2023 Jonah Crab Benchmark Stock Assessment

October 16, 2023

Acknowledgments

- Jonah Crab Technical Committee:
  - Derek Perry (Chair), MA DMF
  - Kathleen Reardon, ME DMR
  - Joshua Carloni, NHF&G
  - Burton Shank, NMFS
  - Allison Murphy, NMFS
  - Corinne Truesdale, RI DEM
  - Chris Scott, NY DEC
  - Chad Power, NJ DFW
  - Craig Weedon, MD DNR
  - Somers Smott, VMRC

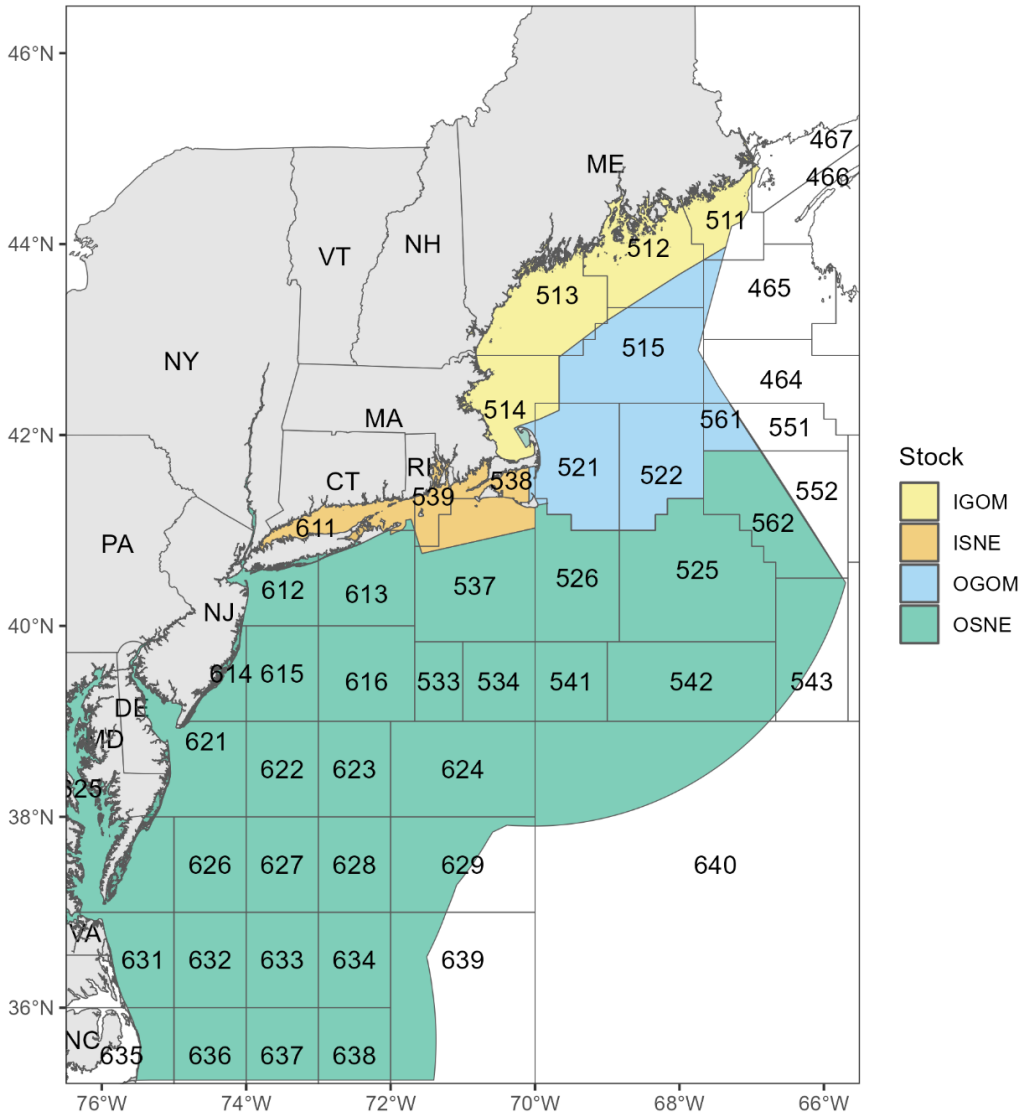
- Jonah Crab Stock Assessment Subcommittee:
  - Joshua Carloni (Chair), NHF&G
  - Derek Perry, MA DMF
  - Kathleen Reardon, ME DMR
  - Burton Shank, NMFS
  - Corinne Truesdale, RI DEM
  - Jeremy Collie, URI
  - Jeff Kipp, ASMFC

Outline

- Stock Structure
- Fishery Characterization
- Available Data
- Stock Status

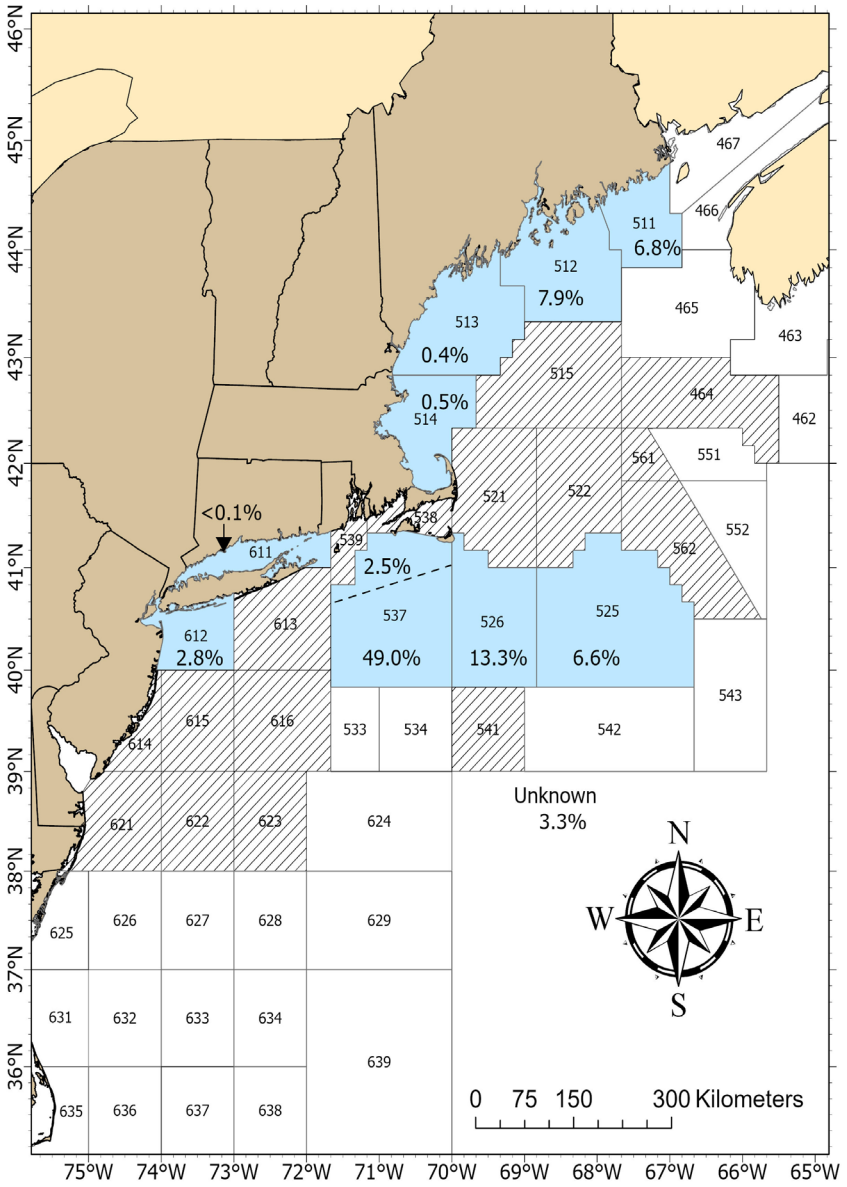
Stock Structure

- Four stocks
  - Biological aspects
  - Management considerations
  - Fishery characteristics
  - Data availability



Fishery Characterization

- Provides detailed background of fisheries for context on drivers of catch and challenges quantifying effort
- Nature of fisheries by state
  - Low catch per trip indicative of bycatch fisheries in GOM areas and ISNE
  - High number of participants indicative of potential for growth in IGOM
  - High catch per trip indicative of targeted fishery OSNE
- Coastwide landings concentrated in a few statistical areas in targeted fishery through time
- Catch fluctuates due to various drivers confounding interpretation of landings trends



Available Data

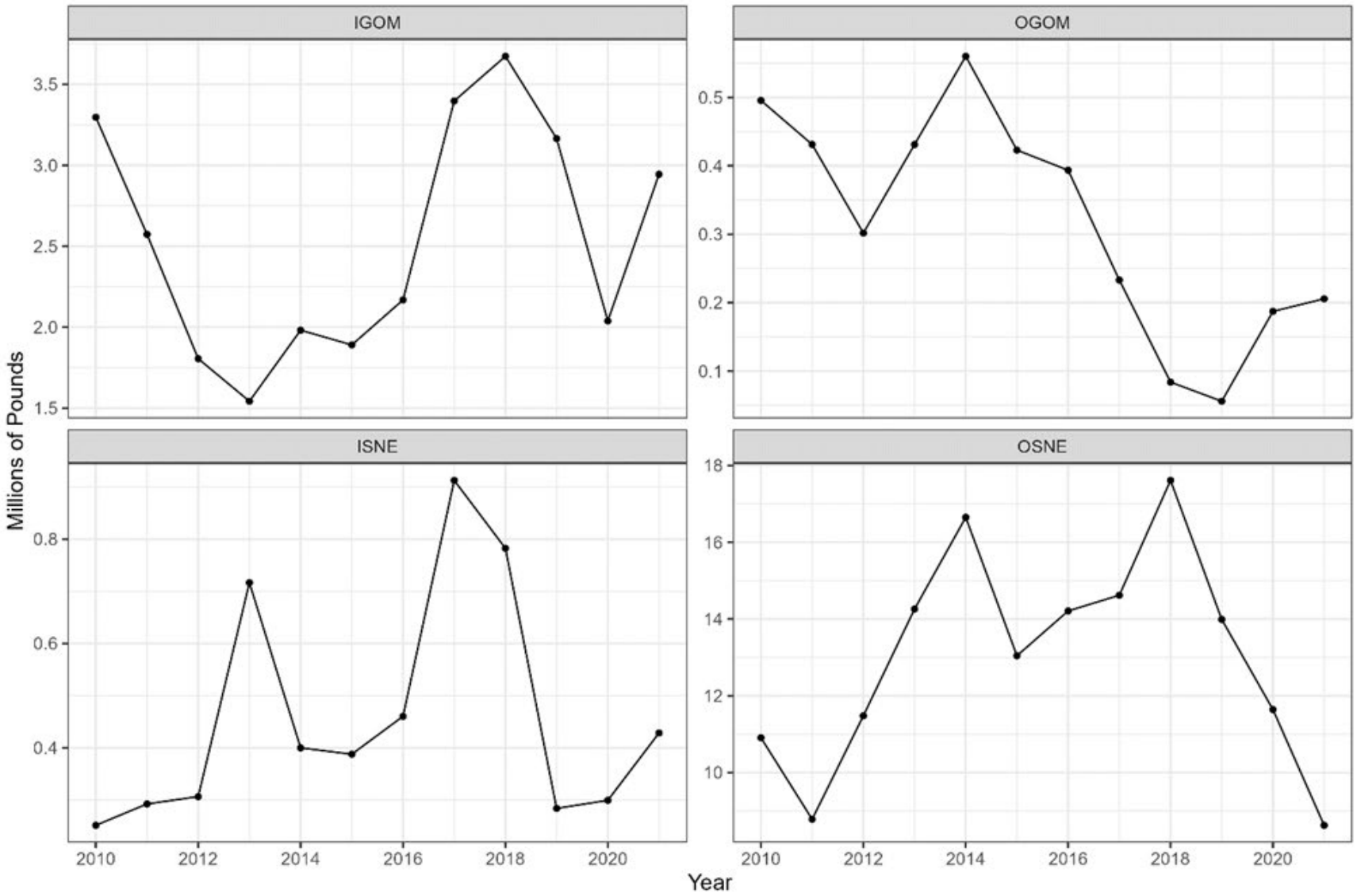
- Fishery-dependent data

- Fishery-independent data

Fishery-Dependent Data

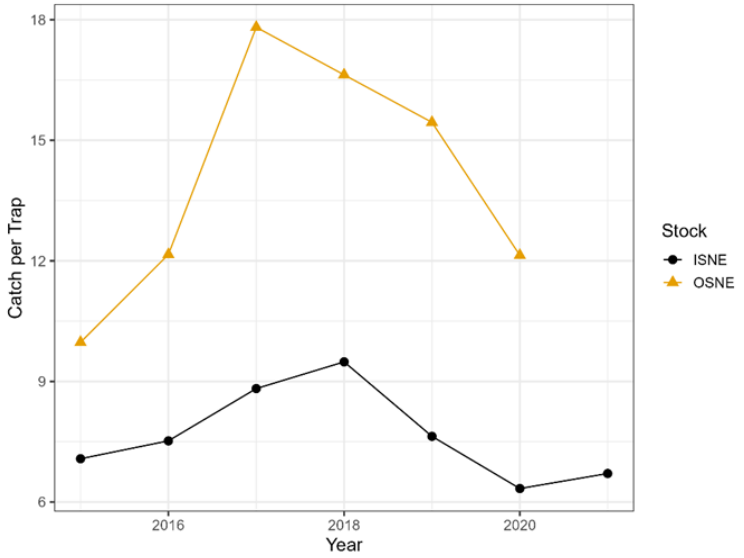
- Landings
- Participation (trips and permits)
- Catch rates
- Size structure

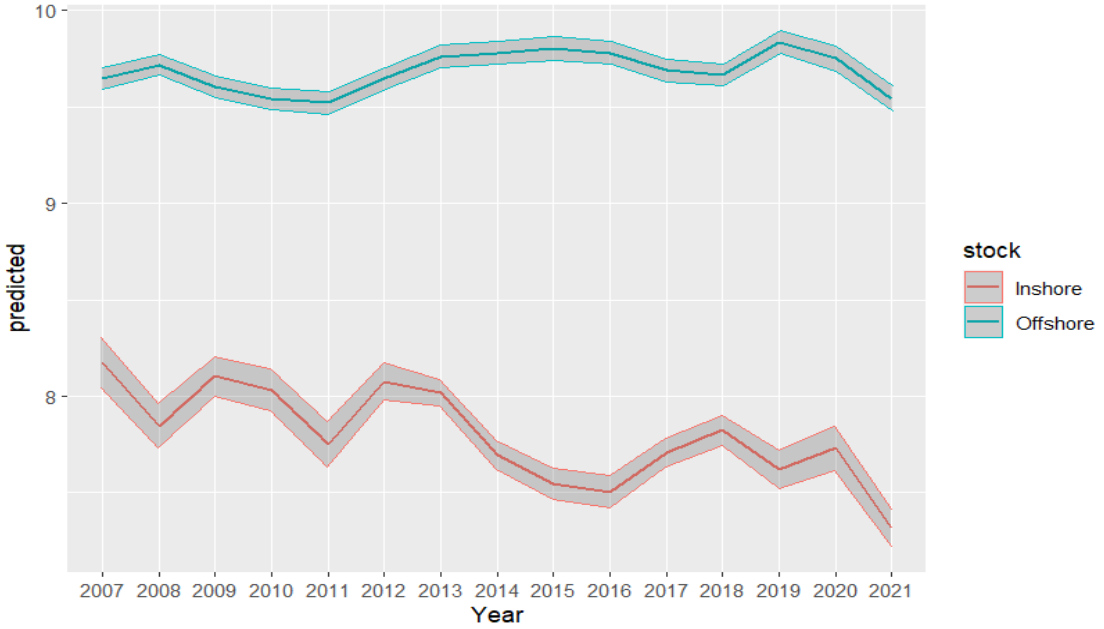
Landings


IGOM
OGOM
ISNE
OSNE
Millions of Pounds
Year
3.5
3.0
2.5
2.0
1.5
0.5
0.4
0.3
0.2
0.1
0.8
0.6
0.4
18
16
14
12
10
2010
2012
2014
2016
2018
2020

Catch Rates

- CFRF VTS CPUE
- DRM CPUE
- Reference Fleet CPUE





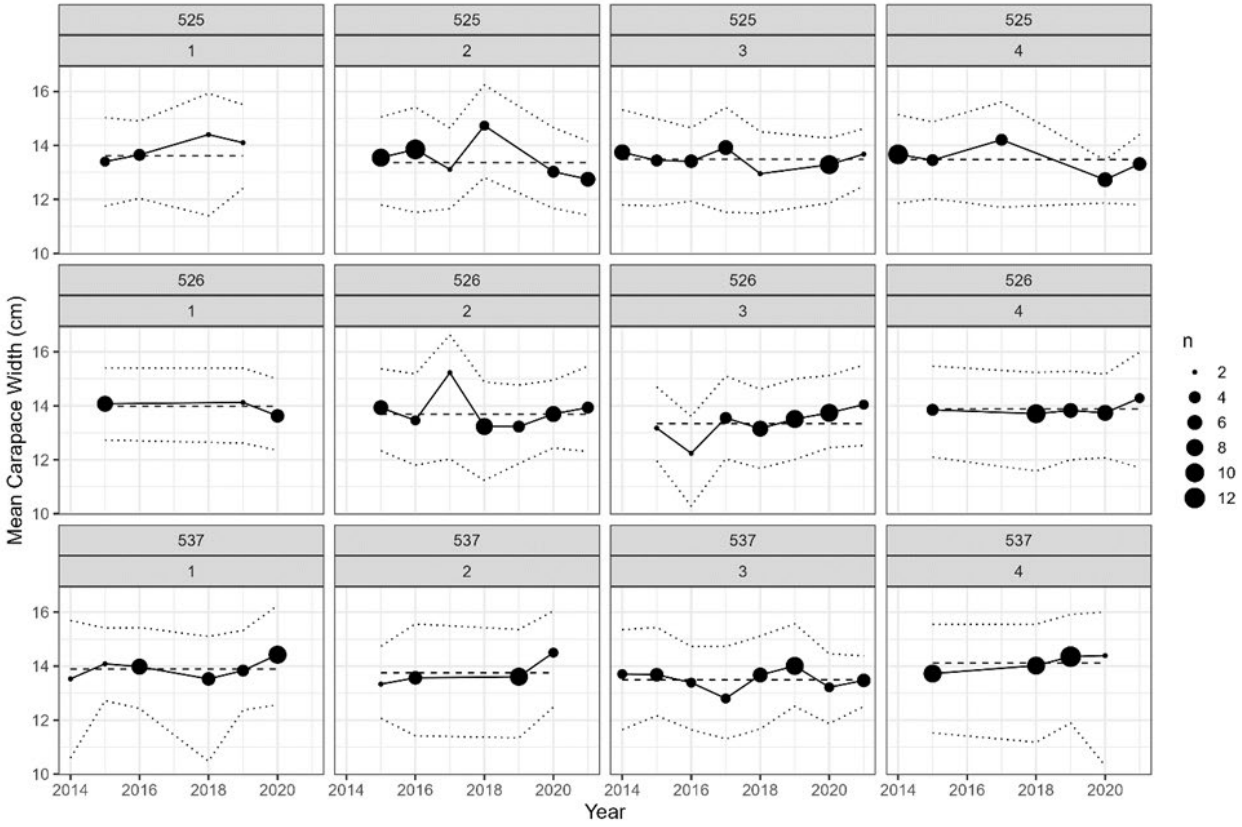
Size Structure

- Biosampling data from ME, NH, MA, RI, NY, MD, CFRF, and NOAA Fisheries

- Summary statistics calculated as potential exploitation indicators
  - Data too limited for stockwide statistics
  - Mean size of males by statistical area
  - Mean size of the 5% largest males by statistical area

Size Structure

- Size structure generally stable
- Favorable exploitation status or indicators unreliable for measuring exploitation changes?
- Not recommended for indicators, but should be revisited in future assessments



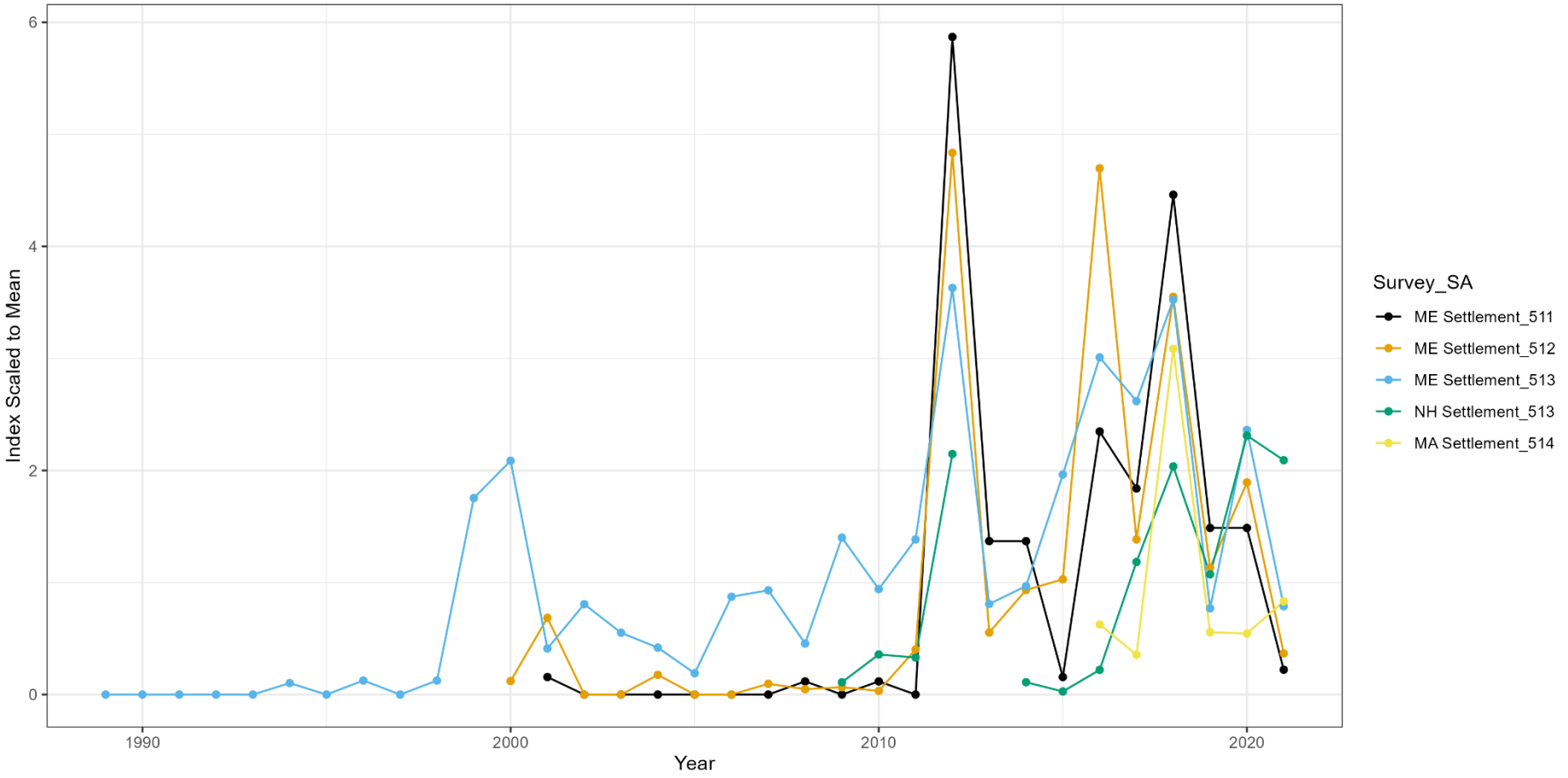
Fishery-Independent Data

- Settlement Survey Indices

- Trawl Survey Indices
  - Recruit abundance
  - Exploitable abundance
  - Spawning abundance

