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# Yellowtail Flounder Research Track Overview

November 18, 2024

# Yellowtail flounder working group

- Charles Adams (NEFSC), chair
- Larry Alade (NEFSC), CCGOM lead
- Alex Hansell (NEFSC), GB lead
- Cameron Hodgdon (NEFSC), SNEMA lead
- Chris Legault (NEFSC)
- Steve Cadrin (SMAST)
- Tara Dolan (MADMF)
- Robin Frede (NEFMC)
- Conor McManus (~~RIDEM~~ NEFSC)



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# Acknowledgements

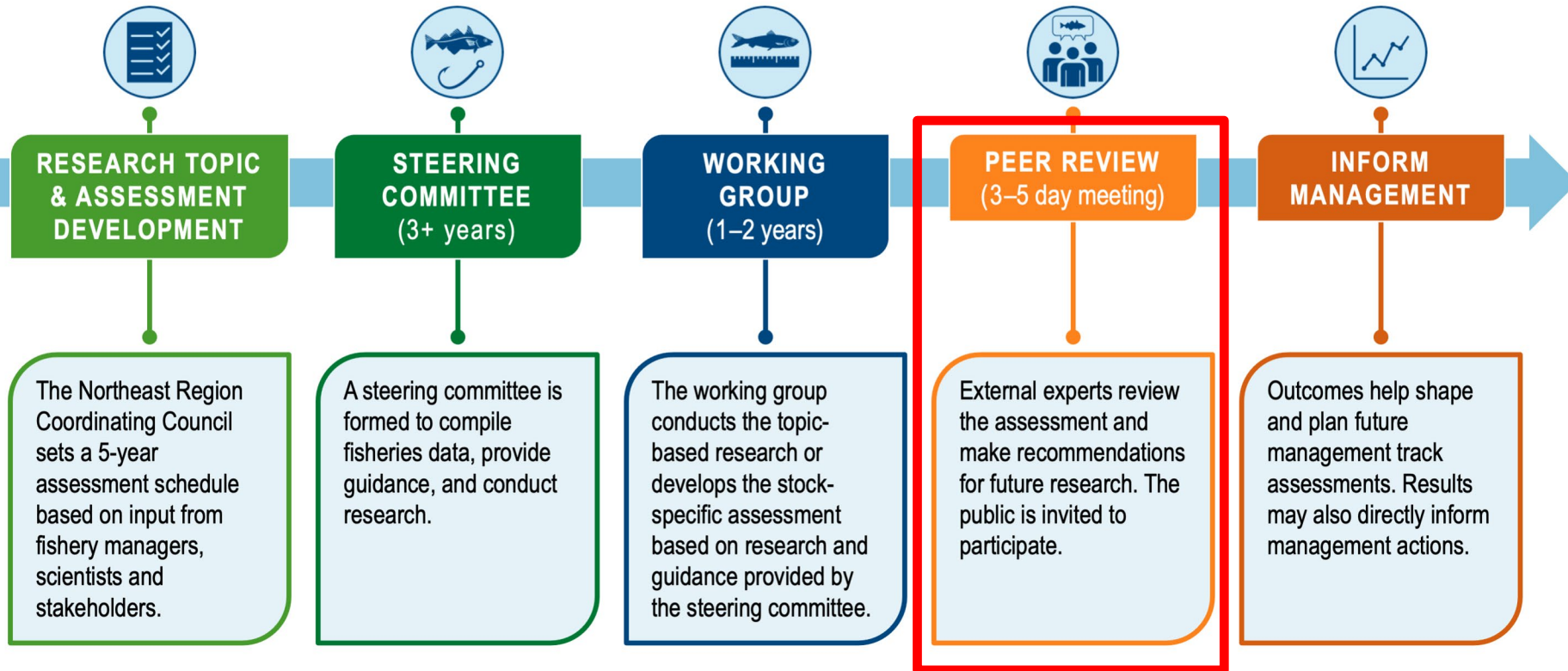
- Jessie Kittel and Cole Carrano (both SMAST) assisted with modeling (TOR4) for GB yellowtail
- Tim Miller (NEFSC) provided assistance with WHAM
- Leona Burgess (NEFSC) provided assistance with the STOCKEFF database and outputs
- Many others participated in meetings and provided feedback throughout the process





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# RESEARCH TRACK STOCK ASSESSMENTS



# Working group meetings

- 17 working group meetings were held between October 4, 2022 and September 30, 2024
- All meetings were virtual except for a hybrid modeling meeting April 29, 2024
- Stakeholder engagement meeting was held March 9, 2023
- Rapporteurs recorded discussions and decisions



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# Stakeholder engagement 3/9/2023

- 28 attendees, including 8 industry members
- Notable feedback
  - Low abundance of GB & SNEMA stocks = no longer economically viable
  - CCGOM stock is in better shape; however, the need to avoid cod in the GOM (co-occurrence with yellowtail), and market forces are driving a decline in economic viability
  - Yellowtail flounder are no longer common bycatch for the GB scallop fishery. Fishers and observers report only 1-2 fish per trip



# Terms of Reference Overview

- TOR1 - Identify relevant ecosystem and climate influences on the stock
- TOR2 - Estimate catch from all sources including landings and discards
- TOR3 - Present the survey data used in the assessment
- TOR4 - Use appropriate assessment approach to estimate annual fishing mortality, recruitment and stock biomass

