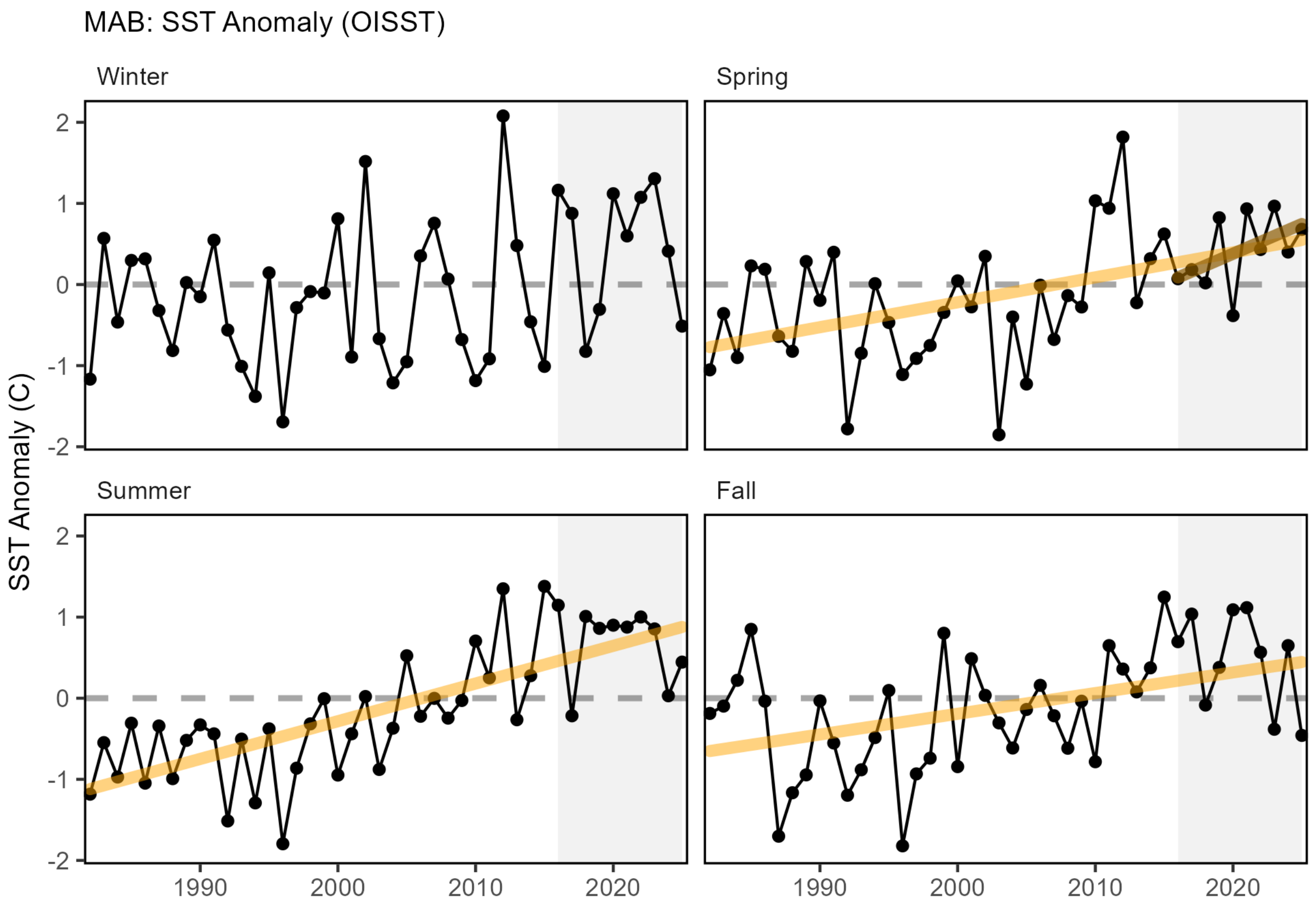


Figure 36: Seasonal OISST anomaly by season for the MAB

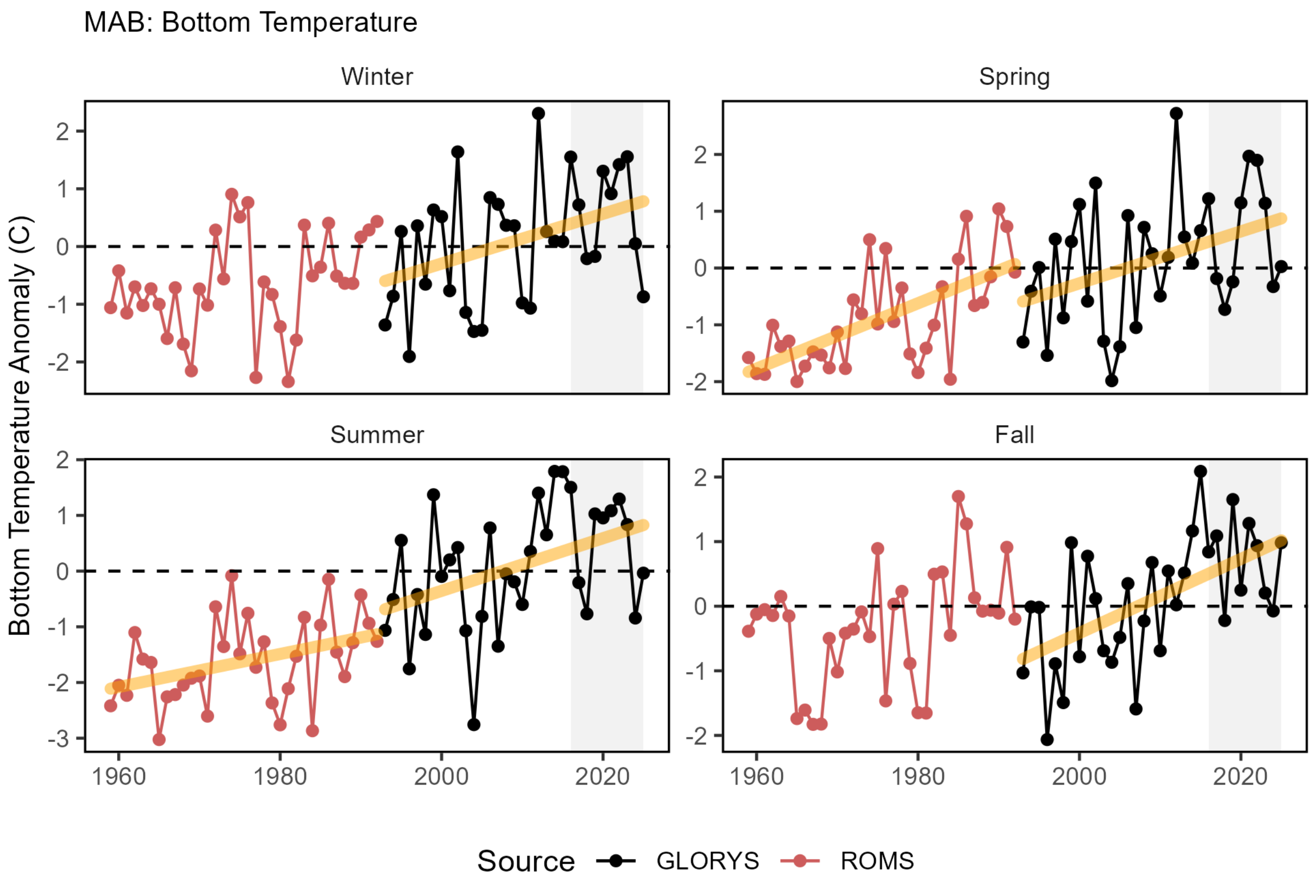


Figure 37: GLORYS (black) and debiased ROMS (red) seasonal bottom temperature anomaly in the MAB.

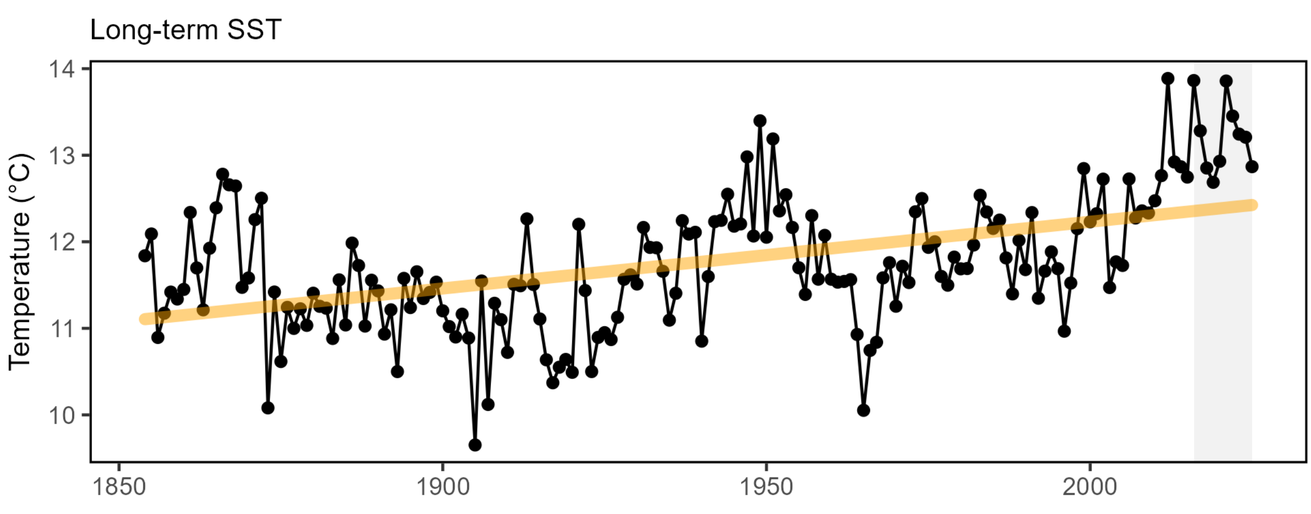


Figure 38: Northeast US annual sea surface temperature (SST, black), with increasing trend (orange).

Species suitable habitat can expand or contract when changes in temperature and major oceanographic conditions alter distinct water mass habitats.The variability of the Gulf Stream is a major driver of the predominant oceanographic conditions of the Northeast U.S. continental shelf. As the Gulf Stream had become less stable and was shifting northward until a recent shift in 2023. Since then, the Gulf Stream has been closer to the long-term average, and the supply of Labrador Slope Water to the Northwest Atlantic Shelf has increased. These changes are linked to some of the cooler water temperatures observed in 2024 and 2025 and the composition of the source water entering the Gulf of Maine through the Northeast Channel (see 2025 Highlights).

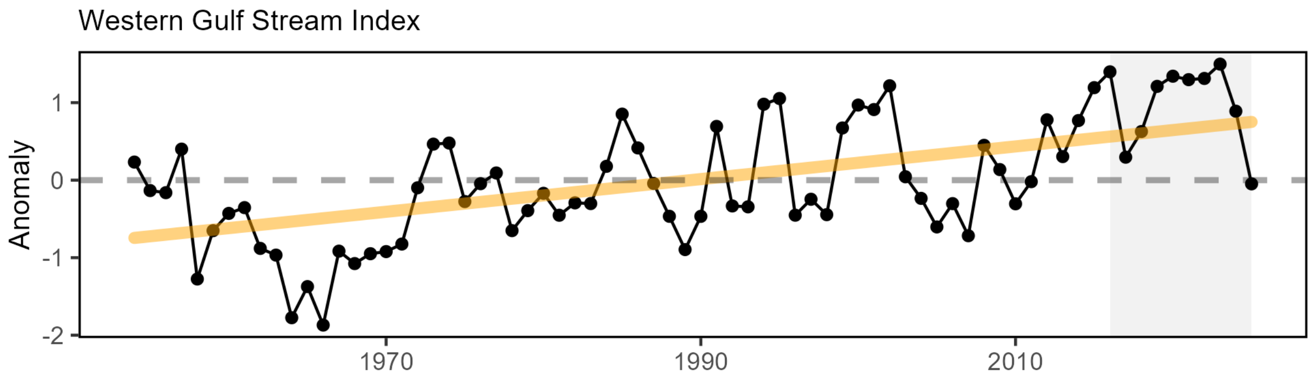


Figure 39: Index representing changes in the location of the western (between 64 and 55 degrees W) Gulf Stream north wall (black). Positive values represent a more northerly Gulf Stream position, with increasing trend (orange).

Changes in ocean temperature and circulation alter habitat features such as the Mid-Atlantic Bight Cold Pool, a band of relatively cold near-bottom water present from spring to fall over the northern MAB. The cold pool represents essential fish spawning and nursery habitat, and affects fish distribution and behavior. The cold pool has been getting warmer and its areal extent has been shrinking over time (Fig. 40). In 2025, however, the cold pool temperature index and extent were above the long-term average, likely due to the influx of Labrador Slope and Scotian Shelf waters into the system. Mobile target species that track a preferred temperature range can show increased interannual variability in their distributions as regional temperatures fluctuate from record warms to average over short periods of time.

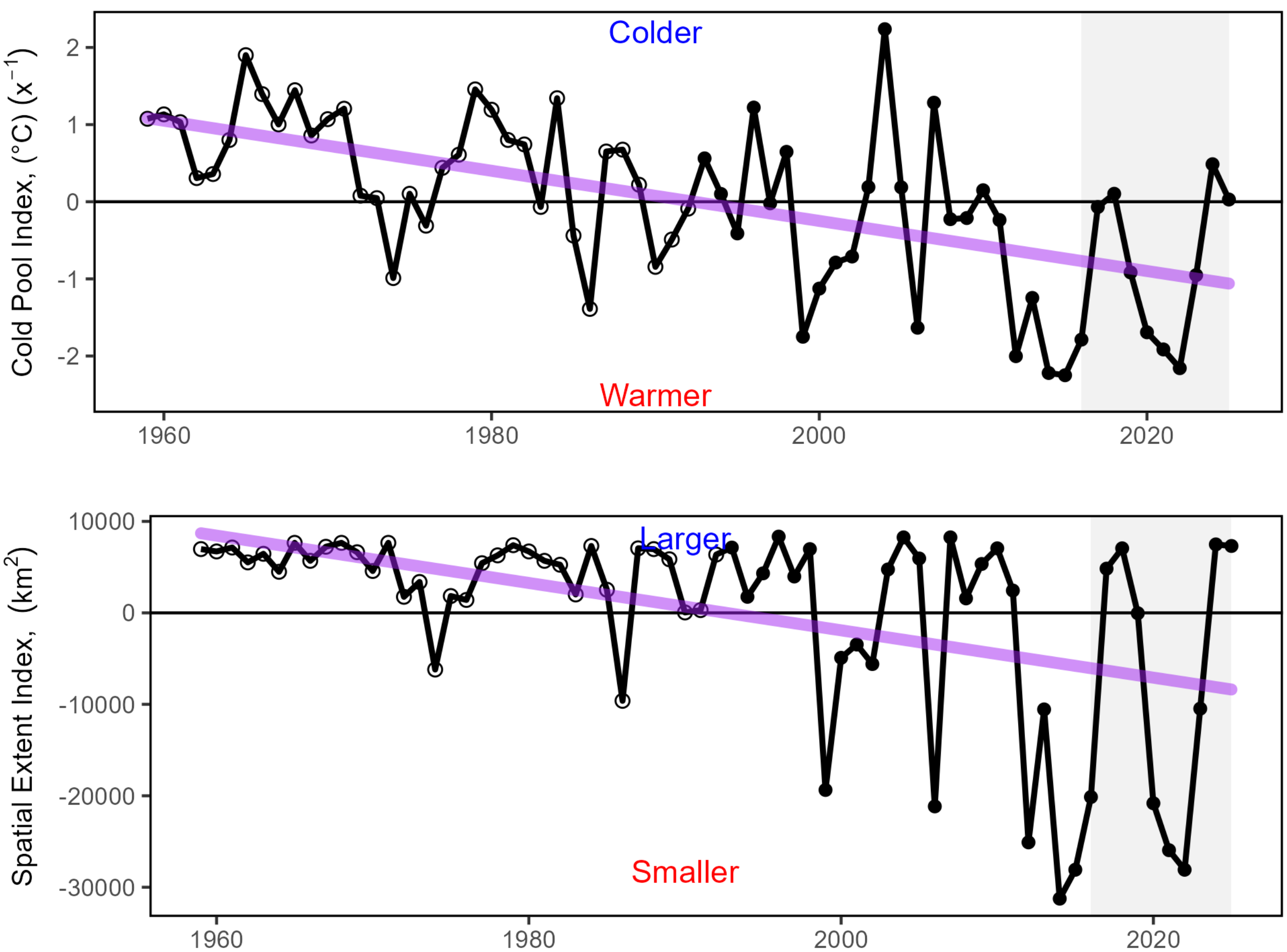


Figure 40: Seasonal cold pool mean temperature (top) and spatial extent index (bottom), based on bias-corrected ROMS-NWA (open circles) and GLORYS (closed circles), with declining trends (purple).

Future Considerations Distribution shifts caused by changes in thermal habitat and ocean circulation are likely to continue as long as long-term trends persist. Episodic and short-term events (see 2024 Highlights and 2025 Highlights) may increase variability in the trends, however species distributions are unlikely to reverse to historical ranges in the short term. Increased mechanistic understanding of distribution drivers is needed to better understand future distribution shifts: species with high mobility or short lifespans react differently from immobile or long-lived species.