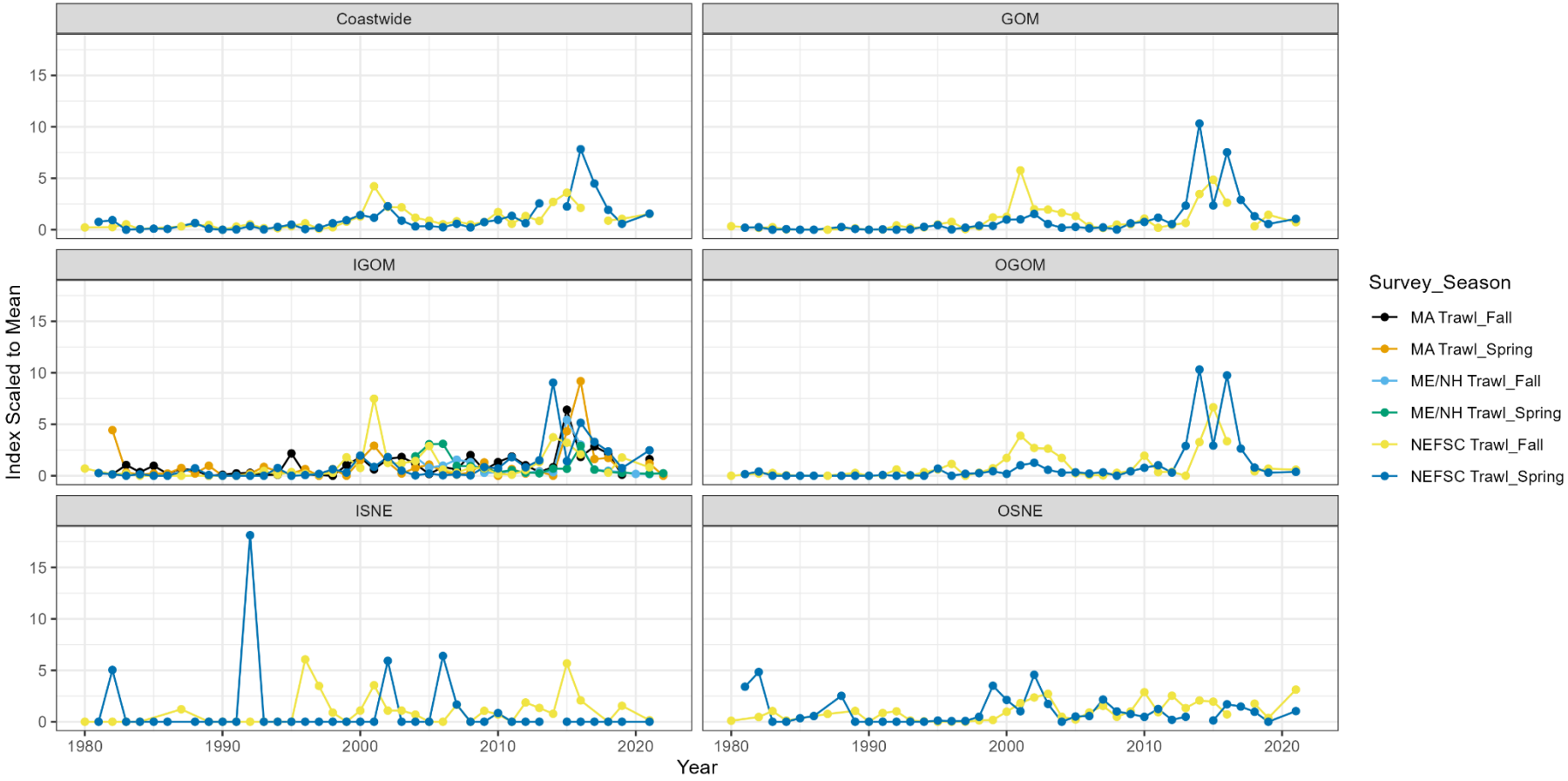
Settlement Survey Indices

- <13mm CW
- All IGOM



Recruit Abundance Indices

- Males 90-119mm CW
- cm bins expected to molt to legal size

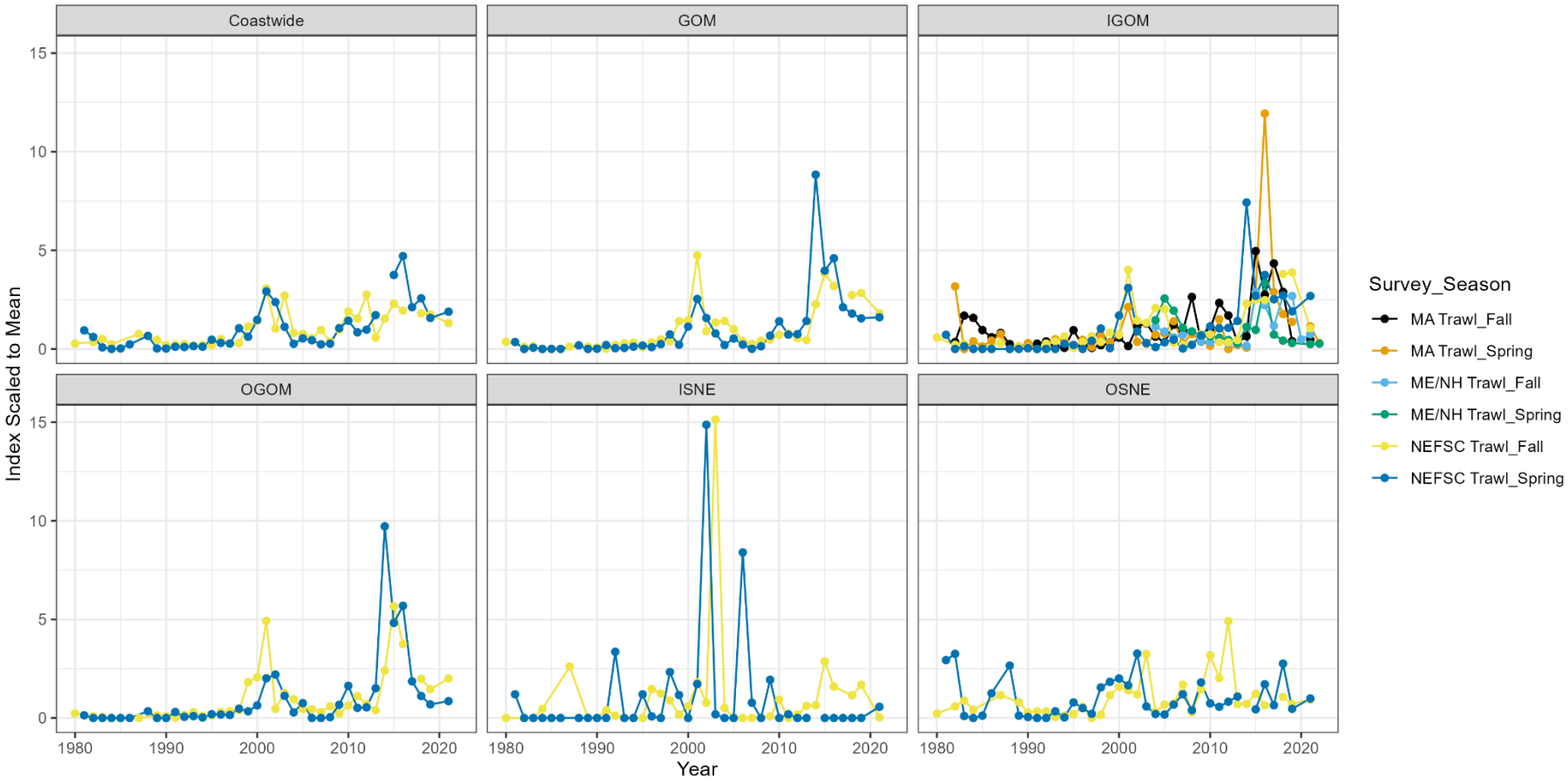


Exploitable Abundance Indices

- Males 120+mm CW
- cm bins inclusive of legal size

Spawning Abundance Indices

- Females 80+mm CW
- cm bins inclusive of SM50 estimates



Methods Stock Status

- Index-*Based Methods*-*Explored, but did not recommend for stock status*.

- Stock Indicators

Stock Indicators

- **Abundance indicators**
  - YOY settlement
  - Recruit abundance (males 90-119mm)
  - Exploitable abundance (males 120+)
  - Spawning abundance (females 80+)

- **Fishery performance indicators**
  - Landings
  - Number and proportion of trips landing Jonah crab
  - Number and proportion of active permits landing Jonah crab
  - Interpreted as measure of fishery performance

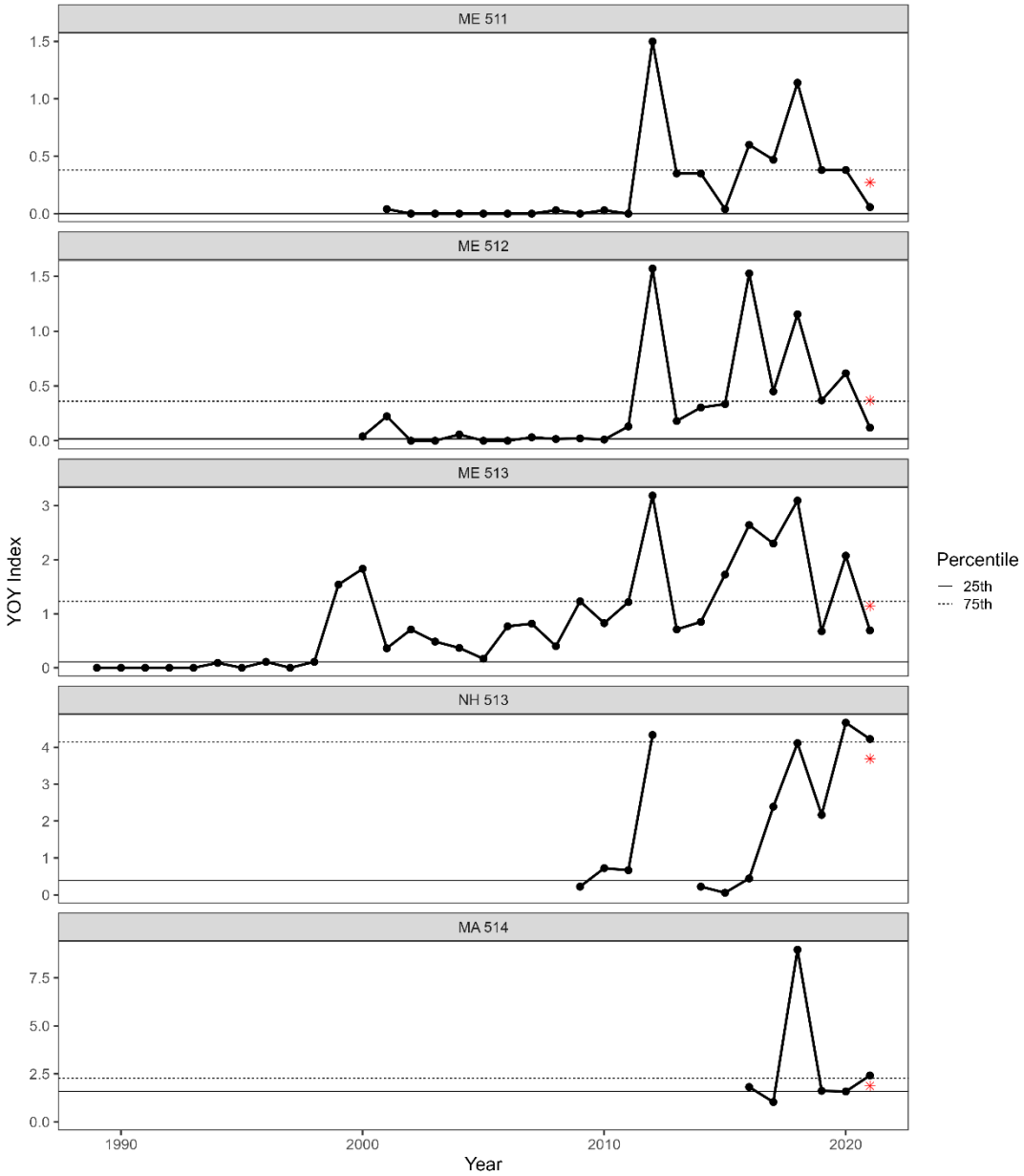
- Positive if above 75th percentile, neutral if between 75th and 25th percentiles, negative if below 25th percentile

- Terminal indicator condition = 2019-2021 average compared to percentiles

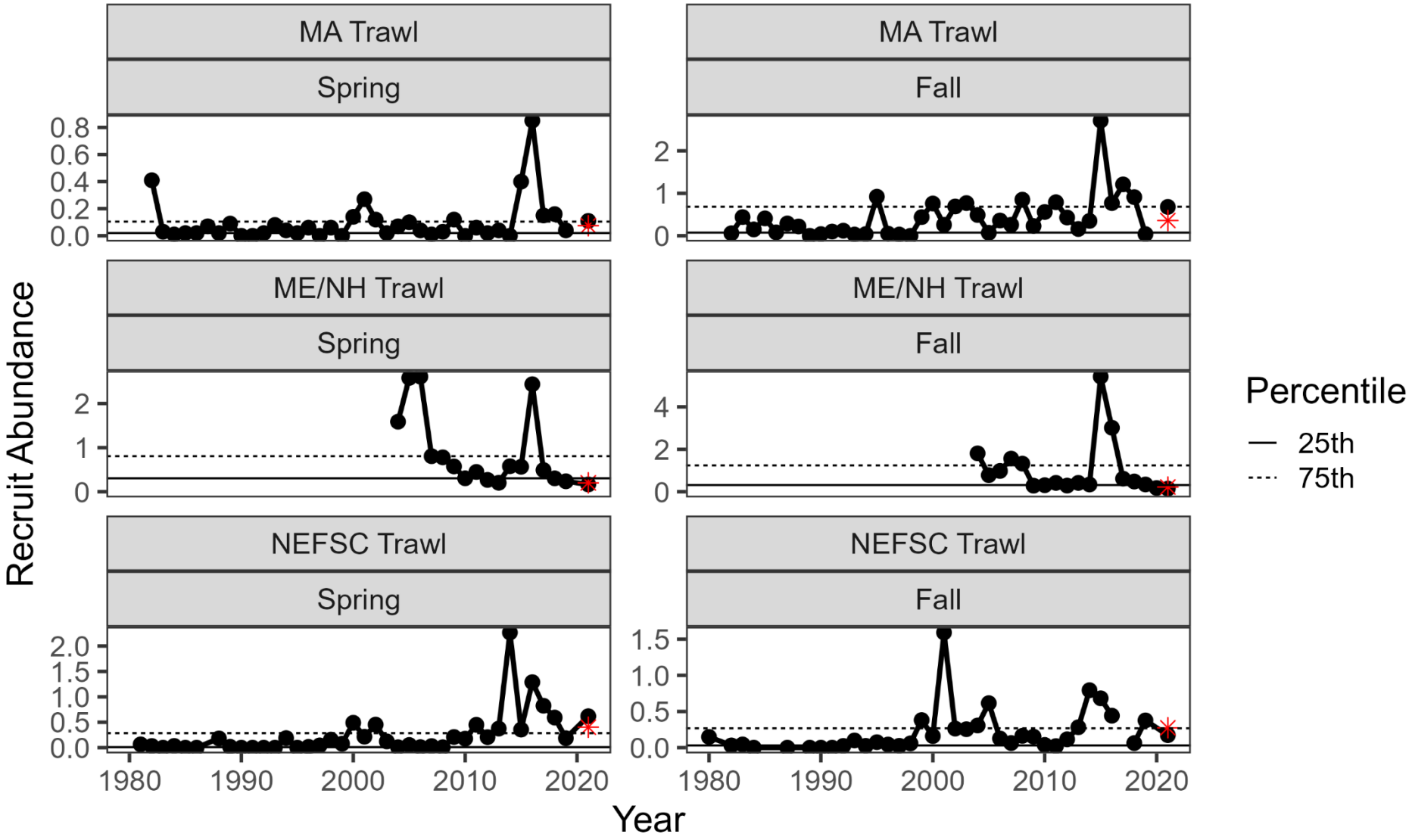
Stock Indicators - Abundance

- **Abundance indicators**
  - YOY settlement
  - Recruit abundance (males 90-119mm)
  - Exploitable abundance (males 120+)
  - Spawning abundance (females 80+)