# Terms of Reference Overview

- TOR5 - Update or redefine status determination criteria
- TOR6 - Define appropriate methods for producing projections
- TOR7 - Review, evaluate, and report on the status of research recommendations
- TOR8 - Develop a backup assessment approach

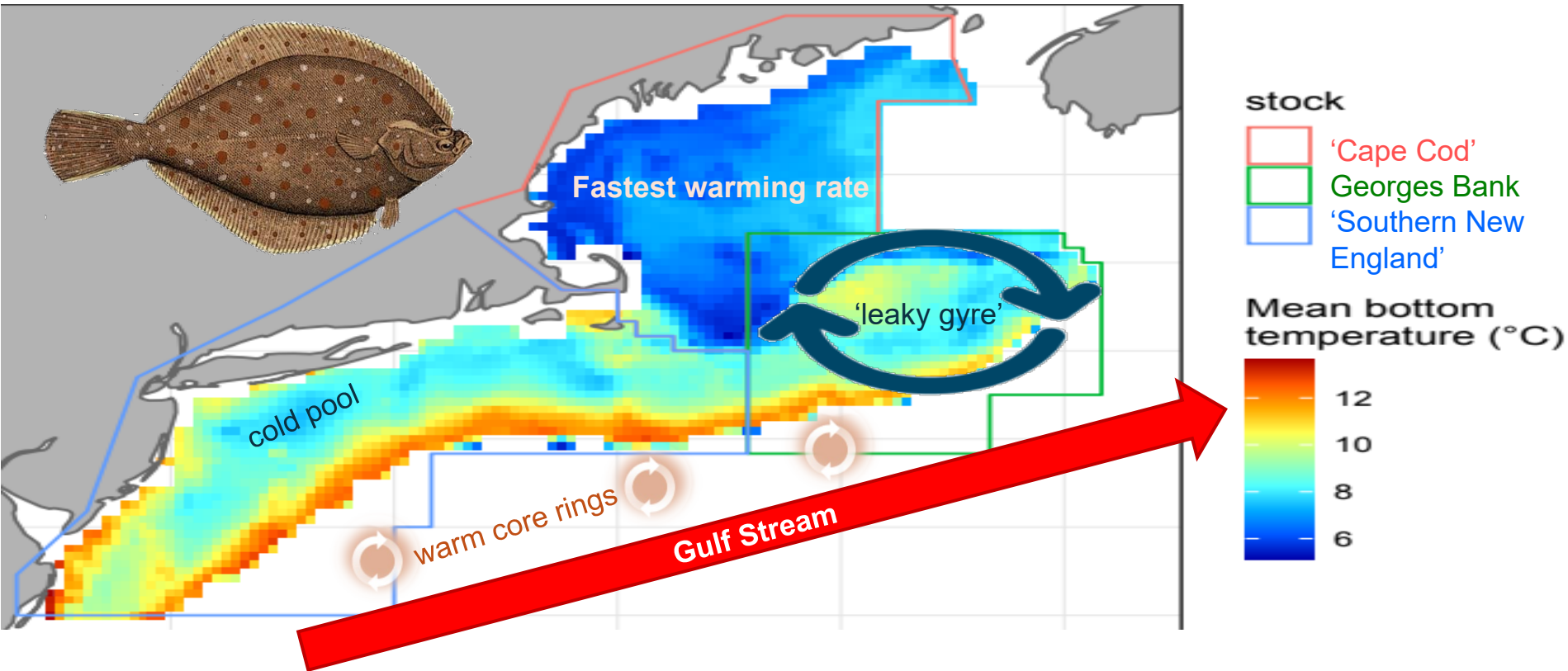


# TOR1 Ecosystem

- Identify relevant ecosystem and climate influences on the stock
  - Characterize the uncertainty in the relevant sources of data and their link to stock dynamics
  - Consider findings, as appropriate, in addressing other TORs
  - Report how the findings were considered under impacted TORs