MOM6 decadal oceanographic forecasts suggest a tendency towards near-normal temperatures over the next decade due to decadal variability in regional circulation. 2026 seasonal forecasts show a high probability of below average surface and bottom temperatures in the winter months. Forecast uncertainty is higher during the spring and summer seasons, and above average conditions are predicted for the fall. These forecasts will continue to be evaluated to determine how well they are able to predict episodic and anomalous events that are outside of the long-term patterns.

Adapting management to changing stock distributions and dynamic ocean processes will require continued monitoring of populations in space and time while evaluating management measures against a range of possible future spatial distributions. The upcoming Climate Vulnerability Assessment 2.0 will also be incorporating MOM6 output and forecasts to help predict changes in species distributions and quantify species exposure to predicted future change. Processes like the East Coast Coordination Group and the HMS Climate Vulnerability Assessment can help coordinate management.

Risks to managing seasonally

The effectiveness of seasonal management actions (fishing seasons or area opening/closing periods) depends on a proper alignment with the seasonal life cycle events (phenology) of fish stocks (e.g., migration and spawning timing). If not accounted for, changes in the timing of these biological cycles can reduce the effectiveness of seasonal management measures. The timing of seasonal patterns can also change the interactions between fisheries and non-target species thus influencing bycatch and the availability of species to surveys.

Indicators: Timing shifts Indicators of phenological changes in fish populations require regular sampling and observations, and therefore a limited number of these indicators are currently available. One indicator shows shifts in spawning timing of haddock and yellowtail flounder. Spawning of both haddock stocks occurred earlier in the year, as indicated by more resting (post-spawning) stage fish in recent years compared to earlier in the time series (Fig. 41). The high percentage of northern stock (Cape Cod/GOM) yellowtail flounder females in the resting maturity stage shown earlier in the time series is reflective of spring surveys sampling them well before spawning, which peaks in June for the northern stock. More recently, the females are much closer to spawning, indicating that yellowtail flounder are spawning earlier in the year. Similarly, increased catch of post-spawning fish in Southern New England, indicates that the peak spawning of the southern stock has also shifted to earlier in the year. Yellowtail flounder spawning is related to bottom temperature, week of year, and decade sampled for each of the three stocks. Changes to spawning times could impact the survival of early life stages of fish, subsequently affecting the larger population size, health, and market value.

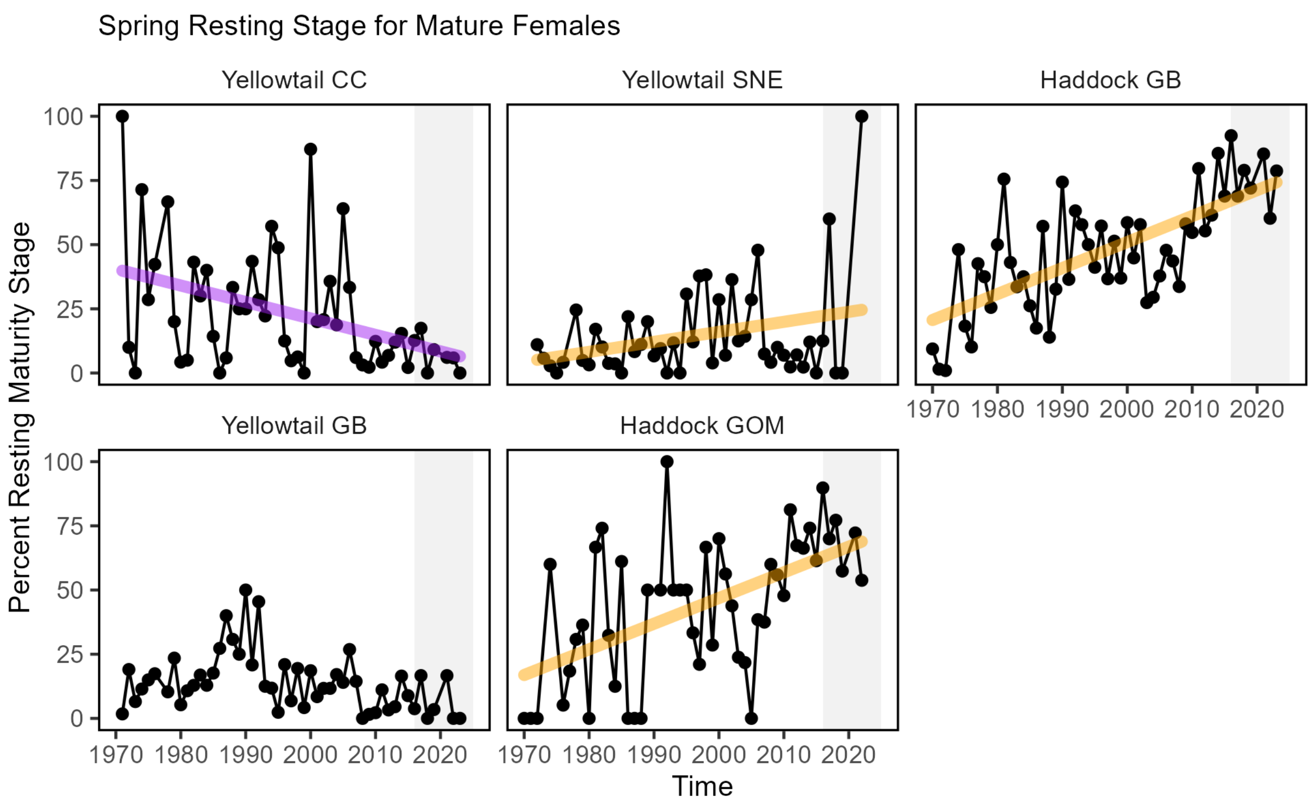


Figure 41: Percent resting stage (non-spawning) mature female fish (black) from spring NEFSC bottom trawl survey with significant increases (orange) and decreases (purple) from two haddock and three yellowtail flounder stocks: CC = Cape Cod Gulf of Maine, GOM = Gulf of Maine, GB = Georges Bank, SNE = Southern New England.

Migration timing of some tuna and large whale migrations has changed. An analysis of recreational fishing data between 2019 and 2022 identified multiple shifts in important HMS species. For example, Bigeye tuna were caught 50 days earlier; small and large bluefin tuna were caught 38 and 80 days earlier respectively in Massachusetts; and blue marlin in New York were caught 27 days earlier. A separate analysis of acoustic telemetry data predicted delayed departure of southward-migrating sharks from the northeast region under future sea surface temperatures. These results are further supported by the Atlantic Highly Migratory Species Climate Vulnerability Assessment, which found that 57 of 58 highly migratory species and stocks have high or very high potential to shift distributions. In Cape Cod Bay, peak spring habitat use by right and humpback whales has shifted 18-19 days later over time.

Understanding whether seasonal patterns are changing for stocks requires regular observations throughout the year. For example, baseline work on cetacean presence in Southern New England shows different seasonal use patterns for whale and dolphin species. Despite the importance of understanding seasonal patterns, we have few indicators that directly assess timing shifts of species. We plan on incorporating more indicators of timing shifts and phenology in future reports.

Drivers: The drivers of timing shifts in managed stocks are generally coupled to shifts in environmental or biological conditions, since these can result in changes in habitat quality or food availability within the year. Changes in the timing of fall phytoplankton blooms and seasonal shifts in zooplankton communities are indicators of changes in seasonal food availability to stocks.

Along with the overall warming trends in the Mid-Atlantic Bight, ocean summer conditions have been lasting longer (Fig. 42) due to the later transition from warm summer conditions to cooler fall temperatures. These transition dates relate how daily temperatures compare to the seasonal norm. Changes in the timing of seasonal environmental cycles can alter biological processes (migrations, spawning, etc.) that are triggered by seasonal events.

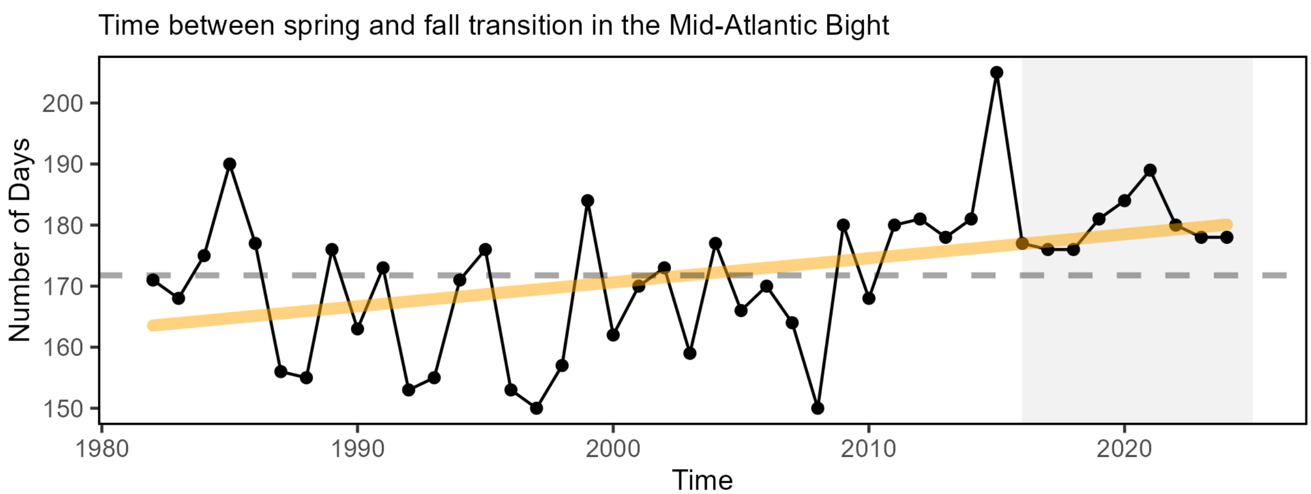


Figure 42: Ocean summer length in the MAB: the annual total number of days between the spring thermal transition date and the fall thermal transition date (black), with an increasing trend (orange). Transition dates are based on sea surface temperatures.

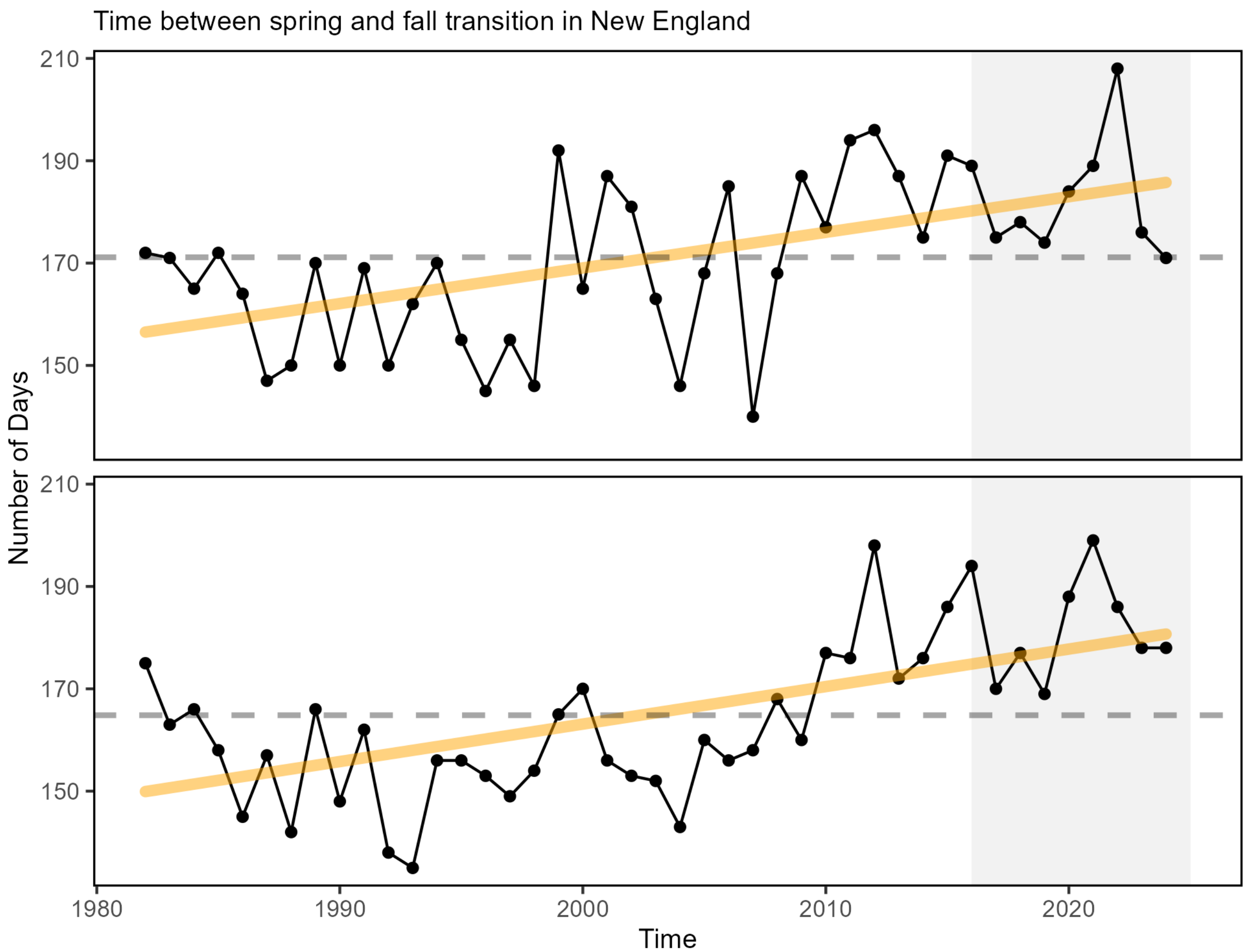


Figure 43: Ocean summer length in New England (Georges Bank, top; Gulf of Maine, bottom): the annual total number of days between the spring thermal transition date and the fall thermal transition date (black), with an increasing trend (orange). Transition dates are based on sea surface temperatures.

06_risk_seasonal_midatlantic.Rmd

As noted above, the Mid-Atlantic Cold Pool is a summer to early fall feature that creates seasonally suitable habitat for some species. Cold pool persistence has decreased indicating that the duration of the cold pool habitat is shorter compared to the 1960s (Fig. 44). However, all cold pool indices were near or above the long-term average in 2025 and likely related to the influx of northern waters into the system (see 2024 Highlights). A change in the timing of the autumn breakdown of the Cold Pool may impact the recruitment of species that rely on it for seasonal cues and habitat. Southern New England-Mid Atlantic yellowtail flounder recruitment and settlement are related to the strength of the MAB Cold Pool (a factor of extent and persistence). The correlation of pre-recruit settlers to the Cold Pool is thought to represent a bottleneck in yellowtail flounder life history, whereby a local and temporary increase in bottom temperature can negatively impact the survival of settlers. Including the effect of Cold Pool variations on yellowtail recruitment reduced retrospective patterns and improved predictive skill in a stock assessment model. This connection is especially important given the long-term decline in the duration of the Cold Pool.

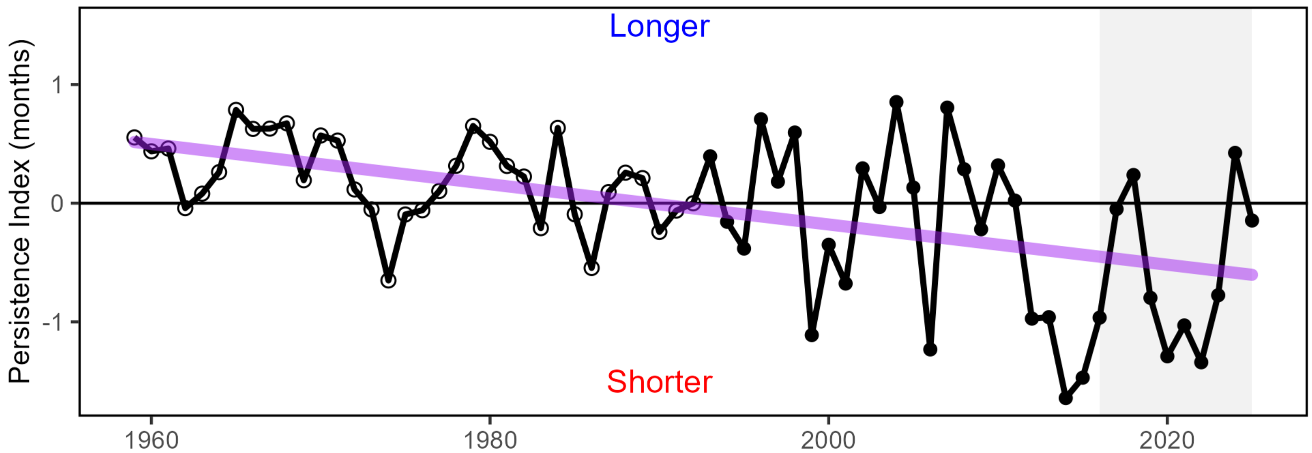


Figure 44: The Mid Atlantic Bight Cold Pool persistence index based on bias-corrected ROMS-NWA (open circles) and GLORYS (closed circles), with significant long-term decline (purple).

