
# State of the Ecosystem New England

NEFMC SSC
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Many thanks to:
Kimberly Bastille, Geret DePiper, Sarah Gaichas,
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and all SOE contributors

# State of the Ecosystem (SOE) reporting

## Improving ecosystem information and synthesis for fishery managers

- Ecosystem indicators linked to management objectives (DePiper, et al., 2017)
  - Contextual information
  - Report evolving since 2016
  - Fishery-relevant subset of full Ecosystem Status Reprorts
- Open science emphasis (Bastille, et al., 2020)


*The IEA Loop*[1]

[1] https://www.integratedecosystemassessment.noaa.gov/national/IEA-approach

# State of the Ecosystem: Maintain 2021 structure for 2022

## 2021 Report

1. Graphical summary
    - Page 1-2 report card re: objectives →
    - Page 3 risk summary bullets
    - Page 4 synthesis themes
2. Performance relative to management objectives
3. Risks to meeting management objectives

Example ecosystem-scale fishery management objectives

| Objective Categories | Indicators reported here |
|---|---|
| **Provisioning and Cultural Services** | |
| Seafood Production | Landings; commercial total and by feeding guild; recreational harvest |
| Profits | Revenue decomposed to price and volume |
| Recreation | Days fished; recreational fleet diversity |
| Stability | Diversity indices (fishery and ecosystem) |
| Social & Cultural | Community engagement/reliance status |
| Protected Species | Bycatch; population (adult and juvenile) numbers, mortalities |
| **Supporting and Regulating Services** | |
| Biomass | Biomass or abundance by feeding guild from surveys |
| Productivity | Condition and recruitment of managed species, Primary productivity |
| Trophic structure | Relative biomass of feeding guilds, Zooplankton |
| Habitat | Estuarine and offshore habitat conditions |

# State of the Ecosystem summary 2022



## Performance Relative to Fishery Management Objectives

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

### Gulf of Maine (GOM)

| OBJECTIVE (INDICATOR) | Seafood production (total and NEFMC managed landings) | Commercial profits (2020 regional landings not yet available) | Stability (fishery and ecosystem diversity maintained over time) |
|---|---|---|---|
| 30 YEAR TREND | GOM: ↘ | Total: ↔ ; Managed: ↘ | Fishery: ⤭ ; Ecosystem: ⤭ |
| CURRENT STATUS | Status not updated for 2020 | Status not updated for 2020 | Fishery: Comm (−) Rec (•) ; Ecosystem (+) |
| IMPLICATIONS | Regional commercial landings data are not yet available for 2020, but coastwide landings trends for federally managed species were mixed when compared to recent years. Monkfish, lobster, and scallop landings declined while aggregate groundfish landings increased over recent averages. Recreational harvest in New England reached its lowest point in 2020, driven in part by management to address poor/unknown stock status.<br><br>Climate indicators continue trending toward uncharted territory, which affects stock distributions and will generate other ecosystem changes. | Coast-wide, a number of species managed by the NEFMC, as well as lobster, experienced a decline in revenue when compared to the average revenue generated 2015 - 2019. This decline was driven by a mix of landings declines (monkfish, lobster, scallops) and price declines (monkfish, lobster, scallops, and groundfish). | Fishery: Commercial fleet diversity indicates a continued shift toward reliance on fewer species with a large drop in 2020 leading to the lowest species diversity to date.<br><br>Recreational: Species diversity is increasing due to increases in southerly species and lower catch limits on traditional regional species.<br><br>Ecosystem: Overall indicators suggest stability, but several climate and oceanography metrics are changing and should be monitored as warning signs for potential regime shift or ecosystem restructuring. |

### Georges Bank (GB)

| OBJECTIVE (INDICATOR) | Seafood production (total and NEFMC managed landings) | Commercial profits (indicator not updated, 2020 regional landings not yet available) | Stability (fishery and ecosystem diversity maintained over time) |
|---|---|---|---|
| 30 YEAR TREND | GB: ↘ | GB: ↔ | Fishery: ⤭ ; Ecosystem: ⤭ |
| CURRENT STATUS | Status not updated for 2020 | Status not updated for 2020 | Fishery: Comm (−) Rec (•) ; Ecosystem (+) |
| IMPLICATIONS | Regional commercial landings data are not yet available for 2020, but coastwide landings trends for federally managed species were mixed when compared to recent years. Monkfish, lobster, and scallop landings declined while aggregate groundfish landings increased over recent averages. Recreational harvest in New England reached its lowest point in 2020, driven in part by management to address poor/unknown stock status.<br><br>Climate indicators continue trending toward unprecedented levels, which affects stock distributions and will generate other ecosystem changes. | Coast-wide, a number of species managed by the NEFMC, as well as lobster, experienced a decline in revenue when compared to the average revenue generated 2015 - 2019. This decline was driven by a mix of landings declines (monkfish, lobster, scallops) and price declines (monkfish, lobster, scallops, and groundfish). | Fishery: Commercial fleet diversity indicates a continued shift toward reliance on fewer species, with a large drop in 2020 leading to the lowest species diversity to date.<br><br>Recreational: Species diversity is increasing due to increases in southerly species and lower catch limits on traditional regional species.<br><br>Ecosystem: Overall indicators suggest stability, but several climate and oceanography metrics are changing and should be monitored as warning signs for potential regime shift or ecosystem restructuring. |

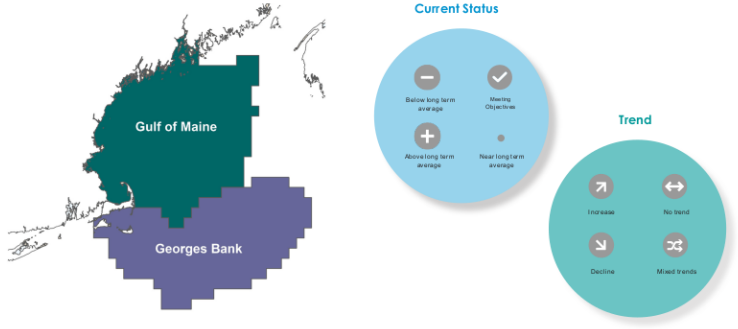


2022 STATE OF THE ECOSYSTEM | New England

## Performance Relative to Fishery Management Objectives

### Common to both regions

| OBJECTIVE (INDICATOR) | Recreational opportunities (effort and fleet diversity) | Social and cultural (community fishery engagement, reliance, and environmental justice vulnerability) | Protected species (coastwide bycatch, population numbers, mortalities) |
|---|---|---|---|
| 30 YEAR TREND | Effort: ↔ ; Diversity: ↔ | Status only indicator | Bycatch: ⤭ ; Populations: ⤭ |
| CURRENT STATUS | Effort: • ; Diversity: • | Environmental justice status for top commercial and recreational communities. | Bycatch — Harbor porpoise: (−) ; Gray seal: (+)<br>Populations — NARW: (−) ; Gray seal: (+) |
| IMPLICATIONS | Relative stability in the overall number of recreational opportunities in the region. | These indicators are used to identify top fishing communities and those with environmental justice concerns based on 2019 data. Highlighted communities may be vulnerable to changes in fishing patterns due to regulations and/or climate change. When any of these communities also experience environmental justice issues, they may have lower ability to successfully respond/adapt to change.<br><br>All communities showing environmental justice concerns score high in the poverty index, while some also score high in personal disruption and population composition indices. | Mixed bycatch trends through 2019 are related to fishery management, shifts in population distribution combined with fishery shifts, and population increase for gray seals. Bycatch indices were not updated because of low observer coverage caused by COVID-19 restrictions.<br><br>Population drivers for North Atlantic Right Whales (NARW) include combined fishery interactions/vessel strikes, distribution shifts, and copepod availability.<br><br>Unusual mortality events continue for 3 large whale species. |



# State of the Ecosystem: Risks to Meeting Fishery Management Objectives

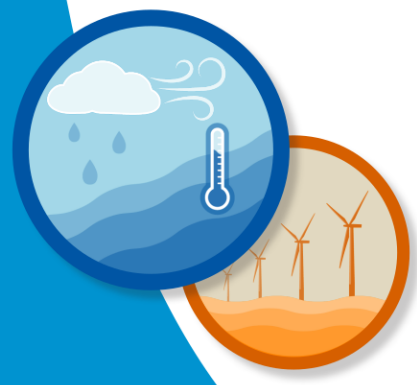


## Risks to Meeting Fishery Management Objectives

### Climate and Ecosystem Productivity Risks

Climate change, most notably ocean warming and changes in the Gulf Stream, continue to affect the New England ecosystem:

- Seasonal water temperatures rivaled or exceeded the record high temperatures recorded in 2012.
- The region is experiencing more frequent and intense marine heatwaves. Georges Bank had record high heat wave intensity in 2021.
- The Gulf Stream is becoming less stable. The northward shift of the Gulf Stream is related to the dominance of warm slope water and little to no Labrador Slope Water entering the Gulf of Maine through the Northeast Channel.
- The Mid-Atlantic cold pool is becoming warmer, smaller, and shorter in duration, which affects habitat for multiple federally managed species.
- In 2021, there was no notable spring phytoplankton bloom in the Gulf of Maine and below average summer chlorophyll concentrations throughout the region. There was an above average late fall bloom on Georges Bank, which may benefit haddock recruitment.
- Fish condition in 2021 was generally above average on Georges Bank and mixed in the Gulf of Maine.
- Aggregate shifts in species distributions and the appearance of more southern species moving into the Gulf of Maine may cause unexpected species interactions.



### Other Ocean Uses: Offshore Wind Risks

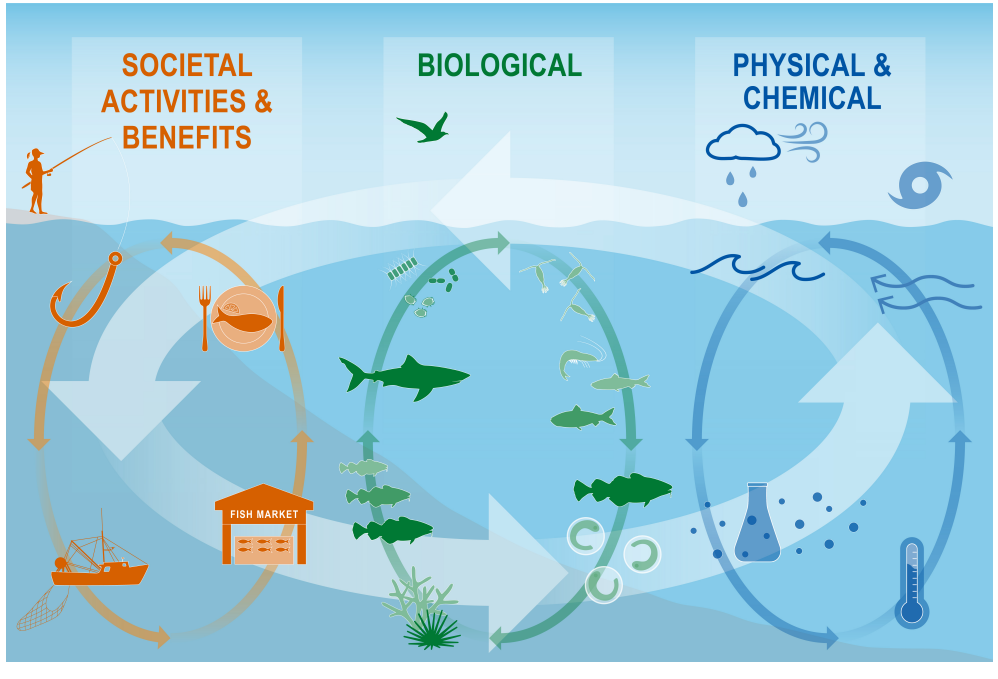
More than 20 offshore wind development projects are proposed for construction on the Northeast shelf, covering more than 1.7 million acres by 2030. An additional 6 lease areas (488,000 acres) were recently identified in the New York Bight. If all existing and proposed leases are developed in the Northeast:

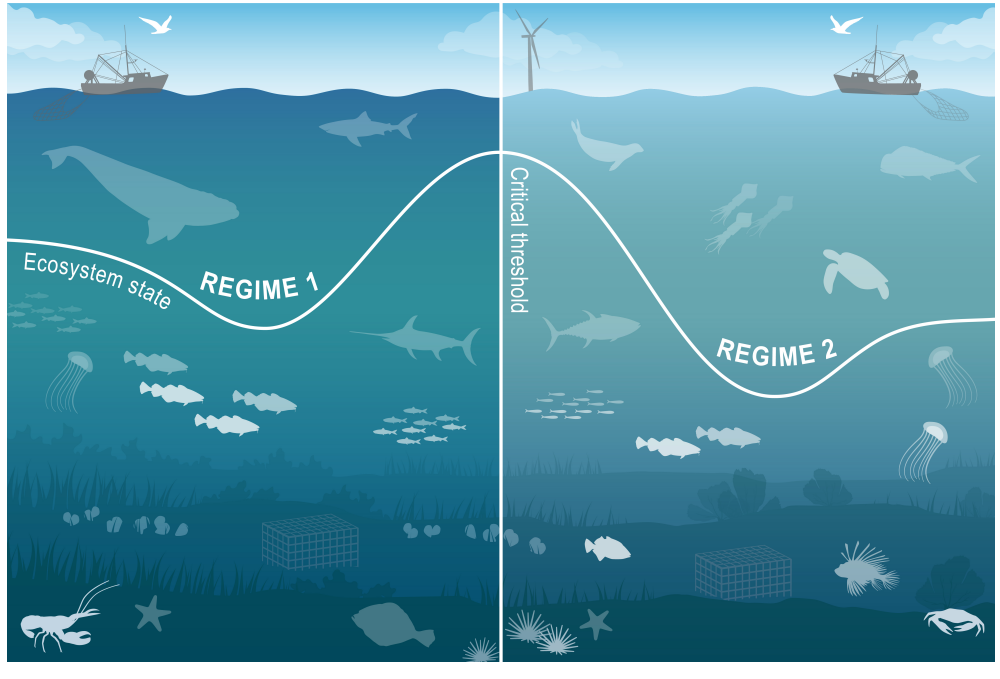
- Rapid buildout according to current development plans will have greater impact to the Mid-Atlantic than New England, although some lease areas are in RI and MA; floating offshore technologies are likely to be used in Gulf of Maine in the future, with anticipated site designations beginning in 2023.
- 2-69% of port revenues from fisheries currently comes from areas proposed for offshore wind development. Some of these communities score medium-high to high in environmental justice concerns and gentrification vulnerability.
- Up to 12% of annual commercial landings and revenue for major New England species could be displaced from lease areas.
- Development will affect species differently, negatively affecting species that prefer soft bottom habitat while potentially benefiting species that prefer hard structured habitat.
- Planned wind areas overlap with one of the only known right whale foraging habitats, and altered local oceanography could affect right whale prey availability. Development also brings increased vessel strike risk and the potential impacts of pile driving noise.
- Evaluating the impacts to scientific surveys has begun.