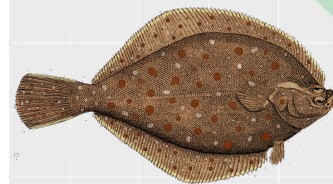
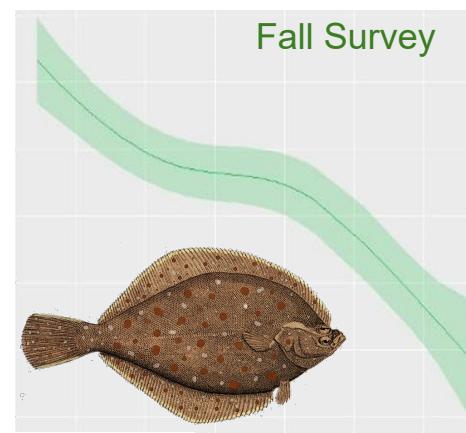
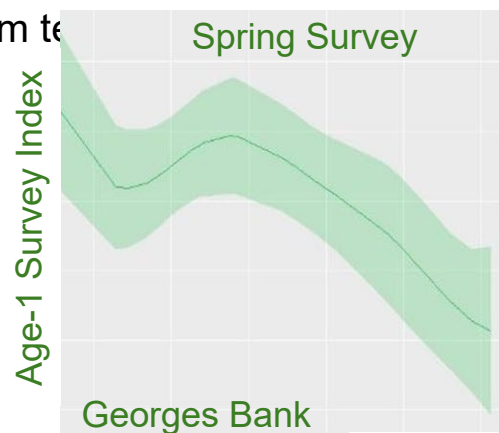
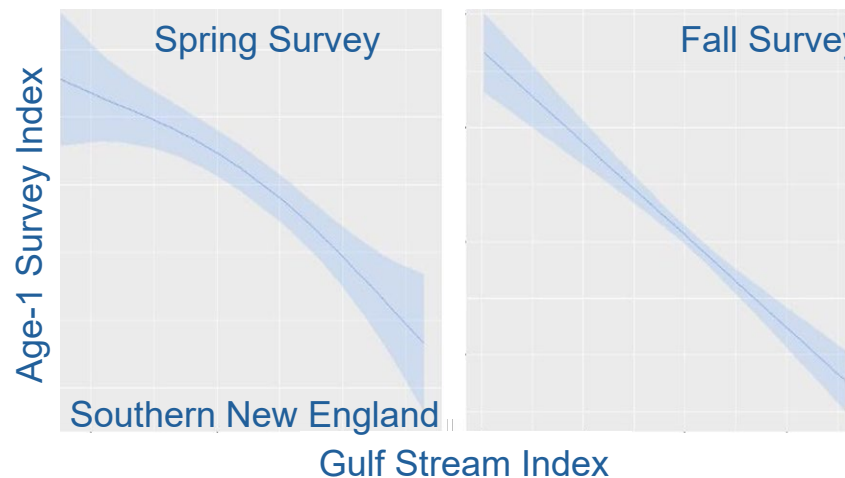
# Term of Reference 1: Environmental Effects

- Yellowtail was a primary target species in New England and is data-rich.
- Yellowtail stocks have different environments and responses to regional conditions.



# ToR1 Recommendations for Assessment Models

- Based on literature review, stakeholder input, and exploratory data analyses, the Yellowtail Flounder Research Track Working Group decided to
  - apply time-varying size at age from annual samples or multi-annual samples, and
  - explore environmental covariates to recruitment deviations
    - 'Southern New England' recruitment informed by Gulf Stream Index or Cold Pool Index
    - Georges Bank recruitment informed by bottom temperature or Atlantic Multidecadal Oscillation,