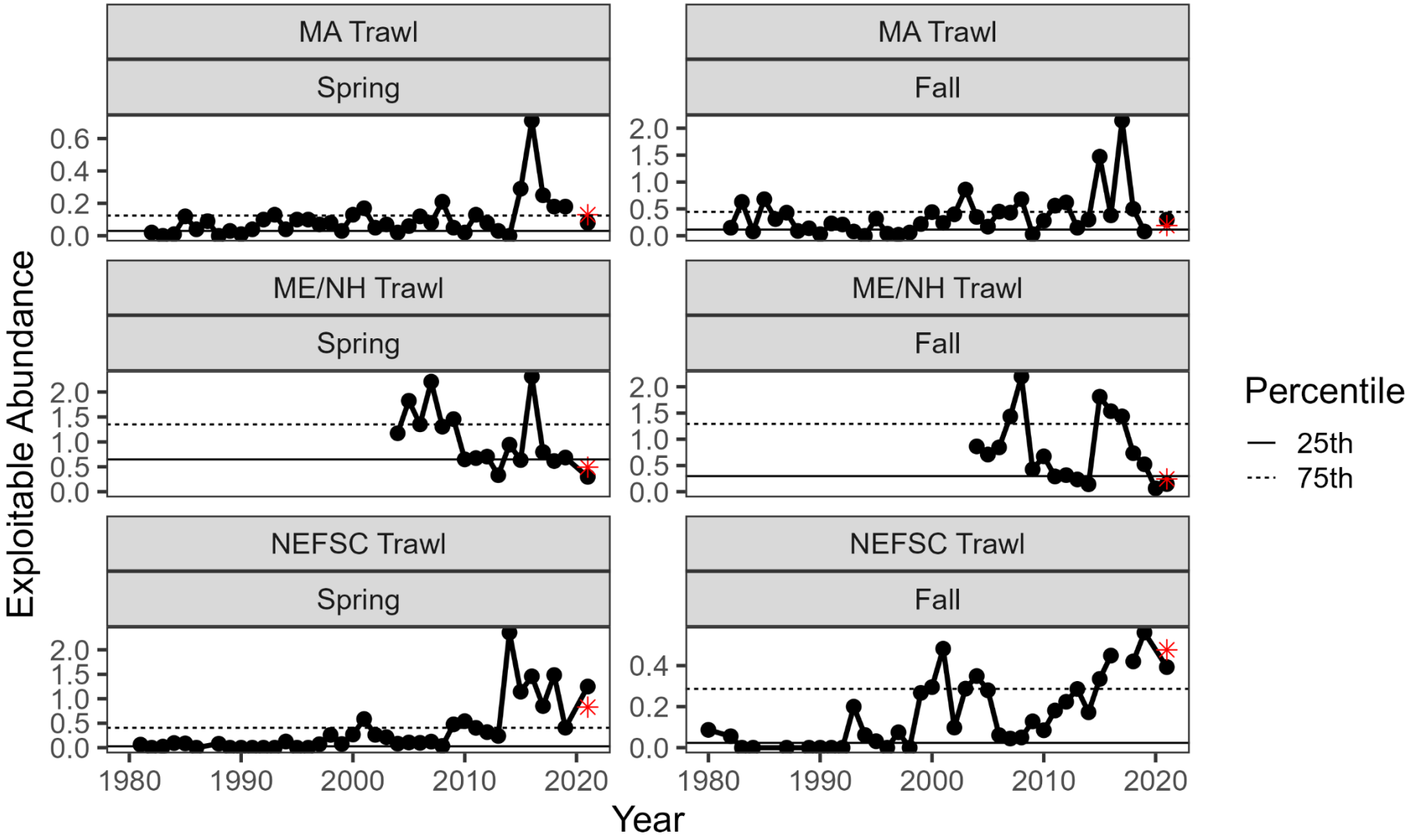
IGOM YOY Settlement



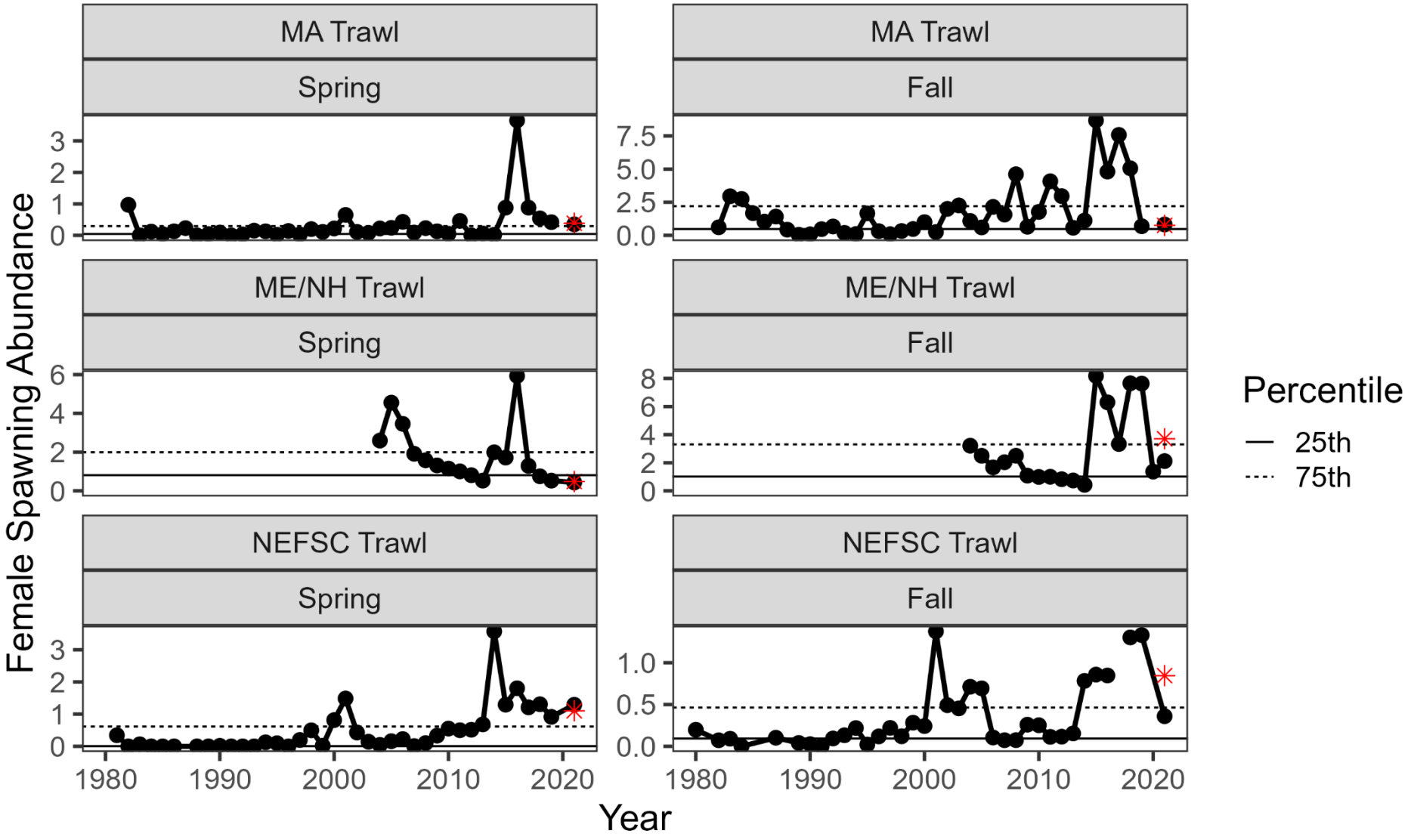
IGOM Recruit Abundance



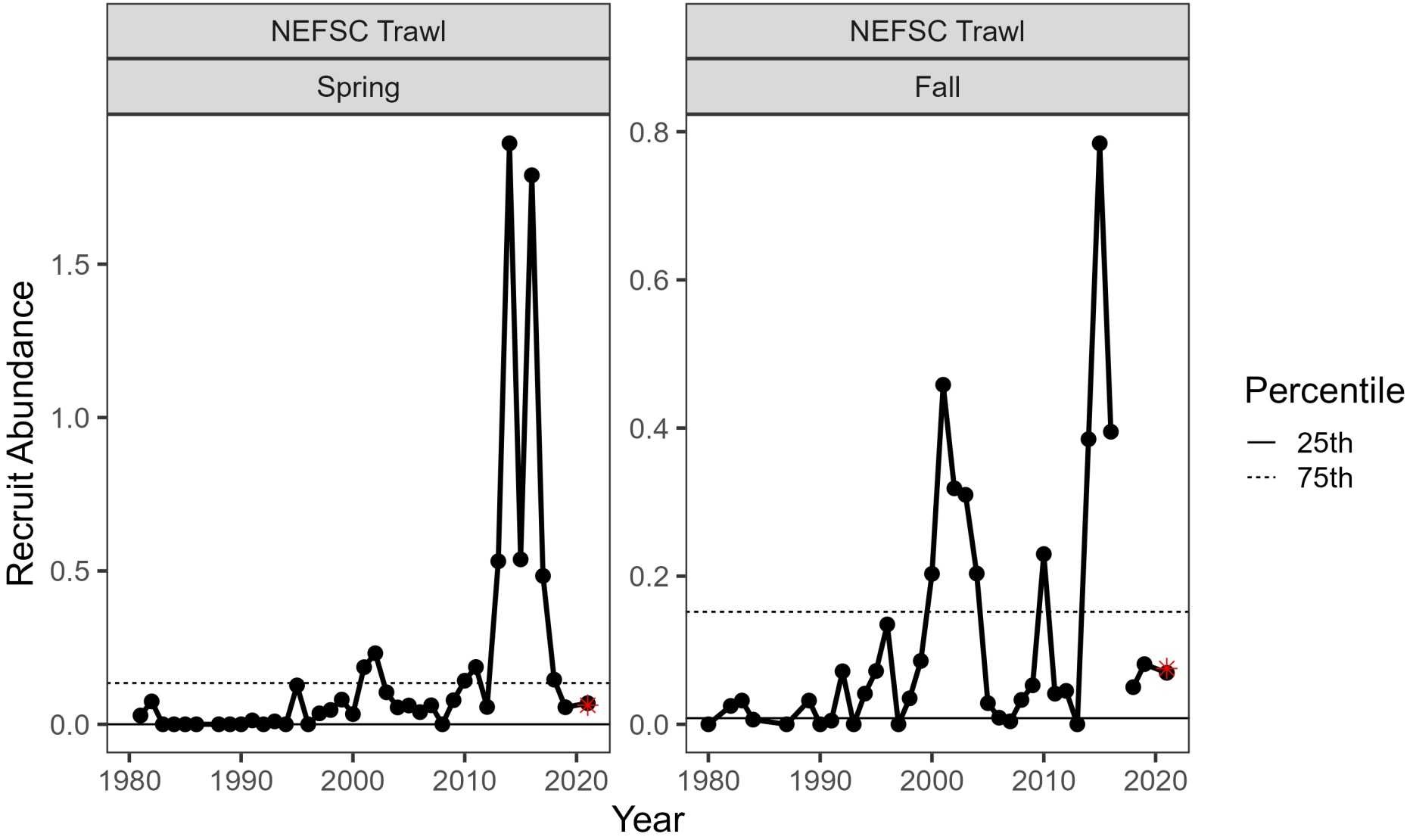
IGOM Exploitable Abundance



IGOM Spawning Abundance



OGOM Recruit Abundance



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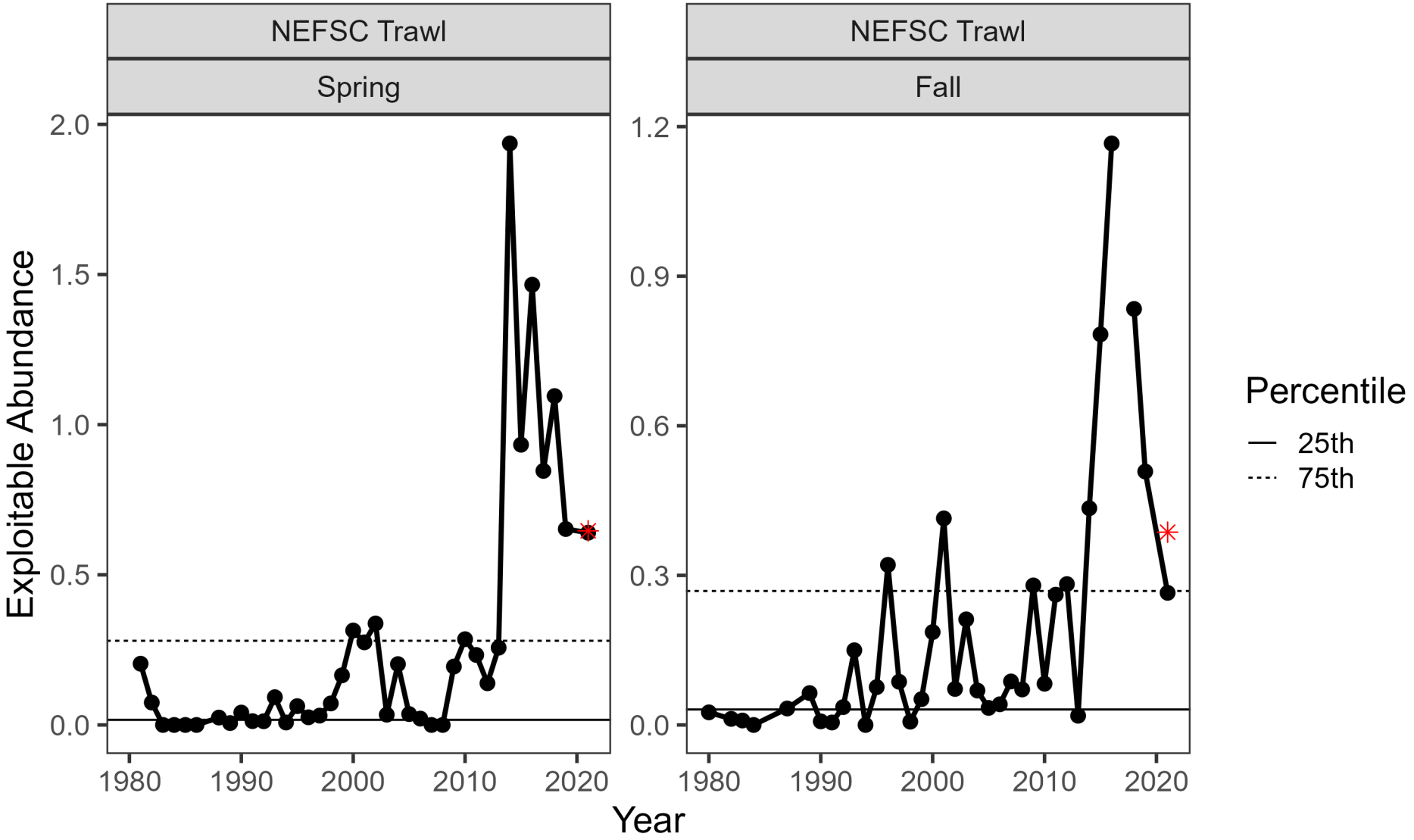
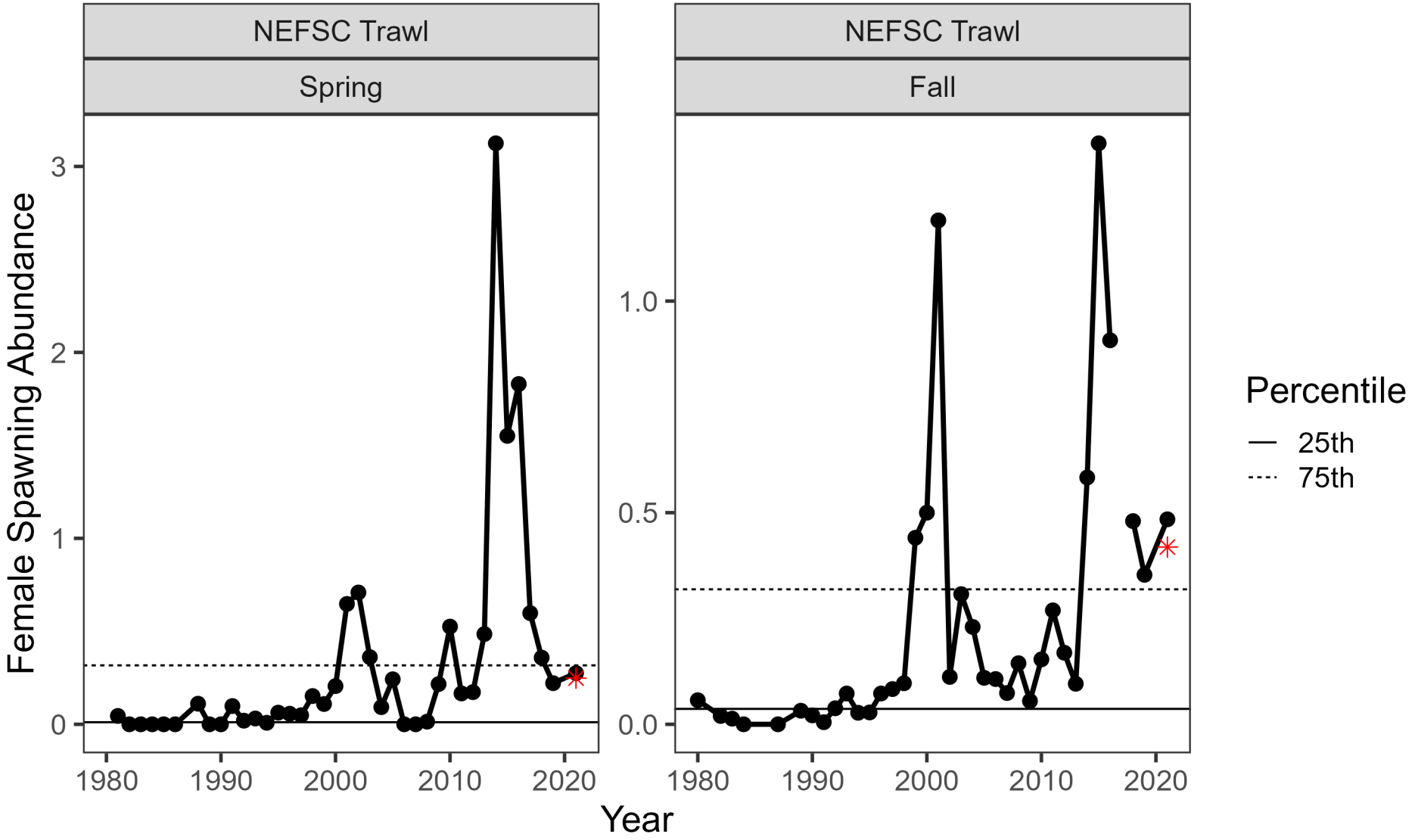
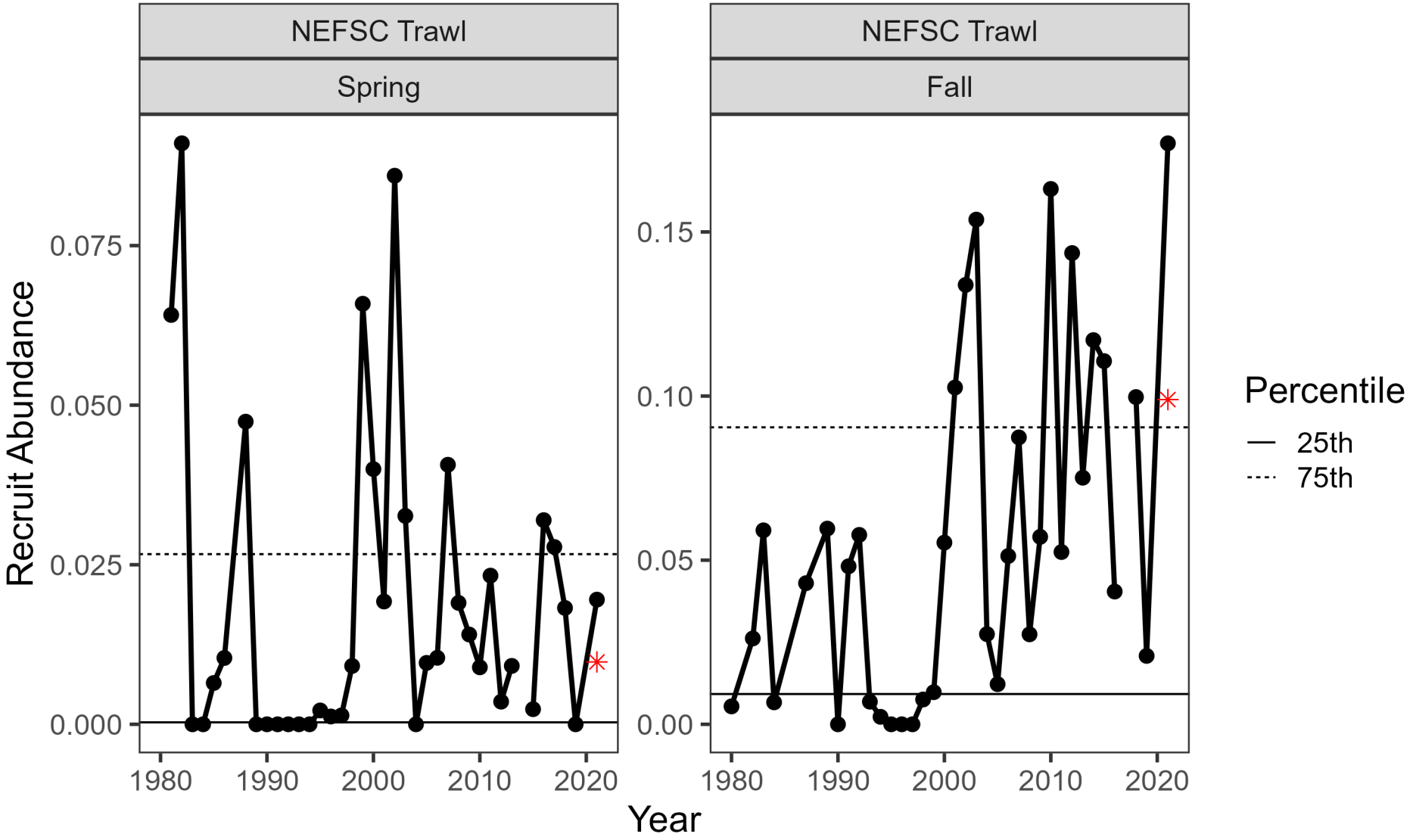


OGOM Spawning Abundance



OSNE Recruit Abundance



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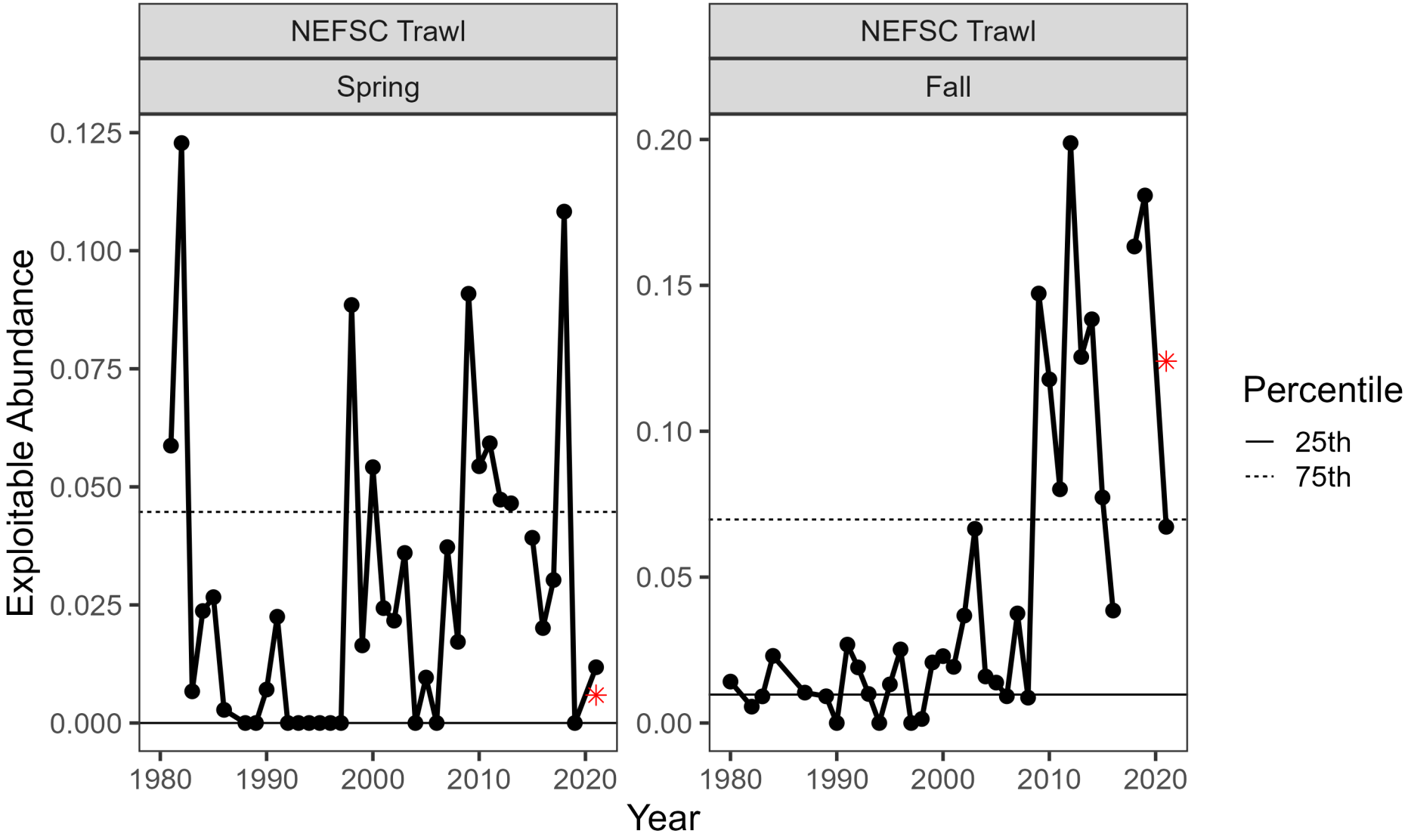
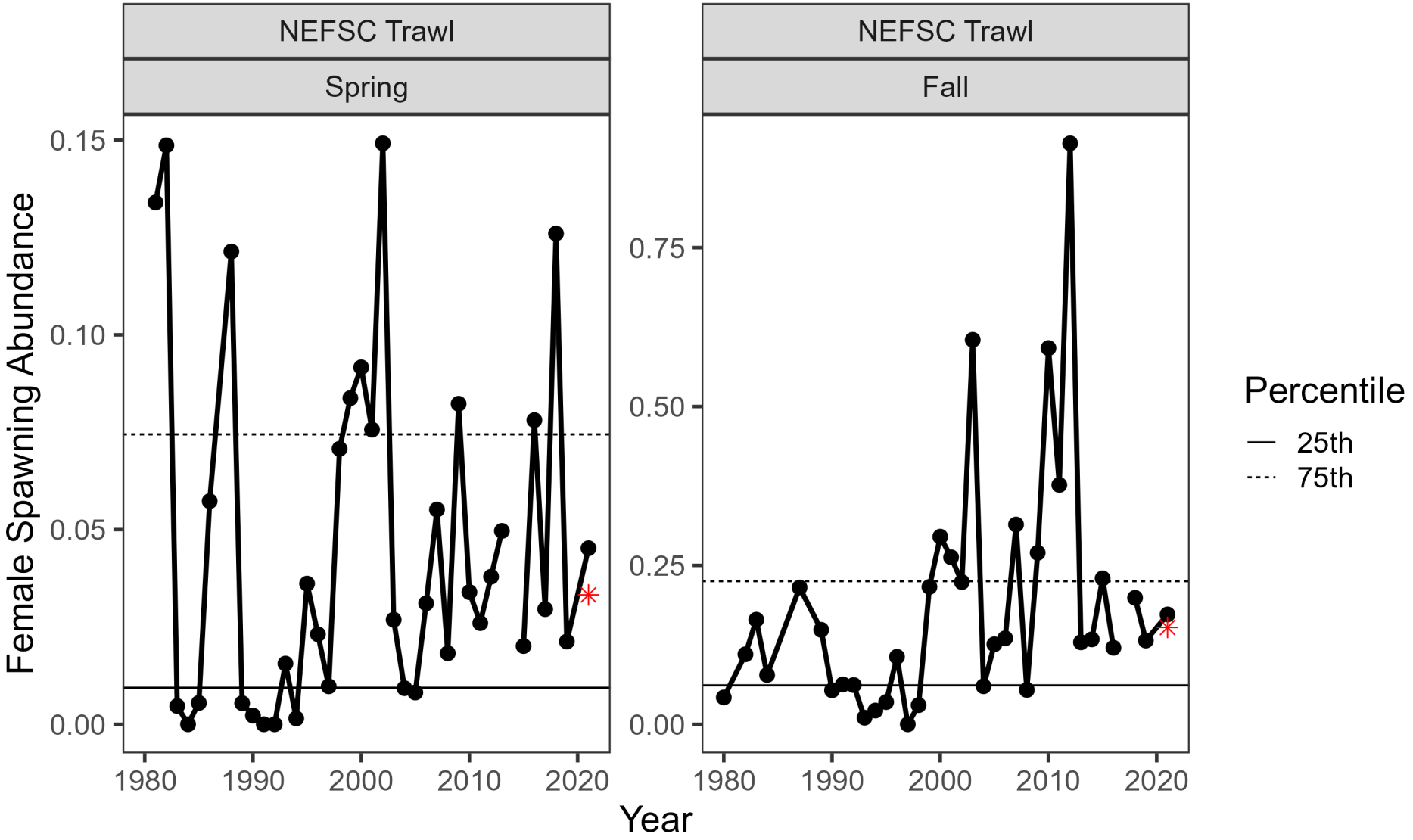


OSNE Spawning Abundance



Stock Status

- Abundance conditions have not declined to historical lows for IGOM, OGOM, and OSNE stocks
  - Abundance conditions unknown for ISNE stock
- Settlement conditions neutral and do not indicate recruitment to GOM stocks will decline to historical lows in the near future
  - Settlement conditions unknown for SNE stocks
- Insufficient information to make statements about exploitation
  - Landings have declined for OSNE stock, but hard to separate influence of other factors such as markets on these declines.