# Ecosystem synthesis themes

Characterizing ecosystem change for fishery management

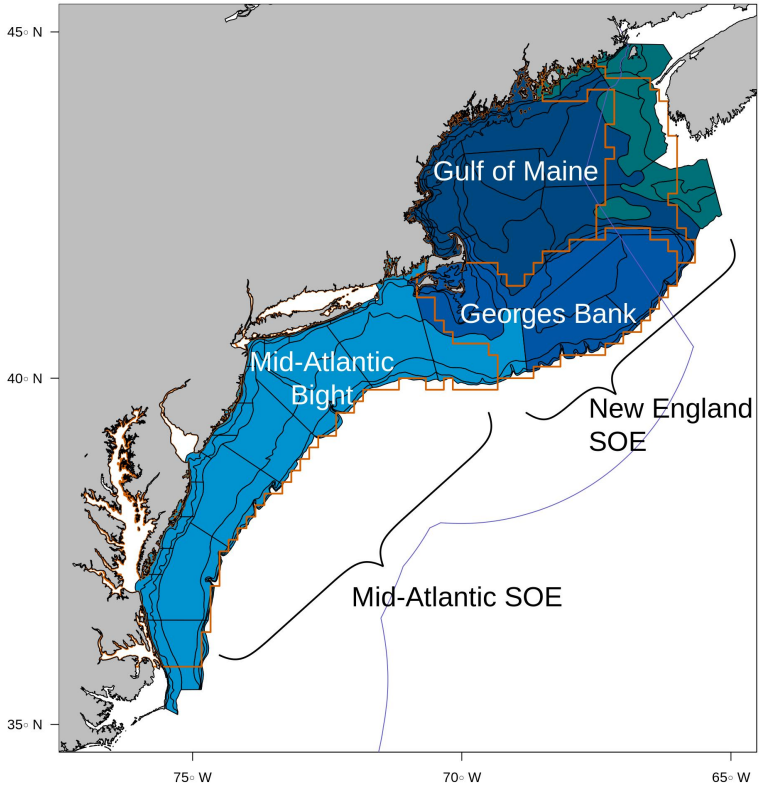
- Societal, biological, physical and chemical factors comprise the **multiple system drivers** that influence marine ecosystems through a variety of different pathways.
- Changes in the multiple drivers can lead to **regime shifts** — large, abrupt and persistent changes in the structure and function of an ecosystem.
- Regime shifts and changes in how the multiple system drivers interact can result in **ecosystem reorganization** as species and humans respond and adapt to the new environment.



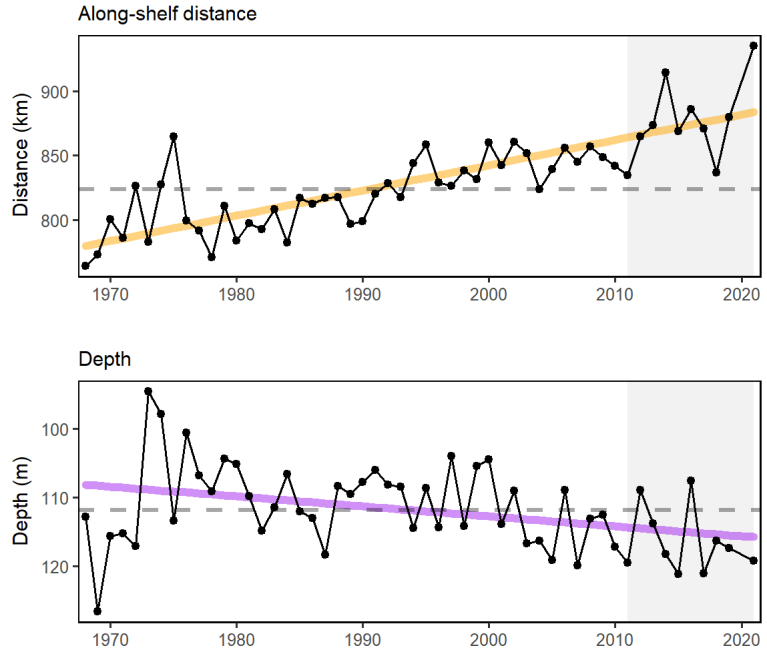
# Document Orientation

## Spatial scale




A glossary of terms, detailed technical methods documentation and indicator data are available online.

## Key to figures




Trends assessed only for 30+ years: more information

Orange line = significant increase

Purple line = significant decrease

No color line = not significant or < 30 years

Grey background = last 10 years

# 2022 Request tracking memo

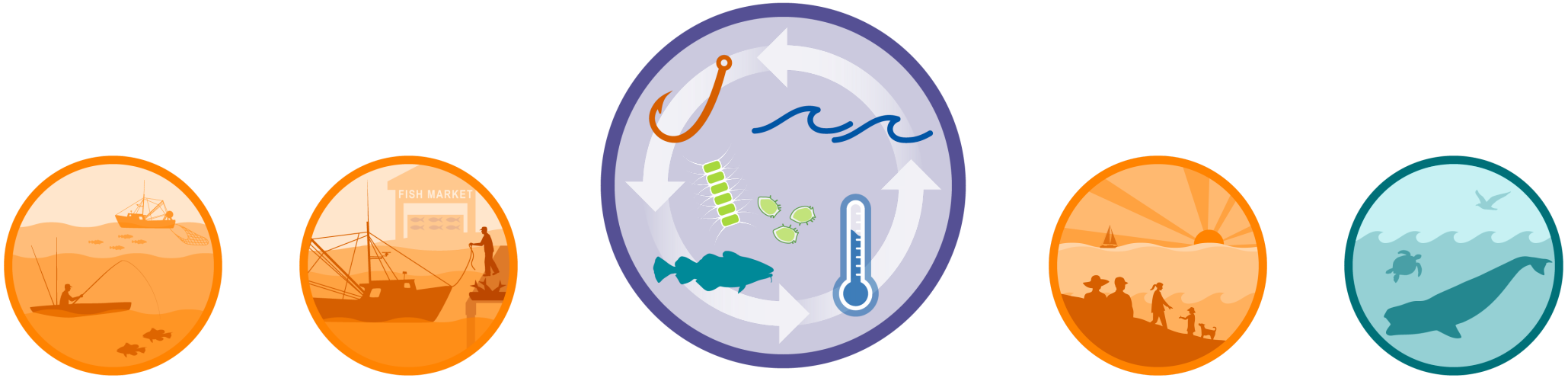
| Request | Year | Source | Status | Progress | Memo Section |
|---|---|---|---|---|---|
| Add "This report is for [audience]" | 2021 | MAFMC SSC | In SOE | Introduction section | 1 |
| State management objectives first in report | 2021 | NEFMC | In SOE | Introduction section + Table | 2 |
| Ocean acidification (OA) in NEFMC SOE | 2021 | NEFMC SSC | In SOE | Climate risks section | 3 |
| Habitat impact of fishing based on gear. | 2021 | NEFMC | In SOE | Habitat risks section | 4 |
| Revisit right whale language | 2021 | NEFMC | In SOE | Protected species section | 5 |
| Sum of TAC/ Landings relative to TAC | 2021 | MAFMC SSC | In SOE-MAFMC | Seafood production section | 6 |
| Estuarine Water Quality | 2020 | NEFMC | In SOE-MAFMC, In progress-NEFMC | Climate and Habitat Risks sections MAFMC; Intern collated New England NERRS data | 7 |
| More direct opportunities for feedback | 2021 | MAFMC SSC | In progress | MAFMC SSC ecosystem subgroup | 8 |
| Further definition of regime shift | 2021 | MAFMC SSC | In progress | Regime shift analyses for specific indicators define "abrupt" and "persistent" quantitatively | 9 |
| Expand collaboration with Canadian counterparts | 2021 | MAFMC SSC | In progress | Currently drafting a NMFS-DFO climate/fisheries collaboration framework. | 10 |
| Fall turnover date index | 2021 | MAFMC SSC | In progress | See Current Conditions report | 11 |
| Links between species availability inshore/offshore (estuarine conditions) and trends in recreational fishing effort? | 2021 | MAFMC | In progress | Bluefish prey index inshore/offshore partially addresses | 12 |
| Apex predator index (pinnipeds) | 2021 | NEFMC | In progress | Protected species branch developing time series | 13 |
| Forage availability index (Herring/Sandlance) | 2021 | NEFMC | In progress | Bluefish prey index partially addresses | 14 |
| Fishery gear modifications accounted for in shark CPUE? | 2021 | MAFMC | In progress | Updated methods in tech-doc | 15 |

# Revised structure in 2021 to address Council requests and improve synthesis

- Performance relative to management objectives
  - *What* does the indicator say--up, down, stable?
  - *Why* do we think it is changing: integrates synthesis themes
    - Multiple drivers
    - Regime shifts
    - Ecosystem reorganization
- Objectives
  - Seafood production
  - Profits
  - Recreational opportunities
  - Stability
  - Social and cultural
  - Protected species

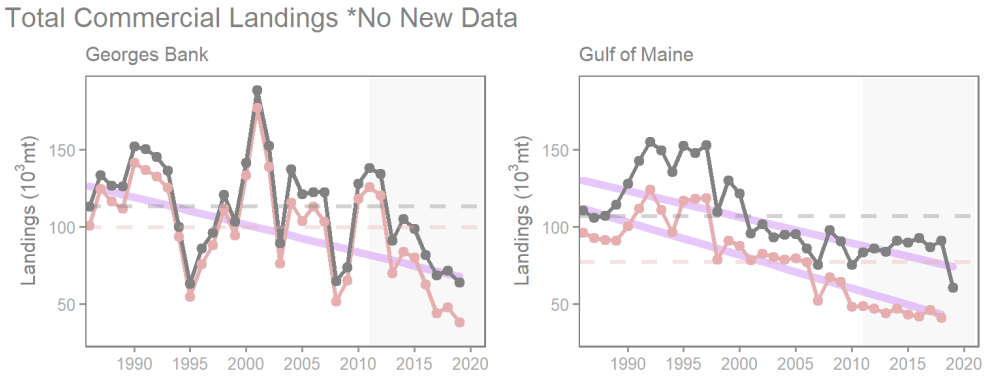
- Risks to meeting fishery management objectives
  - *What* does the indicator say--up, down, stable?
  - *Why* this is important to managers: integrates synthesis themes
    - Multiple drivers
    - Regime shifts
    - Ecosystem reorganization
- Risk categories
  - Climate: warming, ocean currents, acidification
    - Habitat changes (incl. vulnerability analysis)
    - Productivity changes (system and fish)
    - Species interaction changes
    - Community structure changes
  - Other ocean uses
    - Offshore wind development

# Performance relative to management objectives



# Objective: Seafood production

## Indicators: Commercial landings

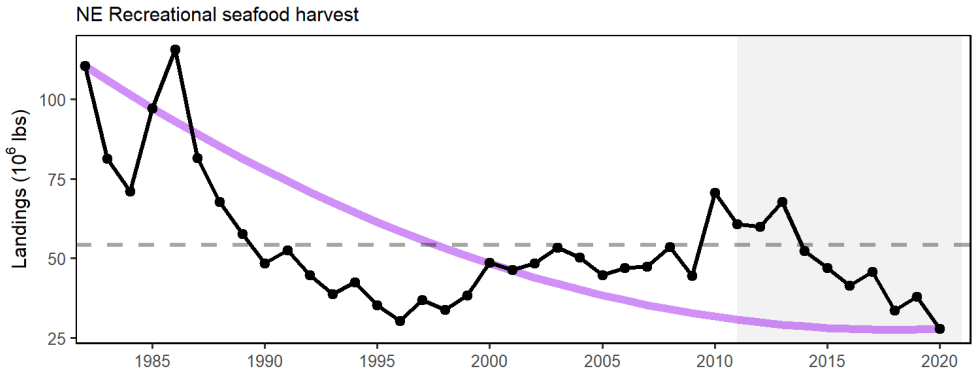


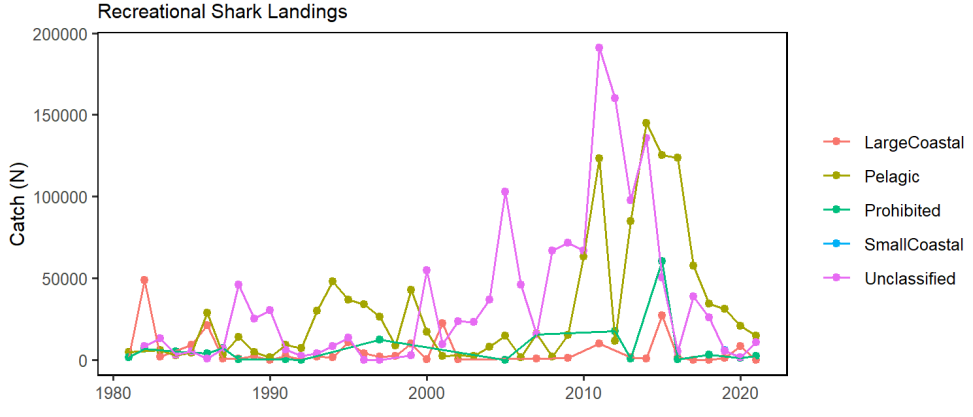

Key: Black = Landings of all species combined;

Red = Landings of NEFMC managed species

Coastwide landings at the Federal fishery management plan (FMP) level were mixed in 2020 when compared to recent years. Landings of groundfish were up, while monkfish and scallop were down. Lobster landings also decreased in 2020.*