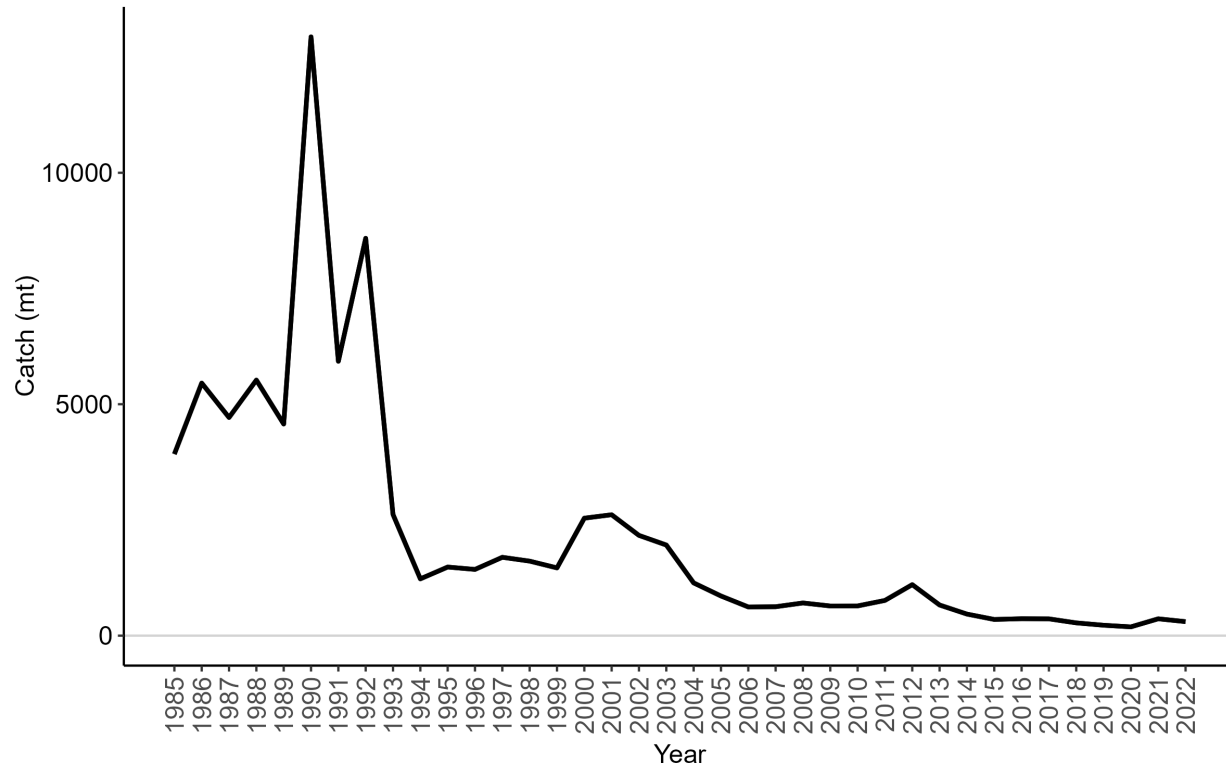


# TOR2 Catch data

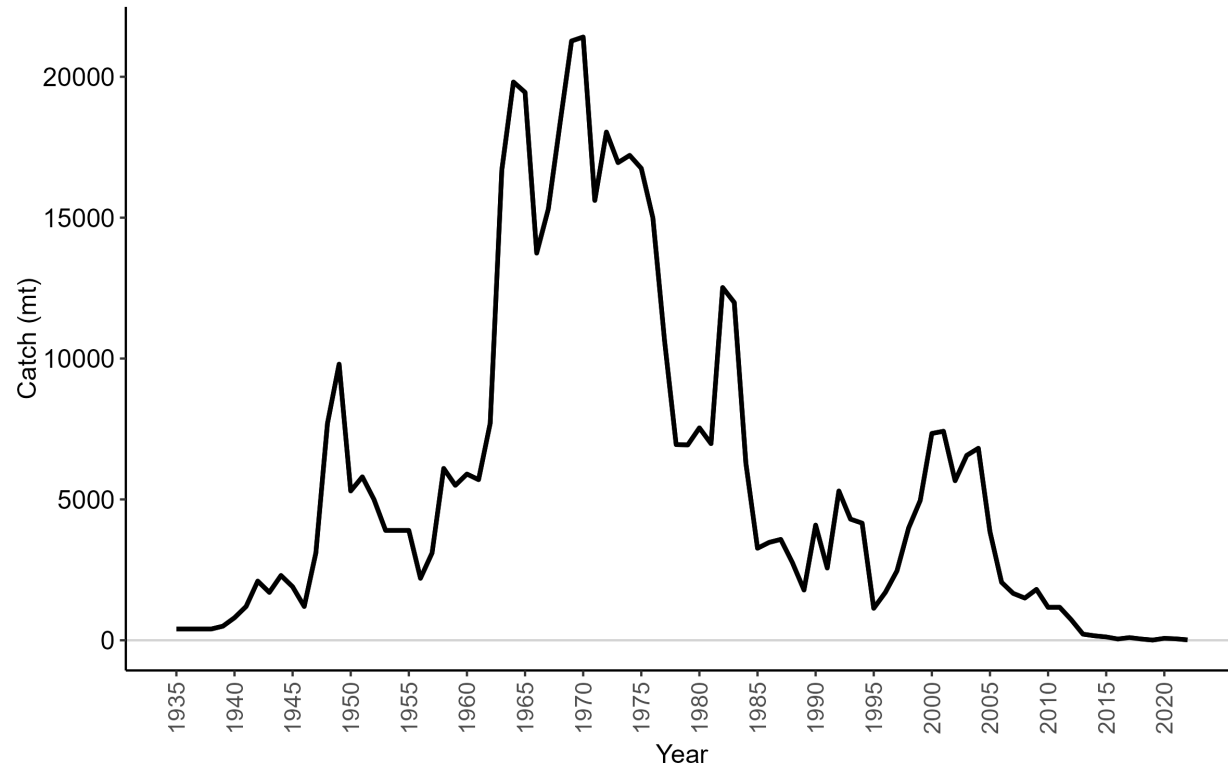
- Estimate catch from all sources including landings and discards
  - Describe the spatial and temporal distribution of landings, discards, and fishing effort
  - Characterize the uncertainty in these sources of data