Research Recommendations

- Collect growth data, particularly from adult crabs and crabs from the OSNE stock
- Conduct video surveys for snapshot of total stock size and improved understanding of catchability
- Research spatio-temporal settlement dynamics and recruitment source for OSNE stock
- Identify ecosystem/environmental drivers, particularly of recruitment
- Determine how to interpret fishery-dependent data considering drivers of these data streams

Questions?

Jonah Crab Stock Assessment Peer Review Report

Jonah Crab Fishery Management Board

October 16, 2023

Stock Assessment Peer Review Process

- Jonah Crab Technical Committee and Stock Assessment Subcommittee developed new stock assessment

- Review Workshop: August 29-31, Providence, Rhode Island

- Scientific review focused on data inputs, analytical methods, results, and overall quality of stock assessment

Products

- ASMFC Stock Assessment and Review Report
- www.asmfc.org/species/jonah-crab

Review Process

Scientific Review Panel

Chair + 2 additional Technical Reviewers, with expertise in

- Crustacean ecology and population dynamics
- Stock assessment modeling
- Data limited methods, trawl and trap indices, stock and fishery indicators

Rich Wong (Chair), Delaware Division of Fish and Wildlife

Paul Rago, NMFS Northeast Fisheries Science Center (retired)

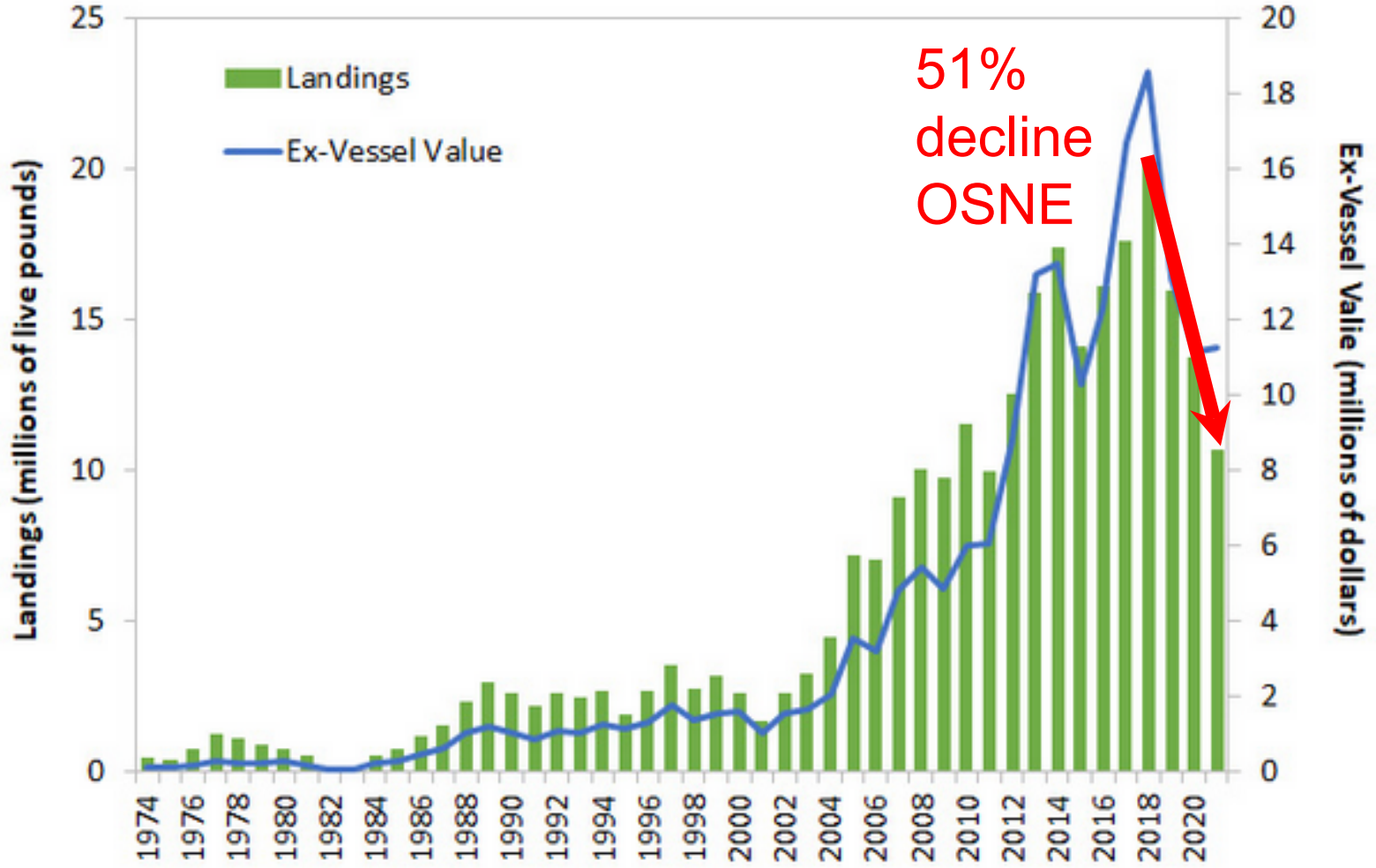
Chris Siddon, Alaska Department of Fish and Game

Review Panel Overall Findings

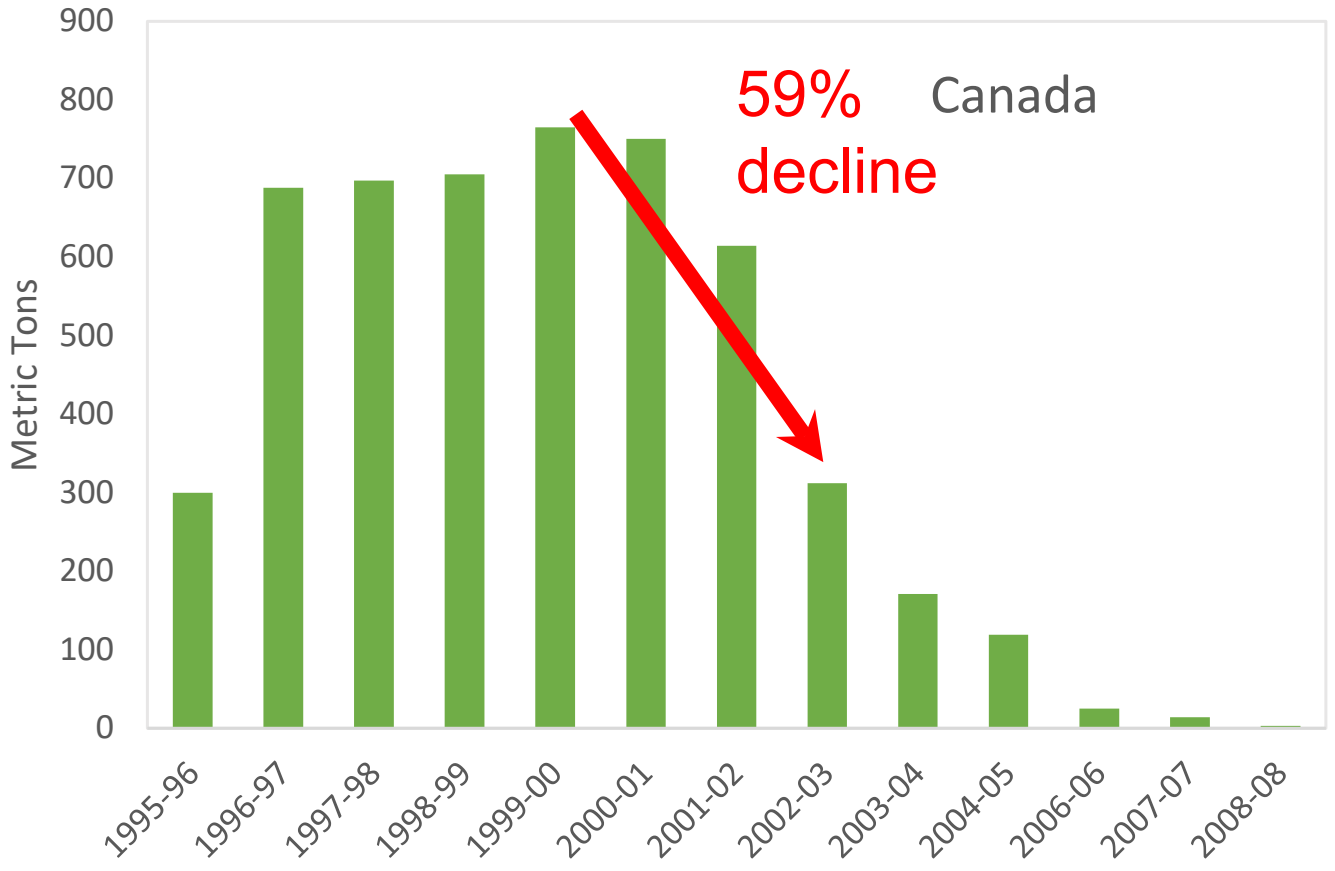
- Stock status is highly uncertain
- Troubling recent fishery-dependent signals
- Close monitoring is critical in the near-term

Jonah Crab Commercial Landings and Ex-Vessel Value

Source: ACCSP Data Wareshouse, 2022



Canada Jonah Crab Fishery Collapse



Review Findings

✓ **ToR 1:** Evaluate the data used in the stock assessment

Conclusions

- Data collection was comprehensive, thorough, well-justified
- Data source variances and caveats were clearly presented
- Data assessed relevant regions (IGOM, OGOM, ISNE, OSNE, Coastwide)
- Uncertainty in effectiveness of trawl surveys for Jonah Crab

Recommendations (for future assessment work)

- Identifying/developing a synoptic index of abundance is crucial

Review Findings

✓ **ToR 2:** Evaluate empirical indicators for the stock and fishery

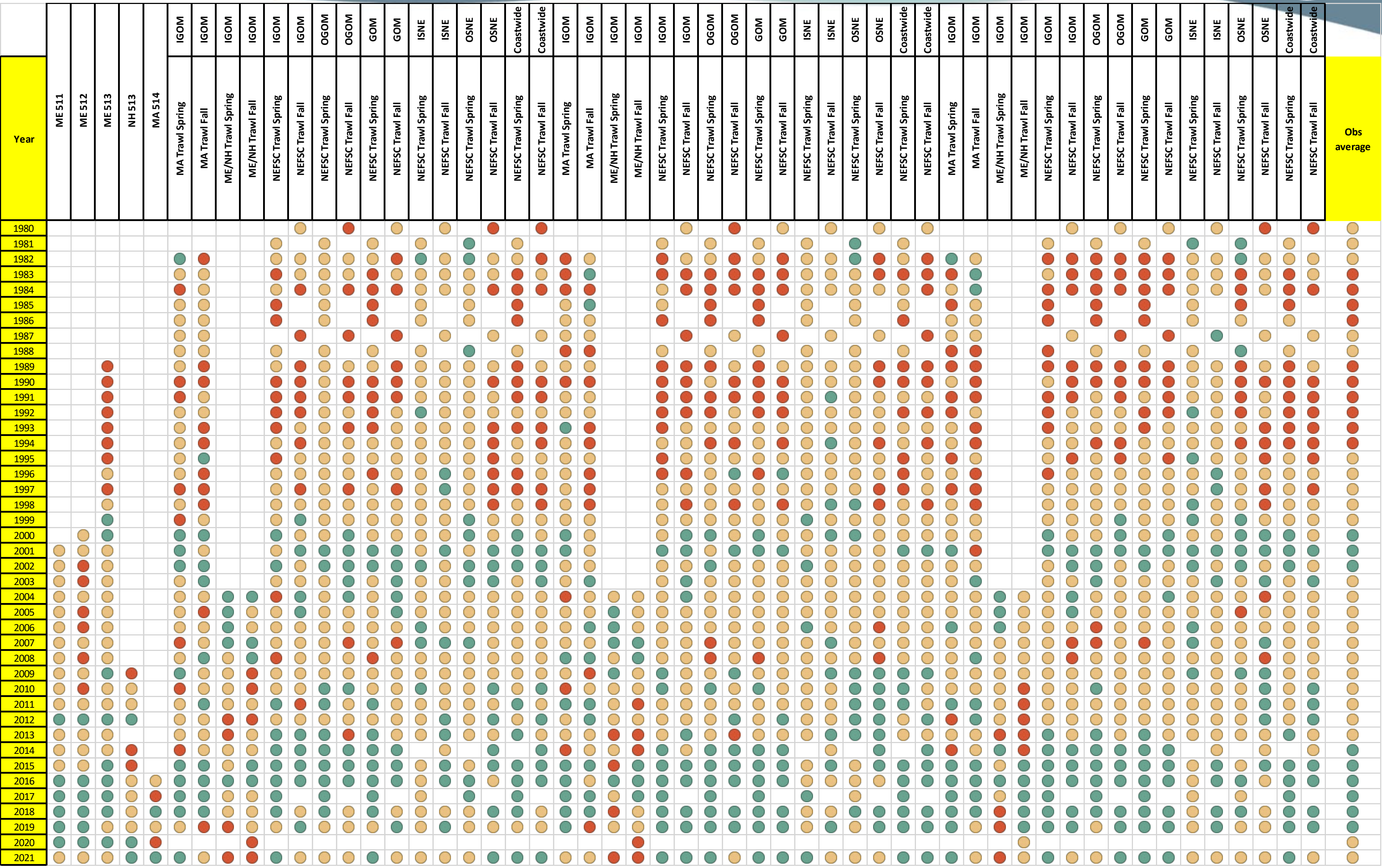
Conclusions

- Large volume of FI, FD indices were presented as best available indicators
- FI indicators, in bulk, show positive long-term trends (42y)
- Declining FD indicators are troubling.
  - 51% decline in OSNE landings (with increasing prices)
  - Declining, directed-effort, Rhode Island FD CPUE (Panel-requested analysis)
- Recent FI declines are sources of concern

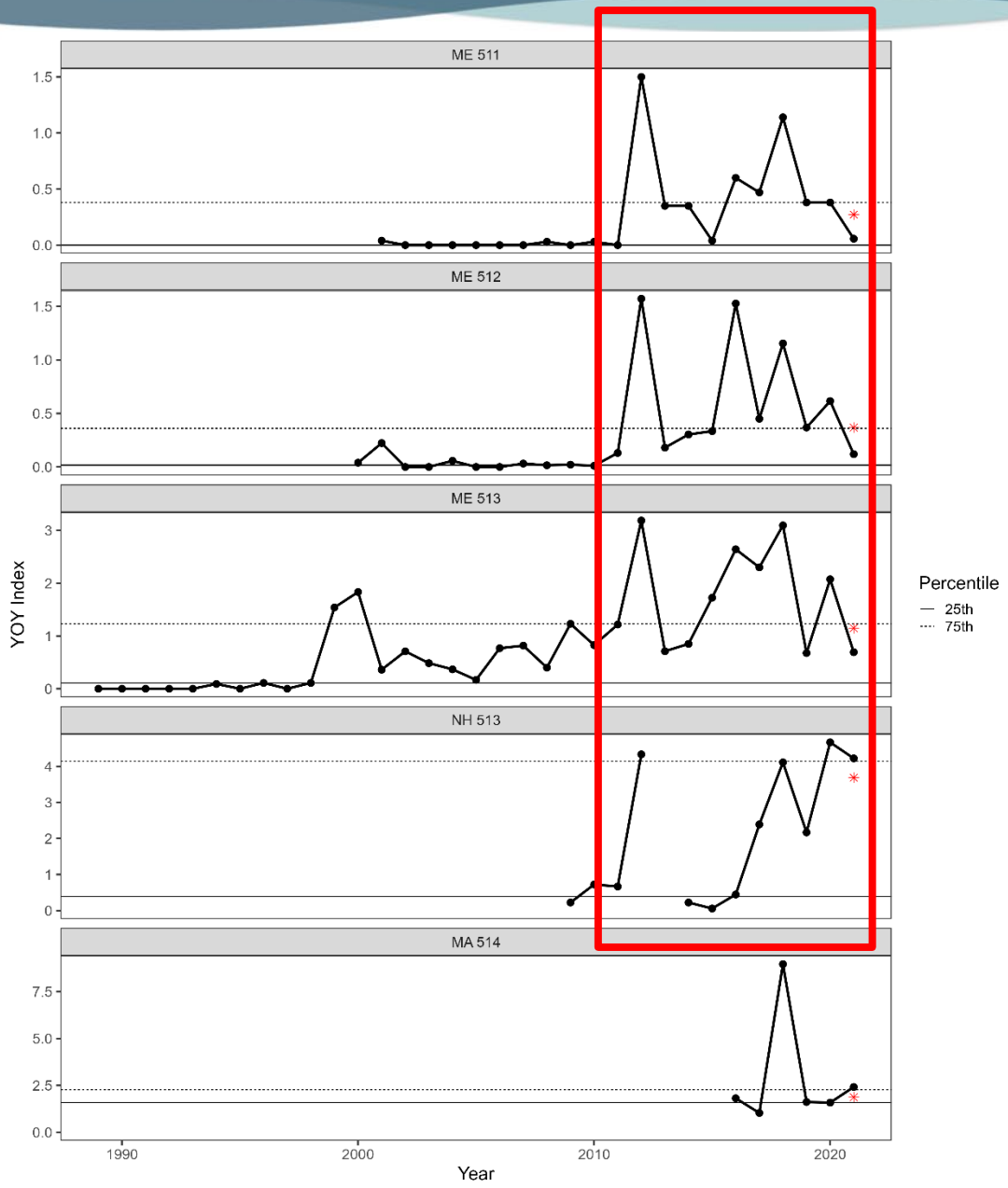
Recommendations

- Recent indicators are worrisome, so close monitoring is needed

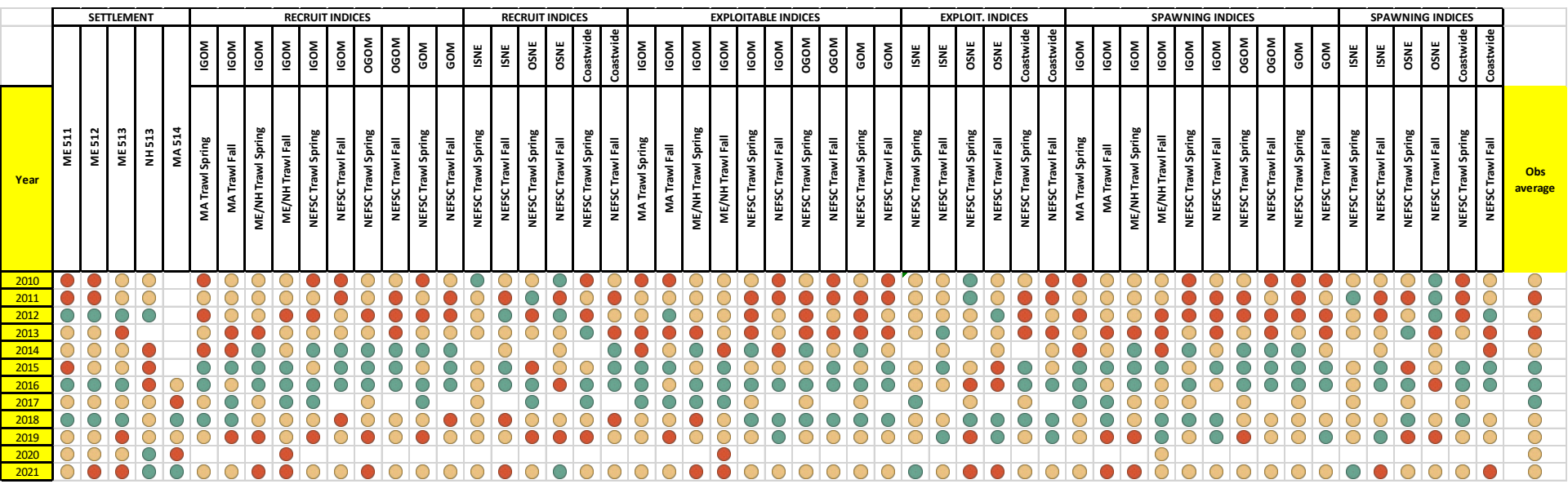
Review Findings



IGOM YOY Settlement



2010-current



Review Findings

✓ **ToR 2:** Evaluate empirical indicators for the stock and fishery

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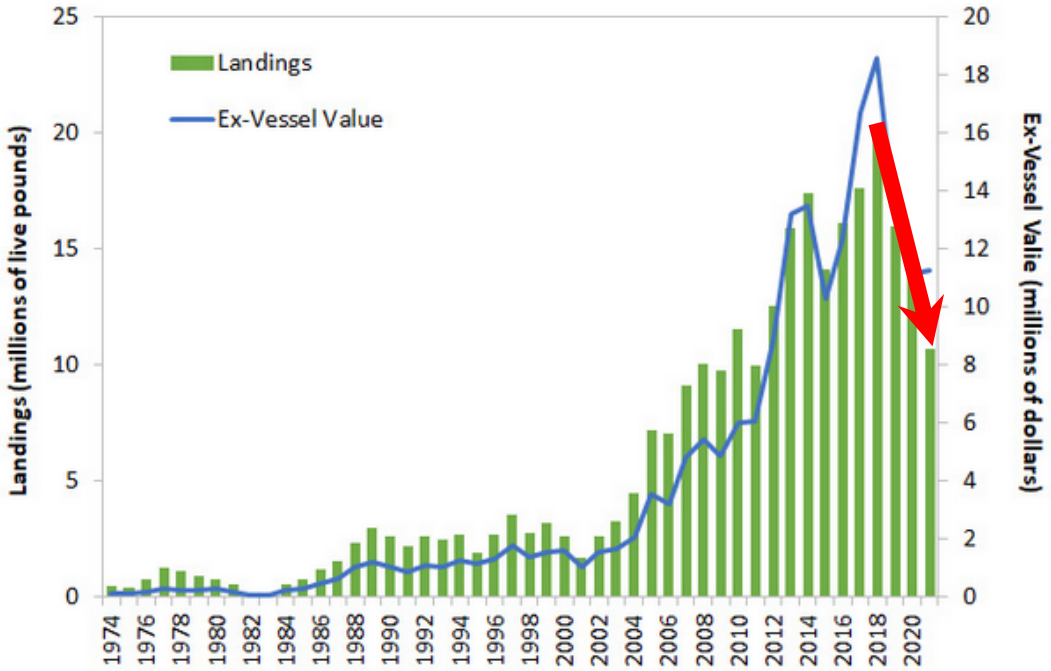