## Indicators: Recreational harvest

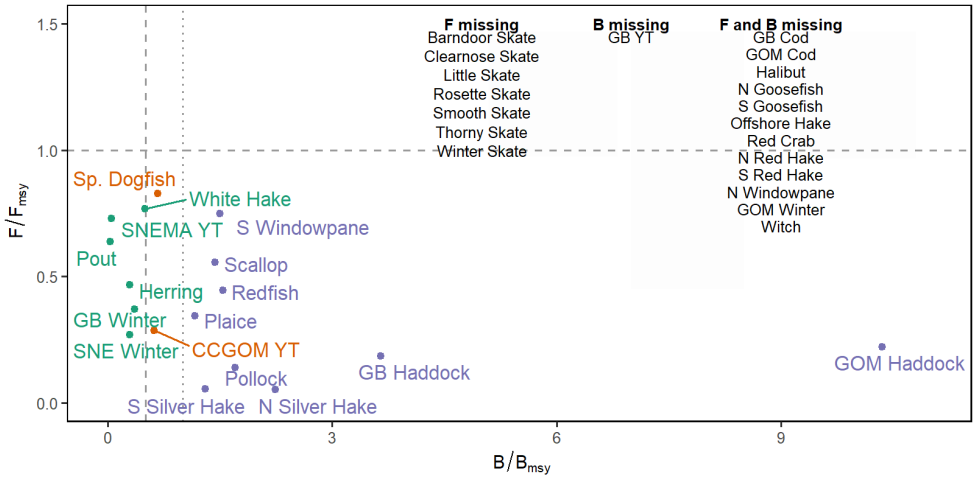


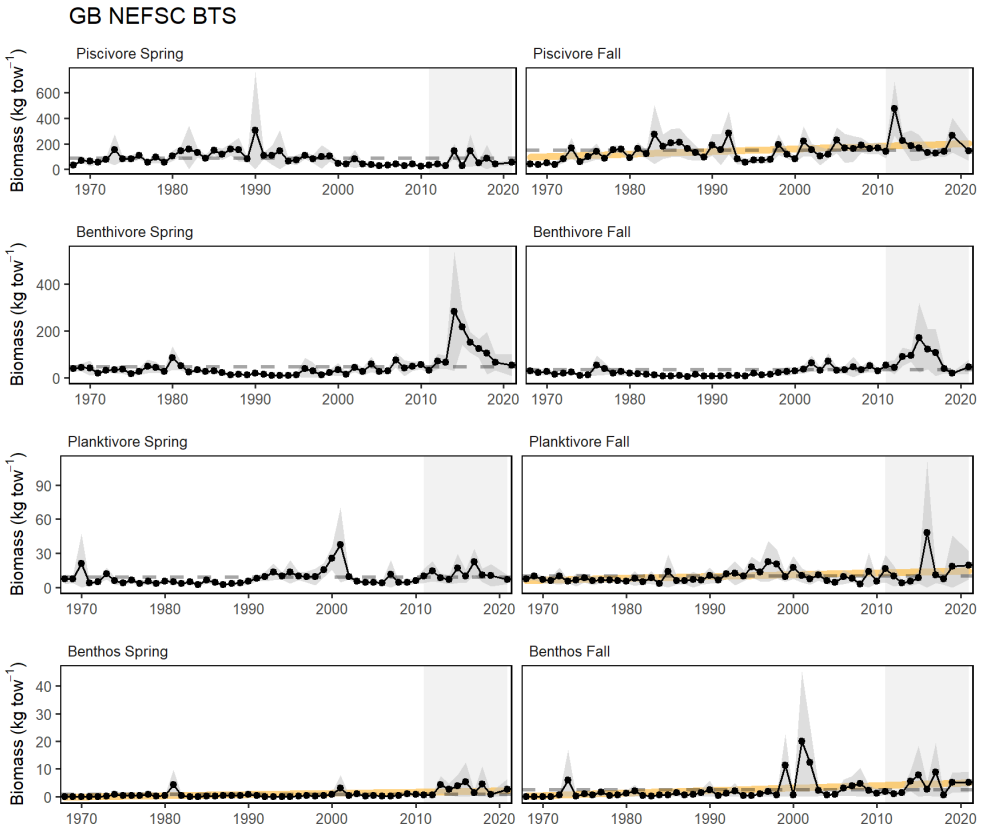

*US Seafood Industry and For-Hire Sector Impacts from COVID-19: 2020 in Perspective

# Landings drivers: Stock status? Survey biomass?

## Indicator: Stock status




## Indicator: Survey biomass



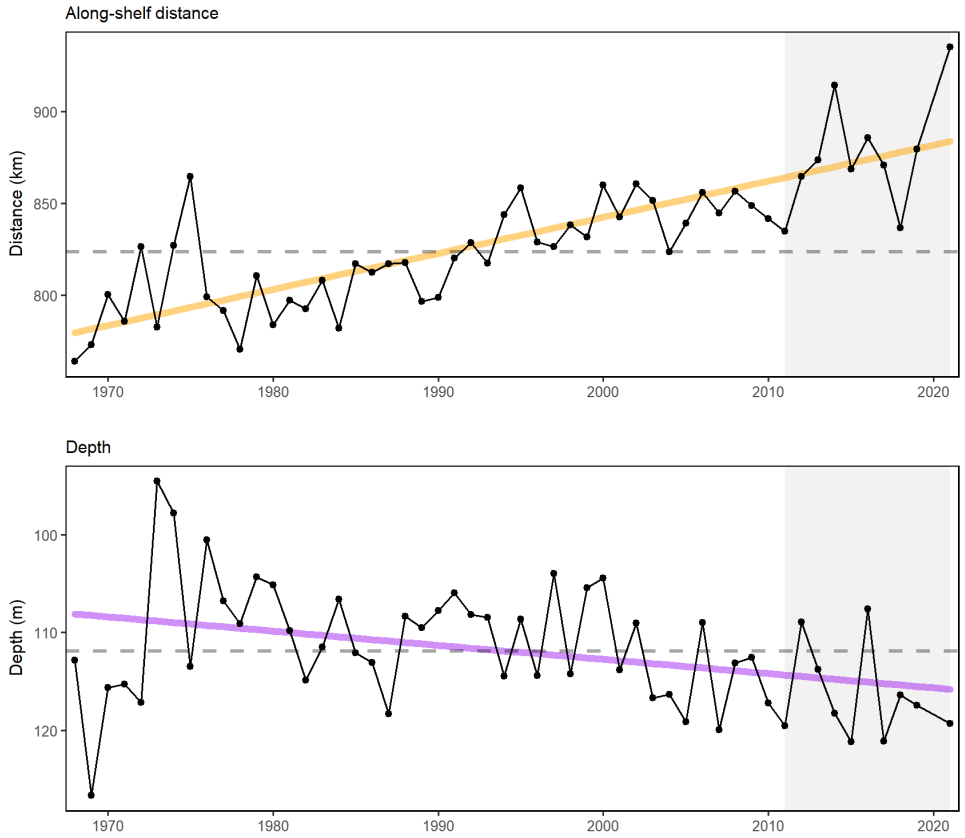
# Implications: Seafood Production

Drivers:

- decline in commercial landings is most likely driven by the requirement to rebuild individual stocks as well as market dynamics
- other drivers affecting recreational landings: shark fishery management, possibly survey methodology

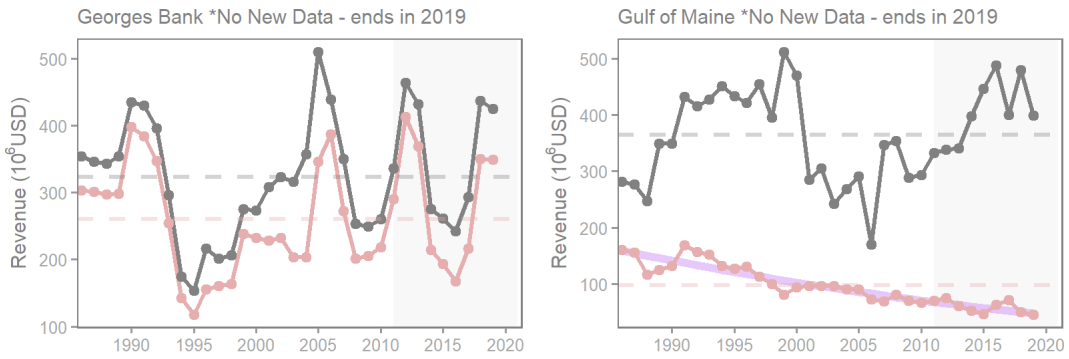
Monitor:

- climate risks including warming, ocean acidification, and shifting distributions
- ecosystem composition and production changes
- fishing engagement



# Objective: Commercial Profits

Indicator: Commercial Revenue




Key: Black = Revenue of all species combined;

Red = Revenue of NEFMC managed species

Both regions driven by single species

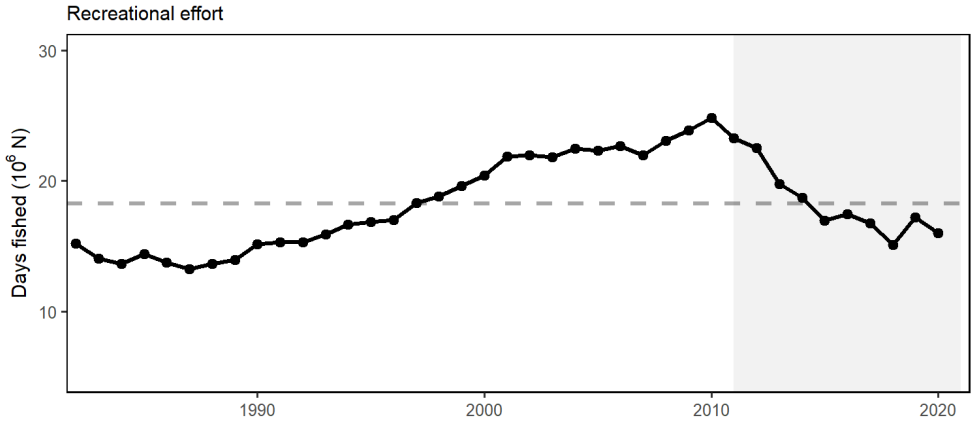
- GOM high revenue despite low volume
- Fluctuations in GB due to rotational management

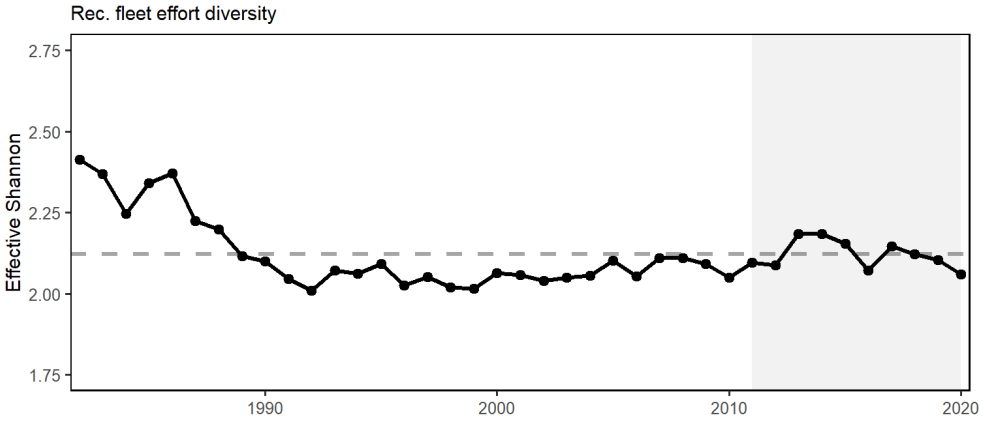
Monitor changes in climate and landings drivers:

- Sea scallops and lobsters are sensitive to ocean warming and acidification

# Objective: Recreational opportunities

## Indicators: Recreational effort and fleet diversity



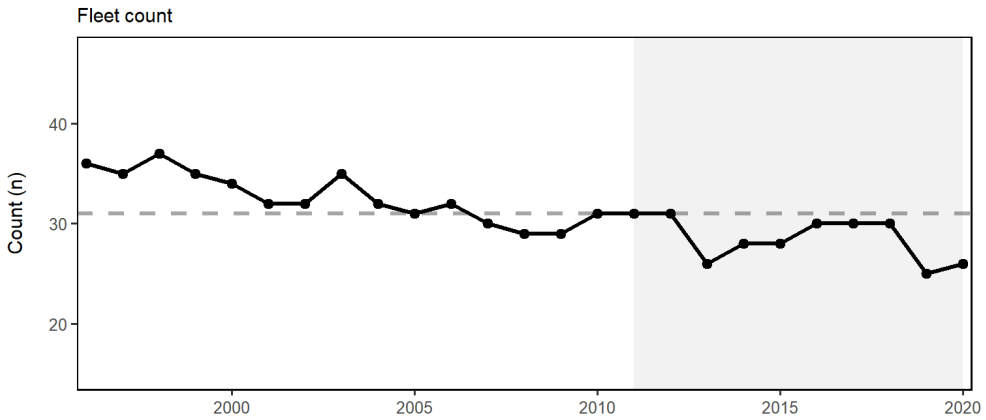



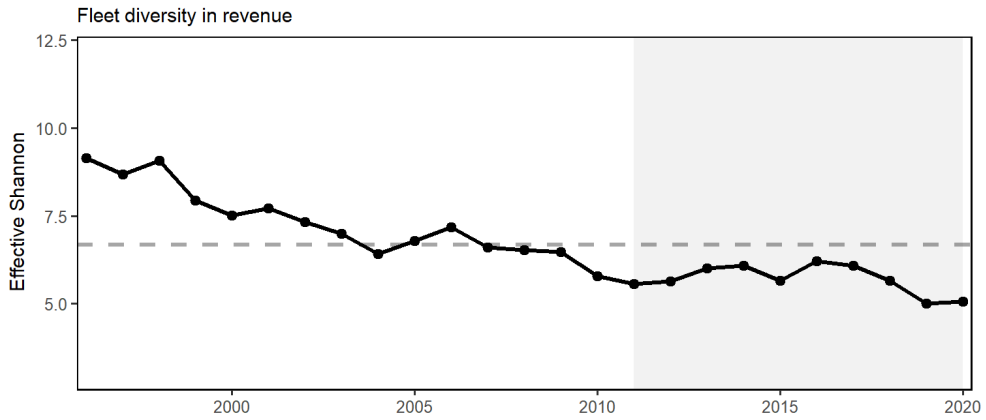

## Implications

- Absence of a long-term trend in recreational effort suggests relative stability in the overall number of recreational opportunities in New England

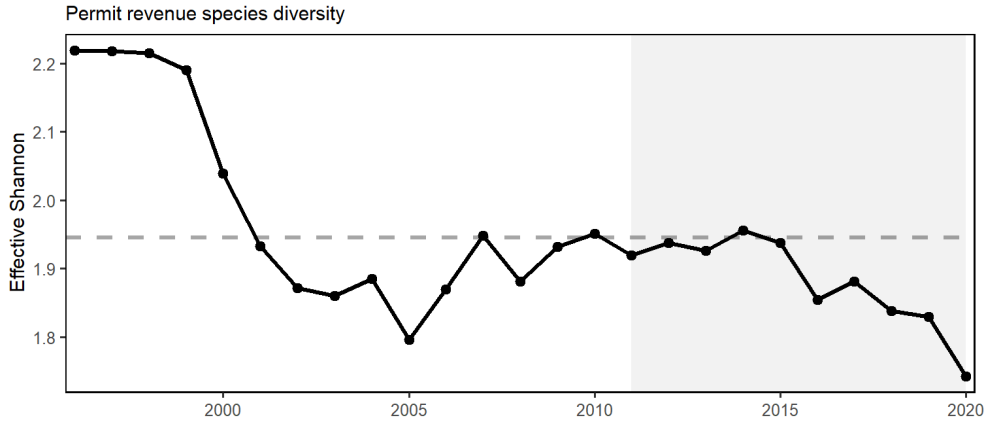
# Objective: Stability ↘ Com −; Rec ●

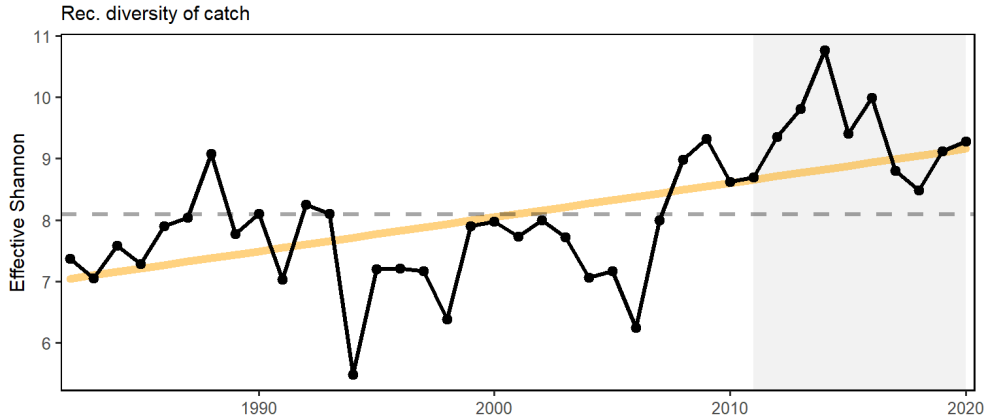
*Fishery* Indicators: Commercial fleet count, fleet diversity