The seasonal timing of Mid-Atlantic phytoplankton blooms shows high interannual variability during the fall bloom period (October-December, Fig. 45). The significant increase in January chlorophyll suggests that the fall bloom period is continuing into the winter, with higher phytoplankton concentrations now than in the late 1990s. The significant decrease of chlorophyll in September could be related to warmer temperatures persisting into early fall and nutrient limitation causing a delay in the fall bloom. Changes to bloom timing can create a mismatch with the timing of larval fish development and may impact recruitment.

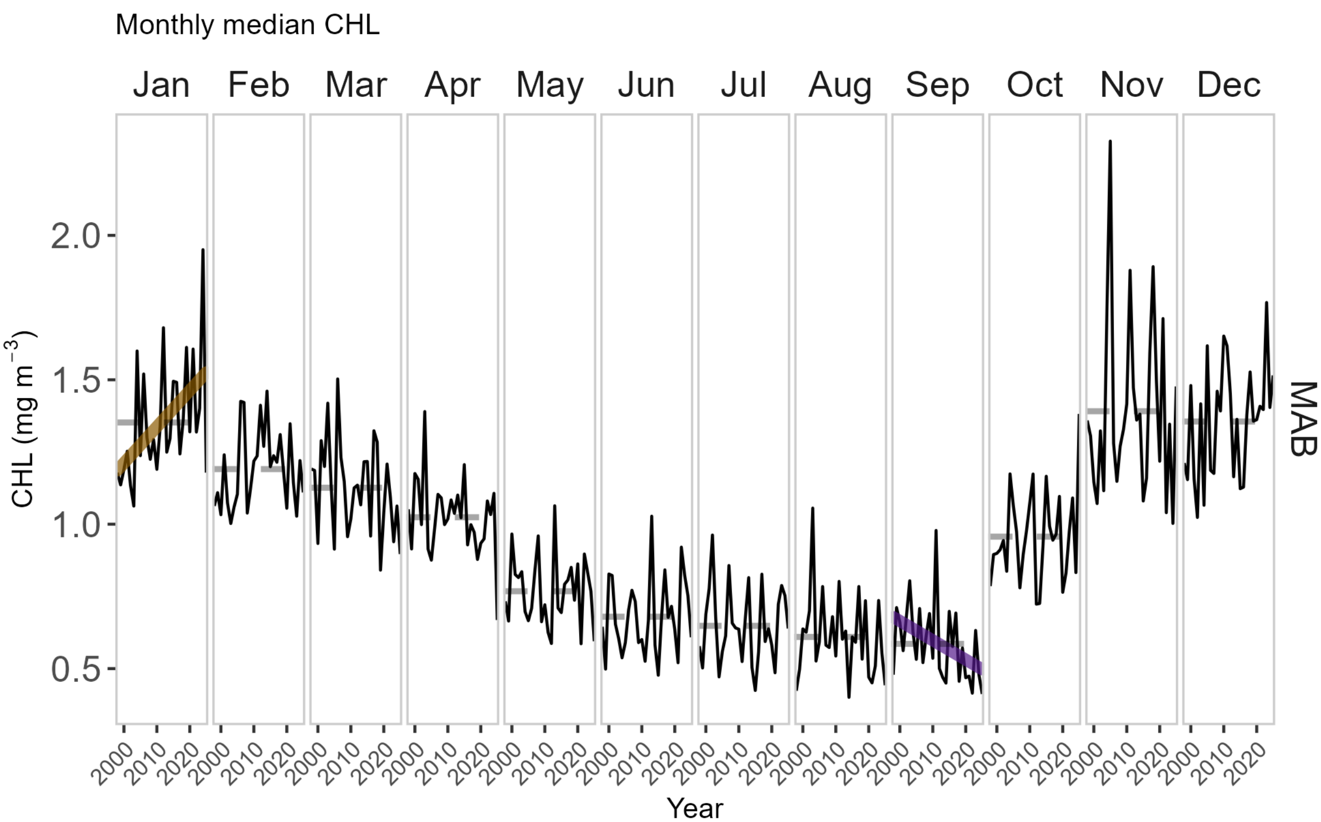


Figure 45: Monthly median chlorophyll a concentration in the MAB (black).

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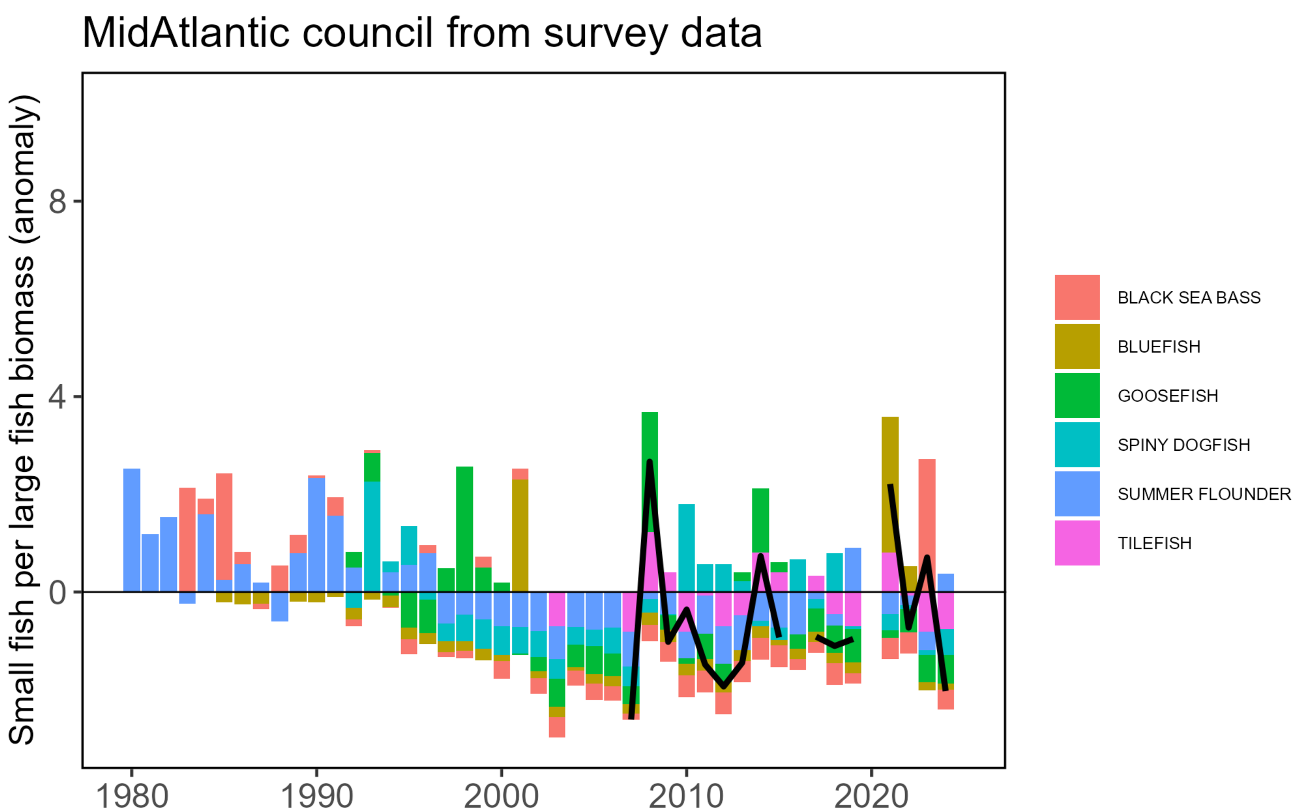
Future Considerations Species are reliant on environmental processes to dictate the timing of their behavior (e.g., phytoplankton bloom timing, thermal transition, or the duration of the cold pool). Some changes are episodic and have interannual variability, while others may be shifting away from a historic baseline on the scales of years to decades. Other species may rely on the general seasonal succession of environmental drivers (e.g., the timing of the fall turnover) to cue biological processes, and long-term trends in seasonal transitions are unlikely to reverse in coming years. Thus, timing shifts in migration or spawning may continue. Management actions that rely on effective alignment of fisheries availability and biological processes should continue to evaluate whether prior assumptions on seasonal timings still hold, and new indicators should be developed to monitor timing shifts for stocks.

Risks to setting catch limits

The efficacy of short-term stock projections and rebuilding plans rely on accurate understanding of processes affecting stock growth, reproduction, and natural mortality. These biological processes are often driven by underlying environmental change. If ignored, environmental change may increase the risk that established stock-level biological reference points no longer reflect the current population and increase projection uncertainty, both of which can contribute to quota misspecification.

07_risk_setting_catch_limits_midatlantic.Rmd

Indicators: Fish productivity and condition shifts Indicators of fish productivity are derived from observations (surveys) or models (stock assessments). Fish productivity declined during the 1990's and 2000's with declining production of summer flounder and has been variable since, as described by the small-fish-per-large-fish anomaly indicator (derived from NEFSC bottom trawl survey) (Fig. 46). Bluefish, black sea bass, and goosefish have sporadic years with large positive anomalies, but most years have small negative anomalies. This decline in fish productivity is also shown by a similar analysis based on stock assessment model outputs (recruitment per spawning stock biomass anomaly). Most species had positive recruitment anomalies in the 1990s and 1990s and are currently showing negative anomalies, indicating a decline in productivity. Fish productivity can be affected by parental condition, environmental conditions, timing and availability of prey for recruits, as well as retention of recruits within favorable habitat. High offshore advection during spawning seasons can reduce recruitment success and affect overall fish productivity.



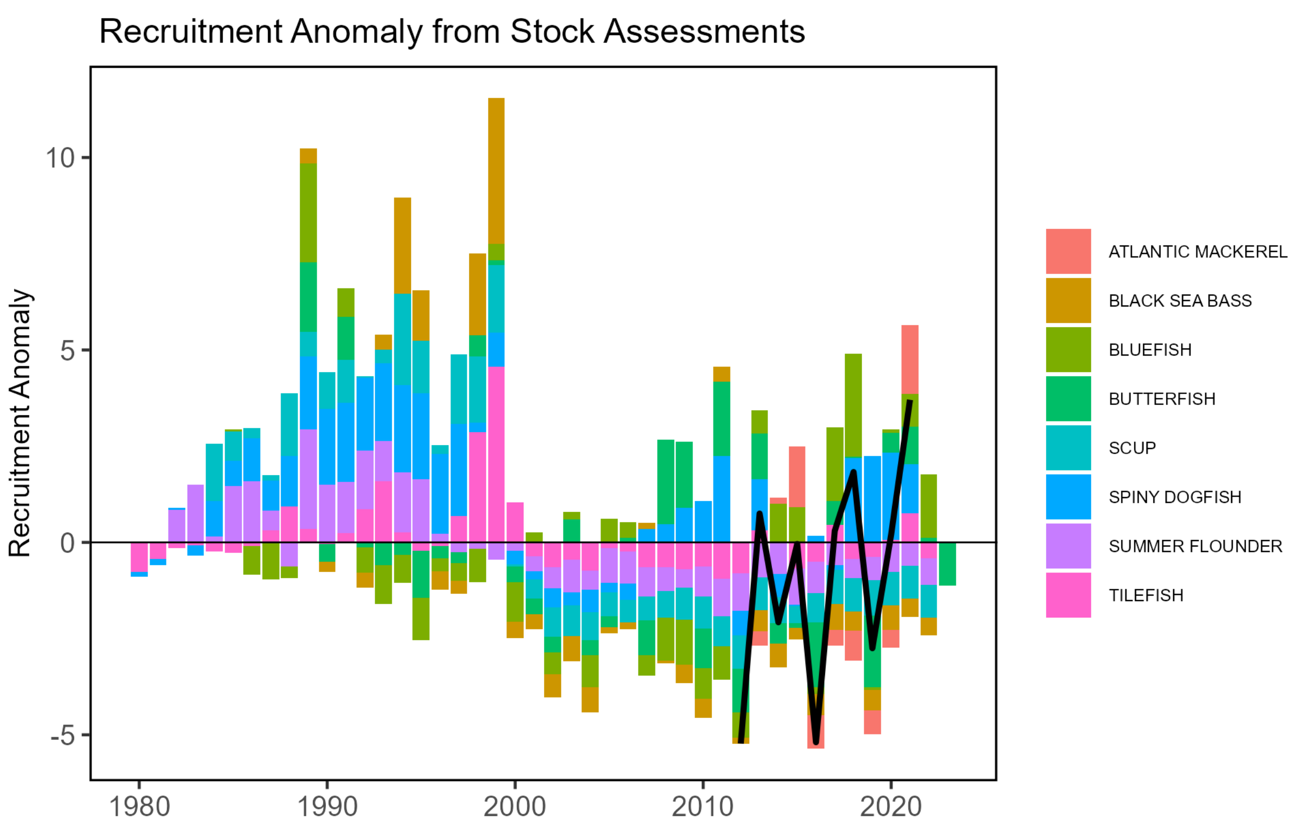


Figure 46: Fish productivity measures. Top: Small fish per large fish survey biomass anomaly of Mid Atlantic Fishery Management Council managed species in the Mid-Atlantic Bight. Bottom: assessment recruitment per spawning stock biomass anomaly for stocks managed by the Mid Atlantic Fishery Management Council. The summed anomaly across species is shown by the black line, drawn across all years with the same number of stocks analyzed.

The health of individual fish (i.e., fish condition, measured as weight for a given length) can contribute to population productivity through improved growth, reproduction and survival. Mid-Atlantic fish condition was generally high to very high prior to 2000, low to very low from 2001-2010 (concurrent with declines in productivity, Fig. 46)), and mixed since 2011. In 2025, condition continued to be mixed, with general improvement since a relatively low condition year in 2021 (Fig. 47). Preliminary analyses show that years dominated by small copepods and warmer spring temperatures may improve fish condition for Atlantic mackerel and butterfish. Similar environmental drivers may be important to other species.

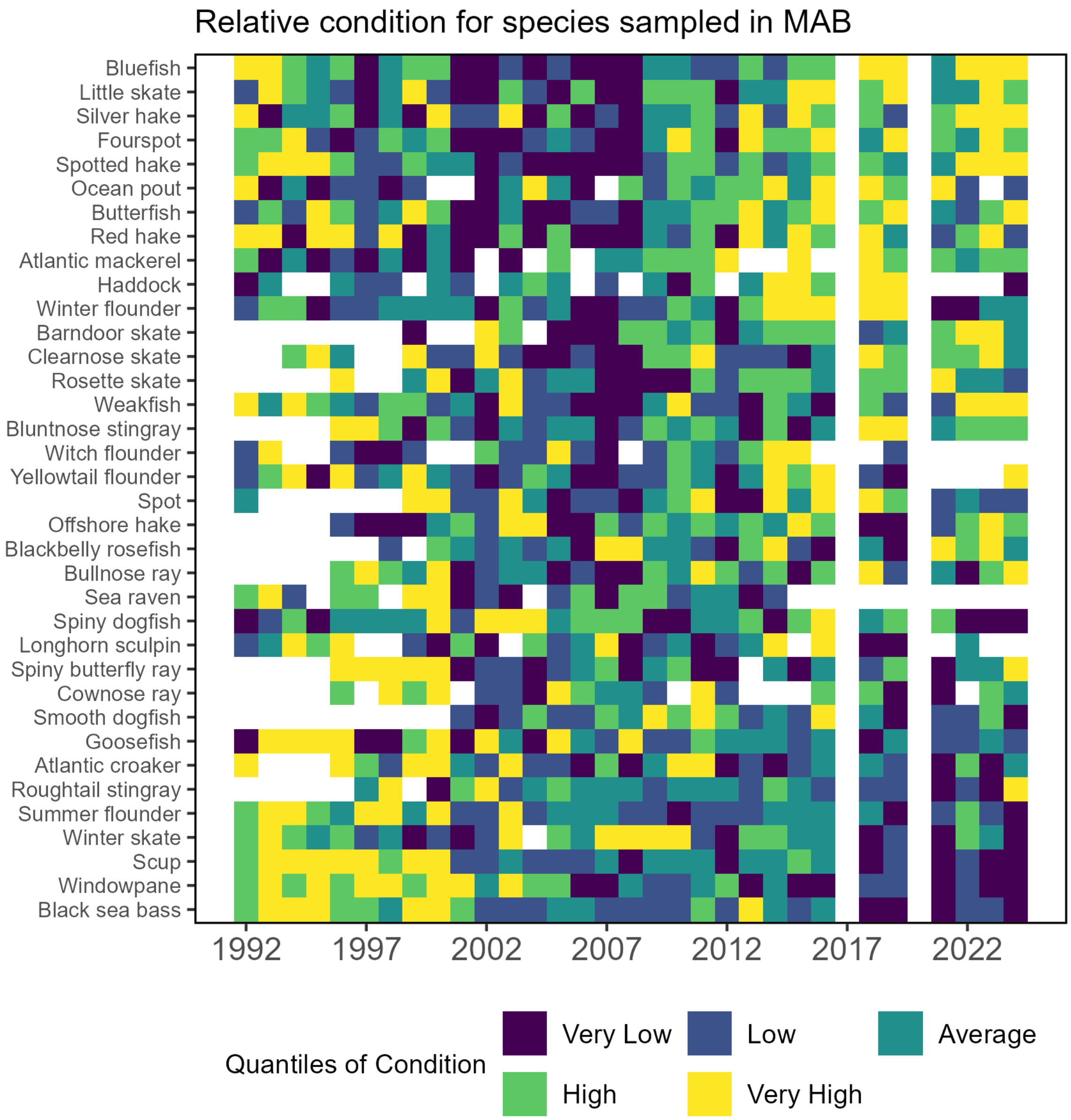


Figure 47: Condition factor for fish species in the MAB based on fall NEFSC bottom trawl survey data. MAB data are missing for 2017 due to survey delays, and no survey was conducted in 2020.