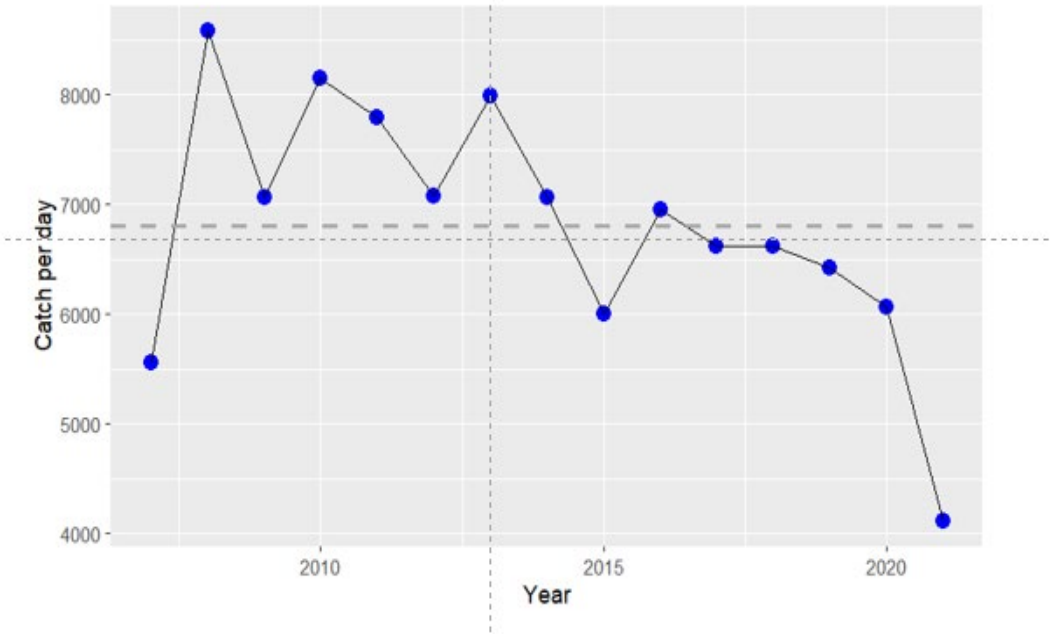

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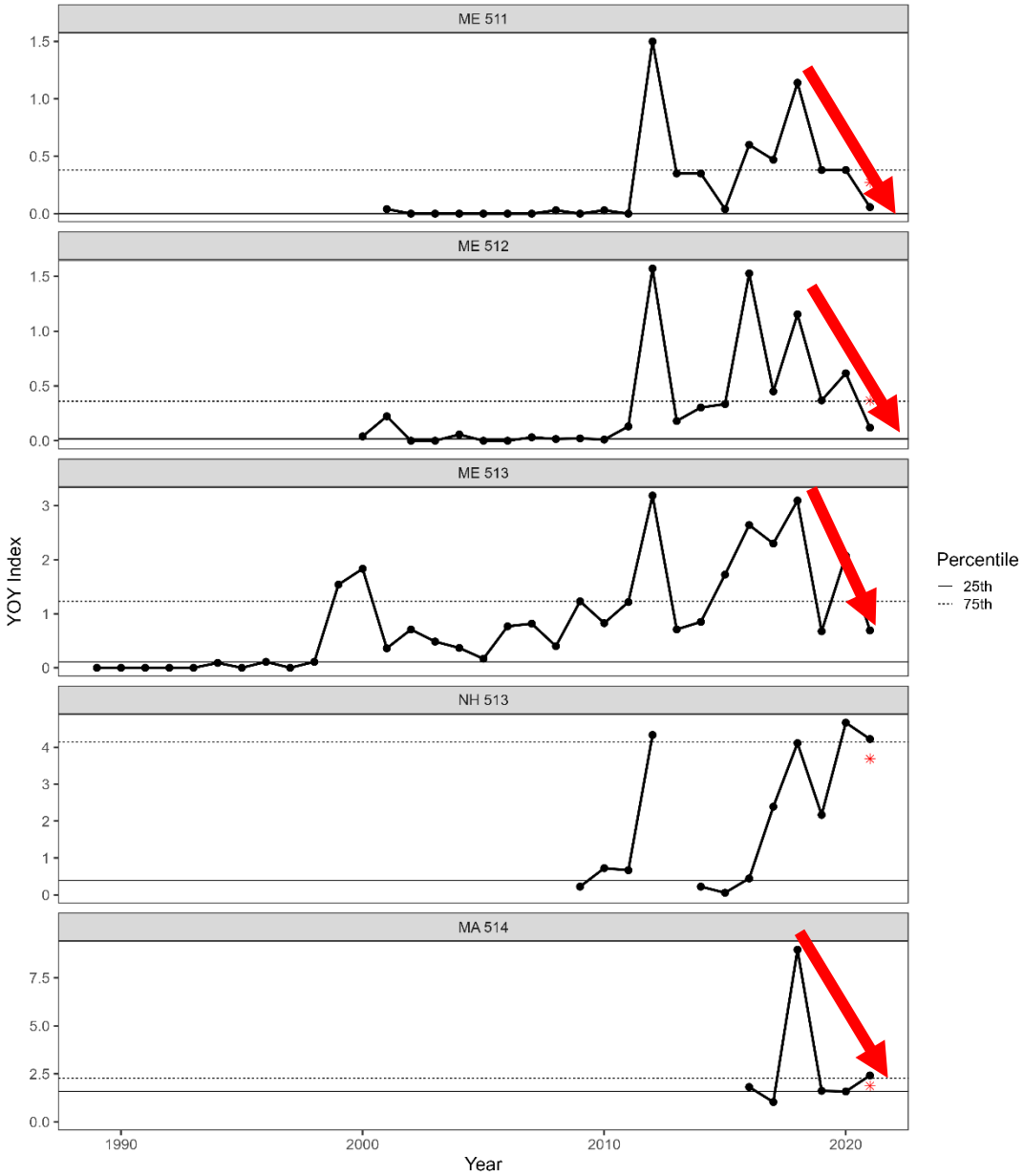
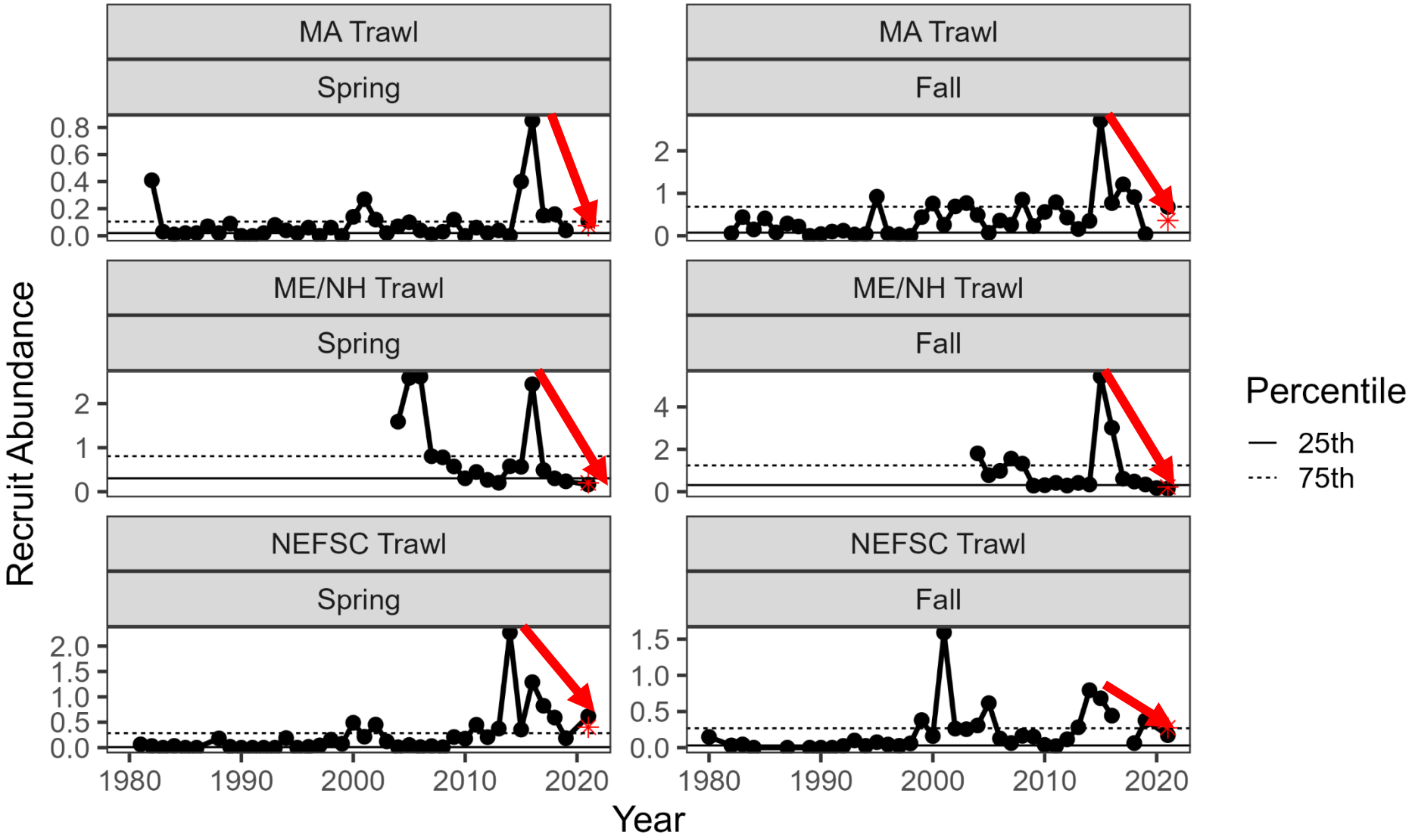
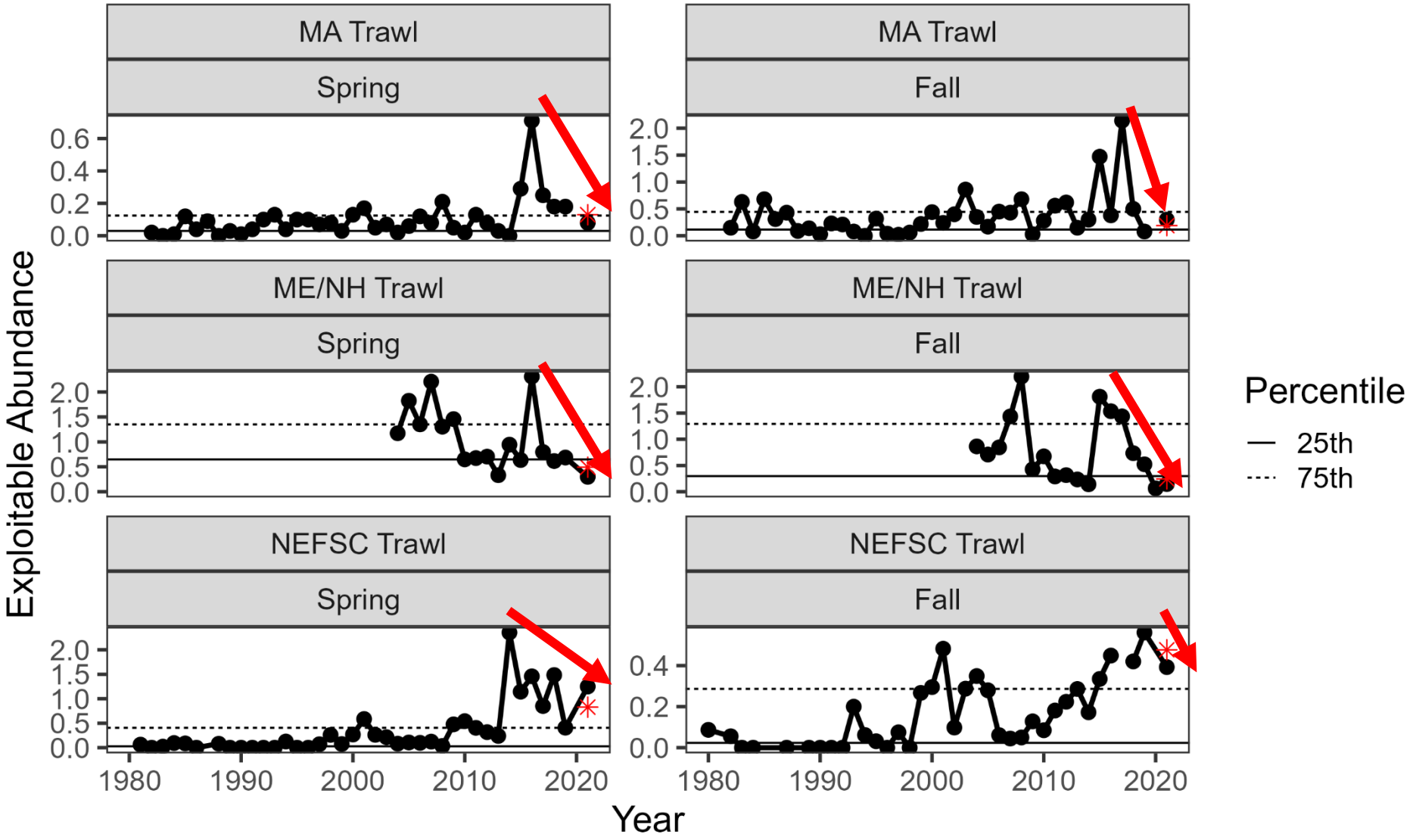