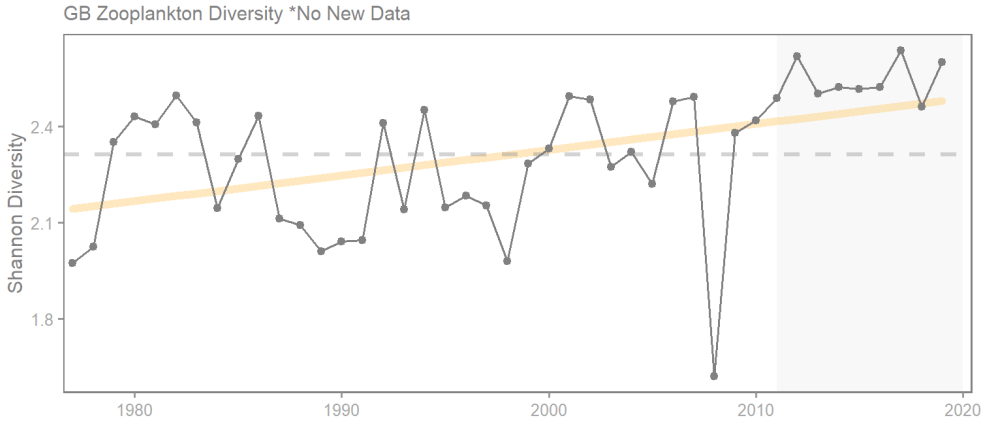

*Fishery* Indicators: commerical species revenue diversity, recreational species catch diversity

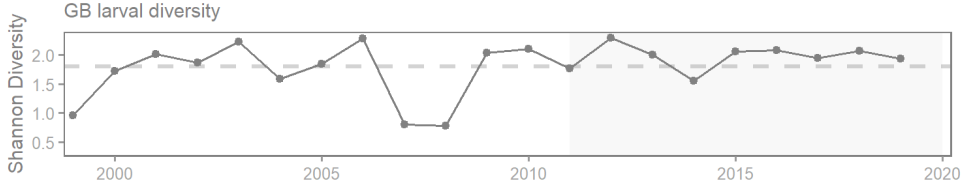


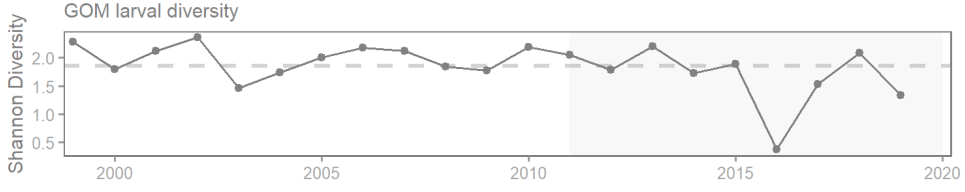



# Objective: Stability

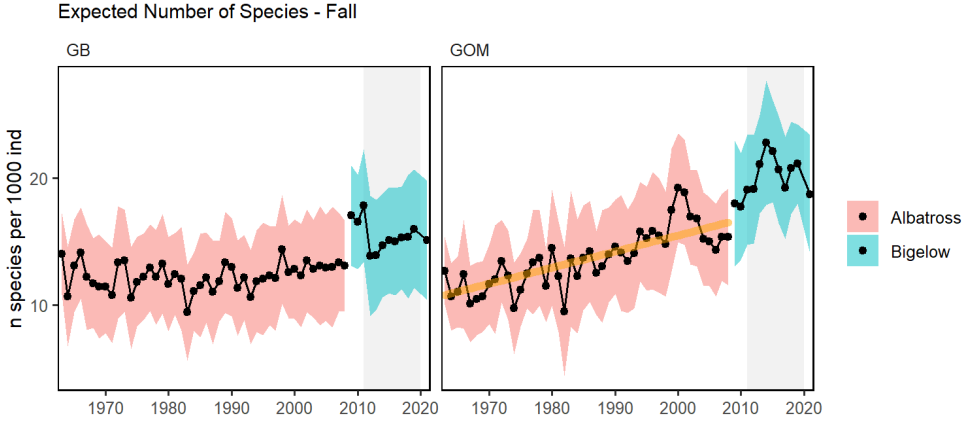
*Ecological* Indicators: zooplankton and larval fish diversity




*Ecological* Indicator: expected number of species, NEFSC bottom trawl survey (Memo 11)

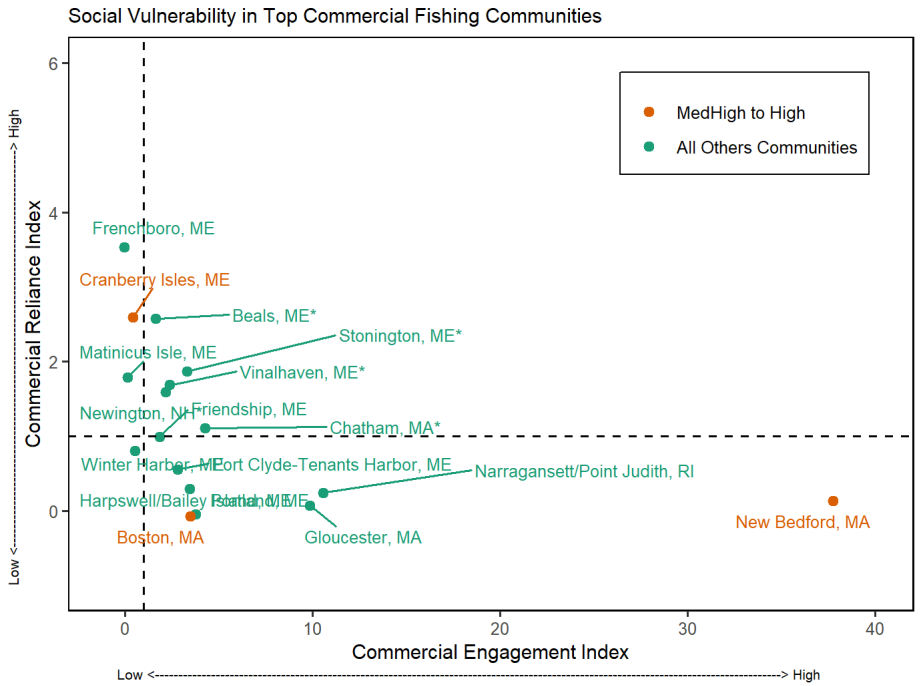


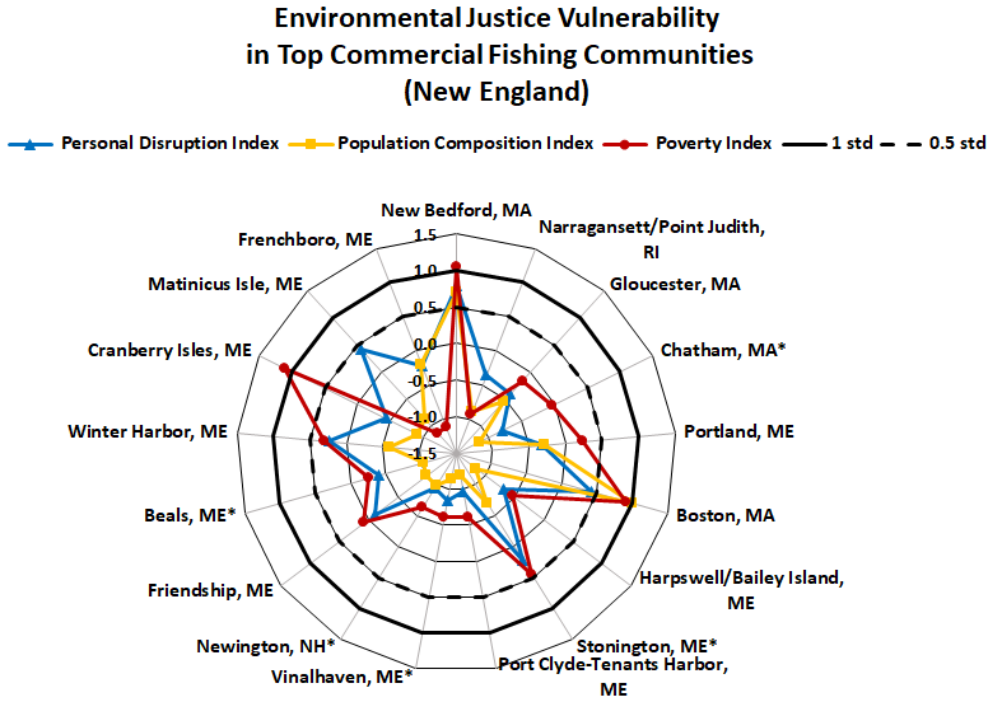

Implications:

- commercial fishery diversity driven by small number of species
- Diminished capacity to respond to future fishing opportunities
- Recreational diversity due to species distributions and regulations
- Adult diversity in GOM suggests increase in warm-water species

# Objective: Environmental Justice and Social Vulnerability

Indicators: Environmental justice vulnerability, commercial fishery engagement and reliance



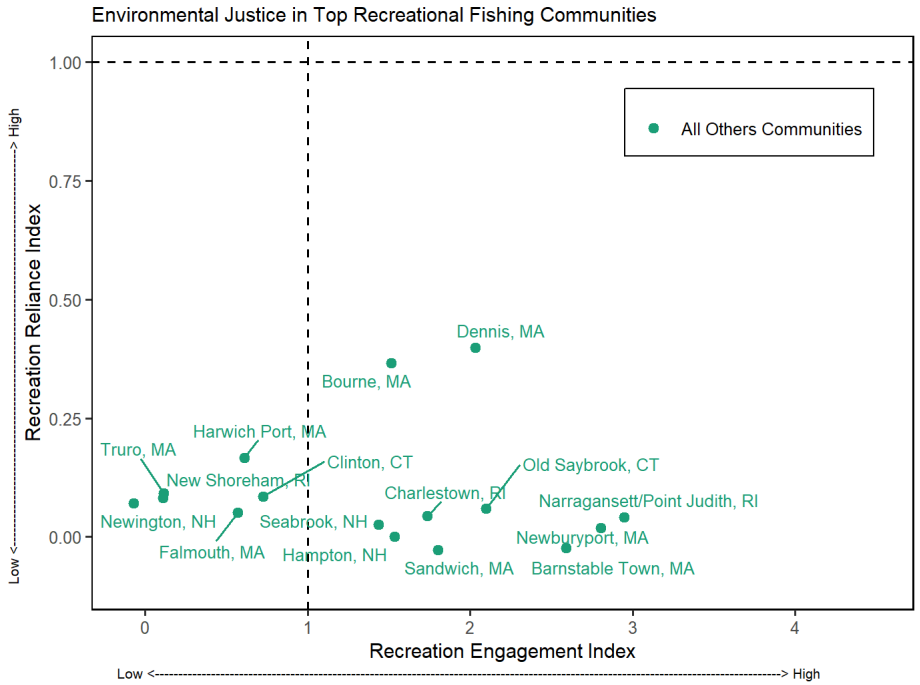



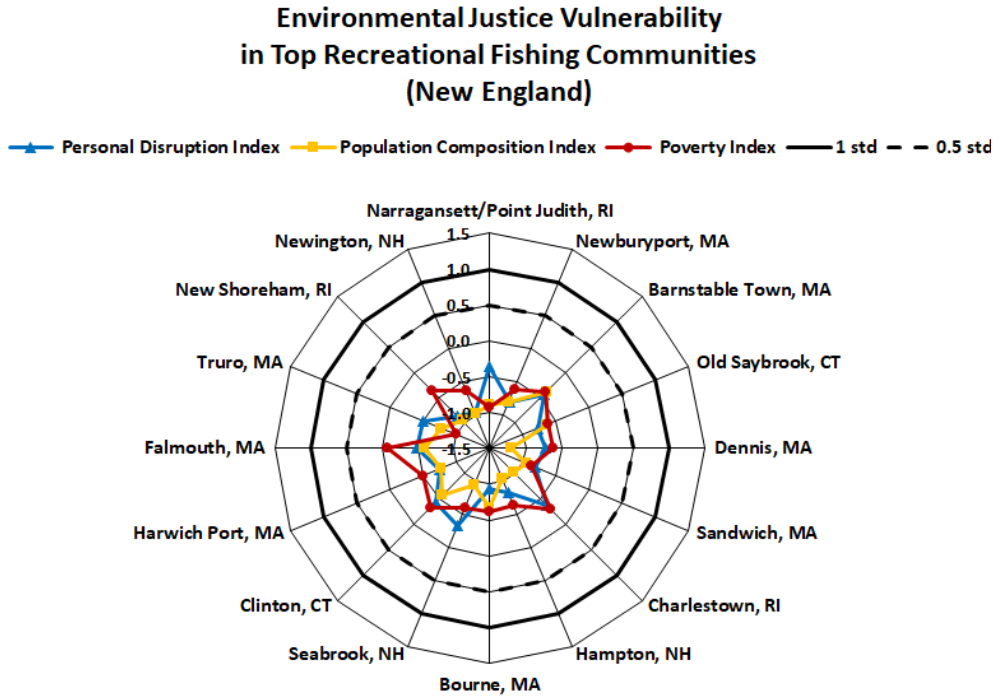

New England commercial fishing communities

Implications: Highlighted communities may be vulnerable to changes in fishing patterns due to regulations and/or climate change. When also experiencing environmental justice issues, they may have lower ability to successfully respond to change.