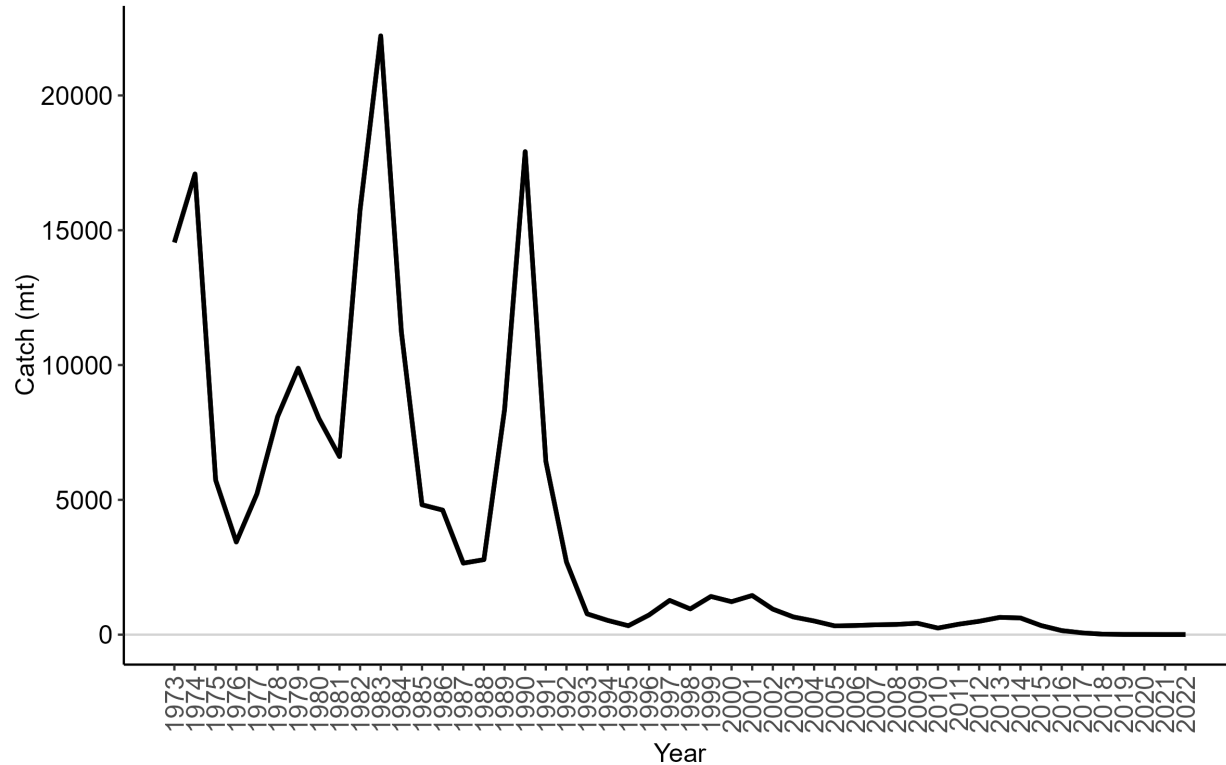
# TOR2 Catch data CCGOM



# TOR2 Catch data GB



# TOR2 Catch data SNEMA



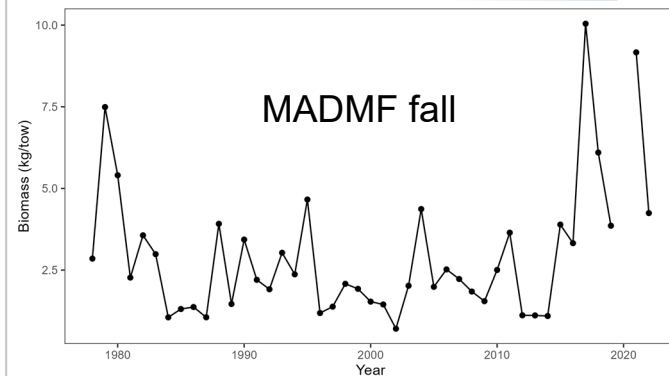
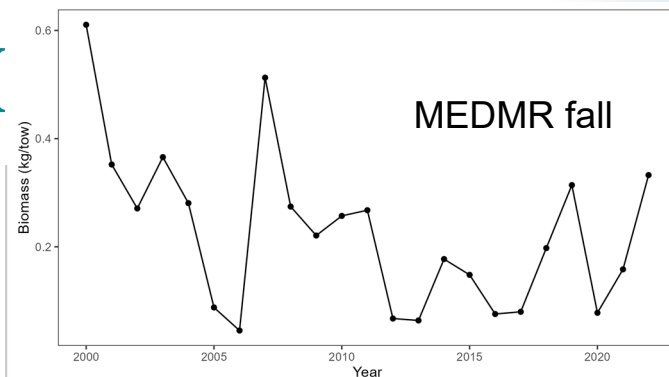
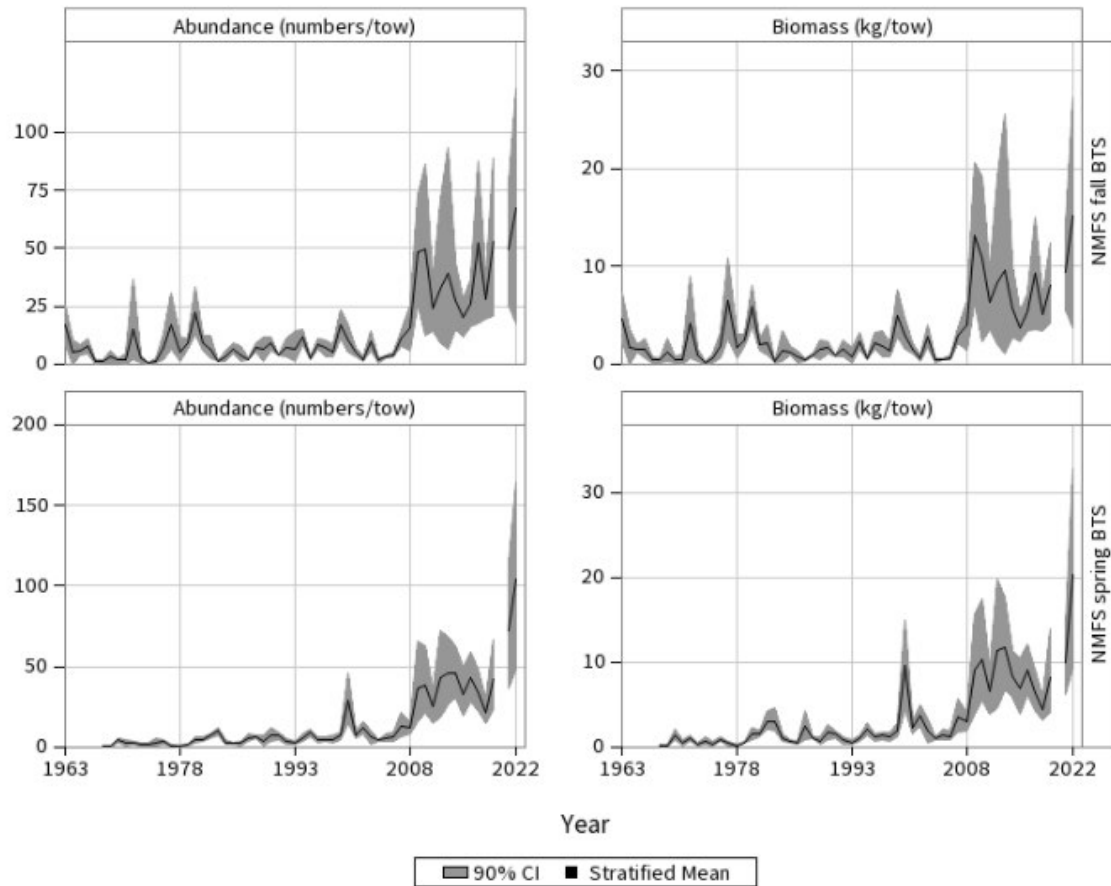
# TOR3 Survey data