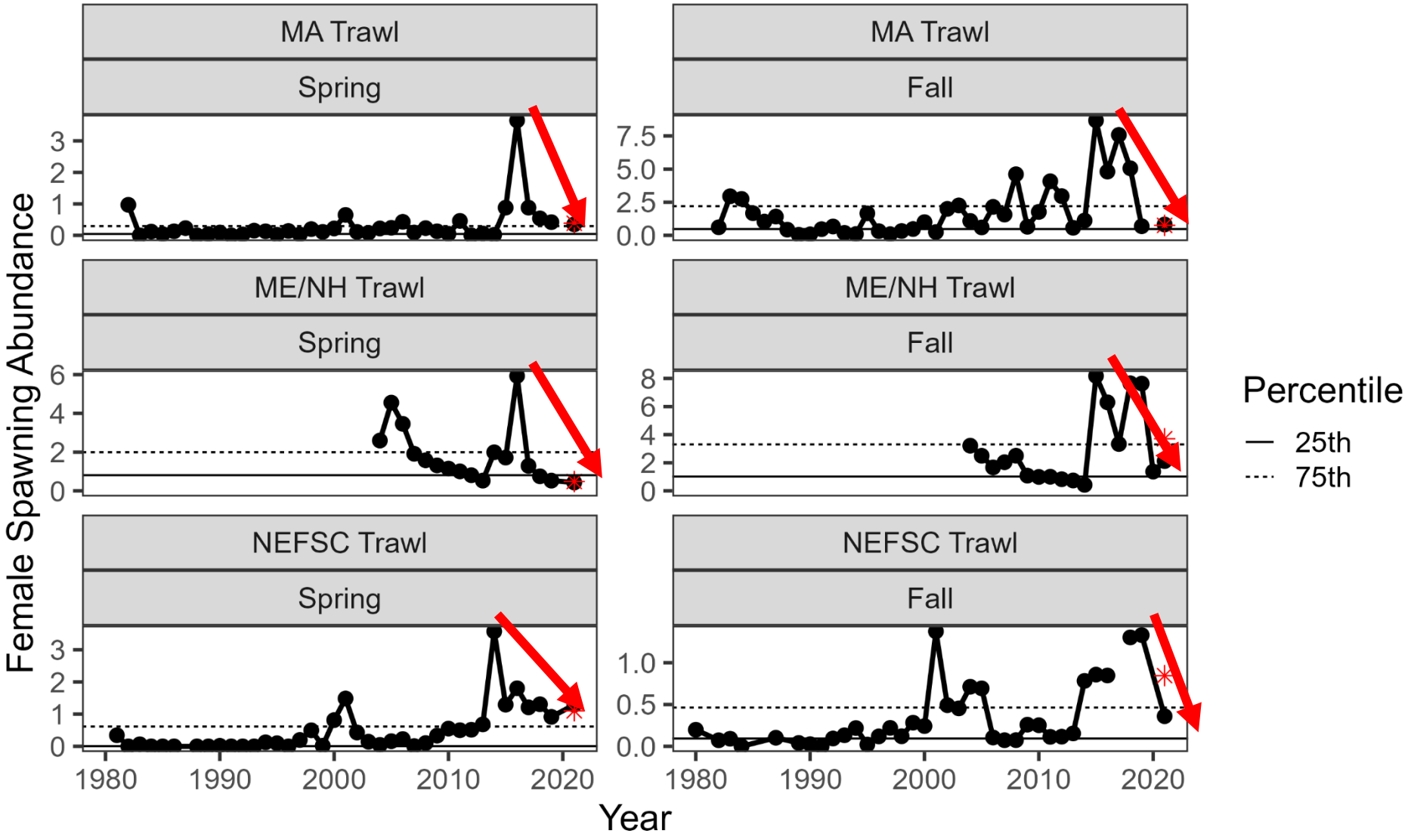
IGOM Recruit Abundance



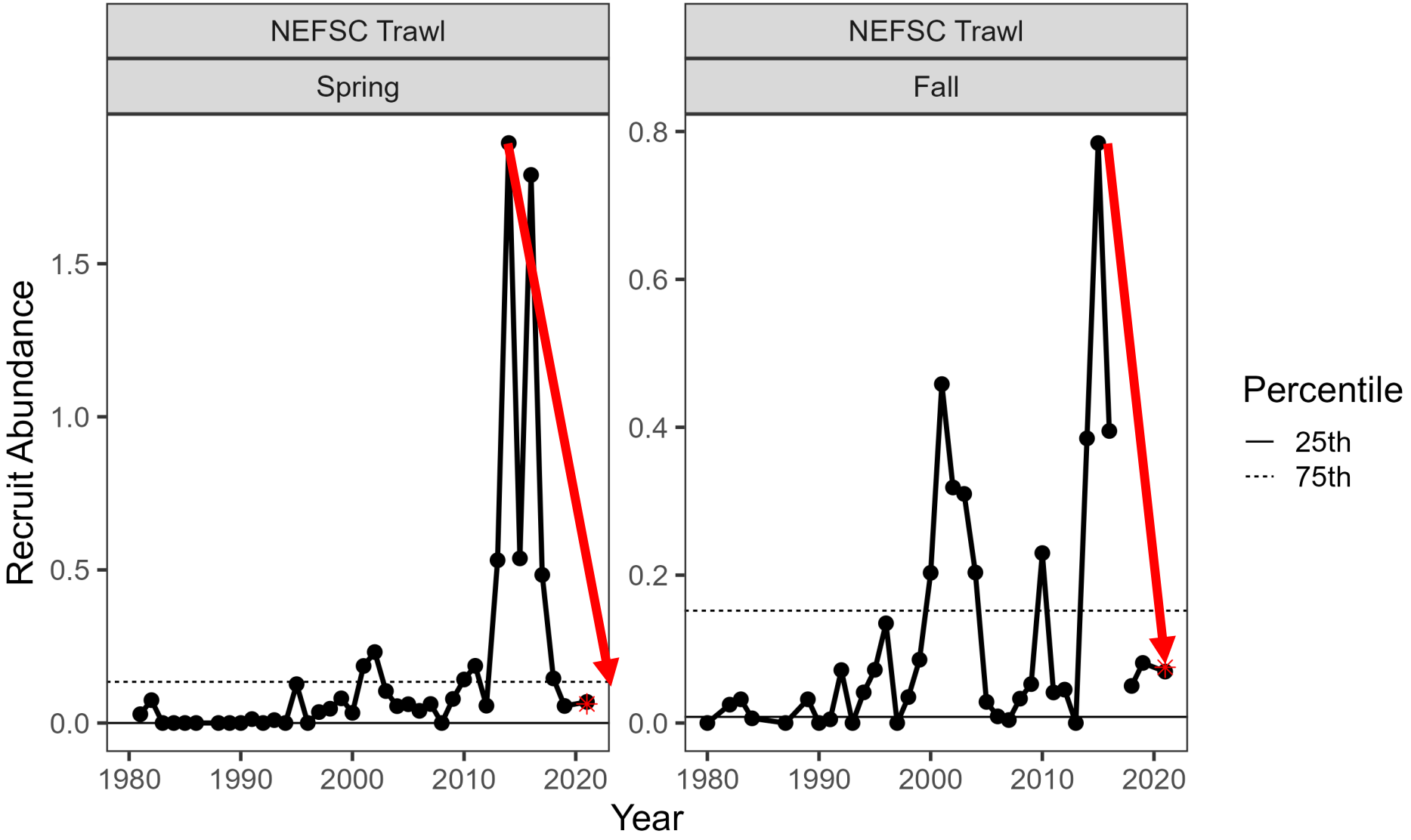
IGOM Exploitable Abundance



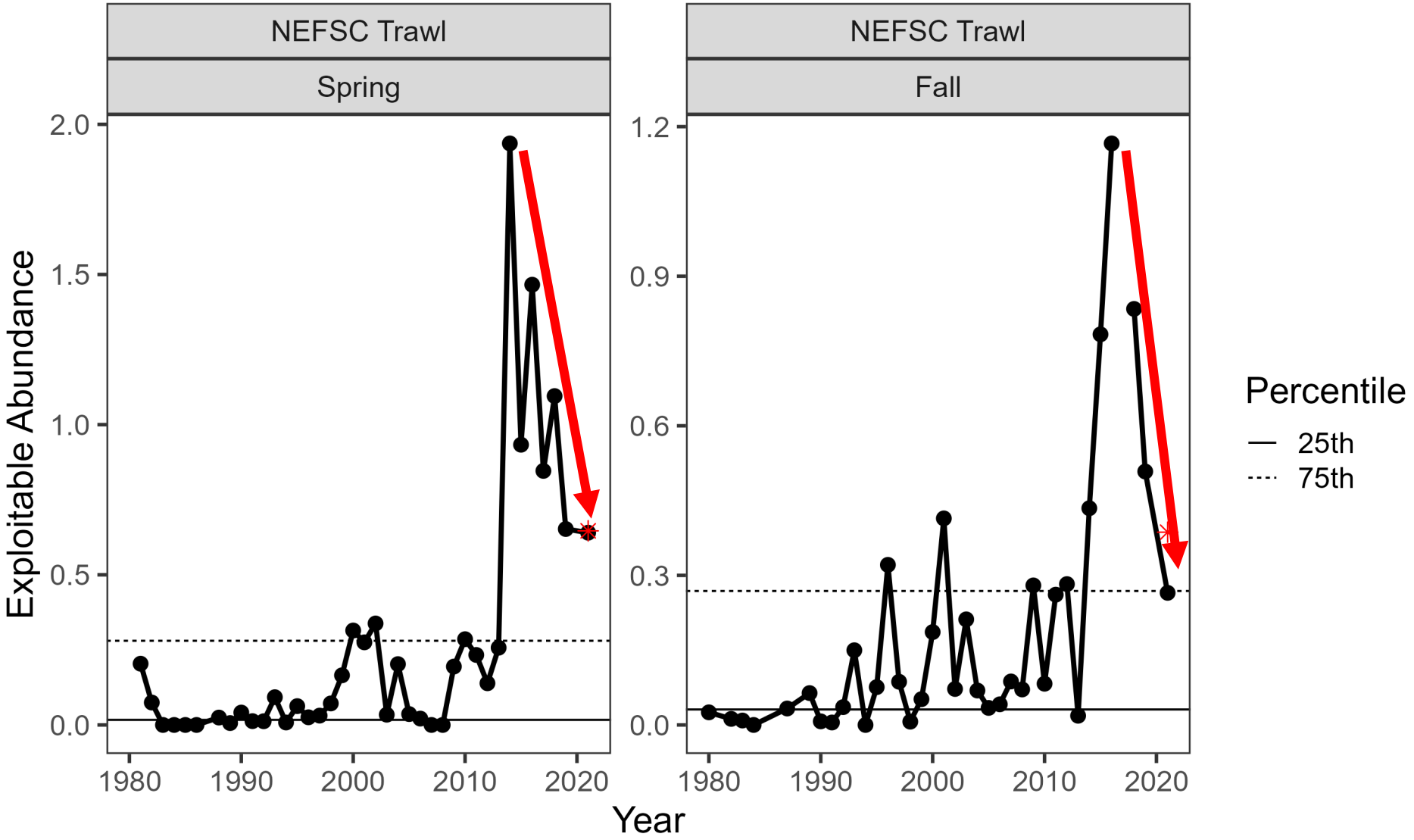
IGOM Spawning Abundance



OGOM Recruit Abundance



OGOM Exploitable Abundance



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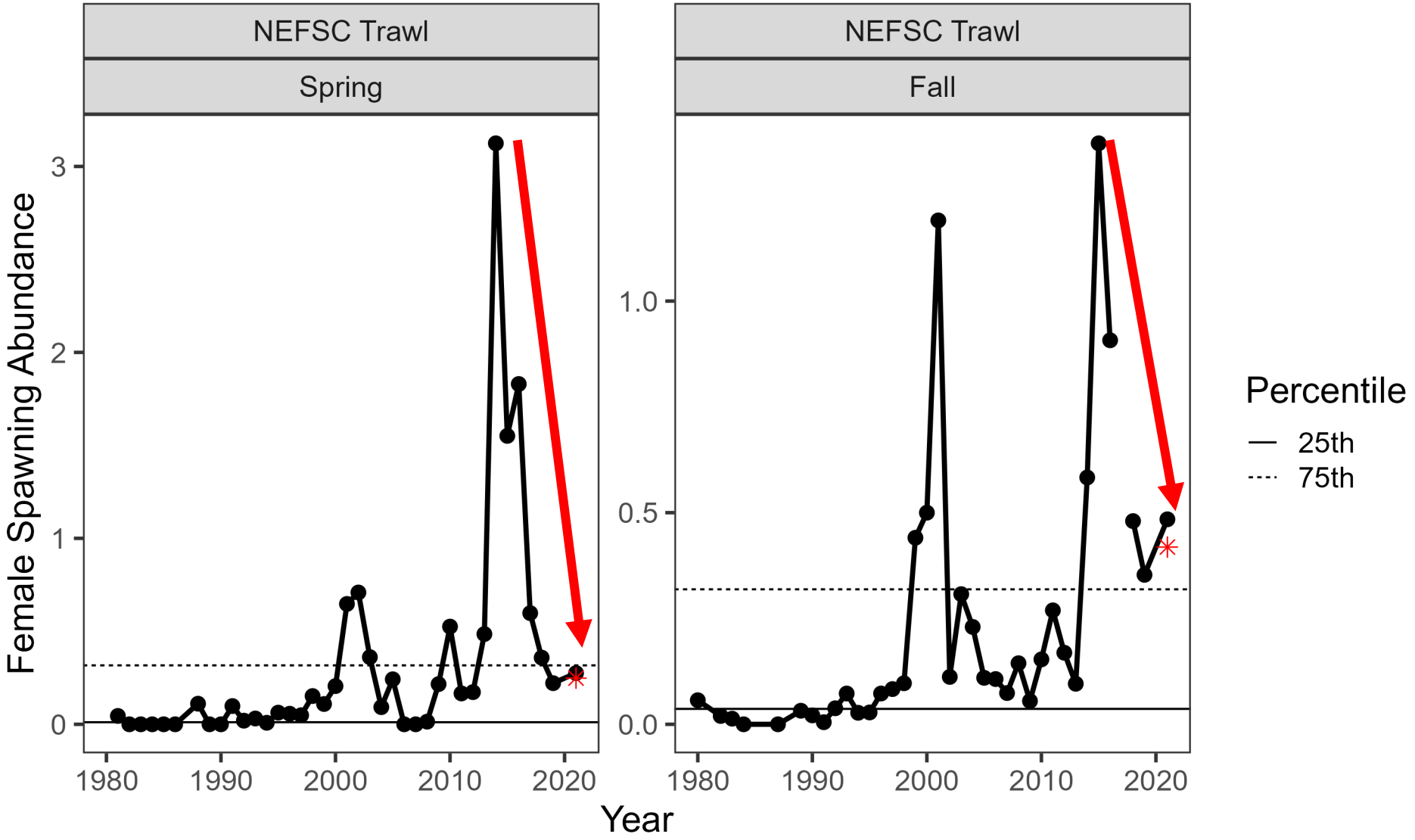

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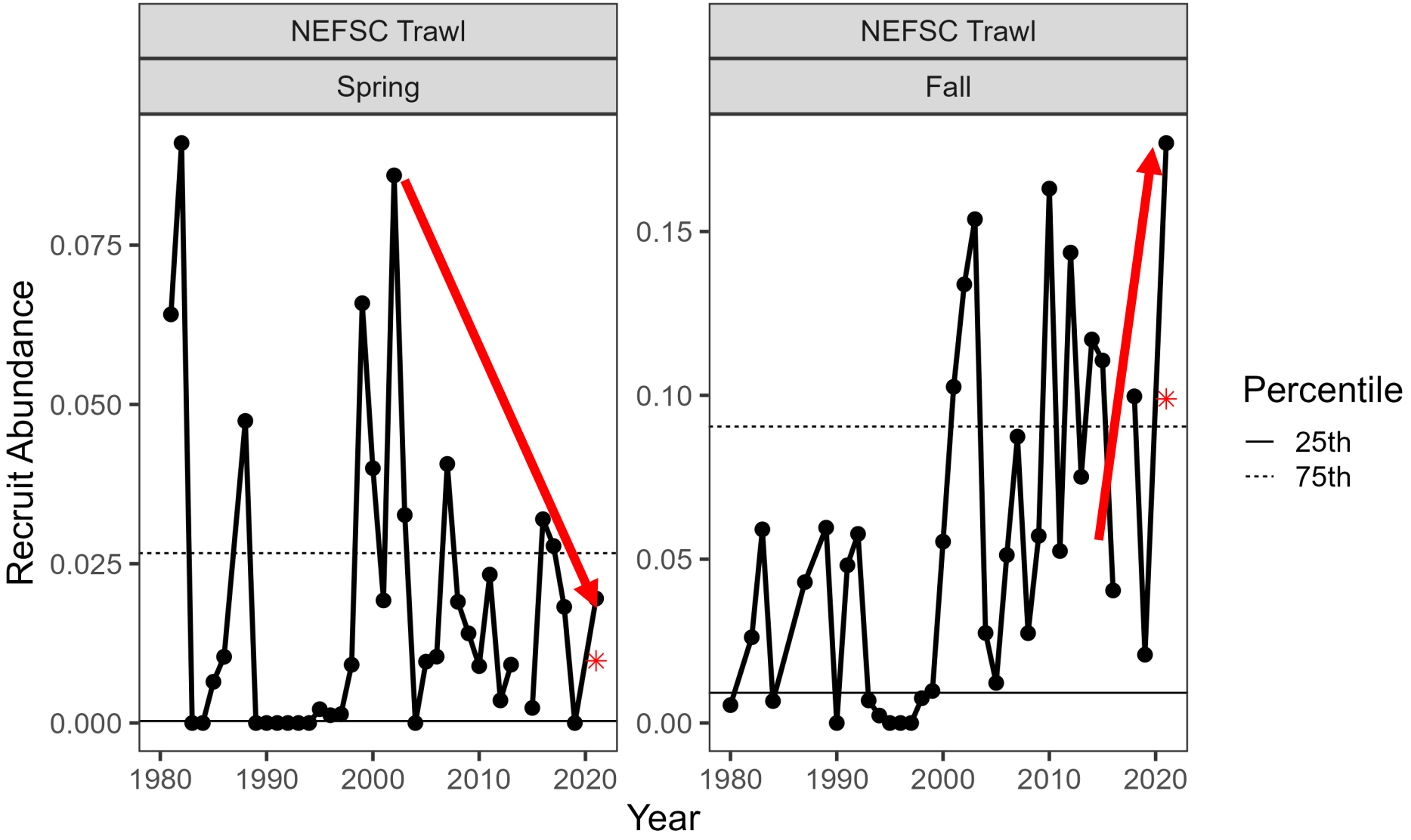

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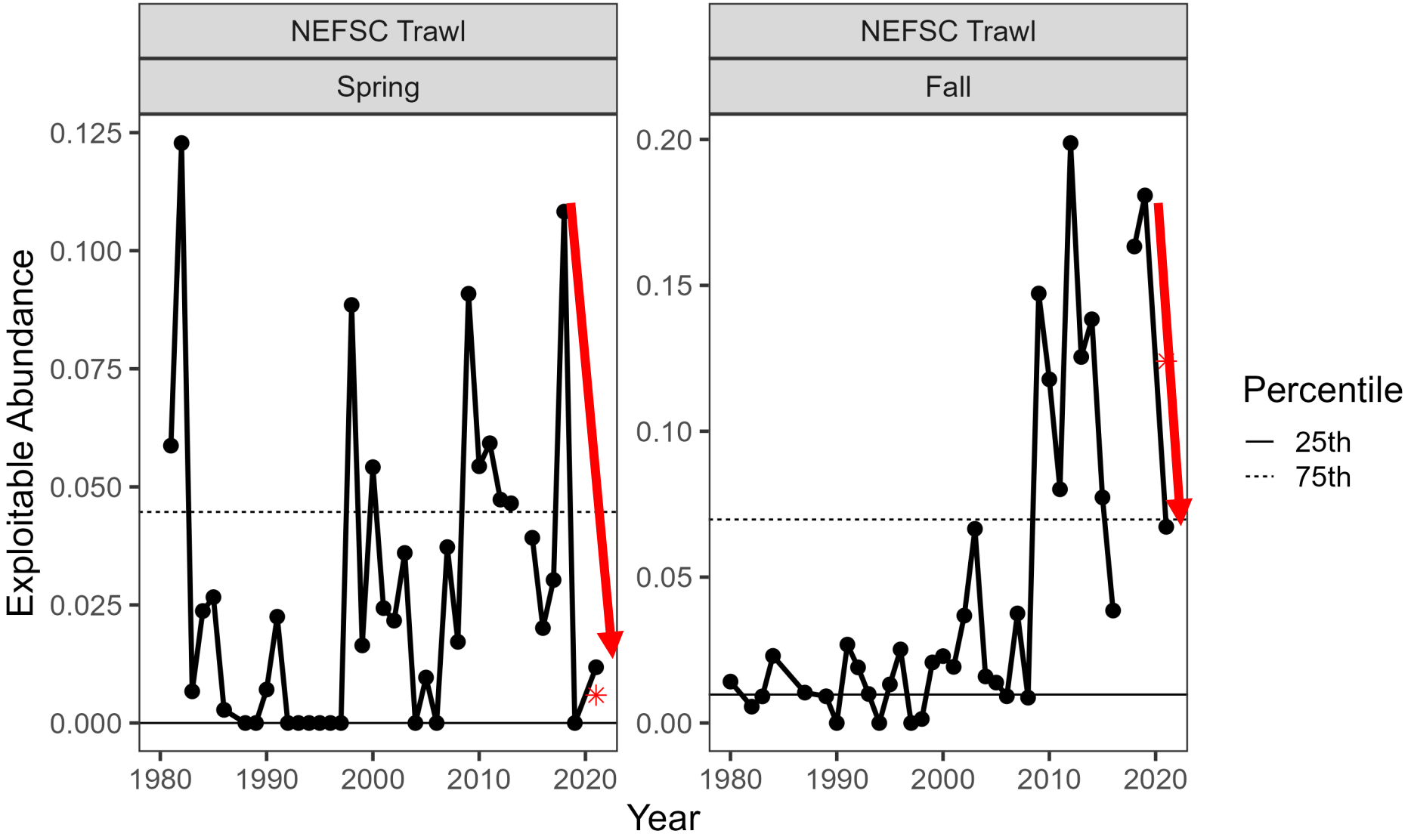
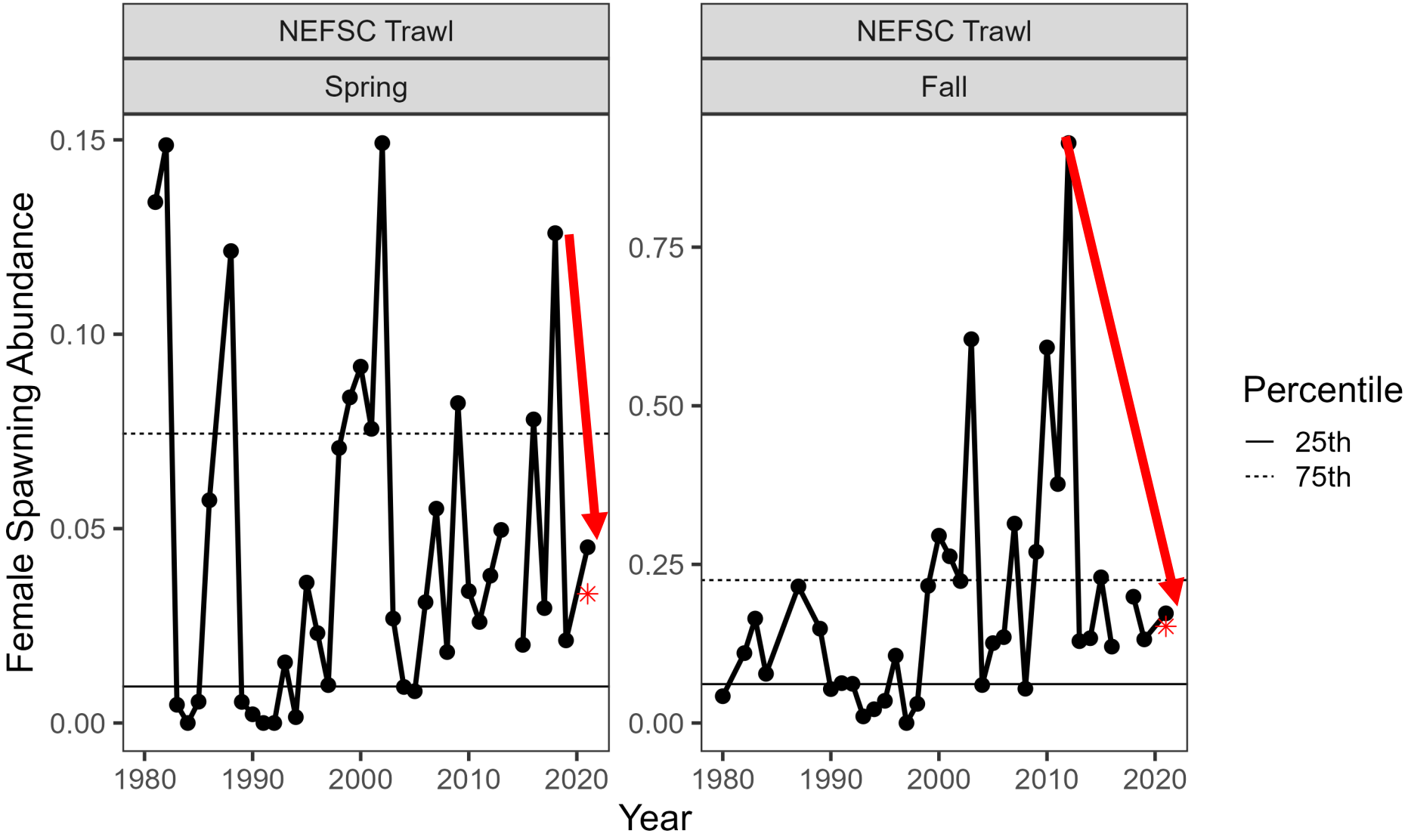


OSNE Spawning Abundance



Review Findings

✓ **ToR 2:** Evaluate empirical indicators for the stock and fishery

Conclusions

- Large volume of FI, FD indices were presented as best available indicators
- FI indicators, in bulk, show positive long-term trends (42y)
- Declining FD indicators are troubling.
  - 51% decline in OSNE landings (with increasing prices)
  - Declining, directed-effort, Rhode Island FD CPUE (Panel-requested analysis)
- Recent FI declines are sources of concern

Recommendations

- Recent indicators are worrisome, so close monitoring is needed

Review Findings

✓ **ToR 3:** Evaluate the assessment methods and models

Conclusions

- Data limitations prevented methods to estimate population parameters (e.g., F, biomass, abundance).
- Methods were straightforward, consisting primarily of
  - Trend analyses
  - Correlation analyses
  - Traditional and model-generated indices
  - Index-based methods
  - Reference-based thresholds
- SAS did a good job of stating assumptions and discussing caveats

Review Findings

✓ **ToR 4:** Evaluate the assessment diagnostic analyses

Conclusions

- Diagnostic analyses were appropriate.
- Correlation analyses were thoroughly explored to investigate cohesion in indicators across life stages, regions,
- Explored potential climate effects on abundance indices
- SAS was transparent in decisions, methods. Analytical results were critically and objectively evaluated

Review Findings

✓ **ToR 5:** Evaluate the methods used to characterize uncertainty in estimated parameters.

<u>Conclusions</u>

- Uncertainty in analytical outputs was quantified (where appropriate) and otherwise clearly stated and acknowledged by the SAS.

Review Findings

✓ **ToR 6:** Recommend best estimates of stock biomass, abundance, and exploitation

Panel Conclusions and Recommendations:

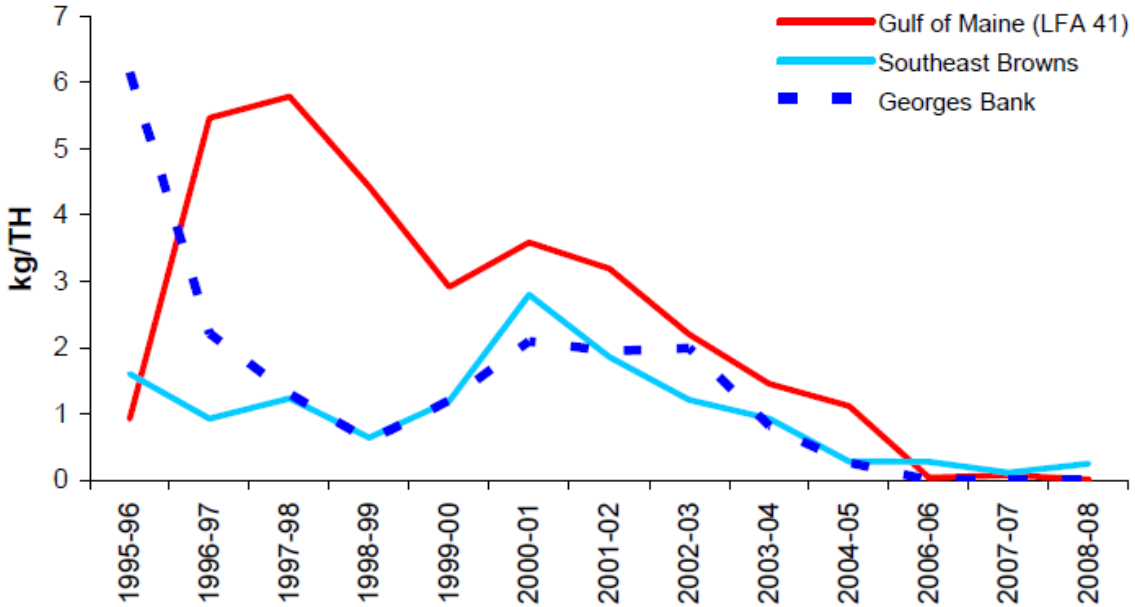
- The SAS was unable to develop analytical models to estimate abundance or exploitation.
- Guidance:
  - A synoptic index is a key hurdle to mount for future assessments
  - Given the data limitations, the Panel recommended pursuing population models such CSA, depletion models, or surplus production models, to generate first estimates of population size and fishing mortality rates.
  - More complex length-based models are possible, but require more substantial length sampling and improved growth information
  - If ageing is possible, this would open up tremendous assessment possibilities

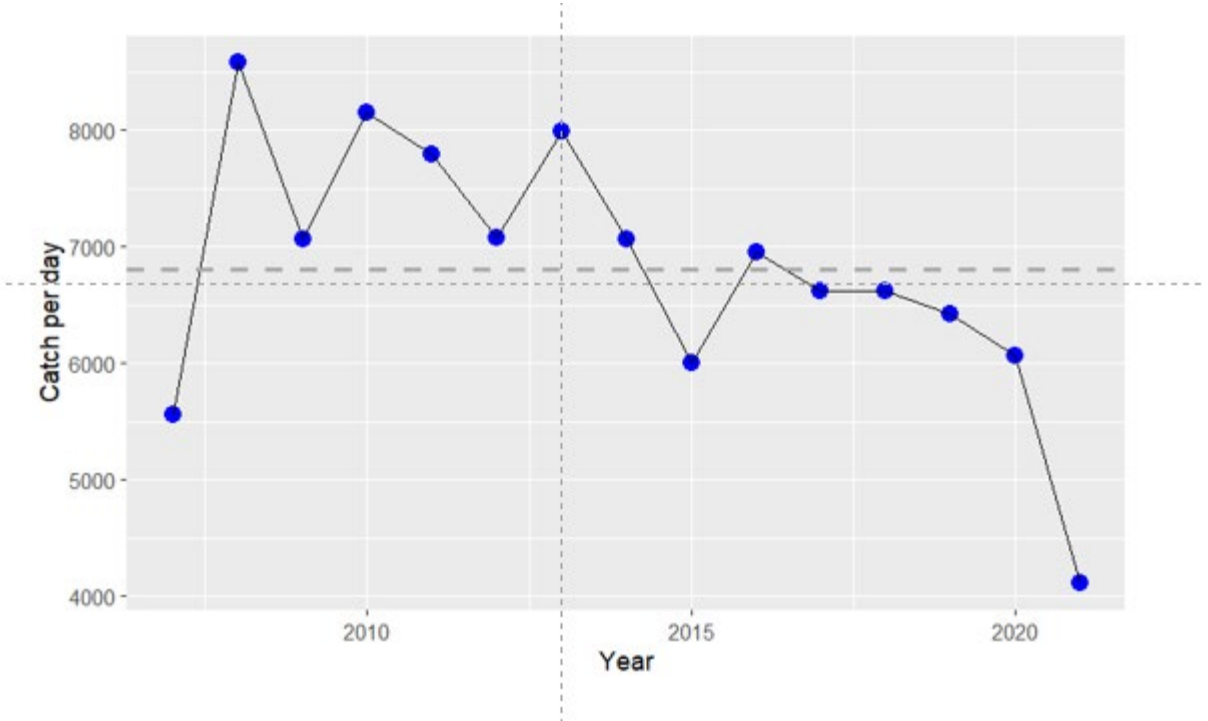
Review Findings

✓ **ToR 7:** Evaluate reference points and stock status determination

Panel Conclusions and Recommendations:

- Stock status is highly uncertain
- Population estimates and reference points were not available
- SDC portray positive long-term trends, but worrisome recent signals
- Positives:
  - Recruitment overfishing is unlikely
  - Minimal female harvest
  - Positive, long-term, fishery-independent (FI) indices
- Concerns:
  - Sharply dropping landings (51% in OSNE past 4 years)
  - Declining fishery-dependent CPUE
  - Very recent drops in FI indices