# Objective: Environmental Justice and Social Vulnerability

Indicators: Environmental justice vulnerability, recreational fishery engagement and reliance



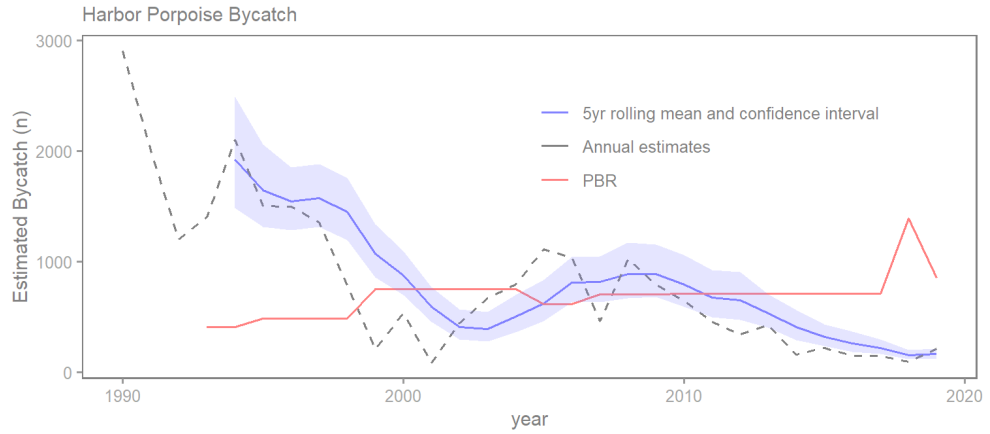



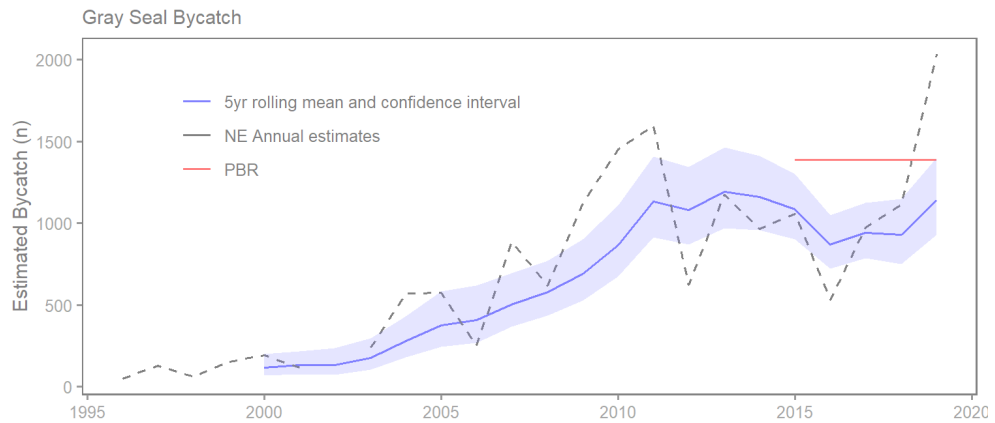

New England recreational fishing communities

Implications: Highlighted communities may be vulnerable to changes in fishing patterns due to regulations and/or climate change. When also experiencing environmental justice issues, they may have lower ability to successfully respond to change.

# Objectives: Protected species *Maintain bycatch below thresholds*

Indicators: Harbor porpoise and gray seal bycatch



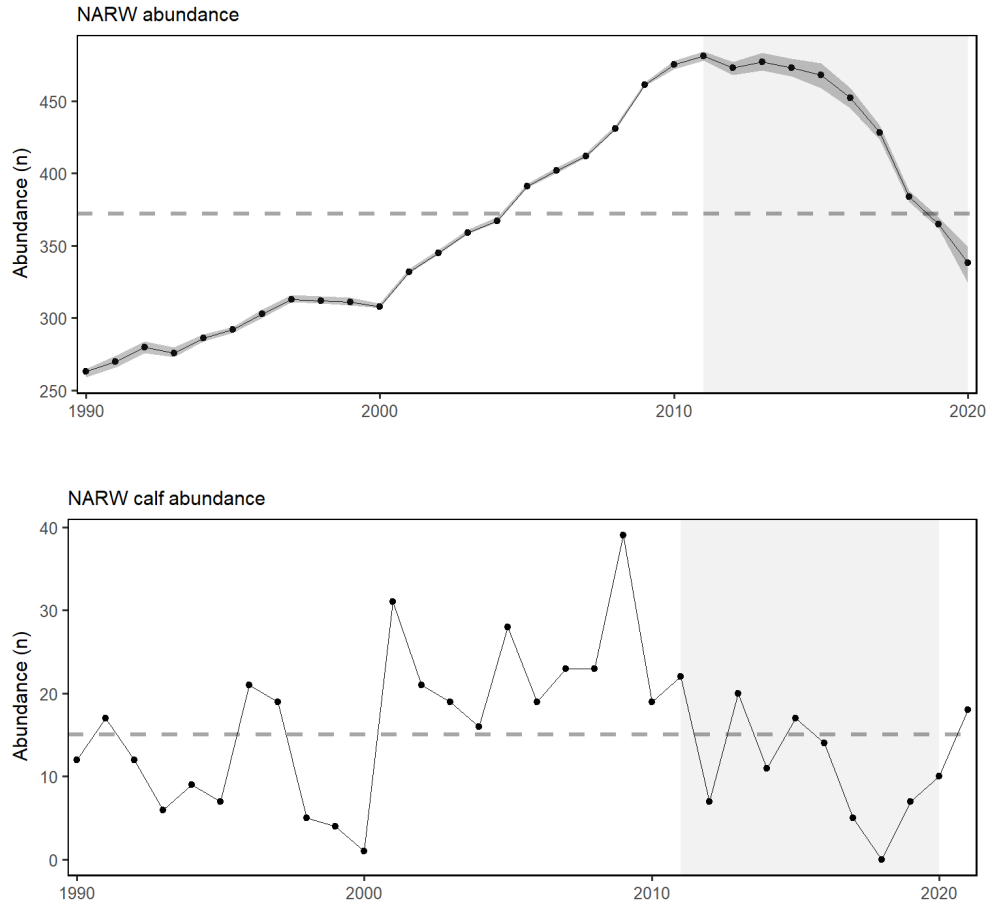




Implications:

- Currently meeting objectives
- The downward trend in harbor porpoise bycatch can also be due to a decrease in harbor porpoise abundance in US waters, reducing their overlap with fisheries, and a decrease in gillnet effort.
- The increasing trend in gray seal bycatch may be related to an increase in the gray seal population (U.S. pup counts).

# Objectives: Protected species *Recover endangered populations*

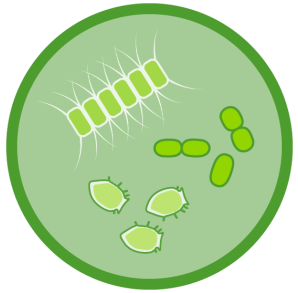
Indicators: North Atlantic right whale population, calf counts

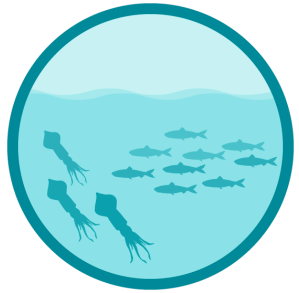


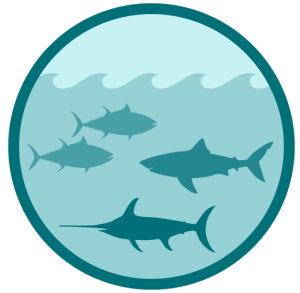

Implications:

- Population drivers for North Atlantic Right Whales (NARW) include combined fishery interactions/ship strikes, distribution shifts, and copepod availability.
- 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.
- Unusual mortality events continue for 3 large whale species.