- Present the survey data used in the assessment (e.g., indices of relative or absolute abundance, recruitment, state surveys, age-length data, application of catchability and calibration studies, etc.) and provide a rationale for which data are used
  - Describe the spatial and temporal distribution of the data
  - Characterize the uncertainty in these sources of data



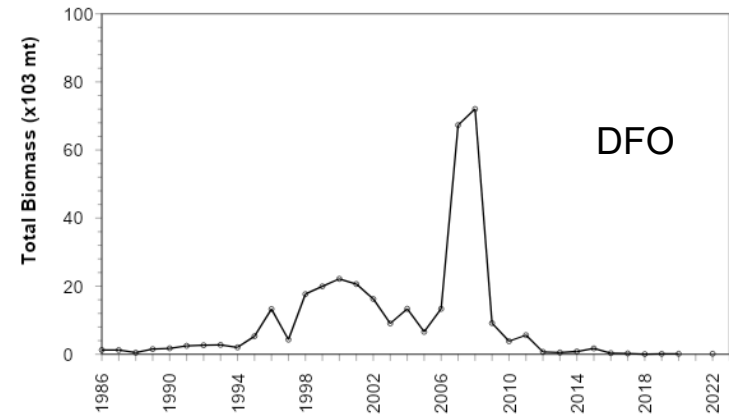
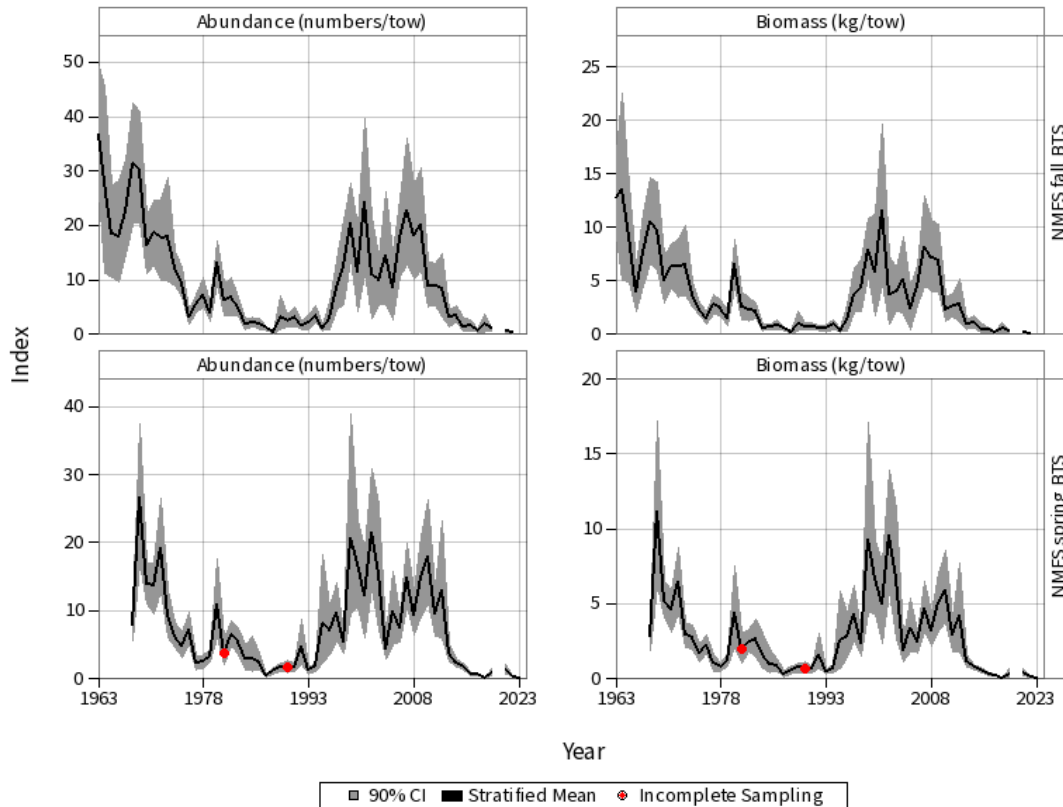
# TOR3 Survey data CCGOM