Drivers: Fish productivity and condition are the cumulative effects of physiological, ecological, and environmental factors. Major factors include increased metabolic demands from increasing temperature and changes in the availability and quality of prey. Long-term environmental trends and episodic extreme temperatures, ocean acidification, and low oxygen events represent multiple stressors that can affect growth rates, reproductive success, recruitment, and cause mortality.

Biological Drivers: Forage quality and abundance The energy density (ED) of prey, in conjunction with its mass, indicates the total amount of energy available to higher trophic level predators. The quality and abundance of this forage base directly impact the productivity and movement of managed and protected species. Management should consider these energetic links, as shifts in forage quality can alter the health of individual stocks and the entire ecosystem.

Forage fish energy content fluctuates based on growth, reproduction, environmental conditions, and ecosystem productivity. In the Mid-Atlantic Bight, butterfish are the most abundant high ED forage species (Fig. \ref{fig:energy-density}), though their fall ED have recently declined toward lower spring averages. Atlantic herring and Atlantic mackerel also serve as high-energy prey, but herring show recently low ED and declining abundance, while mackerel are most abundant in the spring despite having higher ED in the fall. Moderate energy forage species (longfin squid, northern shortfin squid, and silver hake) are of intermediate abundance and show minimal annual and seasonal variation in ED. Other species have high ED but lower abundance decreasing their reliability as a food source.

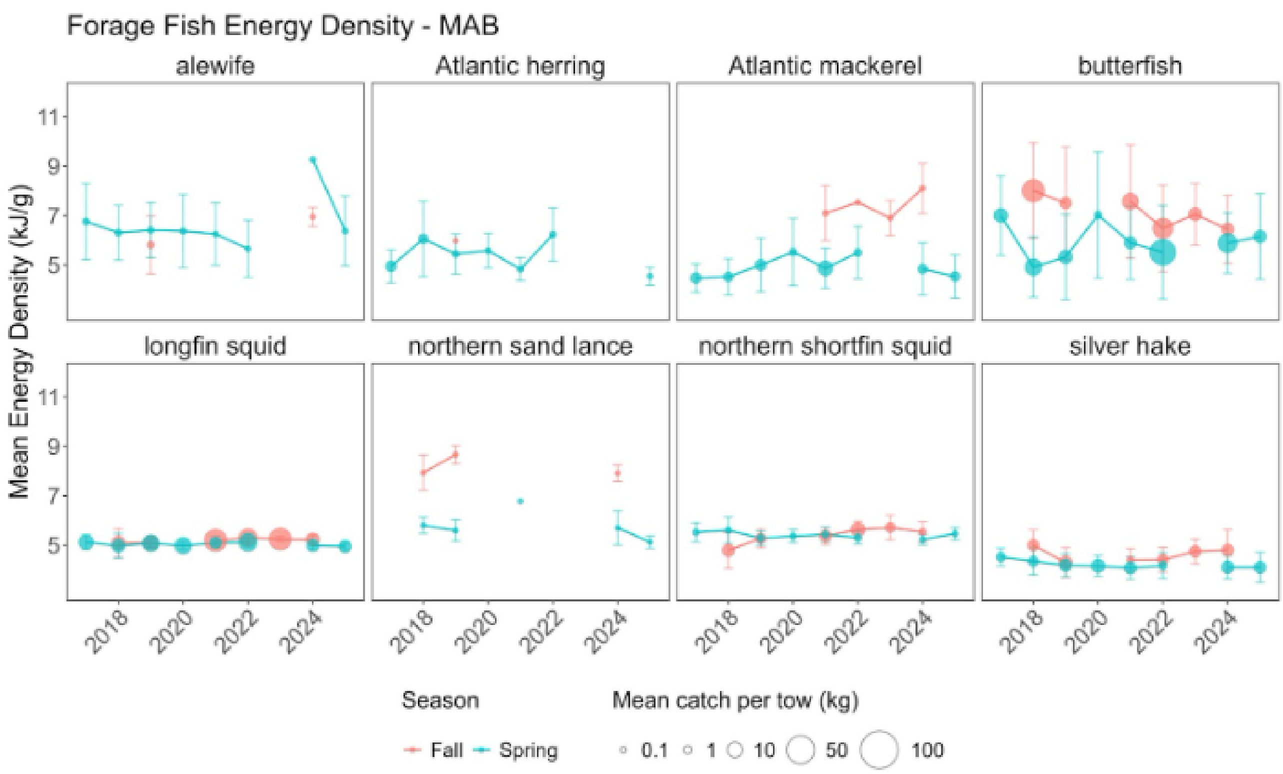


Figure 48: Energy density (mean and standard deviation) of eight forage species from NEFSC bottom trawl surveys by season and year for the MAB. Symbol size represents abundance (mean kg/tow) estimated from bottom trawl survey tows in the MAB.

Changes in the overall abundance of forage fish can influence managed species productivity as it relates to changes in food availability. A spatially-explicit forage index for the Mid-Atlantic shows a long term declining trend in fall, with higher forage biomass in fall than spring (Fig. 49). Forage biomass was highest during fall in the early-1980s. The decrease of fall forage biomass in the Mid-Atlantic may reduce the health and reproductive output of fish species. Additionally, this may be exacerbated by lower energy densities of prey, especially in years of higher water temperatures when metabolic demands are higher.

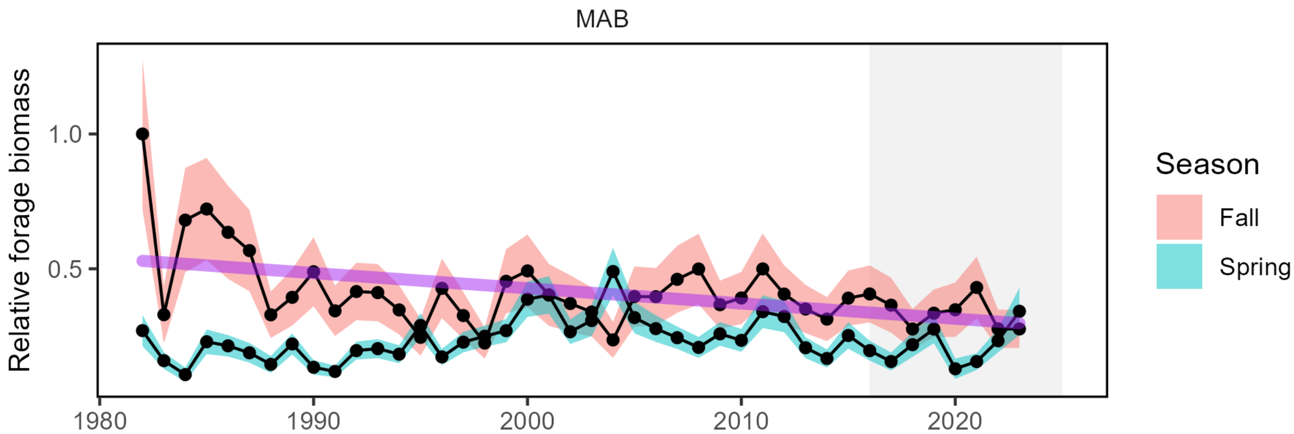


Figure 49: Forage fish index in the MAB for spring (blue) and fall (red) surveys, with a decline (purple) in fall. Index values are relative to the maximum observation within a region across surveys.

Benthic invertebrates are extremely important forage for some managed species (e.g., black sea bass). Macrobenthos are small benthic organisms that tend to be prey for larger benthos and benthivores. Macrobenthos indices show long-term declines in spring (Fig. 50), indicating a potential decrease in food availability for their predators. In contrast, Mid-Atlantic megabenthos indices show long-term increases in spring. Fish productivity may be positively impacted in recent years for juvenile fish that target macrobenthos, such as small crustaceans and polychaetes, and negatively impacted for fish such as black sea bass and striped bass that target megabenthos such as crabs. Other species that are generalist feeders such scup and skates may not be as impacted by offsetting trends in the benthic community.

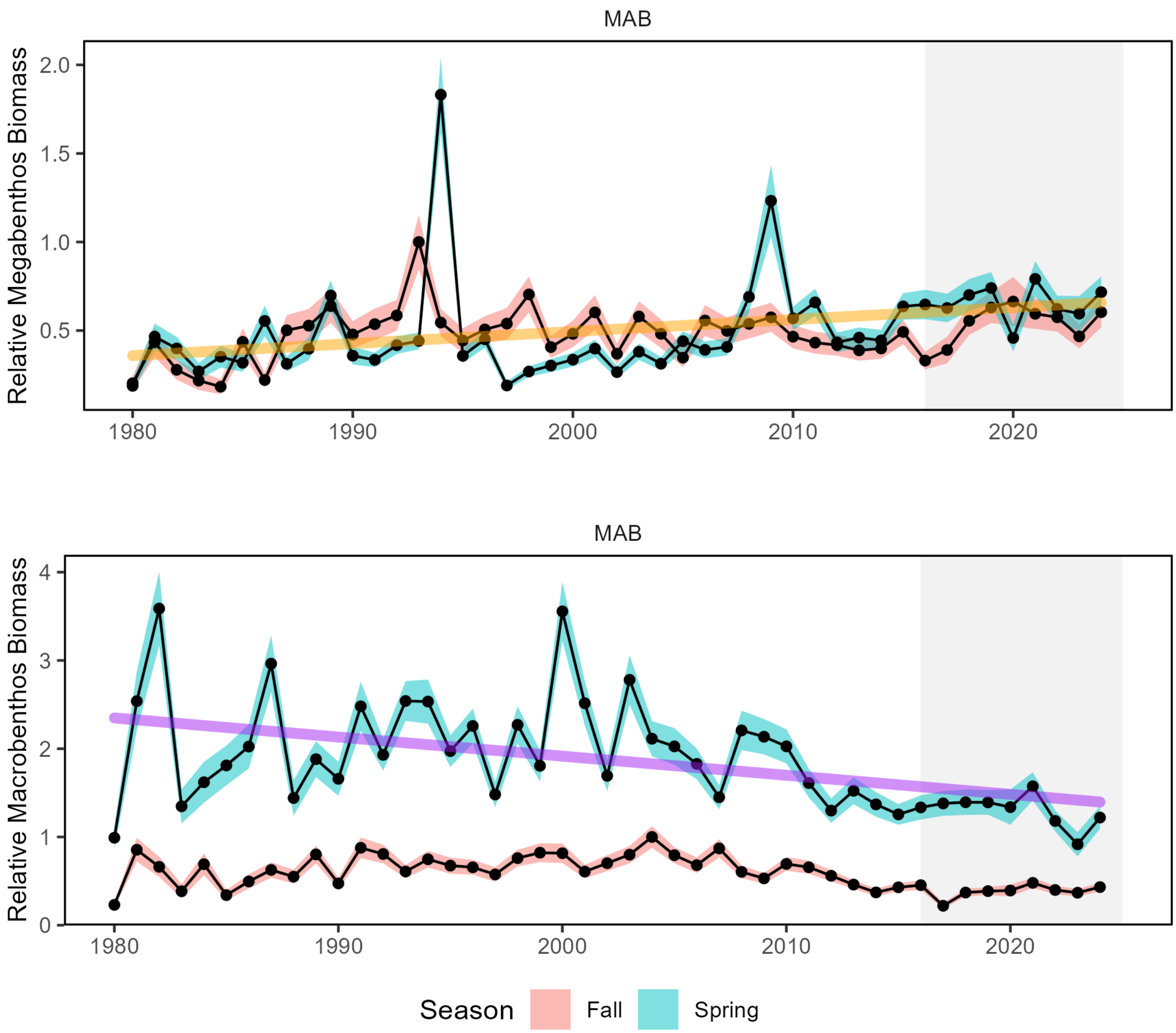


Figure 50: Changes in spring (blue) and fall (red) benthos abundance in the MAB for megabenthos (top) and macrobenthos (bottom), with significant long-term increasing (orange) and decreasing (purple) trends.

Biological Drivers: Lower trophic levels Phytoplankton are the foundation of the food web and are the primary food source for zooplankton and filter feeders such as shellfish. Multiple environmental and oceanographic drivers affect the abundance, composition, spatial distribution, and productivity of phytoplankton. While changes in phytoplankton productivity could affect fish productivity (including the productivity of forage fish), there is no clear long-term trend in Mid-Atlantic total primary production (Fig. 27).

Changing zooplankton abundance abundance may impact forage fish energy content and abundance, as well as the prey field of filter feeding whales, and managed species through food web impacts. Mid-Atlantic indices show high variability without a clear trend for large copepods, while small-bodied copepods (*Calanus finmarchicus*) show long-term and recent decreases, and krill (Euphausiids) show increasing trends (Fig. 51). Energy density varies by season and location, with high-energy large copepods most abundant on the Northeast shelf from April through June. The community is undergoing a systemic shift away from copepod dominance and toward increased krill presence.

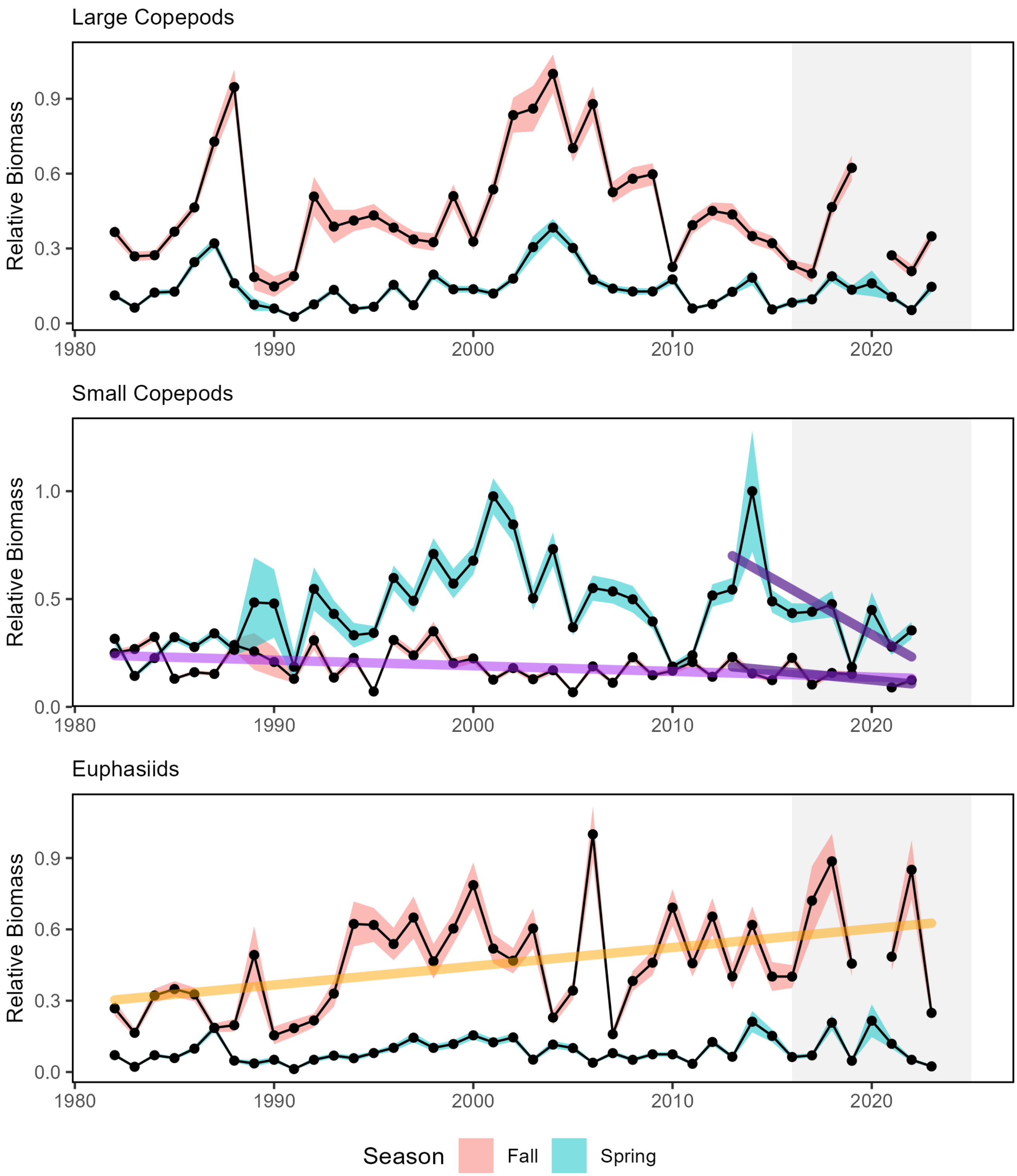


Figure 51: Changes in three dominant zooplankton ((*Calanus finmarchicus*, *Calanus typicus*, and *Pseudocalanus spp*) abundance anomalies for in the MAB for large (top) and small (middle) copepods, and Euphausiids (bottom), with significant decreases (short-term, dark purple; long-term, light purple) in small copepods and and long-term increases (orange) in Euphausiids.