# Risks to meeting fishery management objectives

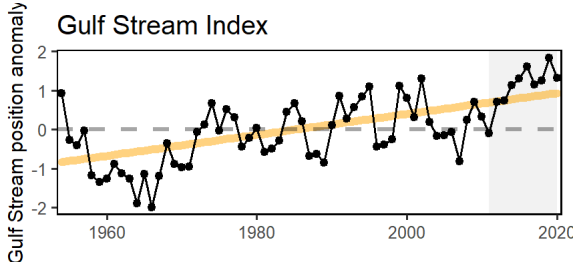


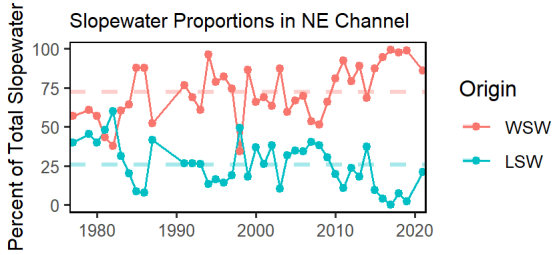


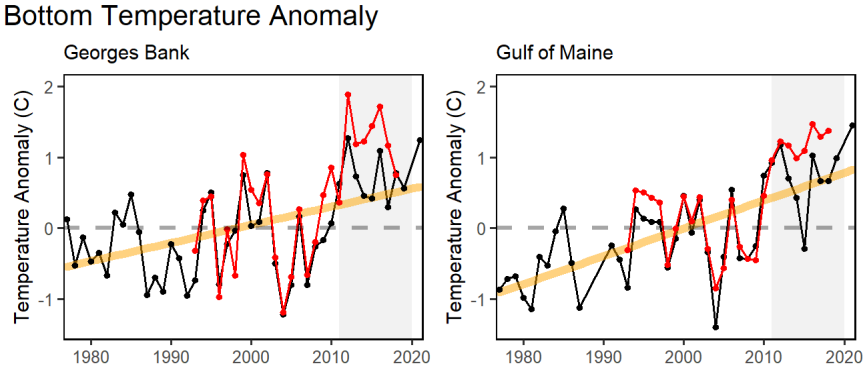


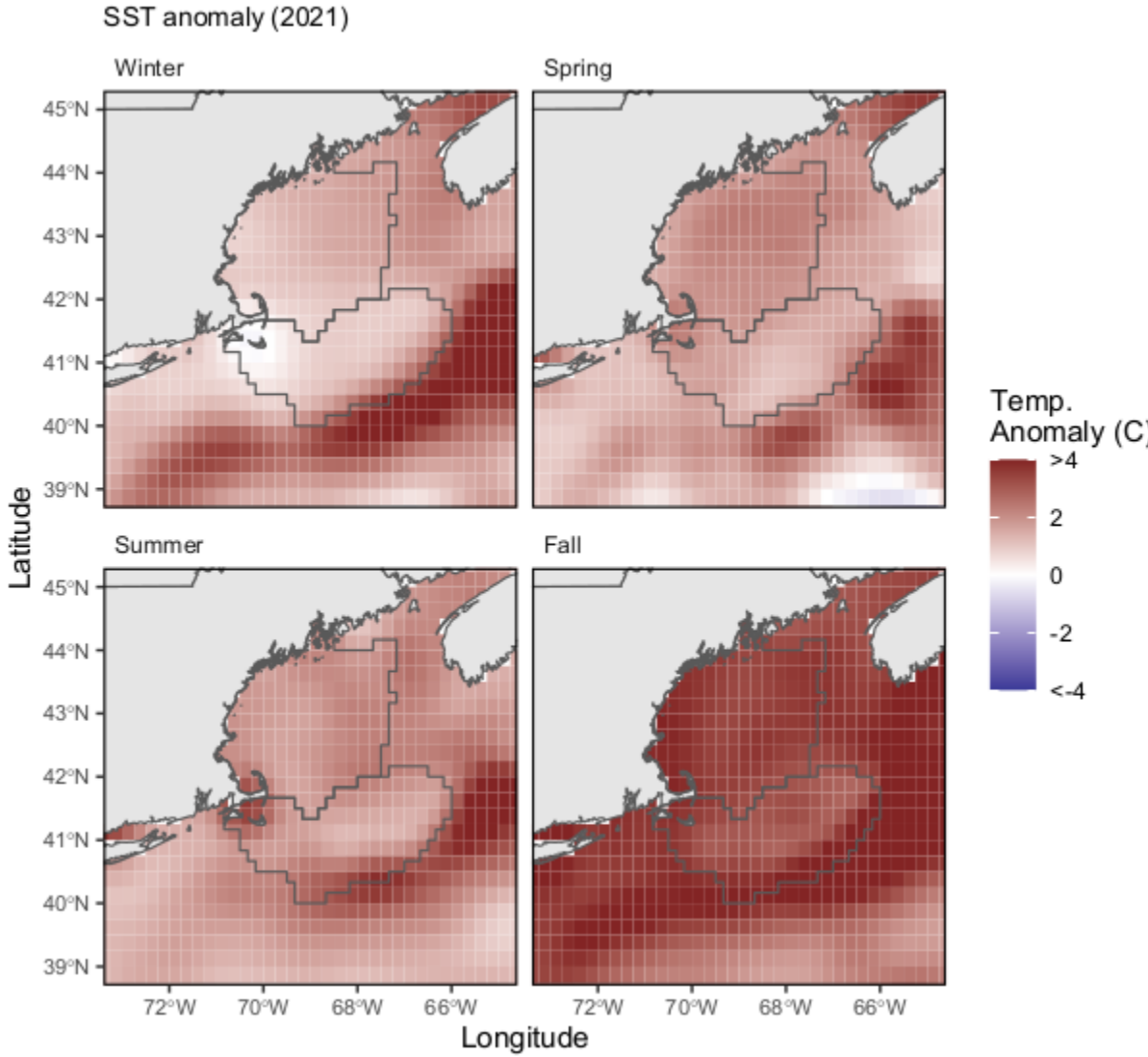
# Risks: Climate change

Indicators: ocean currents, bottom and surface temperature



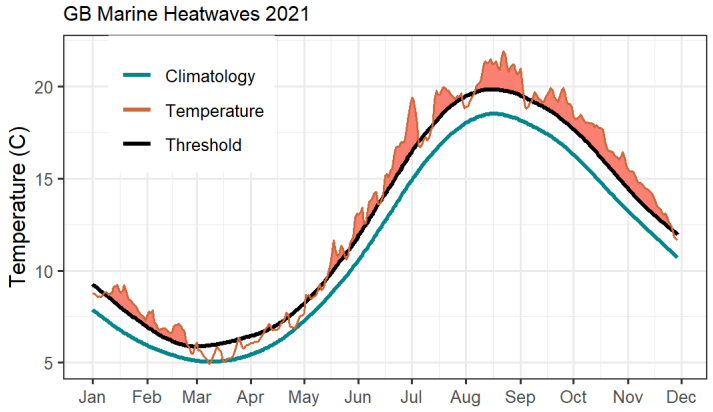



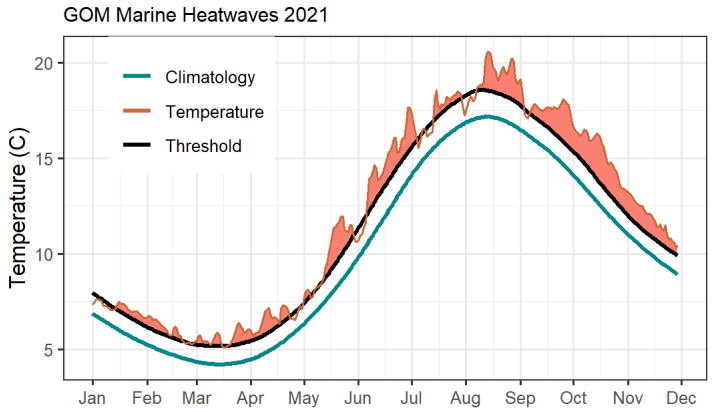



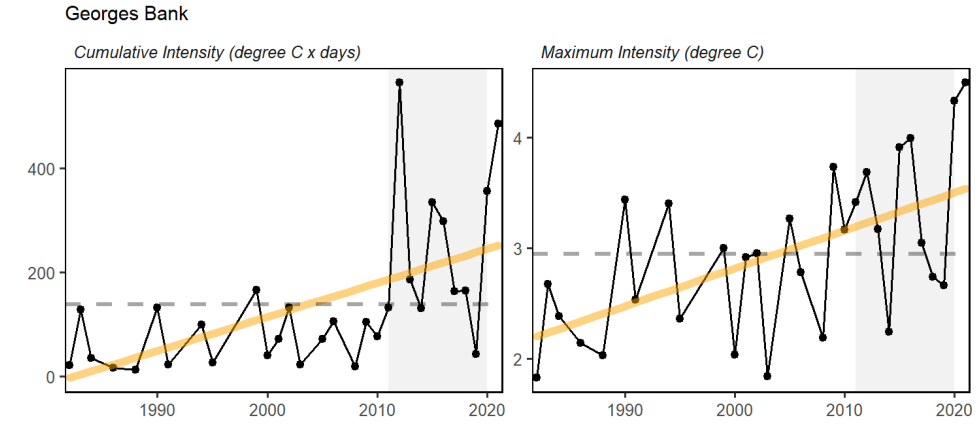



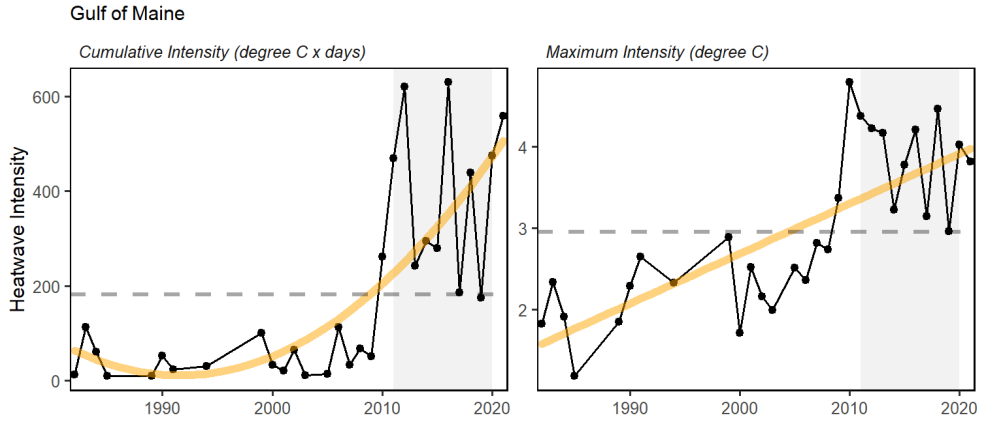
# Risks: Climate change

## Indicators: marine heatwaves



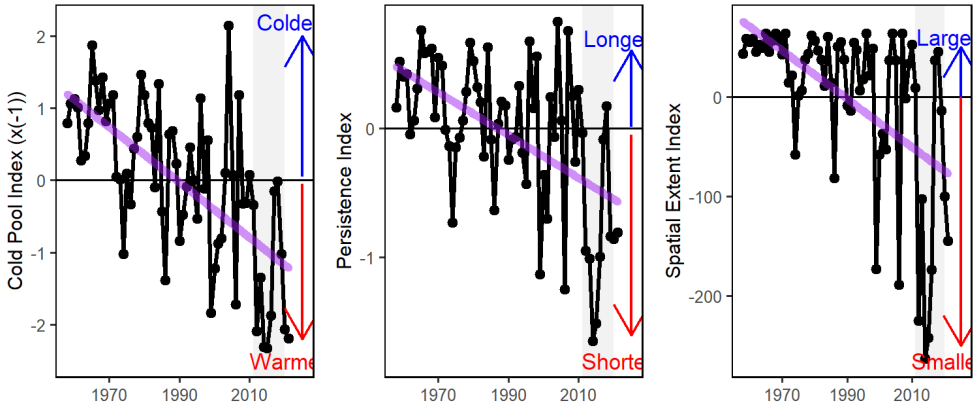



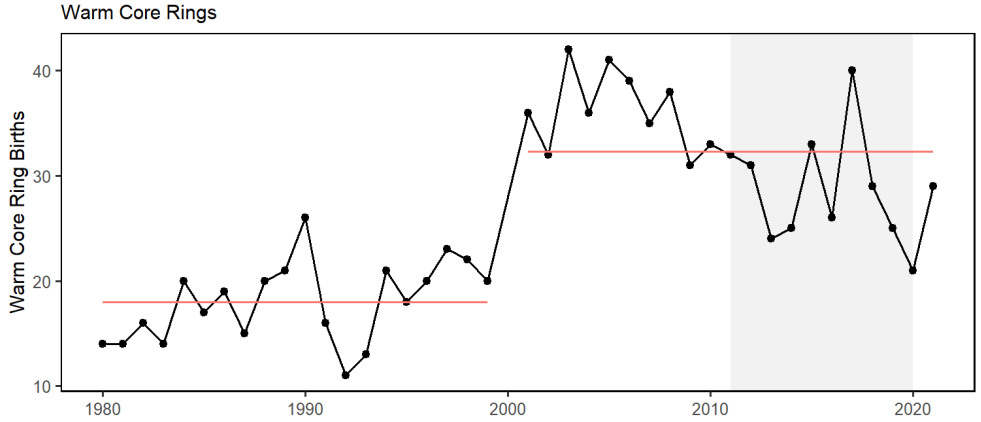



# Risks: Climate change and offshore habitat

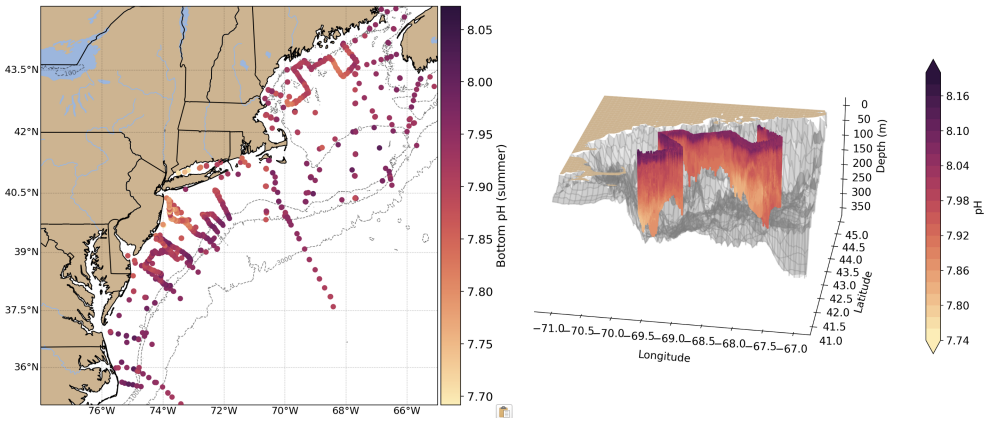
## Indicator: cold pool indices

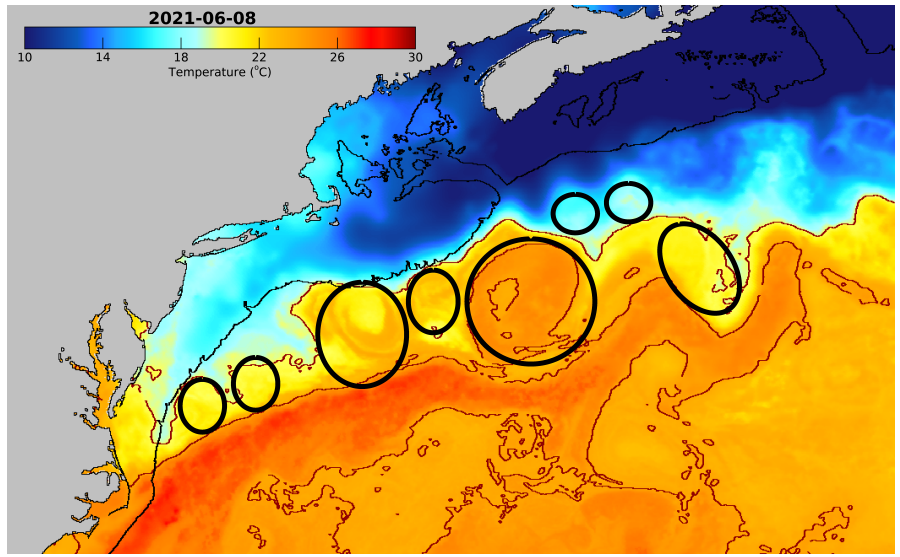



## Indicator: warm core rings



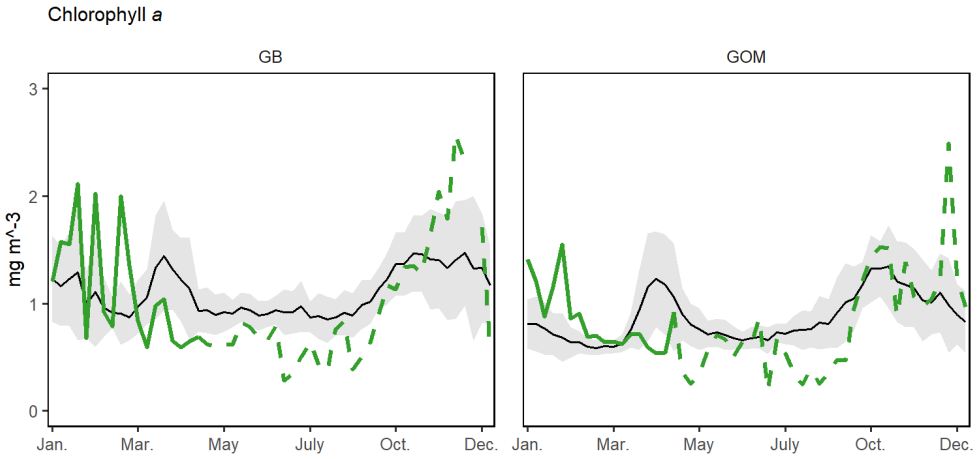

## Indicator: Ocean acidification

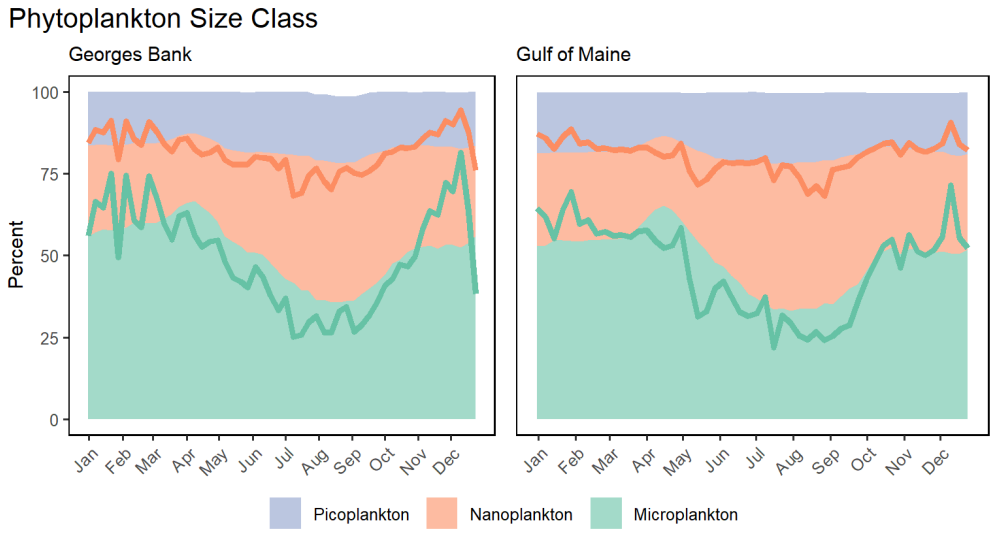


# Risks: Ecosystem productivity

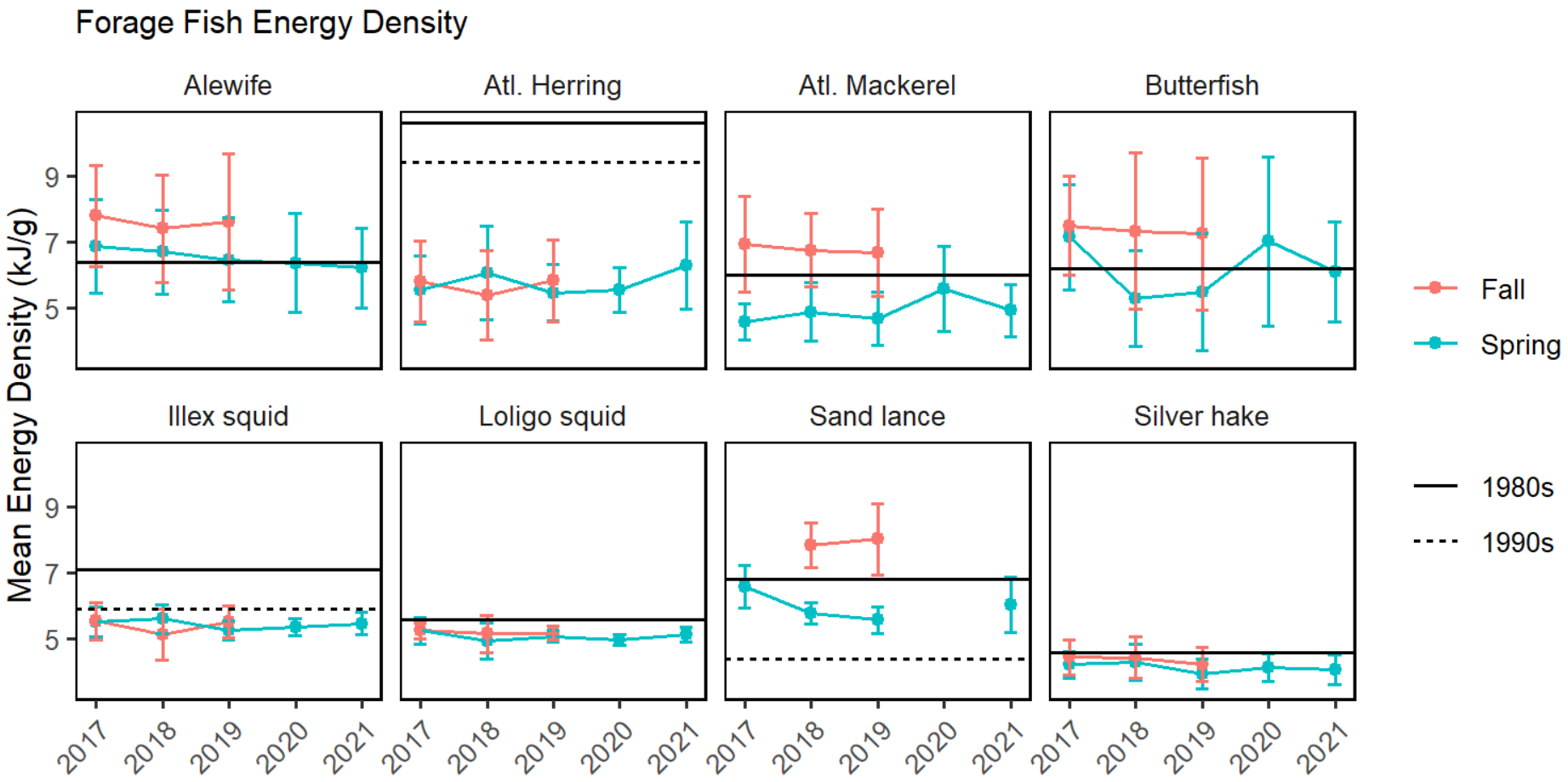
Indicators: chlorophyll, primary production




Implications: increased production by smaller phytoplankton implies less efficient transfer of primary production to higher trophic levels. Monitor implications of increasing gelatinous zooplankton and krill.