Inde

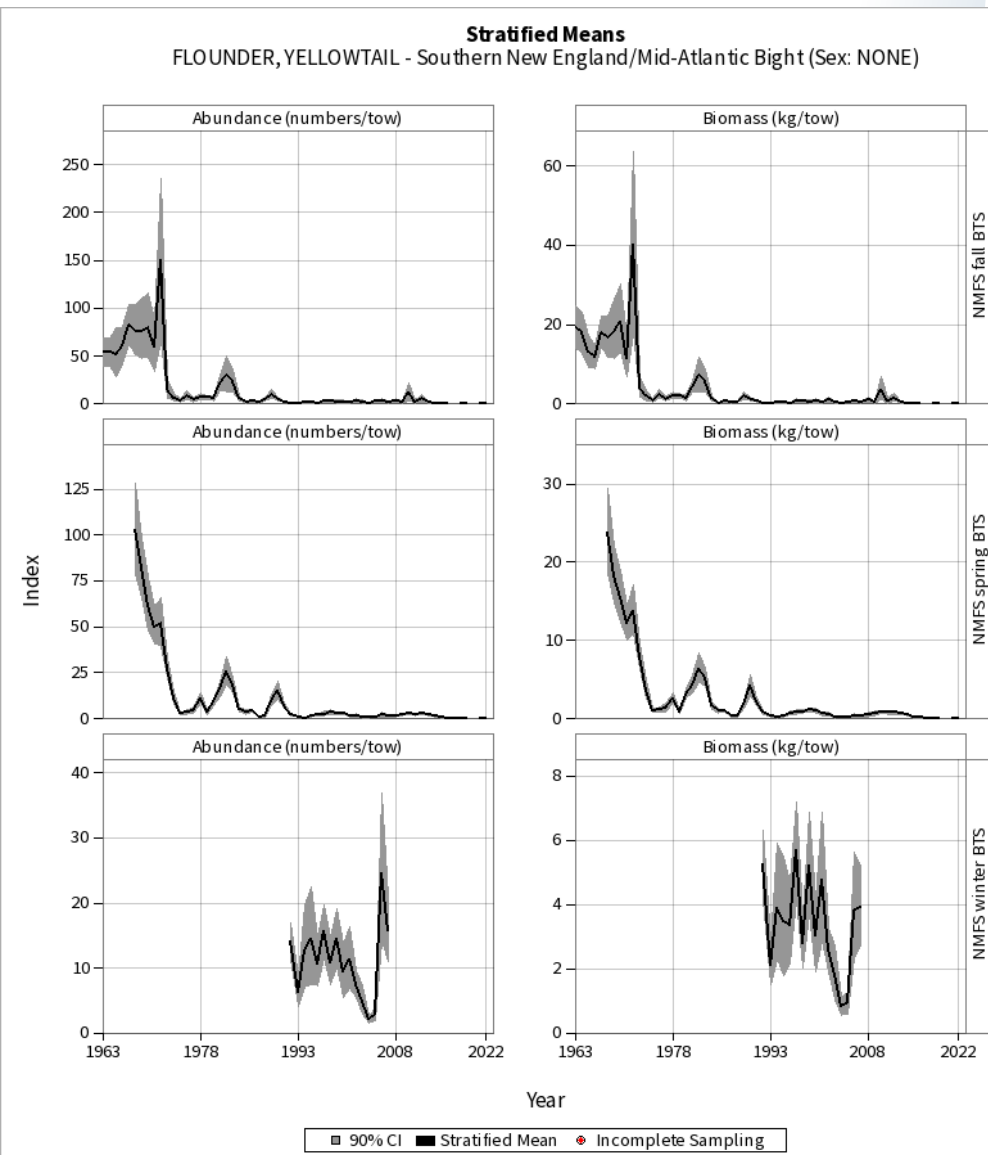


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# TOR3 Survey data GB



# TOR3 Survey data SNEMA



# TOR4 Models

- Use appropriate assessment approach to estimate annual fishing mortality, recruitment and stock biomass (both total and spawning stock) for the time series, and estimate their uncertainty
  - Compare the time series of these estimates with those from the previously accepted assessment(s)
  - Evaluate a suite of model fit diagnostics (e.g., residual patterns, sensitivity analyses, retrospective patterns), and (a) comment on likely causes of problematic issues, and (b), if possible and appropriate, account for those issues when providing scientific advice and evaluate the consequences of any correction(s) applied



# TOR4 Models

- One of the primary goals of the WG was to get all three stocks into WHAM
  - CCGOM: VPA → WHAM
  - GB: Limiter → WHAM
  - SNEMA: ASAP → WHAM
- WHAM is a state-space model that can estimate time-and age-varying random effects on annual transitions in NAA, M, and selectivity, as well as fitting environmental covariates with process and observation errors (Stock and Miller 2021)