Environmental Drivers Fish production can also be directly related to the prevailing environmental conditions by altering metabolism (growth), reproductive processes, and survival. Marine species possess thermal tolerances and can experience stressful or lethal conditions if water temperatures exceed certain levels. We have observed in past years extreme temperatures at both the surface and [bottom](https://noaa-edab.github.io/catalog/bottom_temp_model_anom.html that exceed thermal tolerance limits for some fish and shellfish. However, in 2025, Mid-Atlantic surface and bottom temperatures were near or below the long-term average and the amount of habitat exceeding a 24 oC thermal tolerance was limited to the southern MAB, where those conditions occurred for fewer than 30 days (Fig. 52).

A single surface marine heatwave occurred in the Mid-Atlantic Bight in 2025, starting July 15th and lasting seven days. This brief event was the only heatwave recorded across the entire Continental Shelf for the year. The MAB experienced six surface marine cold spells in 2025, including an event in February that ranked as the 8th strongest on record. Additionally, a significant bottom cold spell occurred in January, lasting 57 days and ranking as the 5th strongest on record. During this period, bottom temperatures averaged 7.2 °C, nearly 2 °C lower than the historical average.

Lower ocean temperatures near long-term averages will affect species differently across the region. While cold-water species like cod may benefit from these conditions, warm-water species such as black sea bass are unlikely to see positive effects. This variability in regional cooling highlights the need for management to account for shifting species distributions and productivity.

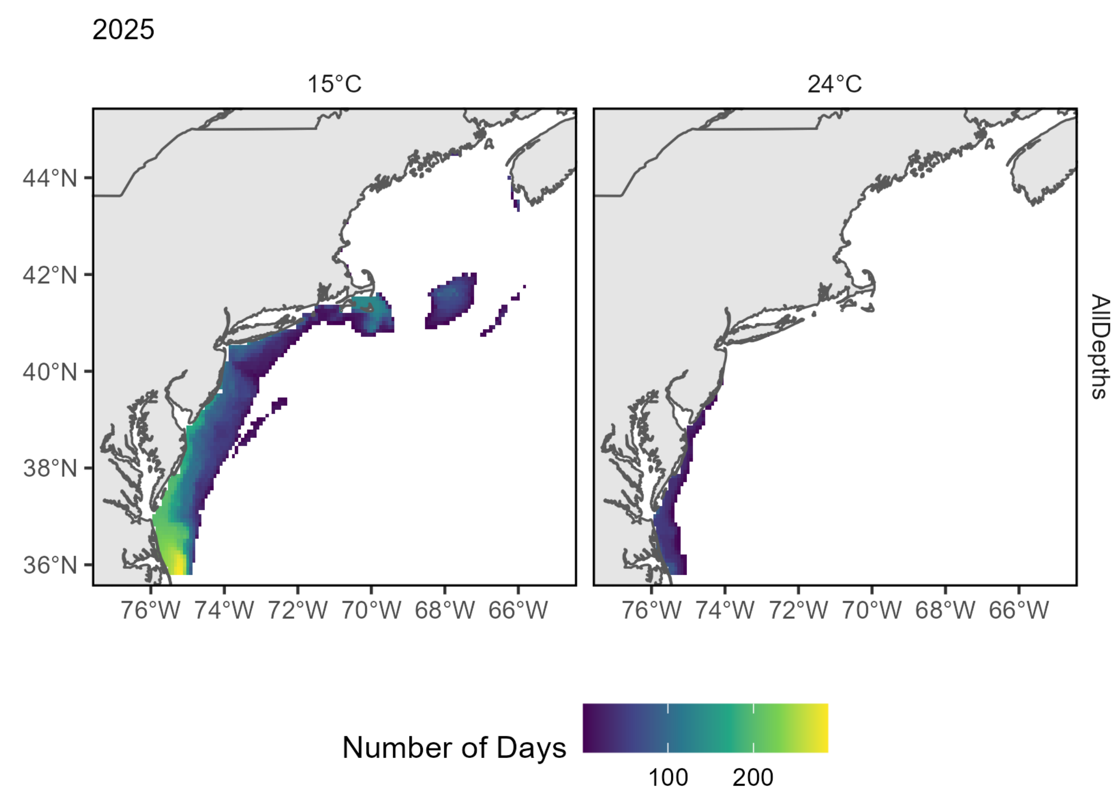
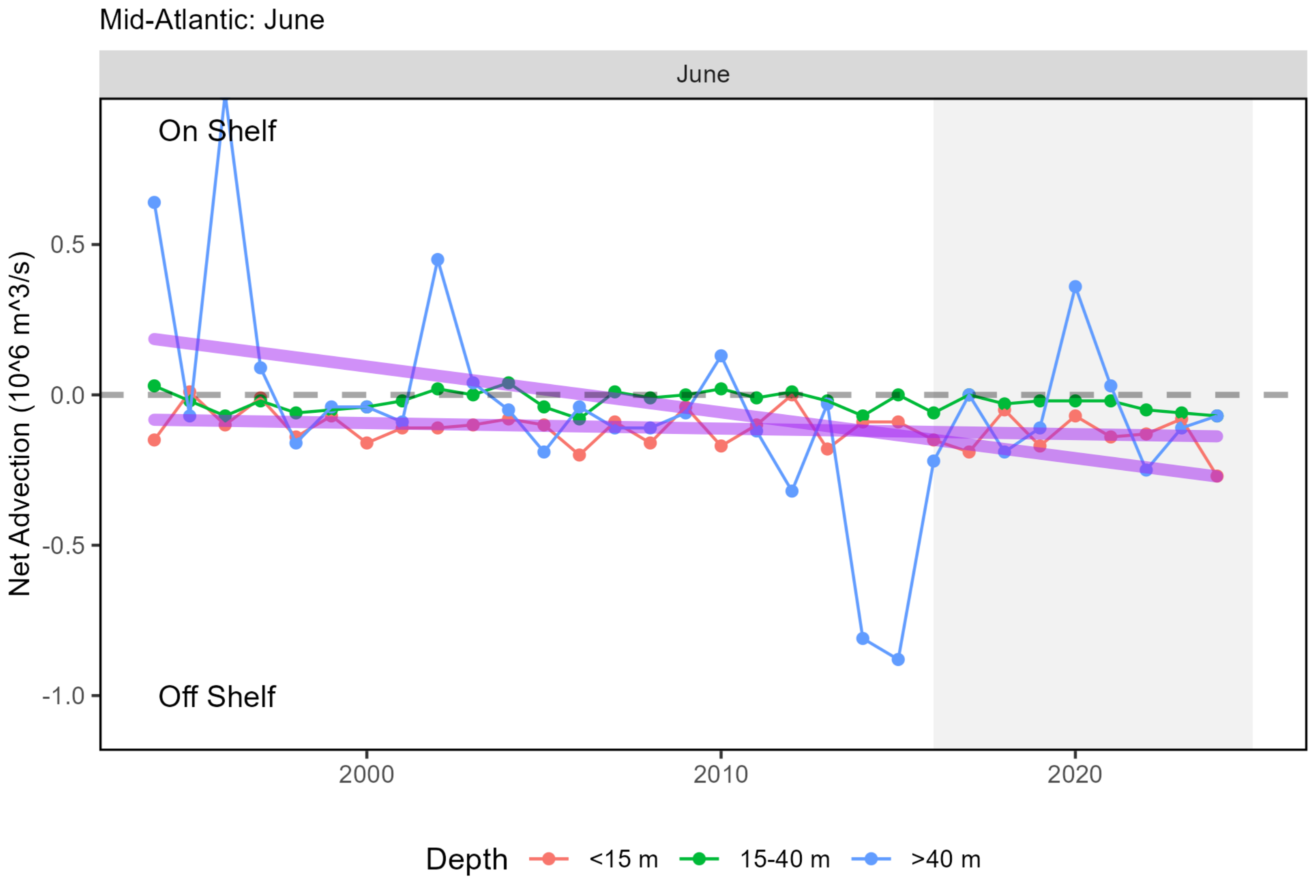


Figure 52: The number of days in 2024 where bottom temperature exceeds 15 degrees (left) and 24 degrees (right) based on the GLORYS 1/12 degree grid.

The newly-developed advection index (Fig. **??**) shows total transport of water onto and off the continental shelf which can impact the survival of early life stages of fish and invertebrates. Long-term trends in the Mid-Atlantic show increased offshore movement of surface and bottom waters in June, which could decrease retention of some species. Further species level studies are needed to link spawning timing and larval periods to advection trends at the corresponding spatial and temporal scalesdepth and month.



Ocean acidification (OA) risks vary among species and include reduced survival, growth, reproduction, and productivity, where high OA risk indicates potential negative effects to species. OA risk can also be heightened during colder conditions due to increased CO2 absorption by colder water or by transport of high CO2 water masses as was suggested to have occurred in 2024 (see 2024 Highlights). The OA indicator observed on the Mid-Atlantic coastal shelf during summer 2024 was the most extreme recorded when compared to all of the years sampled (since 2007). In 2025, however, OA risk conditions were less than those observed in 2023 and 2024. High OA conditions in 2025 were limited to a few outer shelf coastal New Jersey (NJ) observations in spring, where sensitivity levels for Atlantic sea scallops were exceeded (not shown, see ocean acidification), and in nearshore NJ waters in summer, where sensitivity levels for Longfin squid were reached (Fig. 53). Although relatively cool bottom seawater temperatures in 2025 were similar to 2024, salinity was higher in 2025, which suggests a different composition of oceanographic properties and water masses between the two years and as a result, different OA risk conditions.

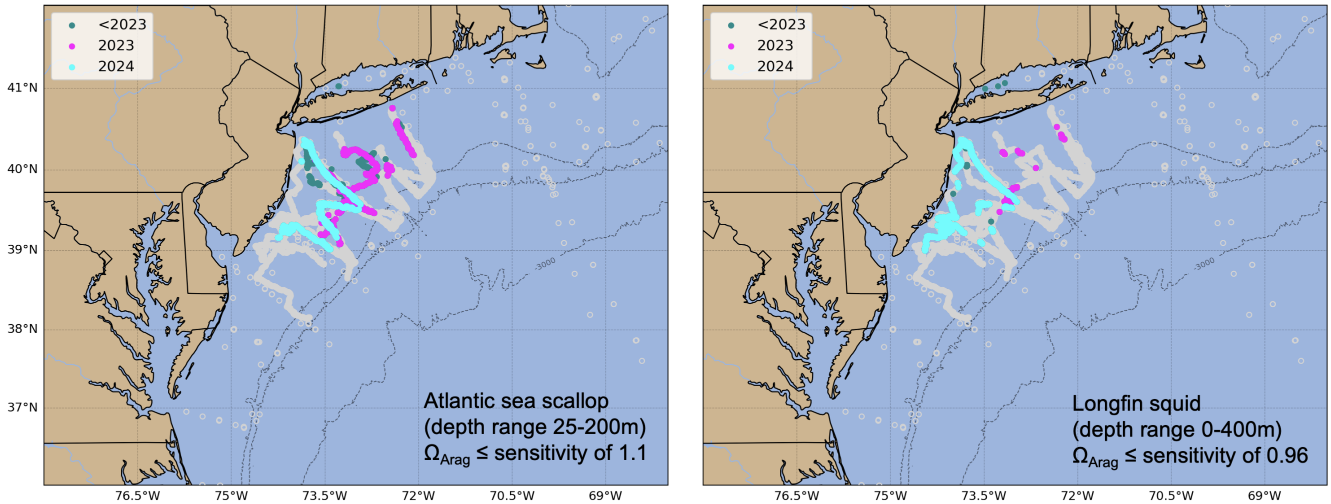


Figure 53: Locations where bottom aragonite saturation state (Ω_{Arag}; summer only: June-August) were at or below the laboratory-derived sensitivity level for Atlantic sea scallop (left panel) and longfin squid (right panel) for the time periods 2007-2022 (dark cyan), 2023 only (magenta) and 2024 only (cyan). Gray circles indicate locations where bottom Ω_{Arag} values were above the species specific sensitivity values..

Low dissolved oxygen levels (< 5 mg/L) remained localized and brief on the MAB shelf in 2025, resulting in no industry-reported mass mortality events despite the potential for hypoxia to reduce species growth or cause death. Localized hypoxia (< 2 mg/L) occurred nearshore east of Point Pleasant, NJ, southwest of Newport, RI, and at the western end of the Cape Cod Canal, while broader shelf-wide levels below 5 mg/L were not widespread. This contrast follows previous years where hypoxic events in Cape Cod Bay (2019, 2020) and off New Jersey (2023) potentially caused fish, lobster, and crab mortality. While shelf-wide monitoring data is currently limited, biological and oceanographic drivers of oxygen levels continue to be tracked to assess the duration and extent of future events.

Drivers: Predation The abundance and distribution of marine mammal, shark predators, and other Atlantic Highly Migratory Species (HMS), can affect both the productivity and mortality rates on managed stocks. Predators can consume managed species or compete for the same resources, resulting in increased natural mortality or decreased productivity. The northeast shift in whales and dolphins (Fig. 33) indicates a change in the overlap between marine mammals and managed fishes. Since we also observe distribution shifts in managed species as well as forage species, the effect of changing predator distributions alone is difficult to quantify.

Indicators for shark populations, combined with information on gray seals (see Protected Species Implications section, above), suggests predator populations range from stable (sharks) to increasing (gray seals) in the MAB. Stock status is mixed for HMS stocks (including sharks, swordfish, billfish, and tunas) occurring throughout the Northeast U.S. shelf. While there are several HMS species considered to be overfished or that have unknown stock status, the population status for some managed Atlantic sharks and tunas is at or above the biomass target, suggesting the potential for robust (or rebuilt) predator populations and subsequent predation pressure on managed species. Increasing predator populations or changing distribution of predators may result in increased predation pressure.

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Future Considerations The processes that control fish productivity and mortality are dynamic and complex, and are the result of the interactions between multiple system drivers. If the observed changes to these processes outlined in this report are not considered when managing fisheries, there is an increased risk that short-term stock projections and rebuilding plans will be more uncertain and will not reflect the current stock productivity. To mitigate this risk, time series of stock productivity and ecosystem conditions are regularly reviewed and are used to select appropriate reference periods that inform projections and reference point estimation. Next generation stock assessment models have also expanded the capacity to incorporate ecosystem changes into scientific products that support fishery management. Increasingly, NEFSC stock assessments model time-varying processes and in some cases environmental time series are used directly to describe changing stock dynamics. Research efforts to understand system drivers, identify change points, and develop paths to use this information more effectively in stock assessment and management are ongoing.

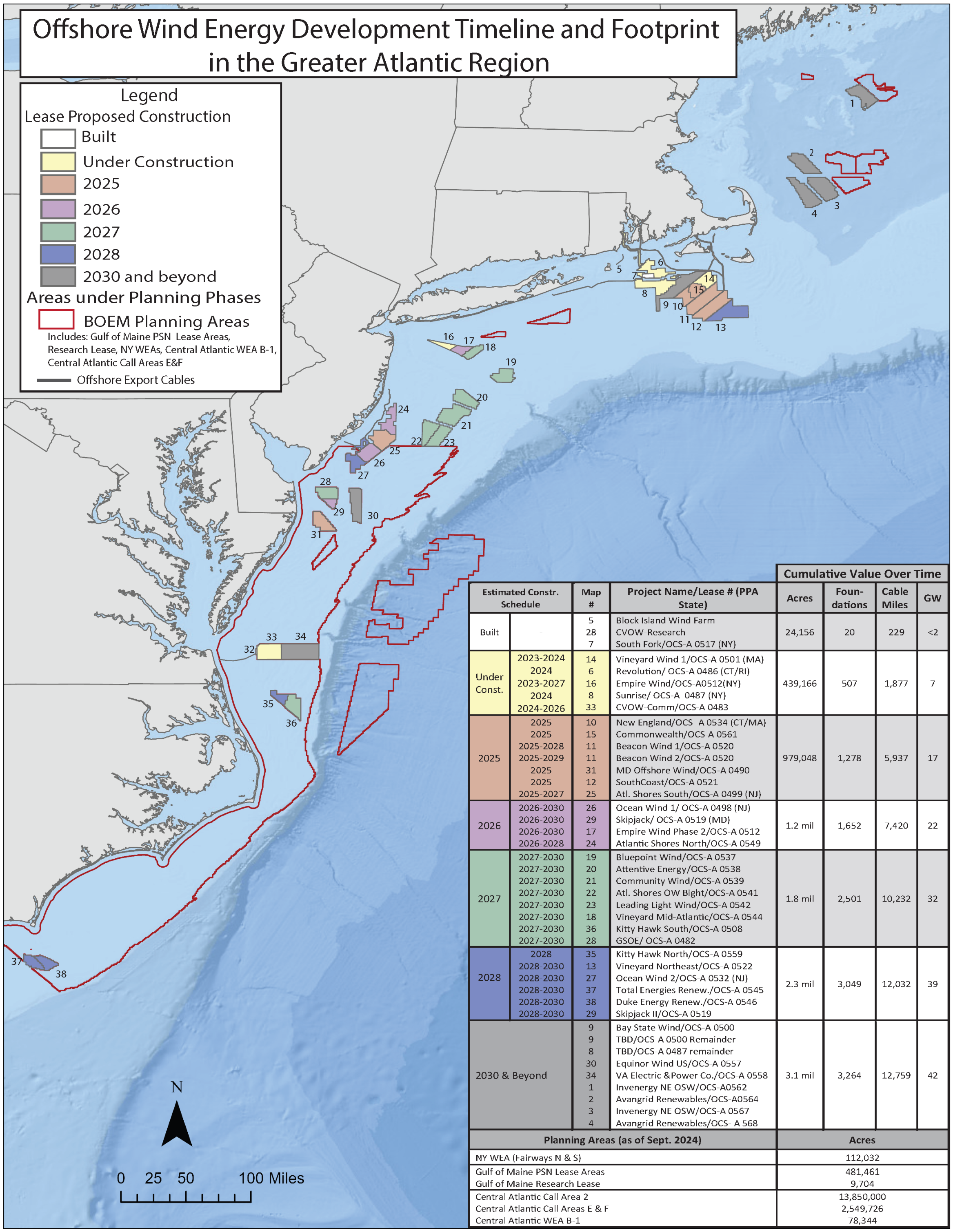
Other Ocean Uses: Offshore Wind

Indicators: development timeline, revenue in lease areas, coastal community vulnerability

All reported potential offshore wind development status and data are based on BOEM's Offshore Renewable Activities page and projects' Final Environmental Impact Statements. In 2025, the Presidential Memorandum 90 FR 8363 removed existing planning areas and excluded the establishment of additional lease areas.