# Risks: Ecosystem productivity

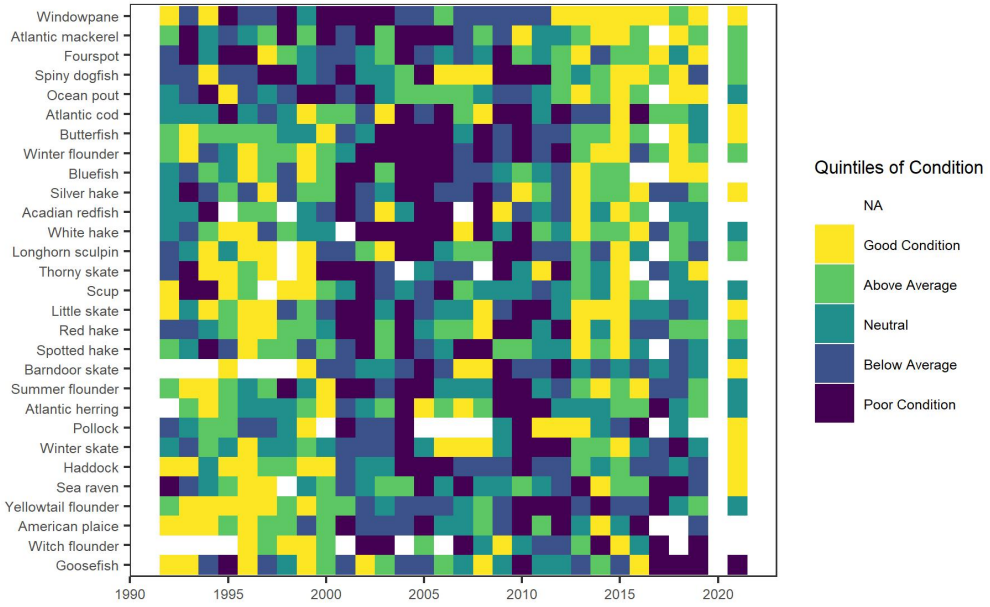



Implications: fluctuating environmental conditions and prey for forage species affect both abundance and energy content. Energy content varies by season, and has changed over time most dramatically for Atlantic herring

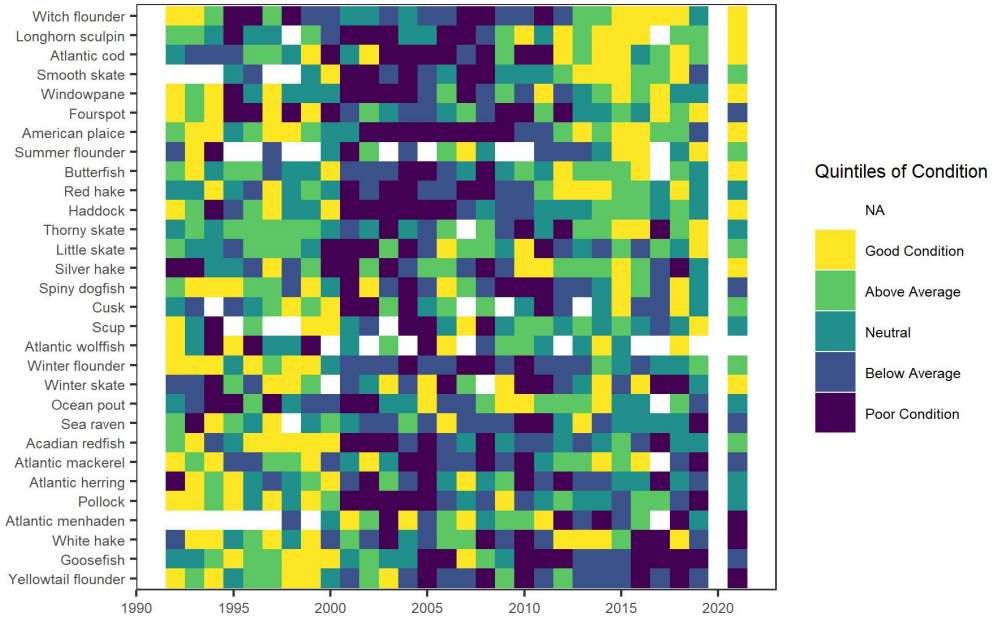
# Risks: Ecosystem productivity

Indicator: fish condition

## Georges Bank



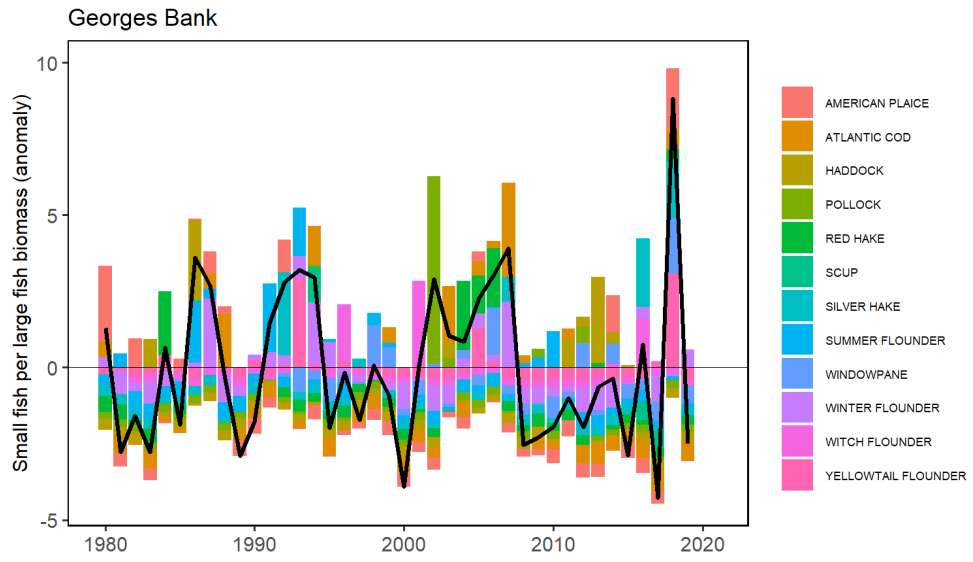

## Gulf of Maine



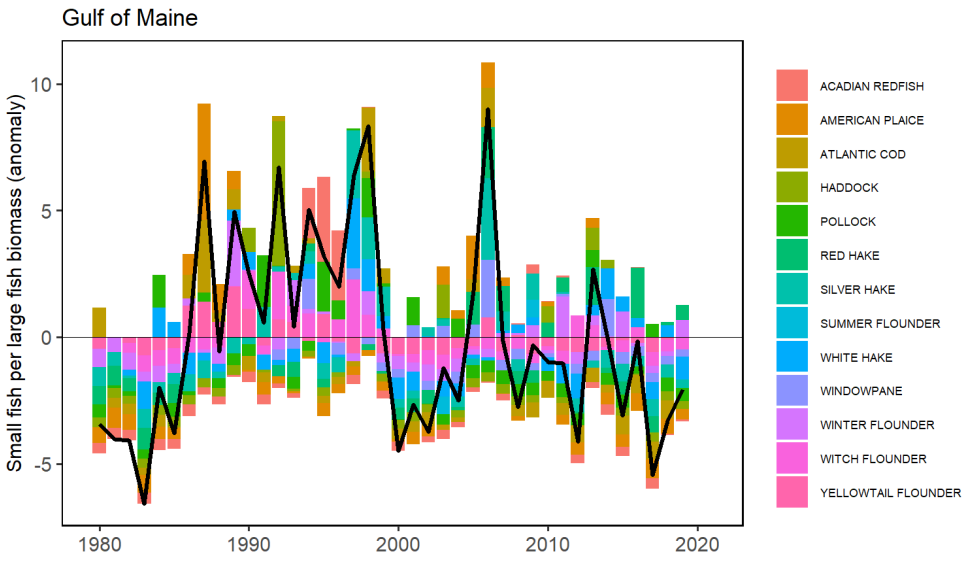

Implications: Many species in New England showed improved condition in 2021. Preliminary results of synthetic analyses show that changes in temperature, zooplankton, fishing pressure, and population size influence the condition of different fish species.

# Risks: Ecosystem productivity

## Indicator: fish productivity anomaly




Small fish per large fish biomass anomaly on Georges Bank. The summed anomaly across species is shown by the black line.

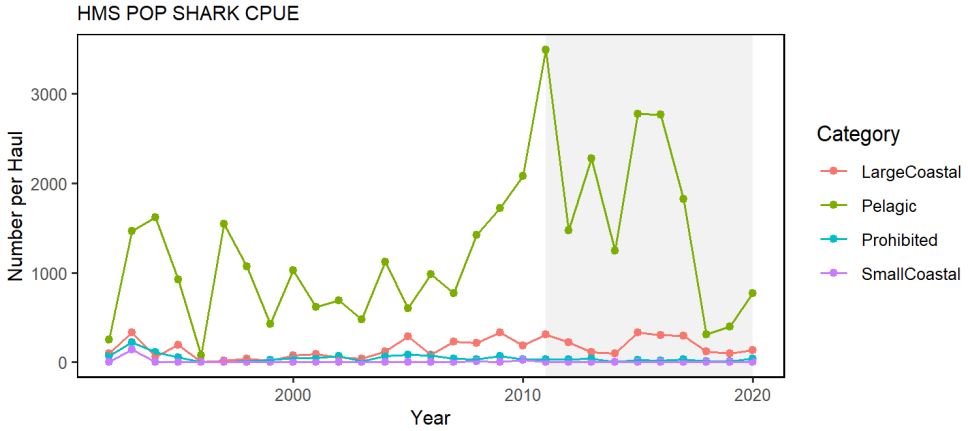



Small fish per large fish biomass anomaly in the Gulf of Maine. The summed anomaly across species is shown by the black line.

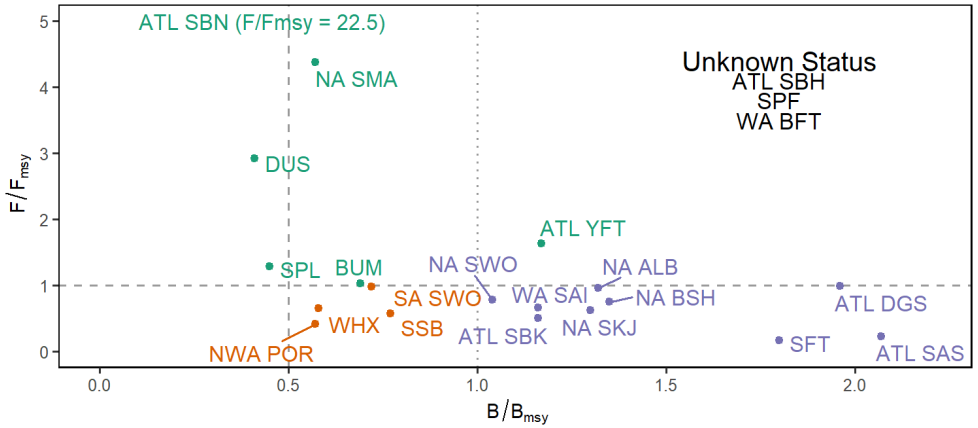
# Risks: Ecosystem structure

Indicators: distribution shifts, diversity, predator status and trends

*No trend in aggregate sharks*

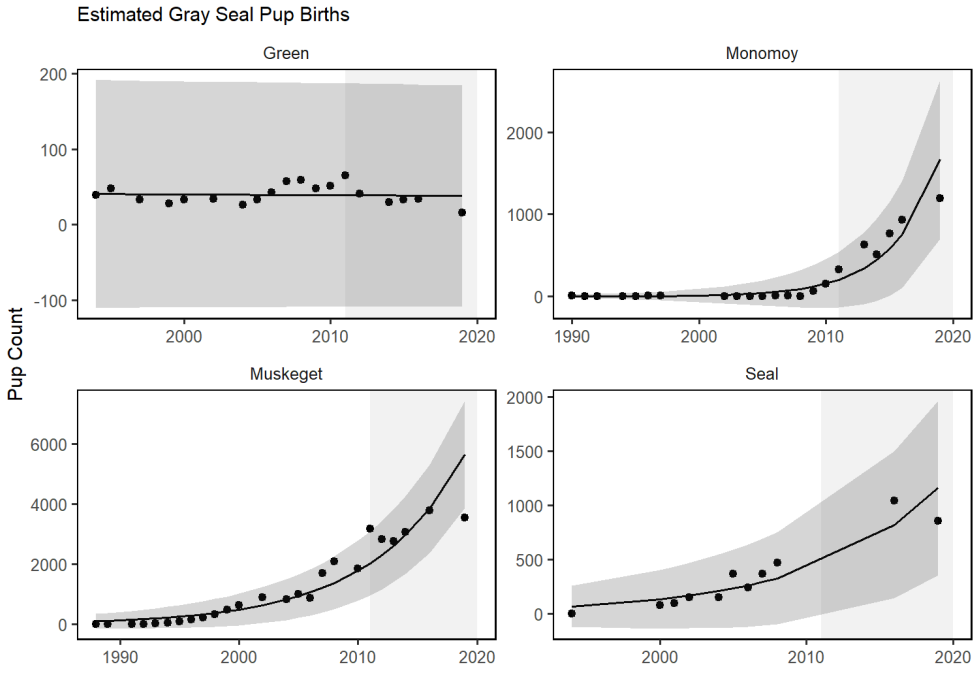



*HMS populations mainly at or above target*



# Risks: Ecosystem structure

Indicators: predators




*Gray seals increasing*

- Breeding season ~ 27,000 US gray seals, Canada's population ~ 425,000 (2016)
- Canada's population increasing at ~ 4% per year
- U.S. pupping sites increased from 1 (1988) to 9 (2019)
- Harbor and gray seals are generalist predators that consume more than 30 different prey species: red, white and silver hake, sand lance, yellowtail flounder, four-spotted flounder, Gulf-stream flounder, haddock, herring, redfish, and squids.

Implications: stable predator populations suggest stable predation pressure on managed species, but increasing predator populations may reflect increasing predation pressure.