Canada Jonah Crab Case Study

- Stock collapse not detected in FI indices
- Collapse was detectable in FD CPUE

Review Findings

✓ **ToR 8:** Review and prioritize research recommendations

<u>Panel Conclusions and Recommendations</u>

- Continue to develop/refine fishery-dependent indicators
- Formally incorporate Local Knowledge from industry to interpret FD data.
- Continue/expand CFRF Ventless Trap Research
- Investigate NEFSC Winter Bottom Trawl Survey as a directed JC survey
- Increase monitoring of female metrics such as 'operational sex-ratios' in surveys and sea sampling, LBSPR, and sperm limitation

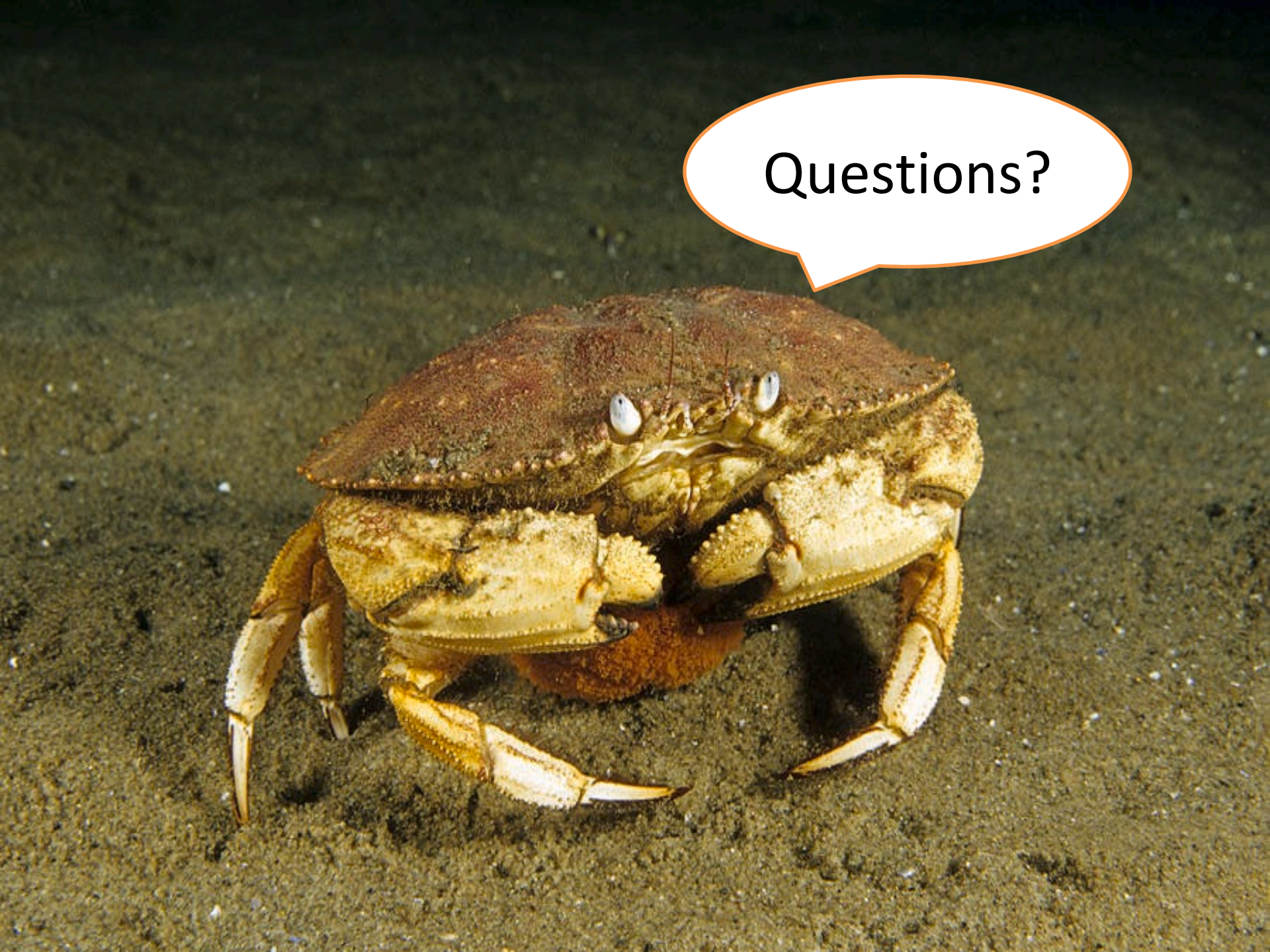
Review Findings

✓ **ToR 9:** Recommend timing of the next stock assessment

- Annual monitoring is needed to understand the nature of recent declines
- 5 to 10 years may be needed to attempt population modeling
- The Panel recommended convening in five years to summarize ongoing work and research progress towards a new assessment
- The potential for rapid declines in crustacean stocks requires a decision process to be in place that is not necessarily reliant on an annual assessment.

Review Panel Conclusions

- Stock status is highly uncertain
- Troubling recent fishery-dependent signals
- Close monitoring is critical in the near-term
  - Identify and prioritize candidate indicators of relative abundance and fishery performance.
  - Conduct a formal annual review of important indicators, and
  - Develop a methodology for making decisions based on ordinal data.


Questions?

2023 Lobster Data Update and Trigger Index

October 16th, 2023

Data Sets

- Data sets include:
  - Trawl survey indicators, including recruit abundance (71-80 mm lobsters) and survey encounter rate
  - Ventless trap survey sex-specific design-based abundances indices by statistical area (53mm+)
  - YOY settlement indicator
- Updated data include 2019, 2020, 2021, and 2022

Indicator Status

- Indicator status determined relative to percentiles of the assessment time series

Indicator	< 25th percentile	Between 25th and 75th percentile	> 75th percentile
Recruitment indices (larval or YOY)	Negative	Neutral	Positive
Recruit abundance	Negative	Neutral	Positive
Ventless trap abundance	Negative	Neutral	Positive
Proportion positive tows	Negative	Neutral	Positive

- Five year means for terminal indicator status

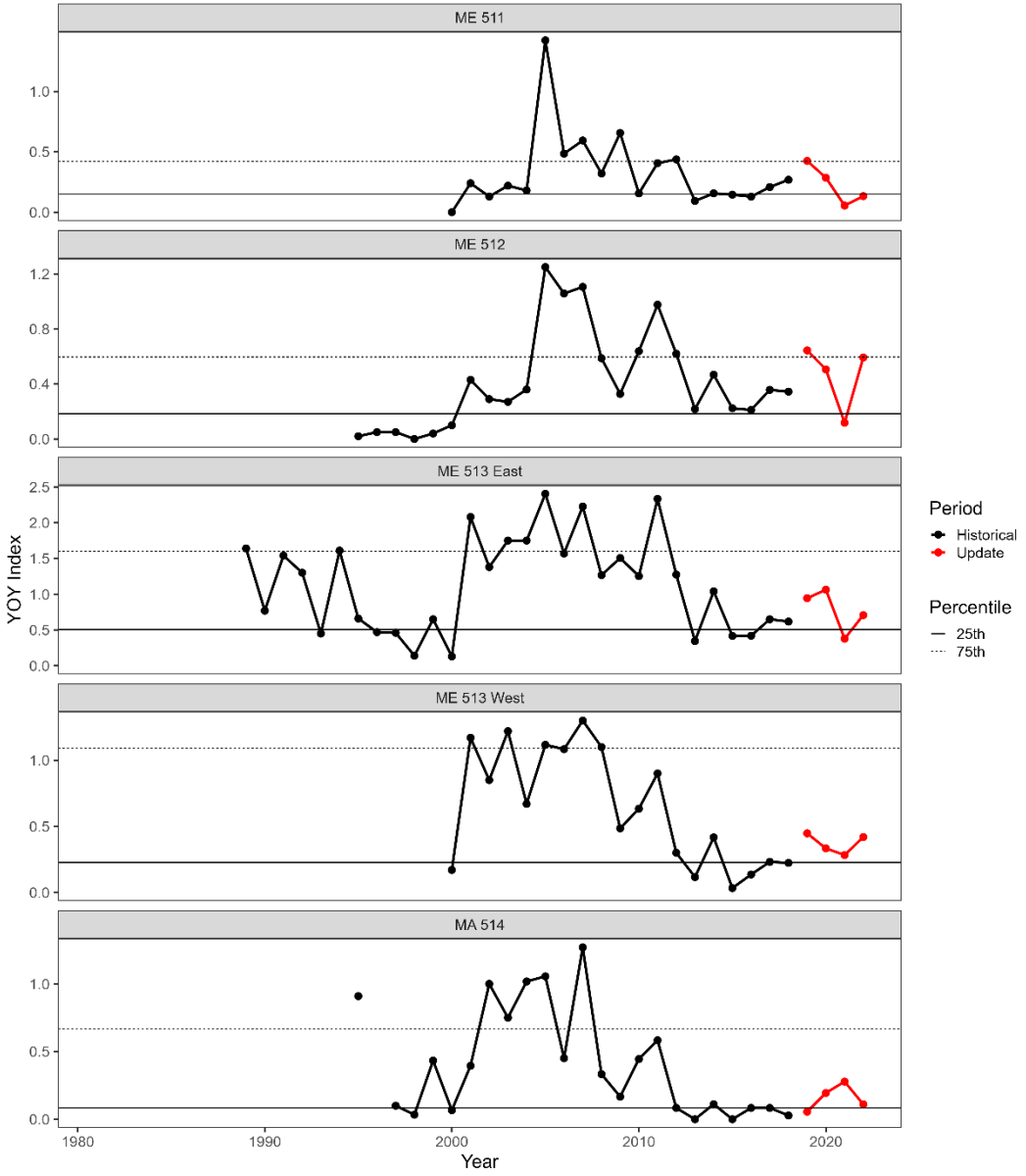
Notes

- Covid-19 impacts on trawl survey sampling efforts in 2020 continue to impact indicator status update five year means (2018-2022)

- Any data revisions or past errors that would lead to changes from previously documented values are described in the appendix

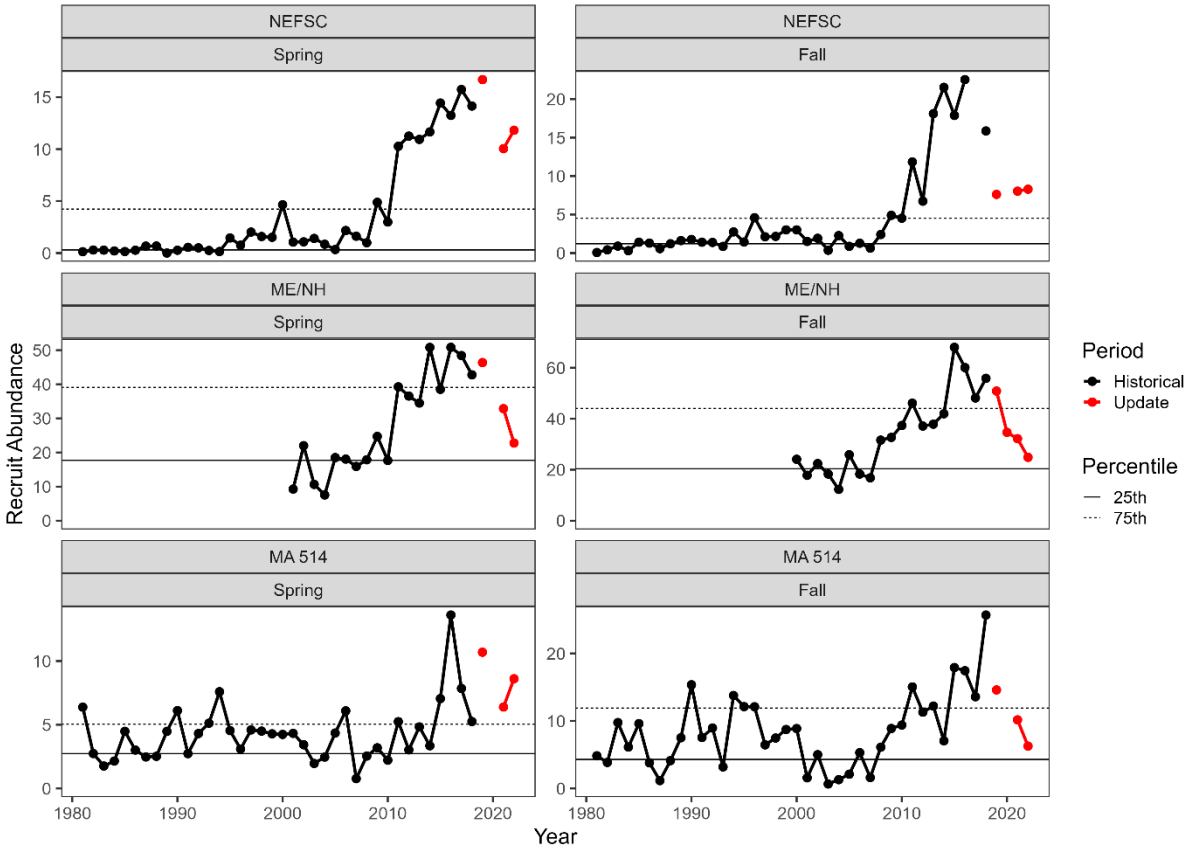
GOM: YOY Indices

- Improvements since the SA, but still not positive
  - Means all neutral
  - 2022 values showed increases from 2021 values with one exception (MA 514)



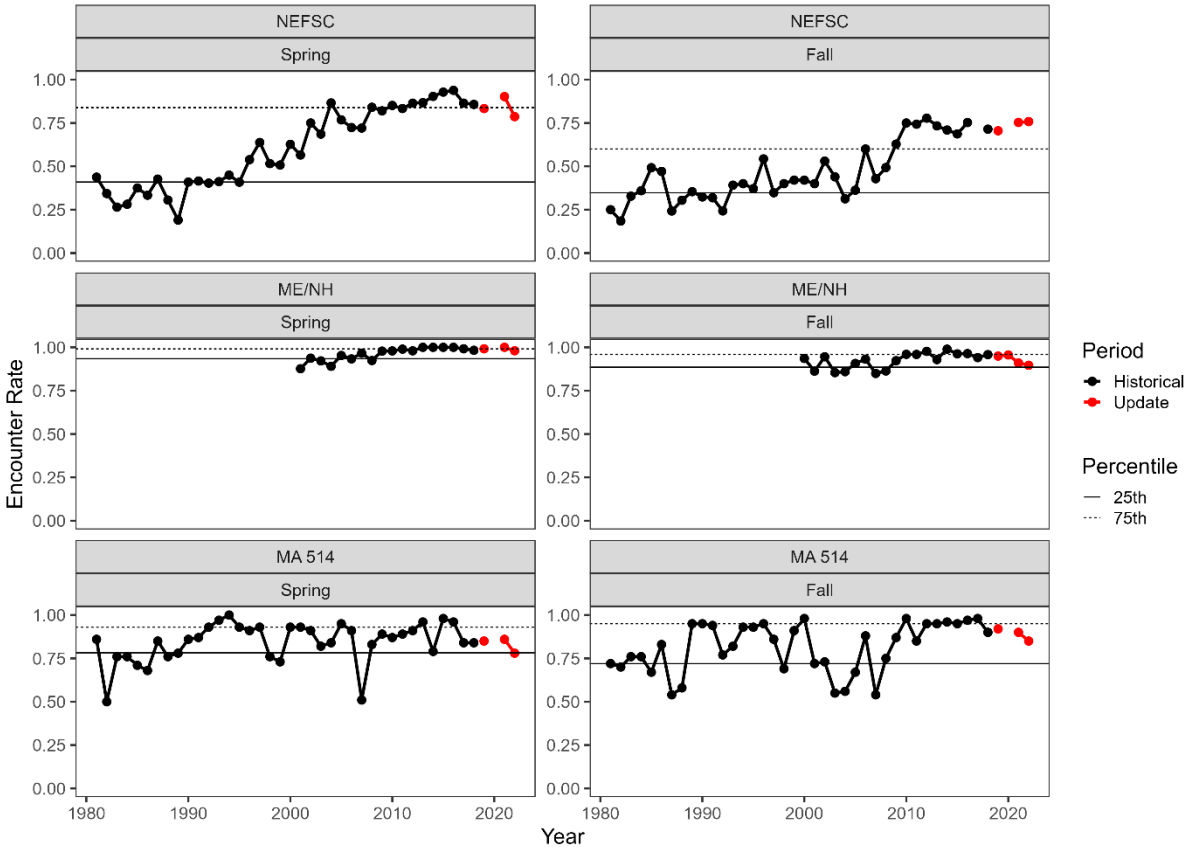
GOM: Recruit Abundance

- Signs of decline since the SA
  - Two means changed from positive to neutral



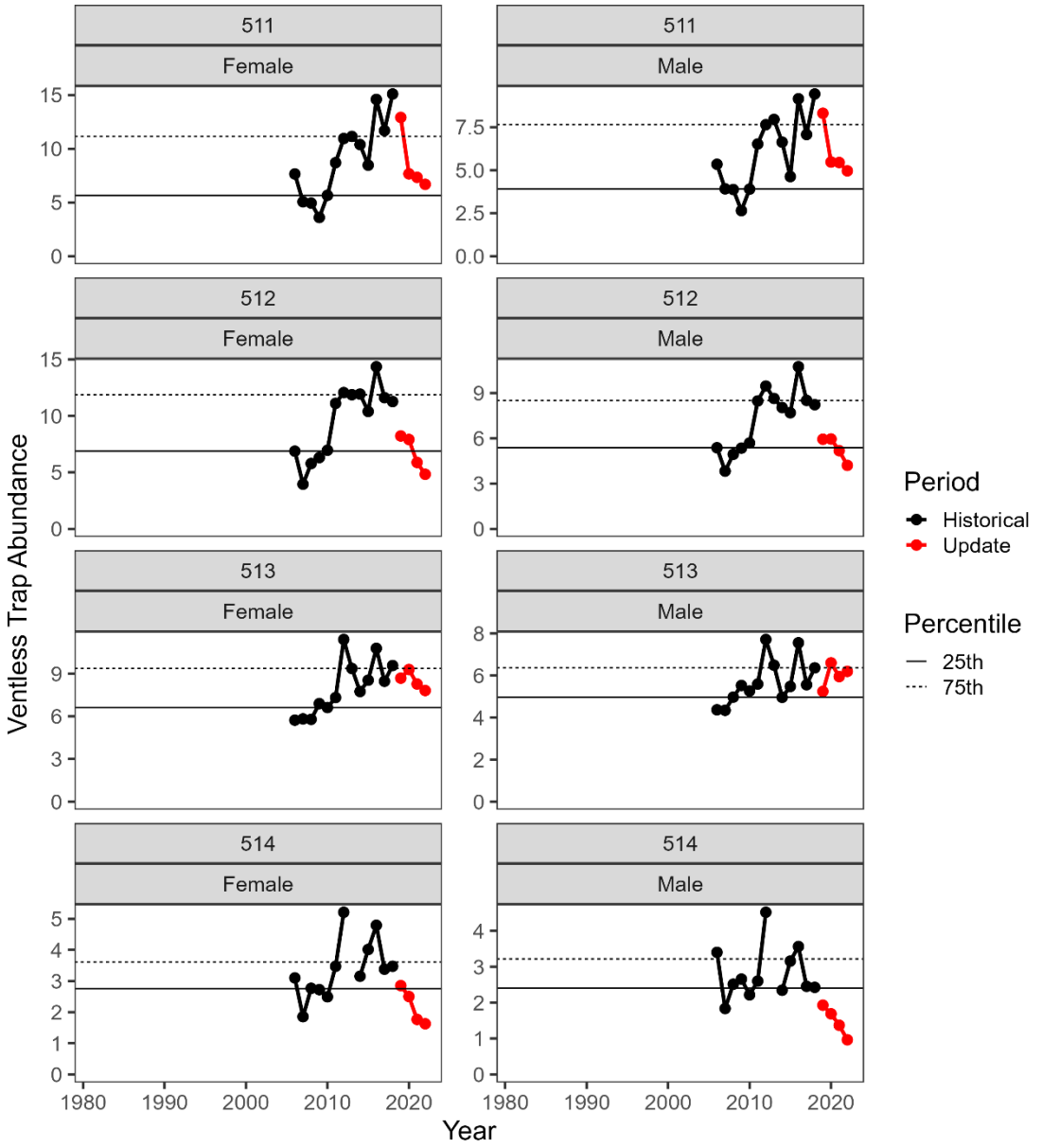
GOM: Encounter Rates

- Deteriorating conditions since the SA
  - All inshore means neutral
  - First negative annual value since 2008 was observed in 2022



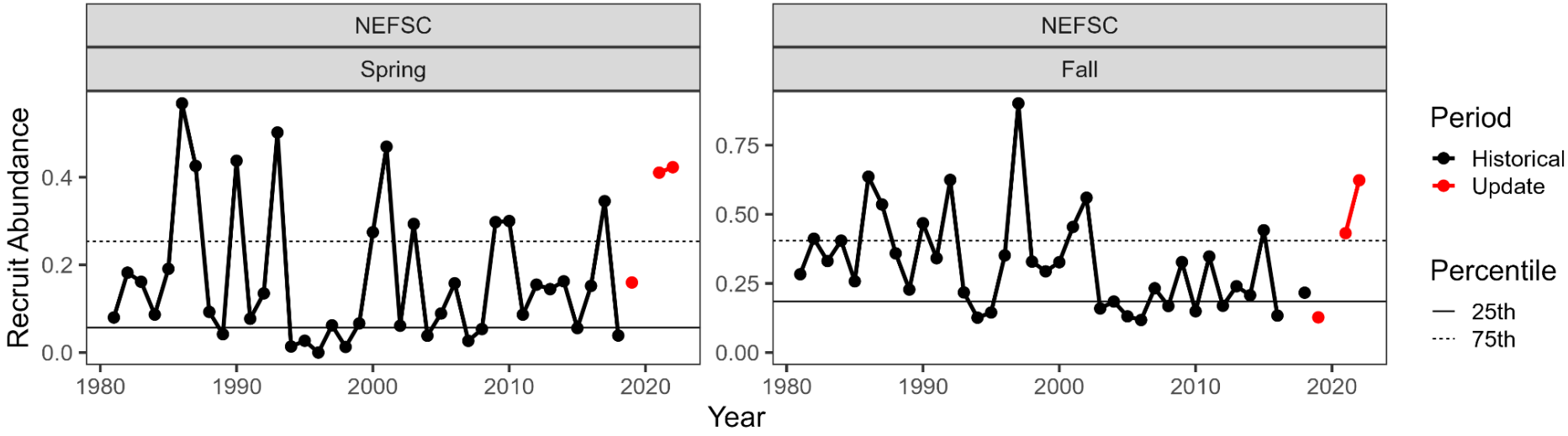
GOM: VTS Indices

- Declines since the SA
  - Six of eight means neutral and two were negative
  - 2022 values for both sexes in statistical areas 512 and 514 were among the lowest values observed during the time series