As of January 2026, 38 offshore wind development leases are under different stages of development in the Northeast (Fig. 54). One project (South Fork Wind Farm) is fully operational and another (Vineyard Wind 1) is partly operational while construction finishes. The southern New England region has two other projects currently under construction (Revolution Wind and Sunrise Wind). Empire Wind and Coastal Virginia Offshore Wind (CVOW) are currently under construction in the New York Bight and Mid-Atlantic Region, respectively, with CVOW expected to start generating power in early 2026.

Construction of these projects during 2025 affected fisheries managed by the [Mid-Atlantic] [New England] Fishery Management Council. There are eight additional projects that have Construction and Operations Plan (COP) approvals (three in Southern New England and five in the Mid-Atlantic/New York Bight) that could begin construction in 2026, however, construction schedules are highly uncertain at this time. Seven additional projects have submitted COPs and are pending approval, while the remaining projects are under the site assessment phase and have not submitted COPs to date (Fig. 54).



Estimated Constr. Schedule		Map #	Project Name/Lease # (PPA State)	Acres	Foun-dations	Cable Miles	GW
				Cumulative Value Over Time			
Built	-	5 28 7	Block Island Wind Farm CVOW-Research South Fork/OCS-A 0517 (NY)	24,156	20	229	<2
Under Const.	2023-2024 2024 2023-2027 2024 2024-2026	14 6 16 8 33	Vineyard Wind 1/OCS-A 0501 (MA) Revolution/ OCS-A 0486 (CT/RI) Empire Wind/OCS-A0512(NY) Sunrise/ OCS-A 0487 (NY) CVOW-Comm/OCS-A 0483	439,166	507	1,877	7
2025	2025 2025 2025-2028 2025-2029 2025 2025 2025-2027	10 15 11 11 31 12 25	New England/OCS- A 0534 (CT/MA) Commonwealth/OCS-A 0561 Beacon Wind 1/OCS-A 0520 Beacon Wind 2/OCS-A 0520 MD Offshore Wind/OCS-A 0490 SouthCoast/OCS-A 0521 Atl. Shores South/OCS-A 0499 (NJ)	979,048	1,278	5,937	17
2026	2026-2030 2026-2030 2026-2030 2026-2028	26 29 17 24	Ocean Wind 1/ OCS-A 0498 (NJ) Skipjack/ OCS-A 0519 (MD) Empire Wind Phase 2/OCS-A 0512 Atlantic Shores North/OCS-A 0549	1.2 mil	1,652	7,420	22
2027	2027-2030 2027-2030 2027-2030 2027-2030 2027-2030 2027-2030 2027-2030 2027-2030	19 20 21 22 23 18 36 28	Bluepoint Wind/OCS-A 0537 Attentive Energy/OCS-A 0538 Community Wind/OCS-A 0539 Atl. Shores OW Bight/OCS-A 0541 Leading Light Wind/OCS-A 0542 Vineyard Mid-Atlantic/OCS-A 0544 Kitty Hawk South/OCS-A 0508 GSOE/ OCS-A 0482	1.8 mil	2,501	10,232	32
2028	2028 2028-2030 2028-2030 2028-2030 2028-2030 2028-2030	35 13 27 37 38 29	Kitty Hawk North/OCS-A 0559 Vineyard Northeast/OCS-A 0522 Ocean Wind 2/OCS-A 0532 (NJ) Total Energies Renew./OCS-A 0545 Duke Energy Renew./OCS-A 0546 Skipjack II/OCS-A 0519	2.3 mil	3,049	12,032	39
2030 & Beyond		9 9 8 30 34 1 2 3 4	Bay State Wind/OCS-A 0500 TBD/OCS-A 0500 Remainder TBD/OCS-A 0487 remainder Equinor Wind US/OCS-A 0557 VA Electric &Power Co./OCS-A 0558 Invenergy NE OSW/OCS-A0562 Avangrid Renewables/OCS-A0564 Invenergy NE OSW/OCS-A 0567 Avangrid Renewables/OCS- A 568	3.1 mil	3,264	12,759	42

Planning Areas (as of Sept. 2024)	Acres
NY WEA (Fairways N & S)	112,032
Gulf of Maine PSN Lease Areas Gulf of Maine Research Lease	481,461 9,704
Central Atlantic Call Area 2 Central Atlantic Call Areas E & F Central Atlantic WEA B-1	13,850,000 2,549,726 78,344

Figure 54: All Northeast Project areas by year construction ends (each project has a 2 year construction period).

With the first offshore wind energy projects now under construction and operation, all indicator analyses in this section follow a different reporting format than in previous years. Where previous years reported data for all lease areas, this year we investigate impacts of the six commercial scale projects currently under construction or operation, (i.e., Active Projects: South Fork Wind Farm, Revolution Wind, Sunrise Wind, Empire Wind 1, Vineyard Wind 1, and CVOW-Commercial).

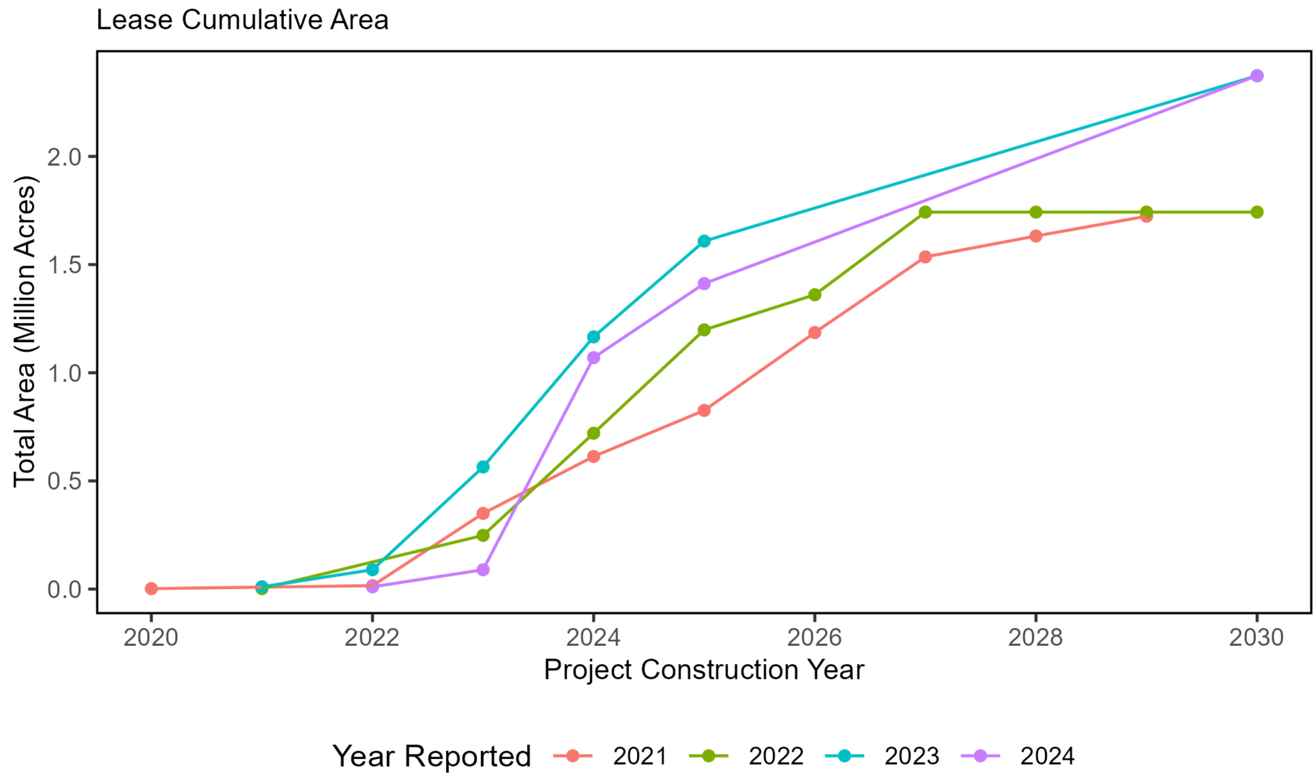


Figure 55: Total area proposed for wind development on the Northeast Shelf through 2030.

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Based on federal vessel logbook data, commercial fishery revenue from trips in the current offshore wind lease areas, including the newly designated lease areas in the Central Atlantic, have varied annually from 2008-2023, with less than $1 million in maximum annual revenue overlapping with these areas for most fisheries with the exception of the surfclam, monkfish, and longfin squid fisheries. Some fisheries see periodic spikes in revenue overlap with wind energy lease areas, including the surfclam ($6.5 million), longfin squid ($4.8 million), monkfish ($2.5 million), and summer flounder ($1.3 million) fisheries (Fig. 56).

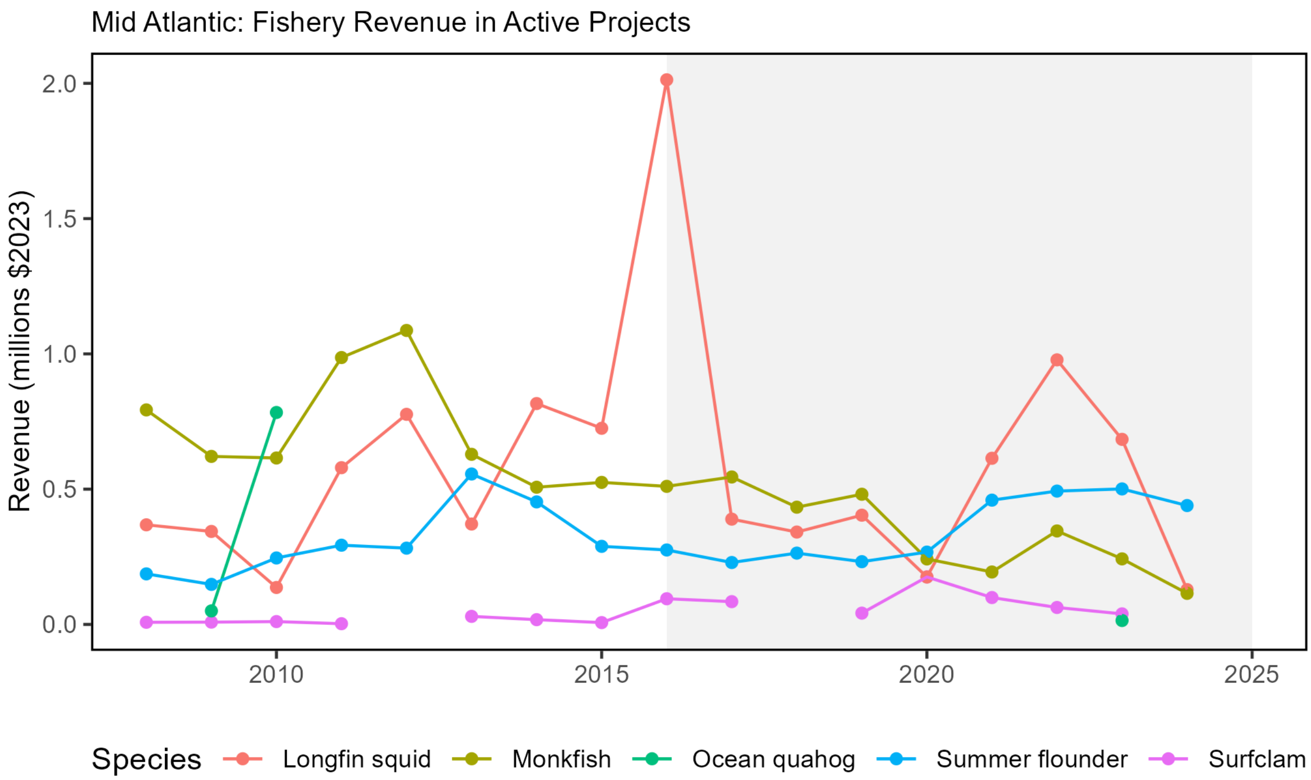

Figure 56: Revenue of species managed by the Mid-Atlantic Fishery Management Council within Active Projects.

Within Active Projects, the MAFMC managed fisheries most affected based on historic landings include longfin squid, monkfish, scup, Atlantic mackerel, and summer flounder, with a maximum of 6% of annual regional fishery revenue for chub mackerel occurring within Active Projects during 2008-2024, 5% for bluefish, 4% for butterfish, and 3% each for monkfish, scup, black sea bass, and longfin squid, respectively (see Table 6). Future offshore wind development may increase effects on these and additional species if more projects begin construction. Future fishery resource overlap with wind leases, especially surfclams and ocean quahogs, may change due to species distribution shifts attributable to climate change and recruitment and larval dispersion pattern changes caused by hydrodynamic flow disruptions from turbine foundations, which could also affect fishery landings/revenue.

Table 6: Mid-Atlantic managed species Landings and Revenue from Wind Energy Areas. *Less than a maximum of 50,000 lb was reported landed annually in wind energy lease areas for these species.

NEFMC, MAFMC, and ASMFC Managed Species	Maximum Percent Total Annual Regional Species Landings	Maximum Percent Total Annual Regional Species Revenue
Longfin Squid	3.31	3.25
Monkfish	4.66	3.23
Ocean Quahog	2.21	2.34
Summer Flounder	1.78	2.01
Scup	3.32	3.26
Atlantic Mackerel	2.93	2.40
Black Sea Bass	2.70	3.01
Atlantic Surfclam	0.69	0.65
Butterfish	4.37	3.88
Spiny Dogfish	1.66	1.77
Illex Squid	0.24	0.42

Table 6: Mid-Atlantic managed species Landings and Revenue from Wind Energy Areas. *Less than a maximum of 50,000 lb was reported landed annually in wind energy lease areas for these species.

NEFMC, MAFMC, and ASMFC Managed Species	Maximum Percent Total Annual Regional Species Landings	Maximum Percent Total Annual Regional Species Revenue
Bluefish	3.60	4.85
Golden Tilefish	0.22	0.24
Chub Mackerel	5.32	5.80
Blueline Tilefish	0.14	0.11

Proposed wind development areas interact with the region's federal scientific surveys. Scientific surveys are impacted by offshore wind in four ways: 1. exclusion of NOAA Fisheries' sampling platforms from the wind development area due to operational and safety limitations. 2. impacts on the random-stratified statistical design that is the basis for scientific analyses, assessments, and advice. 3. alteration of benthic and pelagic habitats, and airspace in and around the wind energy development, requiring new designs and methods to sample new habitats. 4. reduced sampling productivity through navigation impacts of wind energy infrastructure on aerial and vessel survey operations.

Increased vessel transit between stations may decrease data collections that are already limited by annual days-at-sea day allocations. In the Northeast region, 14 NEFSC surveys overlap with offshore wind development projects at varying capacities, with each of the 38 existing lease areas overlapping between 4-13 surveys. The Active Projects overlap between 10-12 surveys. Implementation of the region-wide survey mitigation program is underway with requirements to mitigate impacts to surveys included as a condition of project approvals.