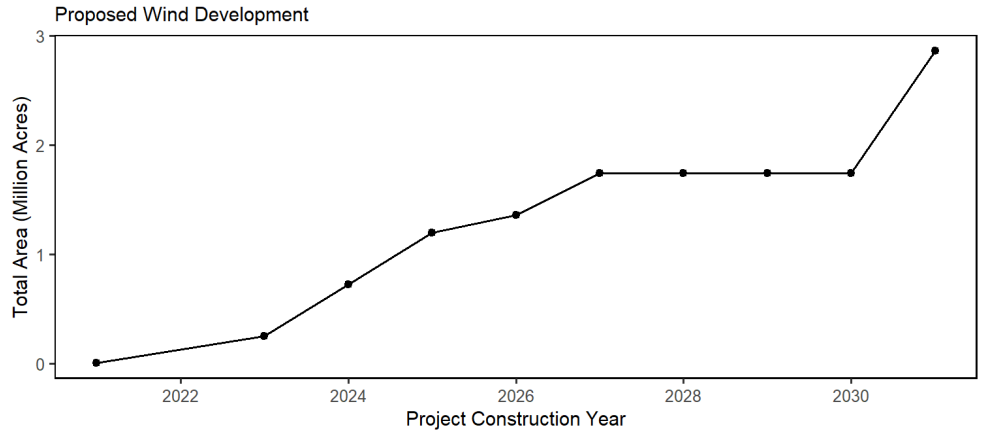
# Risks: Habitat climate vulnerability

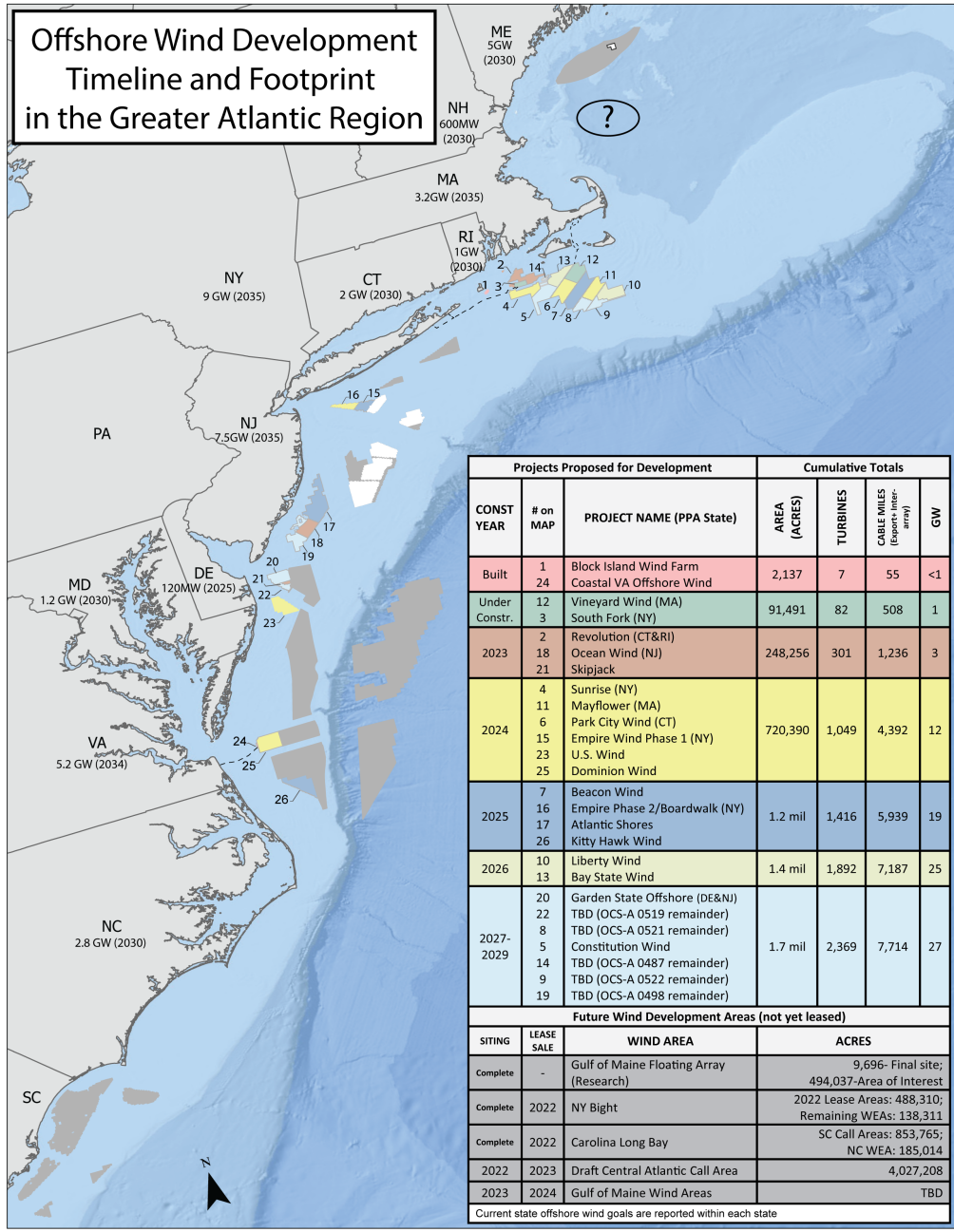
Indicators: climate sensitive species life stages mapped to climate vulnerable habitats

| Species | Stage | New England native salt marsh | Marine/estuarine intertidal shellfish reef | Marine/estuarine submerged aquatic vegetation | Marine kelp | Marine intertidal rocky bottom | Marine intertidal sand | Marine intertida mud |
|---|---|---|---|---|---|---|---|---|
| Alewife | Eggs/Larva | | | | | | | |
| Alewife | Juvenile/YOY | | | | | | | |
| Alewife | Adult | | | | | | | |
| Alewife | Spawning Adult | | | | | | | |
| Atlantic cod | Eggs/Larva | | | | | | | |
| Atlantic cod | Juvenile/YOY | | | High | | High | High | |
| Atlantic cod | Adult | | | High | | | High | |
| Atlantic cod | Spawning Adult | | | High | | | High | |

# Risks: Offshore Wind Development

## Indicators: development timeline




| Projects Proposed for Development | | | Cumulative Totals | | | |
|---|---|---|---|---|---|---|
| CONST YEAR | # on MAP | PROJECT NAME (PPA State) | AREA (ACRES) | TURBINES | CABLE MILES (Export+ Inter-array) | GW |
| Built | 1<br>24 | Block Island Wind Farm<br>Coastal VA Offshore Wind | 2,137 | 7 | 55 | <1 |
| Under Constr. | 12<br>3 | Vineyard Wind (MA)<br>South Fork (NY) | 91,491 | 82 | 508 | 1 |
| 2023 | 2<br>18<br>21 | Revolution (CT&RI)<br>Ocean Wind (NJ)<br>Skipjack | 248,256 | 301 | 1,236 | 3 |
| 2024 | 4<br>11<br>6<br>15<br>23<br>25 | Sunrise (NY)<br>Mayflower (MA)<br>Park City Wind (CT)<br>Empire Wind Phase 1 (NY)<br>U.S. Wind<br>Dominion Wind | 720,390 | 1,049 | 4,392 | 12 |
| 2025 | 7<br>16<br>17<br>26 | Beacon Wind<br>Empire Phase 2/Boardwalk (NY)<br>Atlantic Shores<br>Kitty Hawk Wind | 1.2 mil | 1,416 | 5,939 | 19 |
| 2026 | 10<br>13 | Liberty Wind<br>Bay State Wind | 1.4 mil | 1,892 | 7,187 | 25 |
| 2027-2029 | 20<br>22<br>8<br>5<br>14<br>9<br>19 | Garden State Offshore (DE&NJ)<br>TBD (OCS-A 0519 remainder)<br>TBD (OCS-A 0521 remainder)<br>Constitution Wind<br>TBD (OCS-A 0487 remainder)<br>TBD (OCS-A 0522 remainder)<br>TBD (OCS-A 0498 remainder) | 1.7 mil | 2,369 | 7,714 | 27 |

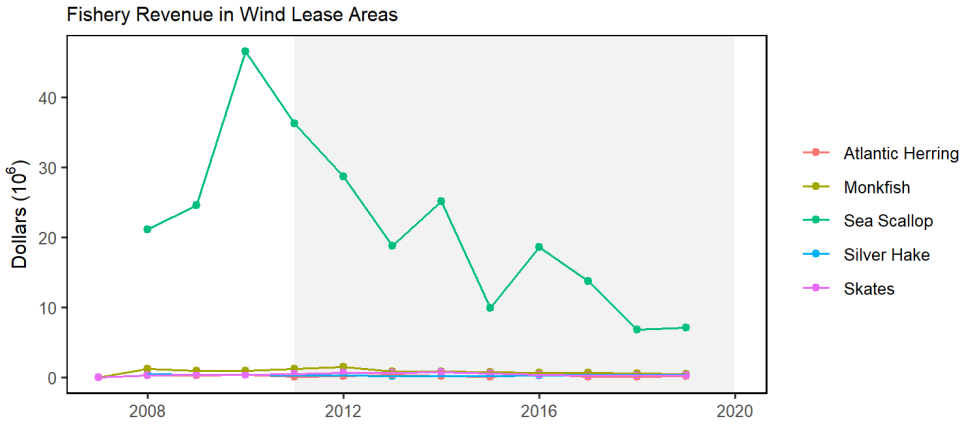
| Future Wind Development Areas (not yet leased) | | | |
|---|---|---|---|
| SITING | LEASE SALE | WIND AREA | ACRES |
| Complete | - | Gulf of Maine Floating Array (Research) | 9,696- Final site; 494,037-Area of Interest |
| Complete | 2022 | NY Bight | 2022 Lease Areas: 488,310; Remaining WEAs: 138,311 |
| Complete | 2022 | Carolina Long Bay | SC Call Areas: 853,765; NC WEA: 185,014 |
| 2022 | 2023 | Draft Central Atlantic Call Area | 4,027,208 |
| 2023 | 2024 | Gulf of Maine Wind Areas | TBD |

Current state offshore wind goals are reported within each state

Wind area boundaries, construction data and timelines are frequently updated.This map contains the most recent published information **as of 2/2/22**
Sources: South Fork Wind Farm FEIS, BOEM GIS data, BOEM Leasing Path Forward 2021-2025

# Risks: Offshore Wind Development

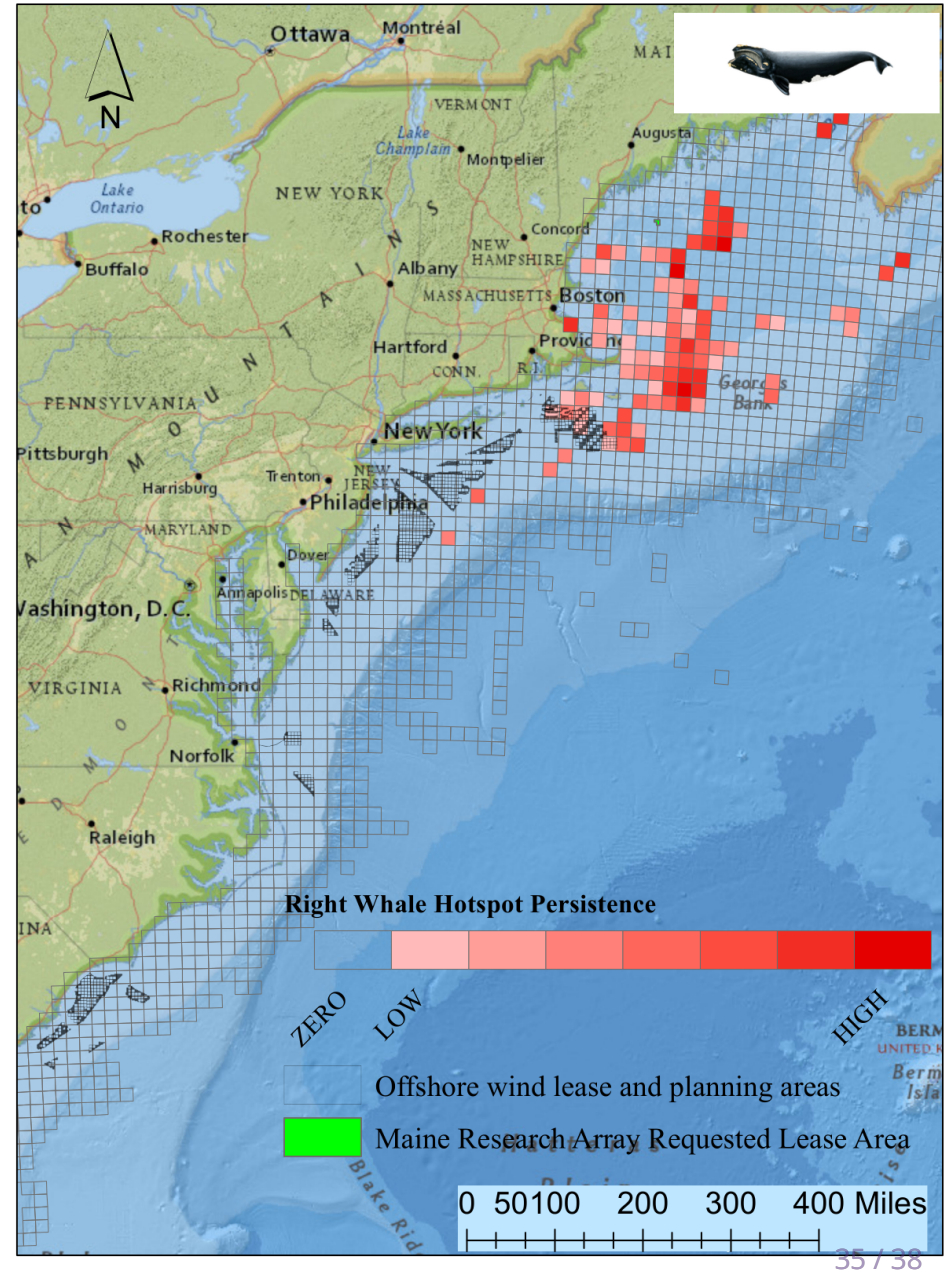
Indicators: fishery and community specific revenue in lease areas



# Risks: Offshore Wind Development

Implications:

- 2-69% of port revenue from fisheries currently comes from areas proposed for offshore wind development. Some communities have environmental justice concerns and gentrification vulnerability.
- Up to 12% of annual commercial landings and revenue for major New England species occur in lease areas.
- Development will affect species differently, negatively affecting species that prefer soft bottom habitat while potentially benefiting species that prefer hard structured habitat.
- Planned wind areas overlap with one of the only known right whale foraging habitats, and altered local oceanography could affect right whale prey availability. Development also brings increased vessel strike risk and the potential impacts of pile driving noise.



# Contributors - THANK YOU!

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NOAA FISHERIES
National Oceanic and Atmospheric Administration

# References

Bastille, K. et al. (2020). "Improving the IEA Approach Using Principles of Open Data Science". In: *Coastal Management* 0.0. Publisher: Taylor & Francis _ eprint: https://doi.org/10.1080/08920753.2021.1846155, pp. 1-18. ISSN: 0892-0753. DOI: 10.1080/08920753.2021.1846155. URL: https://doi.org/10.1080/08920753.2021.1846155 (visited on Dec. 09, 2020).

DePiper, G. S. et al. (2017). "Operationalizing integrated ecosystem assessments within a multidisciplinary team: lessons learned from a worked example". En. In: *ICES Journal of Marine Science* 74.8, pp. 2076-2086. ISSN: 1054-3139. DOI: 10.1093/icesjms/fsx038. URL: https://academic.oup.com/icesjms/article/74/8/2076/3094701 (visited on Mar. 09, 2018).

# Additional resources

- ecodata R package
- Visualizations:
  - New England Human Dimensions indicators
  - New England Macrofauna indicators
  - New England Lower trophic level indicators
- SOE Technical Documentation
- Draft indicator catalog

- Slides available at https://noaa-edab.github.io/presentations
- Contact: Sean.Lucey@noaa.gov

# Discussion

1. Feedback on State of the Ecosystem report
2. Feedback on Memo points
    - 1 to 7 included in SOE
    - 7 to 27 in progress
    - 28 to 45 less progress
3. Prorities for 2023 and future reports

# Thank you!