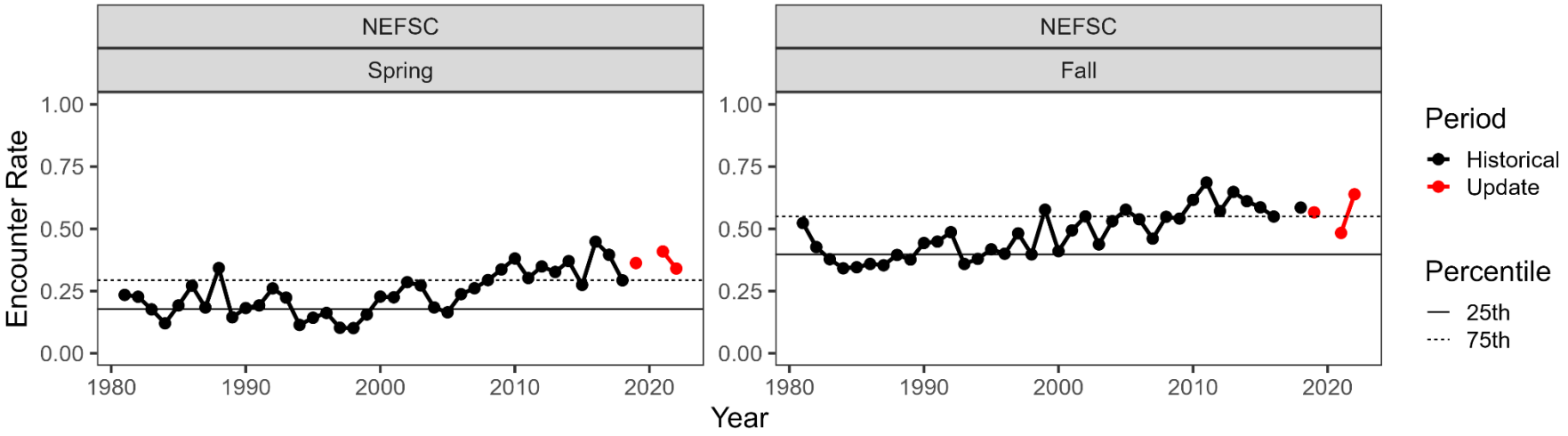
GBK: Recruit Abundance

- Slight improvement since the SA
  - One mean changed from neutral to positive
  - 2022 values were both positive and relatively high



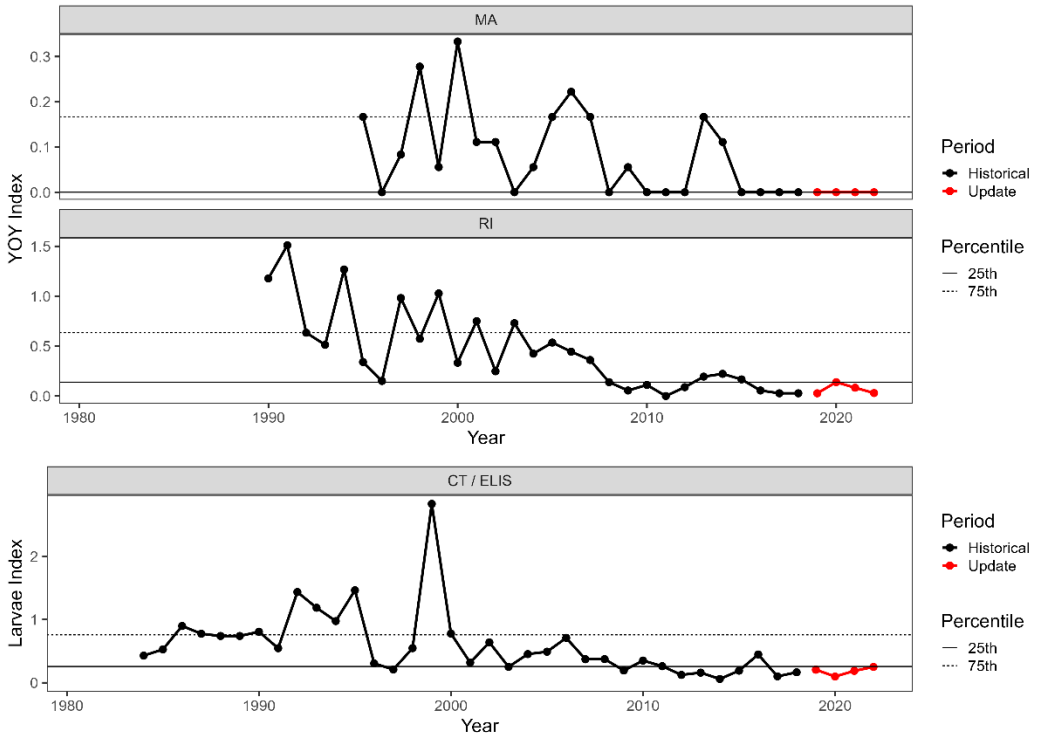
GBK: Encounter Rates

- Conditions similar to during the SA
  - Means both remained positive



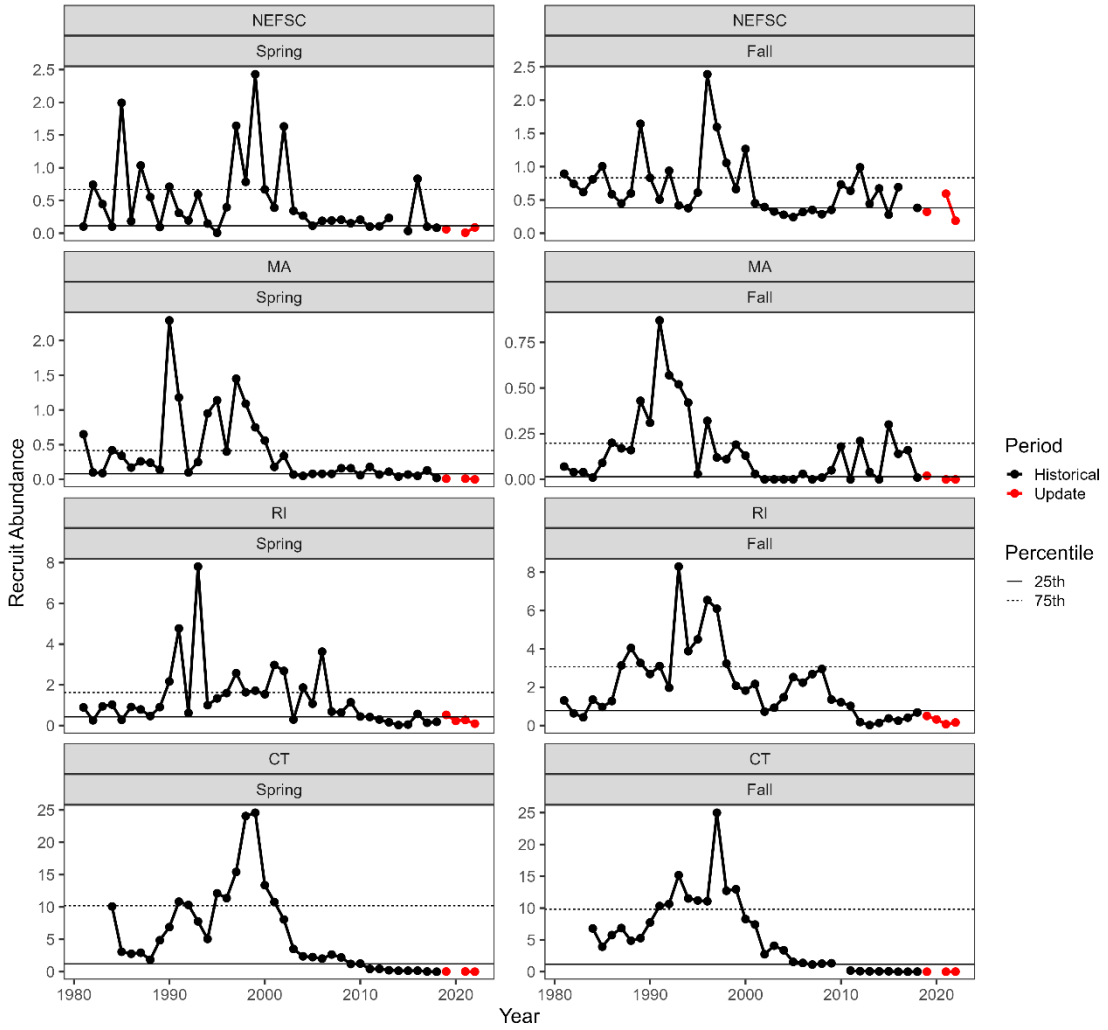
SNE: YOY Indices

- Negative conditions across the stock with some decline since the SA
  - All means negative
  - No YOY caught during MA survey for the last eight years



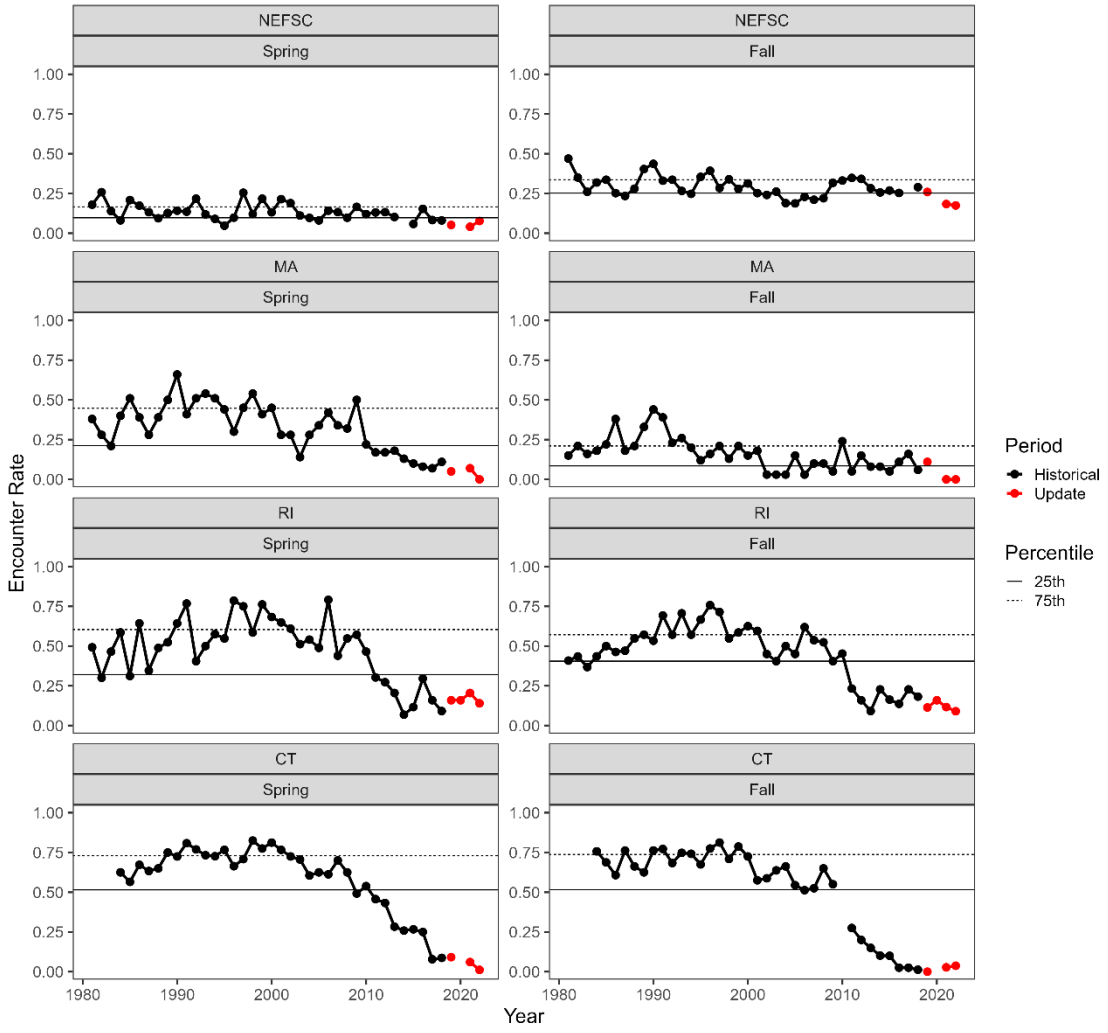
SNE: Recruit Abundance

- Declines since the SA
  - All means negative
  - All 2022 values were negative, the first year values have been negative across all indicators



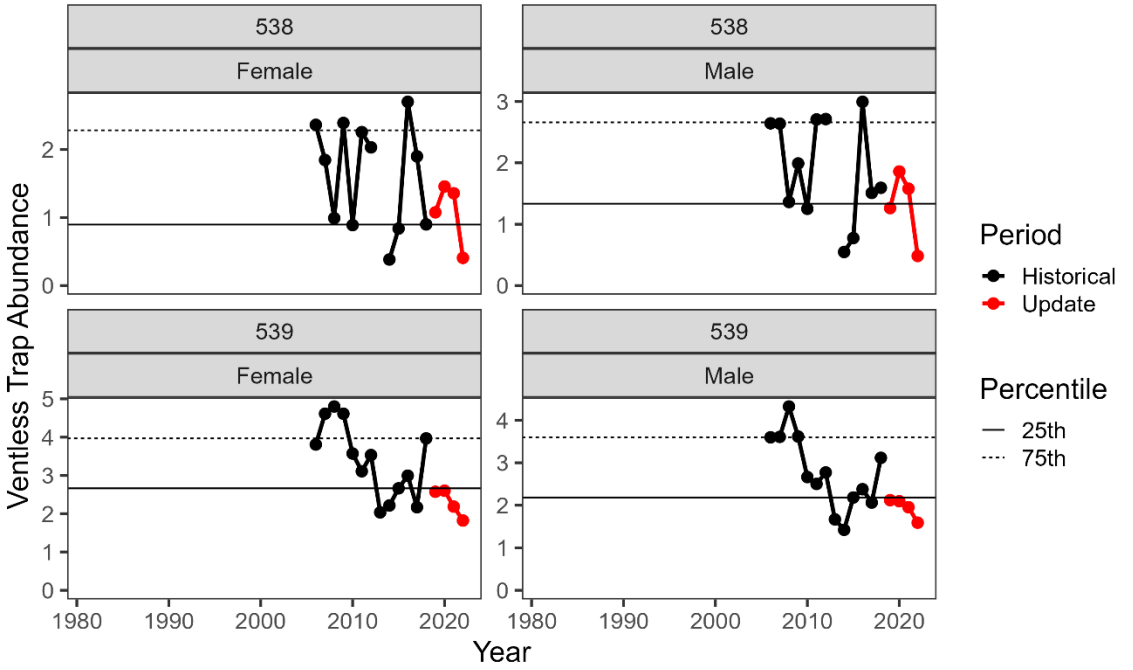
SNE: Encounter Rates

- Deteriorating conditions since the SA
  - All means negative
  - 2022 values all negative for second year in a row



SNE: VTS Indices

- Declines since the SA
  - Two means changed from neutral to negative
  - All 2022 values were negative, the second year values have been negative across all indicators



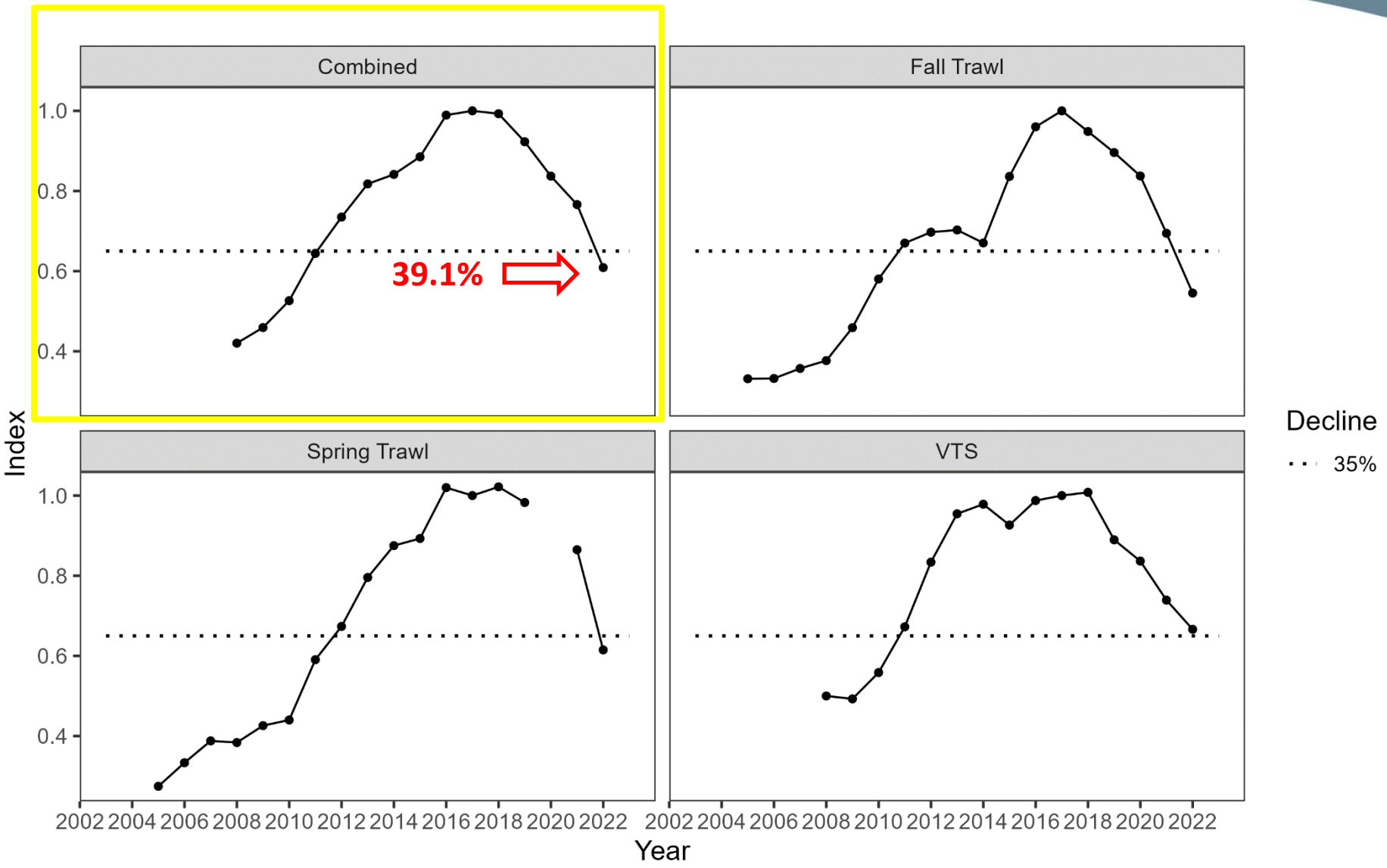
In Summary

- GOM indicators show declines from time series highs observed during the stock assessment
- GBK indicators show slight improvement since the stock assessment
- SNE indicators show continued unfavorable conditions with some further signs of decline since the stock assessment

Addendum XXVII Trigger Mechanism

- The trigger mechanism is based on 3 recruit abundance indices (71-80mm CL):
  - combined ME/NH and MA spring trawl survey index
  - combined ME/NH and MA fall trawl survey index
  - model-based VTS index
- 35% management trigger defined by decline in the recruit indices from reference period (2016-2018)
  - correlates with declines in overall abundance
  - 3 year rolling average so 1 year cannot trigger action

Trigger Index

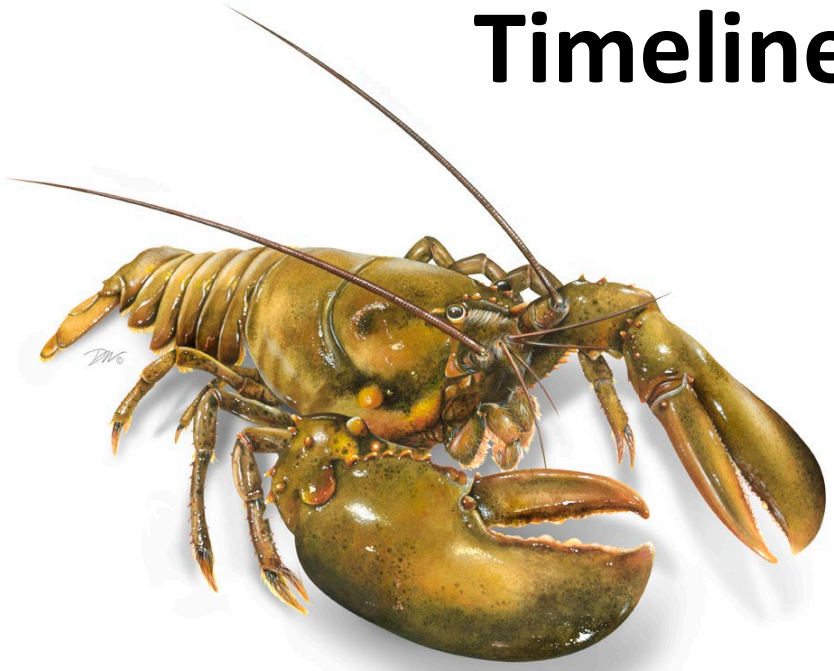


Management Response

- Addendum XXVII, Section 3.2
  - **Year 1 (2024):** LCMA 1 min gauge = 3-5/16” (84 mm)
  - **Year 3 (2026):** LCMA 1 min gauge = 3-3/8” (86 mm)
  - **Year 4 (2027):** LCMA 1 vent size = 2 x 5-3/4” rectangular; 2-5/8” circular
  - **Year 5 (2028):** LCMA 3 and OCC max gauge = 6 ½”

Questions?

2025 American Lobster Benchmark Stock Assessment TORs and Timeline



October 16, 2023

Materials

- Terms of Reference for the Assessment
- Terms of Reference for the Peer Review
- Assessment Timeline

TOR 1

Estimate catch and catch-at-length from all appropriate fishery-dependent data sources including commercial and potential discard data.

TOR 2

Present the abundance data being considered and/or used in the assessment (e.g., regional indices of abundance, length data, etc.).

TOR 3

Evaluate new information on life history such as growth rates, size at maturation, natural mortality rate, and migrations.

- Consider any new information on growth for potential to update the growth transition matrices.

TOR 4

Identify, describe, and, if possible, quantify environmental/climatic drivers.

TOR 5

Use length-based model(s) to estimate population parameters (e.g., effective exploitation rate, abundance) for each stock unit and analyze model performance.

- Conduct projections assuming uncertainty in current and future conditions for all stocks. Compare projections retrospectively with model estimates.

TOR 6

Update simple, empirical, indicator-based trend analyses of abundance, exploitation, fishery performance, and environmental stress for stock or sub-stock areas. Modify or develop new indicators, if warranted.

TOR 7

Evaluate the current regime-based exploitation and abundance reference points (i.e., targets and thresholds). Recommend modifications to these reference points, if necessary.

TOR 8

Characterize uncertainty of model estimates, reference points, and stock status.

TOR 9

Perform retrospective analyses, assess magnitude and direction of retrospective patterns detected, and discuss implications of any observed retrospective pattern for uncertainty in population parameters and reference points.

TOR 10

Report stock status as related to overfishing and depleted reference points (both current and any alternative recommended reference points). Include simple description of the historical and current condition of the stock in layman's terms.

TOR 11

Address and incorporate to the extent possible recommendations from the 2020 Benchmark Peer Review.

TOR 12

Develop detailed short and long-term prioritized lists of recommendations for future research, data collection, and assessment methodology. Highlight improvements to be made by next benchmark review.

TOR 13

Recommend timing of next benchmark assessment and intermediate updates, if necessary relative to biology and current management of the species.

Lobster Assessment Timeline

- Data deadline : January 8, 2024
- Data Workshop: February 2024
- Assessment Workshop 1: June 2024
- Assessment Workshop 2: October 2024
- Assessment report draft finalized by SAS: January 2025
- Assessment reviewed by TC: February 2025
- Peer Review Workshop: May 2025
- Present Assessment and Peer Review Reports to the Board: August 2025

Questions?