The socio-demographic conditions, and resultant vulnerabilities, of some communities may further exacerbate the impacts of offshore wind development in the Northeast such that the impacts of offshore wind development are expected to differentially impact specific coastal communities (Fig. 57)

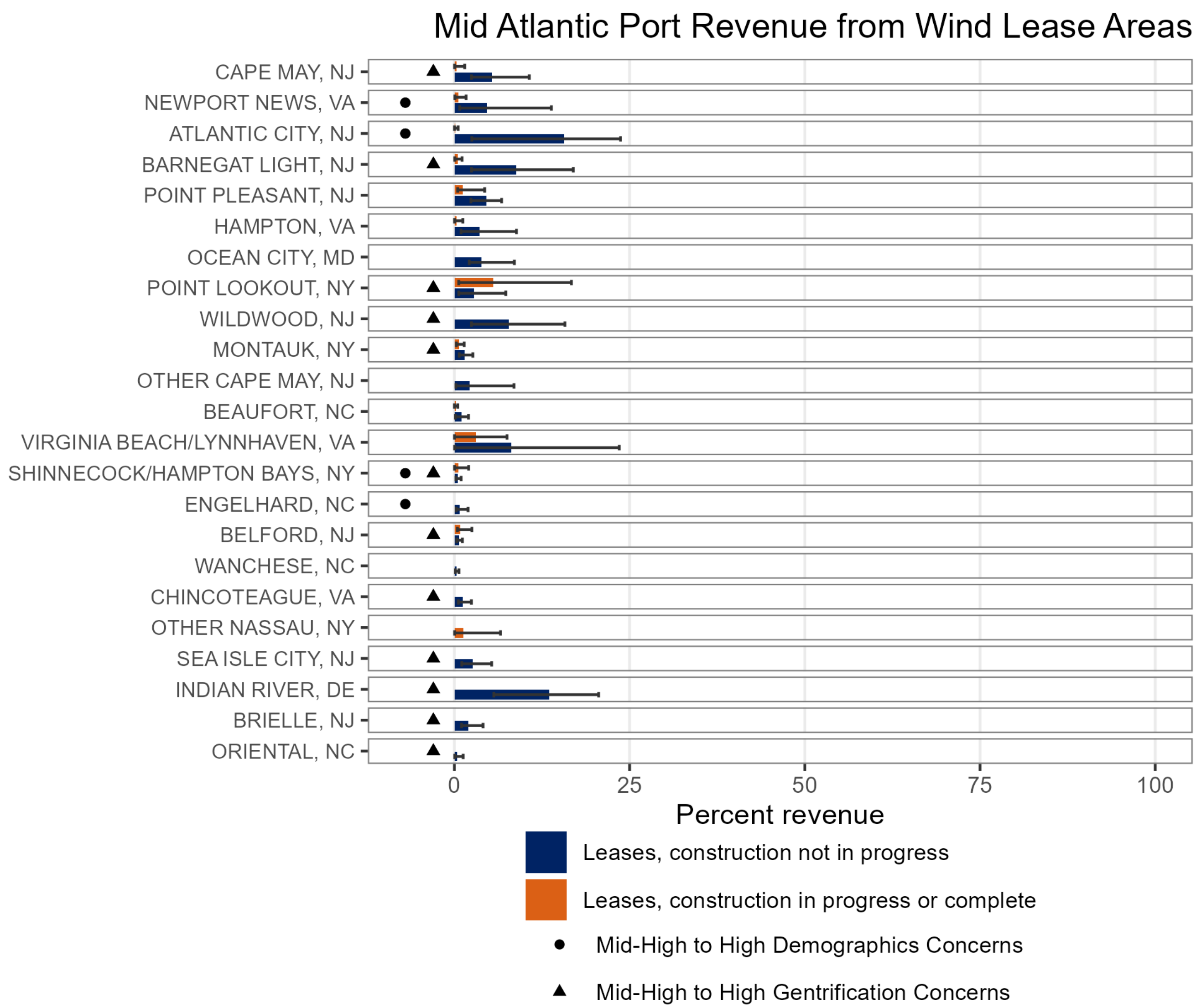

Figure 57: Percent of Mid-Atlantic port revenue from Wind Energy Areas (WEA) from all leases (green), leases not under construction leases (blue), and active leases (orange). Note that North Carolina fisheries management is split between the Northeast and Southeast, and this plot only includes data reported to the Northeast Fisheries Science Center.

Based on federal vessel logbook data, Point Lookout, NY (5.5% average, 17% maximum) and Virginia Beach, VA (3% average, 7.5% maximum) have the highest potential revenue loss from the Active Projects based on 2008-2024 total port fisheries revenue. Fewer Mid-Atlantic ports are affected by the Active Projects to date, as most are in the southern New England region, with the exception of CVOW and Empire Wind 1 (Fig. \ref{fig:wea-port-rev}). Additional fishing revenue may be lost as more areas historically used for fishing are developed for offshore wind energy. In seven New England ports, Mid-Atlantic managed species account for at least 50% of landings from the Active Project areas by value or weight (Fig. 58). Furthermore, impacts of offshore wind development may unevenly affect individual operators, with some permit holders deriving a much higher proportion of revenue from wind areas than the port-based mean.

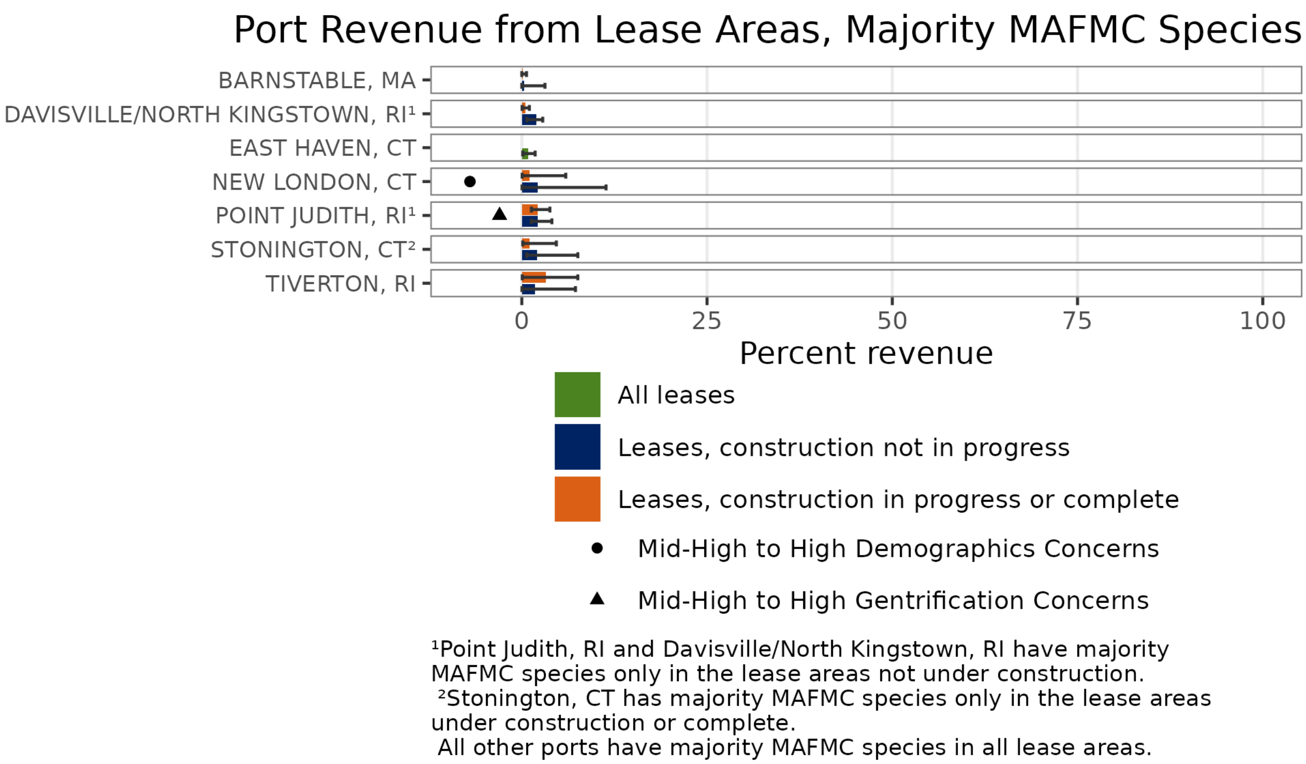

Figure 58: Percent of Mid-Atlantic port revenue with majority NEFMC landings from Wind Energy Areas (WEA) from all leases (green), leases not under construction (blue), and active leases (orange).

Top fishing communities with socio-demographic concerns (i.e., Atlantic City, NJ, and Hampton Bays, NY) should be considered in decision making to reduce the social and economic impacts and aid in the resilience and adaptive capacity of underserved communities. These are communities where we need to provide further resources to reach underserved and underrepresented groups and create opportunities for and directly involve these groups in the decision-making process.

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Implications

Current plans for buildout of offshore wind in a patchwork of areas spreads the impacts differentially throughout the region (Fig. 54). Up to 6% of maximum annual fisheries revenue for major Mid-Atlantic commercial species in lease areas could be forgone or reduced and associated effort displaced if all sites are developed. Displaced fishing effort can alter historic fishing area, timing, and method patterns, which can in turn change habitat, species (managed and protected), and fleet interactions. Several factors, including fishery regulations, fishery availability, and user conflicts affect where, when, and how fishing effort may be displaced, along with impacts to and responses of affected fish species.

Planned development overlaps NARW mother and calf migration corridors and a significant foraging habitat that is used throughout the year (Fig. 59). Turbine presence and extraction of energy from the system could alter local oceanography and may affect right whale prey availability. For example, persistent foraging hotspots of right whales and seabirds overlap on Nantucket Shoals, where unique hydrography aggregates enhanced prey densities. Wind leases (OCS-A 0521 and OCS-A 0522) currently intersect these hotspots on the southwestern corner of Nantucket Shoals and a prominent tidal front associated with invertebrate prey swarms important to seabirds and possibly right whales. Proposed wind development areas also bring increased vessel strike risk from construction and operation vessels. In addition, there are a number of potential impacts to whales from pile driving and operational noise such as displacement, increased levels of communication masking, and elevated stress hormones.

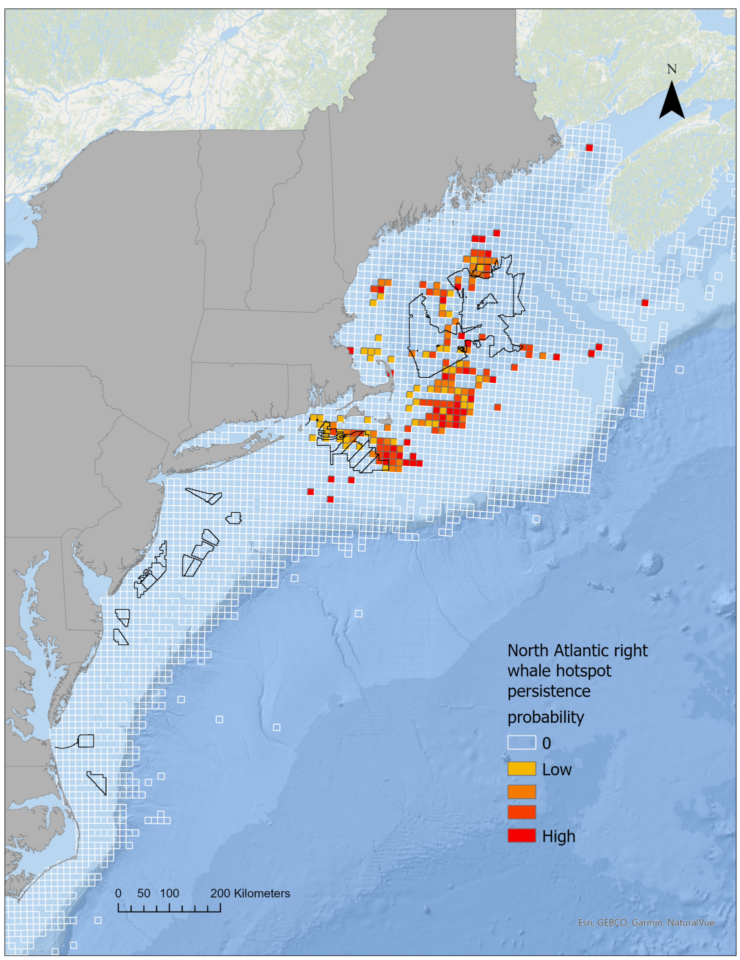

Figure 59: Northern Right Whale persistent hotspots (red shading) and Wind Energy Areas (black outlines).

Scientific data collection surveys for ocean and ecosystem conditions, fish, and protected species will be altered, potentially increasing uncertainty for stock assessments and associated management decision making. Increased vessel transit between stations may decrease data collections that are already limited by annual days-at-sea day allocations.

The increase of offshore wind development can have both positive (e.g., employment opportunities) and negative (e.g., space-use conflicts) effects. Continued increase in coastal development and gentrification pressure has resulted in loss of fishing infrastructure space within ports. Understanding these existing pressures can allow for avoiding and mitigating negative impacts to our shore support industry and communities dependent on fishing. Some of the communities with the highest fisheries revenue overlap with offshore wind development areas that are also vulnerable to gentrification pressure are Beaufort, NC, and Cape May, Barnegat Light, and Long Beach, NJ.

Marine Aquaculture Aquaculture fisheries and federally-managed fisheries could both compete or benefit each other with spatial access, shoreside infrastructure, or the supply of seafood. Unlike offshore wind, offshore aquaculture is not regulated by any federal leasing program but is permitted via the U.S. Army Corps of Engineers and the U.S. EPA. Currently, there are no federally-permitted aquaculture projects in the Northeast U.S. The marine aquaculture industry of the Northeast currently occurs in nearshore waters which are regulated by state leasing and permitting processes and federal permitting processes, as applicable. Analyses are needed to quantify the nearshore spatial distribution of aquaculture in the Northeast.

2025 Highlights

This section intends to provide a record of noteworthy observations reported in 2025 across the Northeast U.S. region. The full ecosystem and fisheries impacts of many of these observations are still to be determined. They should, however, be noted and considered in future analyses and management decisions.

The Northeast U.S. region experienced colder than average ocean temperatures, despite record warm global ocean and air temperatures. Similar to 2024, oceanographic and ecological conditions reflected cooler water and changing species abundance, distribution, and timing.

Northwest Atlantic Phenomena The below average temperatures observed in 2024 persisted into 2025, although there are seasonal and local exceptions to this pattern. Anomalously cold surface conditions (Fig. 96a) were recorded throughout the Northeast Shelf and were widespread across the Slope Sea for much of the year, however the waters were not as fresh as recorded in 2024. Winter bottom temperatures were also below average across much of the Northeast Shelf (Fig. 96b). Multiple oceanographic and atmospheric factors can contribute to these cooler conditions including a more southerly Gulf Stream and higher proportions of Labrador Slope and Scotian Shelf water entering the system.

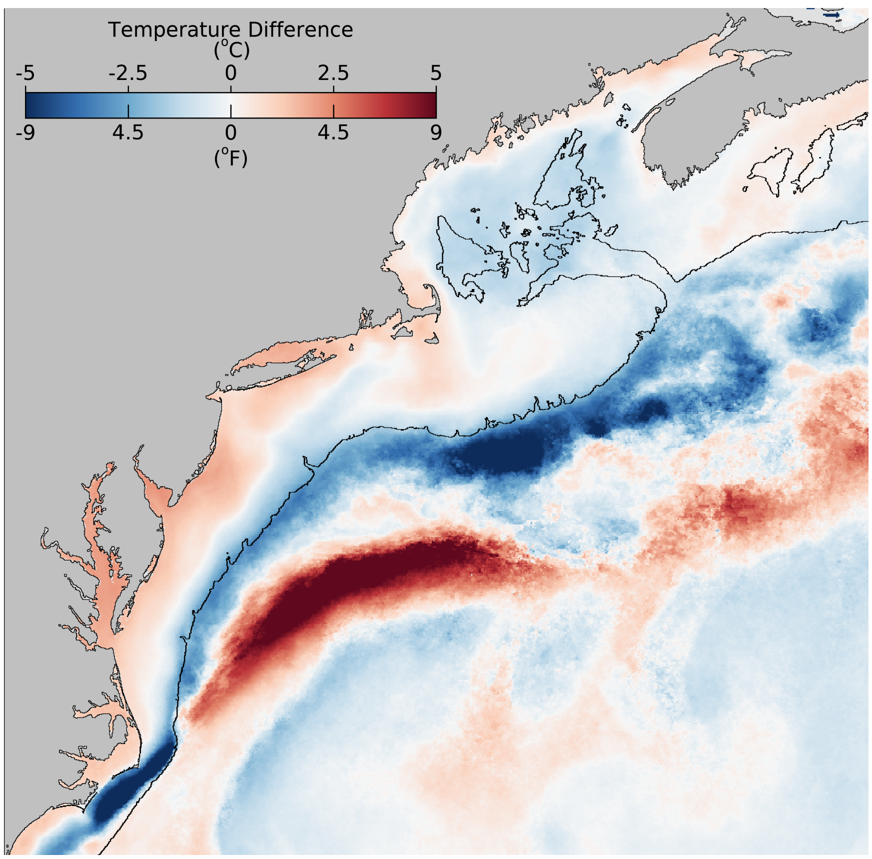

Figure 60: February 2024 sea surface temperature difference compared to the February 2000-2020 long-term mean from the NOAA Advanced Clear-Sky Processor for Ocean (ACSPO) Super-collated SST.

In 2023, Labrador Slope water accounted for more than 50% of the source water entering the Gulf of Maine through the Northeast Channel (Fig. 61); data are still being processed for 2024. Colder, fresher water detected deep in the Jordan Basin for the first half of 2024 suggests an increased influx of Labrador Slope and Scotian Shelf water, which resulted in colder and fresher conditions throughout the Northwest Atlantic and contributed to the increased size and colder temperatures of the Mid-Atlantic Cold Pool.