# TOR4 Models CCGOM

- Highlights of preferred WHAM model
  - Years: 1985-2022
  - $M = 0.4$
  - Fleet selectivity: logistic (RE = none)
  - Fleet age comps: logistic-normal-miss0
  - Surveys: NEFSC spring & fall; MADMF fall; MENH fall
  - Survey selectivity: logistic (RE = none)
  - Survey age comps: logistic normal-ar1-miss0
  - Recruitment: random about mean
  - NAA RE: ar1\_a
  - Ecov: None



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# TOR4 Models GB

- Highlights of preferred WHAM model
  - Years: 1973-2022
  - $M = 0.4$
  - Fleet selectivity:  $Ar1_y$
  - Fleet age comps: logistic-normal-pool0
  - Surveys: NEFSC spring & fall; DFO
  - Survey selectivity: logistic
  - Survey age comps: logistic-normal-pool0
  - Recruitment: Beverton-Holt SR with Ecov (see below)
  - NAA RE: IID
  - Ecov: bottom temperature with  $AR1_y$  correlation structure



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# TOR4 Models SNEMA

- Highlights of preferred WHAM model
  - Years: 1973-2022
  - $M = 0.5$
  - Fleet selectivity: logistic (RE = IID)
  - Fleet age comps: logistic normal-ar1-miss0
  - Surveys: NEFSC spring, fall & winter
  - Survey select: logistic (spring/winter); age specific (fall)
  - Survey age comps: logistic normal-ar1-miss0
  - Recruitment: decoupled; Ecov informed (see below)
  - NAA RE: 2dar1
  - Ecov: Gulf Stream Index modeled via AR1 process



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# TOR5 Reference points

- Update or redefine status determination criteria (SDC; point estimates or proxies for BMSY, BTHRESHOLD, FMSY and MSY reference points) and provide estimates of those criteria and their uncertainty, along with a description of the sources of uncertainty
  - If analytic model-based estimates are unavailable, consider recommending alternative measurable proxies for reference points
  - Compare estimates of current stock size and fishing mortality to existing, and any redefined, SDCs

# TOR5 Reference points CCGOM

- Highlights of BRPs
  - $M = 0.4$
  - 2-year average for maturity
  - 2-year average for WAA
  - Time series R
  - $F_{40\%} = 1.64$
  - $SSB_{40\%} = 4870$  mt

# TOR5 Reference points GB

- Highlights of BRPs
  - $M = 0.4$
  - Maturity constant
  - Time varying WAA
  - MSY for current conditions done by fixing the SR at estimated current conditions (breakpoint)
  - $F_{MSY} = 0.15$
  - $SSB_{MSY} = 4942$  mt

# TOR5 Reference points SNEMA

- Highlights of BRPs
  - $M = 0.5$
  - 2-year average for fleet selectivity
  - 2-year average for WAA
  - Average GSI for 2012–2022
  - $F_{40\%} = 0.73$
  - $SSB_{40\%} = 126 \text{ mt}$

# TOR6 Projections

- Define appropriate methods for producing projections; provide justification for assumptions of fishery selectivity, weights at age, maturity, and recruitment; and comment on the reliability of resulting projections considering the effects of uncertainty and sensitivity to projection assumptions

# TOR6 Projections CCGOM

- Highlights
  - $M = 0.4$
  - Terminal 2-year average for maturity
  - Terminal 2-year average for WAA
  - Time series R

# TOR6 Projections GB

- Highlights
  - $M = 0.4$
  - Maturity constant
  - Terminal 2-year average for WAA
  - Recruitment is influenced by the average bottom water temperature from 2009-2022

# TOR6 Projections SNEMA

- Highlights
  - $M = 0.5$
  - Maturity constant
  - Terminal 2-year average for WAA
  - R is a function of average GSI for 2012–2022



# TOR7 Research recommendations

- Review, evaluate, and report on the status of research recommendations from the last assessment peer review, including recommendations provided by the prior assessment working group, peer review panel, and SSC
  - Identify new recommendations for future research, data collection, and assessment methodology
  - Prioritize research recommendations



# TOR7 Research recommendations

- High priority
  - Enhanced port sampling for improved catch-at-age estimates for all stocks.
  - Given the increasingly low survey catches for SNEMA and GB and the increasing chances of true zeroes in the survey data for this stock, it is imperative to modify WHAM to be able to more appropriately address zero values.
  - Confirm that the assumptions of current conditions continue for projections and reference points (breakpoints for GB bottom temperature and SNEMA GSI).
  - Explore near-term projections of environmental covariates to inform short-term catch projections



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# TOR7 Research recommendations

- Lower priority
  - Update and confirm that the relationships of environmental variables continue (bottom temperature for CCGOM and GB, GSI for SNEMA). If relationships break down, consider alternative environmental metrics that may be more directly influencing yellowtail stocks. In general, continue to explore the relationships of recruitment and other parameters with environmental covariates for all three stocks and continue to explore alternative projection methodologies for GSI (SNEMA) and bottom temperature (GB).
  - Create a data product for salinity that could be explored in future models



# TOR8 Backup plan

- Develop a backup assessment approach to providing scientific advice to managers if the proposed assessment approach does not pass peer review or the approved approach is rejected in a future management track assessment

# TOR8 Backup plan

- The WG recommends
  - The Limiter for GB
  - A modified Limiter for SNEMA
  - Empirical approach for CCGOM



# Questions?