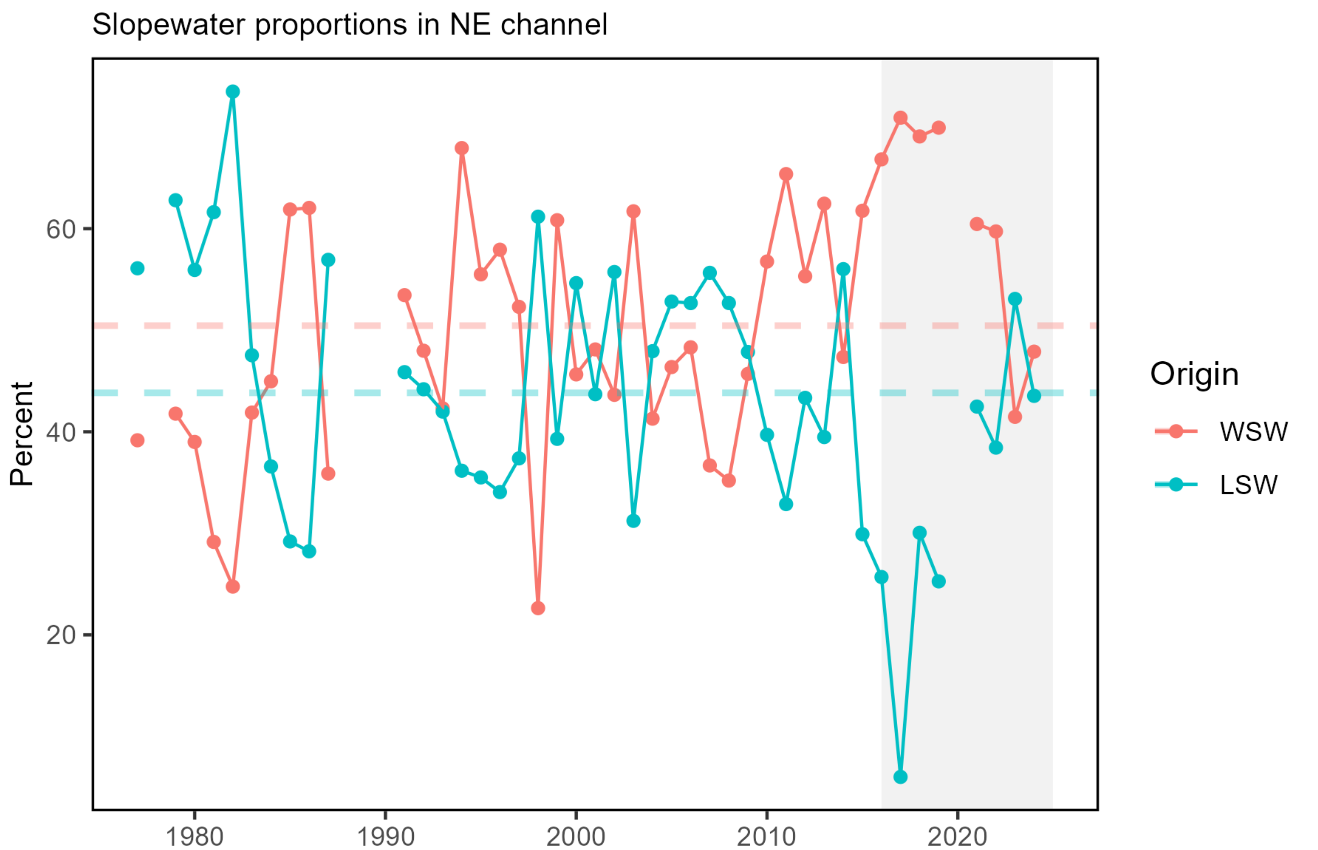

Figure 61: The proportion of Warm Slope Water (WSW) and Labrador Slope Water (LSW) enter the Gulf of Maine through the Northeast Channel from 1977 to 2023. The red and teal dashed lines represent the long-term proportion averages for the WSW and LSW respectively.

Northeast Shelf and Local Phenomena The influx of the northern waters is likely linked to multiple observations across the Northeast Shelf including the uncommon presence of Arctic *Calanus* zooplankton species in the Gulf of Maine, delayed migration of many species, and redistribution of some species. Several members of the fishing community noted delayed migration of species into typical fishing grounds. In particular, they attributed the delayed migration of longfin squid, black sea bass, and haddock to the cooler water temperatures. Many also reported redistribution of some species. Specifically, pollock, bluefin tuna, Atlantic mackerel, longfin squid, bluefish, and bonito were observed in surprising or unusual locations. Some species, such as Atlantic mackerel, were reported outside of typical fishing grounds and in higher abundance compared to recent years. Anglers also reported good catches of red drum in Chesapeake Bay and record high (since 1995) numbers were observed at Poplar Island survey location.

In the summer, Chesapeake Bay recorded warm temperatures and low bottom water dissolved oxygen that resulted in less than suitable habitat for species such as striped bass and blue crabs. These poor conditions can affect their distribution, growth, and survival. Additionally, lower than average spring and summer salinity negatively impacted oyster hatchery operations and increased the area of available habitat for invasive blue catfish, potentially increasing predation on blue crabs and other important finfish species.

During the summer months there were multiple prolonged upwelling events that brought cold water to the surface off the New Jersey coast. There was also an atypical phytoplankton bloom south of Long Island in late June to early July 2024, possibly linked to an upwelling event (Fig. 62). The bloom was dominated by coccolithophores, which have an exoskeleton made up of calcium carbonate plates that can turn the water an opaque turquoise color. Large blooms of coccolithophores are unusual in this region, but they are not considered harmful and are grazed by zooplankton. Additionally, there were observations of multiple whale species aggregating near the Hudson Canyon between May and August.

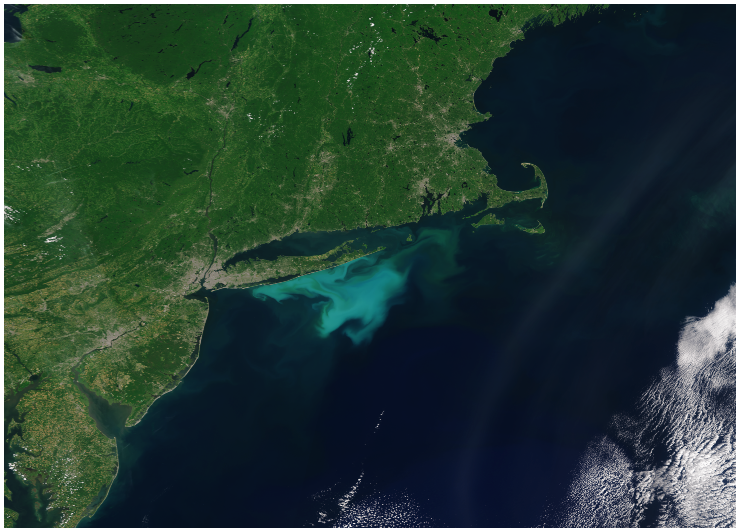

Figure 62: An OLCI Sentinel 3A true color image with enhanced contrast captured on July 2, 2024. Coccolithophores shed their coccolith plates during the later stages of the bloom cycle, which results in the milky turquoise water color (Image credit: NOAA STAR, OCView and Ocean Color Science Team).

Summer bottom ocean acidification (OA) risk in the Mid-Atlantic was the highest recorded since sampling began in 2007. High OA risk is measured as low aragonite saturation state(Ω). Similarly, the winter/early spring Gulf of Maine surface OA risk was significantly above the climatological average and near the sensitivity levels for cod ($\Omega<1.19$) and lobster ($\Omega<1.09$) (Fig.63). These observations were likely driven by the greater volume of fresher, less-buffered Labrador Slope water entering the Gulf of Maine and Mid-Atlantic, as well as cooler conditions. The 2023 and 2024 high summer OA risk has increased the extent of potentially unfavorable habitat for Atlantic sea scallops ($\Omega<1.1$) and longfin squid ($\Omega<0.96$). Additionally, for the first time, high OA risk conditions were observed outside of summer (fall for both species and spring for Atlantic sea scallops).

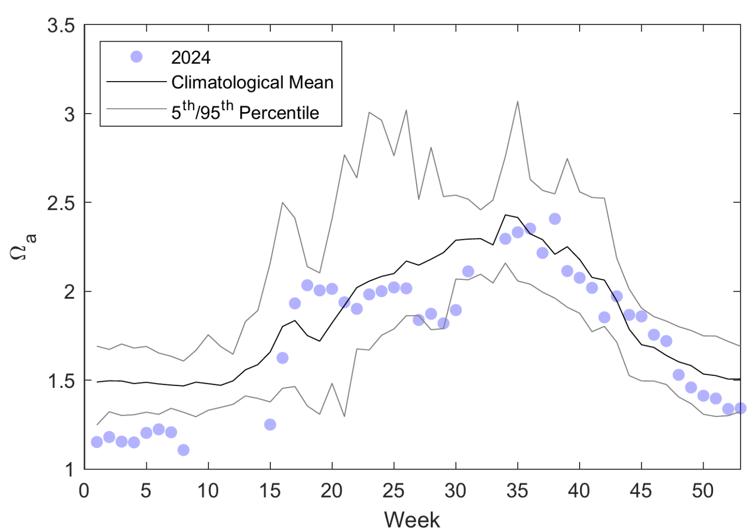

Figure 63: Weekly average surface aragonite saturation state measured at the long-term buoy location in the Gulf of Maine at 43.02 N and 70.54 W

In contrast to the documented die-off of scallops in the Mid-Atlantic Elephant Trunk region between the 2022 and 2023 surveys, in 2024 there was strong scallop recruitment in the southeastern portion of the Nantucket Lightship Area.

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Document Orientation

The figure format is illustrated in Fig 64a. Trend lines are shown when slope is significantly different from 0 at the $p < 0.05$ level. An orange line signifies an overall positive trend, and purple signifies a negative trend. To minimize bias introduced by small sample size, no trend is fit for < 30 year time series. Dashed lines represent mean values of time series unless the indicator is an anomaly, in which case the dashed line is equal to 0. Shaded regions indicate the past ten years. If there are no new data for 2022, the shaded region will still cover this time period. The spatial scale of indicators is either coastwide, Mid-Atlantic states (New York, New Jersey, Delaware, Maryland, Virginia, North Carolina), or at the Mid-Atlantic Bight (MAB) Ecosystem Production Unit (EPU, Fig. 64b) level.

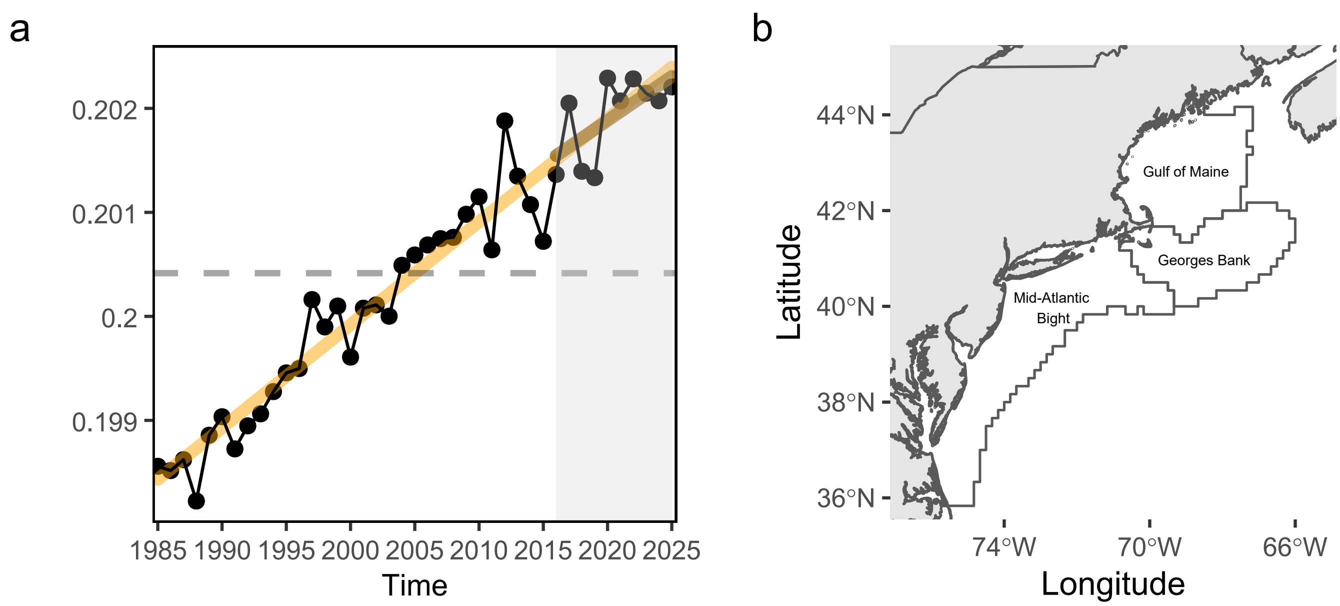

Figure 64: Document orientation. a. Key to figures. b.The Northeast Large Marine Ecosystem.

Fish and invertebrates are aggregated into similar feeding categories (Table 7) to evaluate ecosystem level trends in predators and prey.

Table 7: Feeding guilds and management bodies.

Guild	MAFMC	Joint	NEFMC	State or Other
Apex Predator				shark uncl, swordfish, yellowfin tuna, bluefin tuna
Piscivore	summer flounder, bluefish, northern shortfin squid, longfin squid	spiny dogfish, goosefish	winter skate, clearnose skate, thorny skate, offshore hake, silver hake, atlantic cod, pollock, white hake, red hake, atlantic halibut, windowpane, acadian redfish	sea lamprey, sandbar shark, atlantic angel shark, atlantic torpedo, conger eel, spotted hake, cusk, fourspot flounder, john dory, atlantic cutlassfish, blue runner, striped bass, weakfish, sea raven, northern stargazer, banded rudderfish, atlantic sharpnose shark, inshore lizardfish, atlantic brief squid, northern sennet, king mackerel, spanish mackerel
Planktivore	atlantic mackerel, chub mackerel, butterfish		atlantic herring	harvestfishes, smelts, round herring, alewife, blueback herring, american shad, menhaden, bay anchovy, striped anchovy, rainbow smelt, atlantic argentine, slender snipe eel, atlantic silverside, northern pipefish, atlantic moonfish, lookdown, blackbelly rosefish, lumpfish, northern sand lance, atlantic saury, mackerel scad, bigeye scad, round scad, rough scad, silver rag, weitzmans pearlsides, atlantic soft pout, sevenspine bay shrimp, pink glass shrimp, polar lebbeid, friendly blade shrimp, bristled longbeak, aesop shrimp, norwegian shrimp, northern shrimp, brown rock shrimp, atlantic thread herring, spanish sardine, atlantic bumper, harvestfish, striated argentine, silver anchovy

Table 7: Feeding guilds and management bodies.

Guild	MAFMC	Joint	NEFMC	State or Other
Benthivore	black sea bass, scup, tilefish		barndoor skate, rosette skate, little skate, smooth skate, haddock, american plaice, yellowtail flounder, winter flounder, witch flounder, atlantic wolffish, ocean pout, crab,red deepsea	crab,unc, hagfish, porgy,red, sea bass,nk, atlantic hagfish, roughtail stingray, smooth dogfish, chain dogfish, bluntnose stingray, bullnose ray, southern stingray, longfin hake, fourbeard rockling, marlin-spike, gulf stream flounder, longspine snipefish, blackmouth bass, threespine stickleback, smallmouth flounder, hogchoker, bigeye, atlantic croaker, pigfish, northern kingfish, silver perch, spot, deepbody boarfish, sculpin uncl, moustache sculpin, longhorn sculpin, alligatorfish, grubby, atlantic seasnail, northern searobin, striped searobin, armored searobin, cunner, tautog, snakeblenny, daubed shanny, radiated shanny, red goatfish, striped cusk-eel, wolf eelpout, wrymouth, fawn cusk-eel, northern puffer, striped burrfish, planehead filefish, gray triggerfish, shortnose greeneye, beardfish, cownose ray, american lobster, cancer crab uncl, jonah crab, atlantic rock crab, blue crab, spider crab uncl, horseshoe crab, coarsehand lady crab, lady crab, northern stone crab, snow crab, spiny butterfly ray, smooth butterfly ray, snakefish, atlantic midshipman, bank cusk-eel, red cornetfish, squid cuttlefish and octopod uncl, spoonarm octopus, bank sea bass, rock sea bass, sand perch, cobia, crevalle jack, vermilion snapper, tomtate, jolthead porgy, saucereye porgy, whitebone porgy, knobbed porgy, sheepshead porgy, littlehead porgy, silver porgy, pinfish, red porgy, porgy and pinfish uncl, banded drum, southern kingfish, atlantic spadefish, leopard searobin, dusky flounder, triggerfish filefish uncl, blackcheek tonguefish, orange filefish, queen triggerfish, ocean triggerfish
Benthos	atlantic surfclam, ocean quahog		sea scallop	sea cucumber, sea urchins, snails(conchs), sea urchin and sand dollar uncl, channeled whelk, blue mussel