COMPILATION OF SCIENTIFIC ADVICE FOR EASTERN GEORGES BANK COD AND HADDOCK AND GEORGES BANK YELLOWTAIL FLOUNDER FOR FISHING YEAR 2027

BACKGROUND

Starting in 2025, the process for the Integration of Science Advice for Transboundary Species (ISATS) supports the management of eastern Georges Bank (EGB) cod and haddock, and Georges Bank (GB) yellowtail flounder. This process includes a Technical Science Coordination (TSC) meeting of stock assessment leads where the outcomes from U.S. and Canadian domestic assessments are compiled into a joint document to provide scientific advice in support of the Transboundary Management Guidance Committee (TMGC) process for the joint management of the shared transboundary stocks (Tables 1–3).

This document is the product of a TSC meeting of the Fisheries and Oceans Canada (DFO) and National Oceanic and Atmospheric Administration (NOAA) Fisheries (National Marine Fisheries Service, NMFS) stock assessment leads, held virtually on July 13, 2026. During the meeting, DFO and NMFS staff presented and discussed the results from their domestic assessments, and summarized the science advice herein. TMGC members were able to attend, listen to the meeting discussion, and submit questions afterward as needed. Summary tables of total allowable catch and removals for EGB cod and haddock are provided in Appendix 2. The documents supporting this summary (stock assessment reports, allocation shares report, and survey biomass distribution analysis report) are attached in Appendix 3.

Table 1. Short term projections from DFO eastern Georges Bank (EGB) and NMFS Georges Bank (GB) cod stock assessments. SSB=spawning stock biomass; F=fishing mortality; mt=metric tonnes; CI=confidence interval; MSY=maximum sustainable yield. All SSB values are estimated. Values of catch and F with an asterisk (*) are fixed values of realized catch and F reference points, respectively, while other values of catch and F are estimated. EGB estimates reflect F of preventable decline and catch at that F; GB estimates reflect F at F_{MSY} proxy and catch at that F. Survey biomass distribution values are intended to inform but not constrain management advice.

Model	**Parameter**	**2025 Value**	**2026 Value**	**2027 Value**
DFO EGB cod 2026 Model Values (terminal year of data=2025)	SSB (mt)	8,469	6,257	5,123
	F	0.03	0.052	0.05*
	Catch (mt)	452*	473*	353
NMFS GB cod 2024 Model Values (terminal year of data=2023)	SSB (mt; 95%CI)	2,089 (499–8,739)	1,658 (277–9,937)	1,567 (170–14,457)
	F	0.233*	0.233*	0.233*
	Catch (mt)	518	419	400
Survey biomass distribution of cod in EGB in 2026 (95%)				380

Table 2. Short term projections from DFO eastern Georges Bank (EGB) and NMFS Georges Bank (GB) haddock stock assessments. SSB=spawning stock biomass; F=fishing mortality; mt=metric tonnes; CI=confidence interval. All SSB values are estimated. Values of catch and F with an asterisk (*) are fixed values of realized catch and F reference points, respectively, while other values of catch and F are estimated. EGB haddock values are provided assuming <u>full</u> or <u>partial</u> utilization of catch limit in 2026 fishing year. Survey biomass distribution values are intended to inform but not constrain management advice.

Model	**Parameter**	**2025 Value**	**2026 Value**	**2027 Value**
DFO EGB haddock 2026 Model Values (terminal year of data=2025)	SSB (mt)	12,835	10,757	5,571 (full); 6,407 (partial)
	$F_{\text{fully selected}}$	0.459	0.851 (full); 0.621 (partial)	0.325*
	Catch (mt)	4,920*	4,750* (full); 3,750* (partial)	830–2,020 (full); 1,010–2,210 (partial)[1]
NMFS GB haddock 2026 Model Values (terminal year of data=2025)	SSB (mt; 95%CI)	29, 037	25,281 (9,775–65,382)	21,828 (6,359–74,926)
	$F_{5\text{-}7}$ (95%CI)	0.21	0.247 (0.090–0.675)	0.27*
	Catch (mt; 95%CI)	6,032*	5,768*	5,277 (1,524–18,271)
Survey biomass distribution of haddock in EGB in 2026 (66%)				3,483 (1,006–12,059)

[1] Catch range based on 25% to 75% risk of exceeding the F_{ref} of 0.325.

Table 3. Short term projections from NMFS Georges Bank (GB) yellowtail flounder stock assessments. SSB=spawning stock biomass; F=fishing mortality; mt=metric tonnes; CI=confidence intervals. All SSB values are estimated. Values of catch and F with an asterisk (*) are fixed values of realized catch and F reference points, respectively, while other values of catch and F are estimated.

Model	Parameter	2025 Value	2026 Value	2027 Value
NMFS GB yellowtail flounder 2025 Model Values (terminal year of data=2024)	SSB (mt; 95%CI)	655 (230–1,860)	646 (190–2,198)	654 (180–2,374)
	F	0.034	0.09*	0.09*
	Catch (mt)	22*	57	57

Table 4. Allocation shares for fishing year 2027.

Stock	Allocation Shares Canada	Allocation Shares U.S.
Eastern Georges Bank cod	72%	28%
Eastern Georges Bank haddock	72%	28%
Georges Bank yellowtail	54%	46%

OVERVIEW OF DFO AND NMFS ASSESSMENT MODELS AND RESULTS

DFO Eastern Georges Bank Cod Model

Based on the June 2026 Canadian Science Advisory Secretariat (CSAS) peer review of the Stock Assessment of Atlantic cod on EGB, the 2025 spawning stock biomass (SSB) is at 33% of the limit reference point (26,800 mt). Under the DFO Precautionary Approach Framework this means the stock is in the critical zone with a very high probability (>99%). The 2025 SSB is 8,469 mt, which represents a small increase from the series low of 8,327 mt in 2022. Fishing mortality (F) has remained below 0.05 since 2017, and the 2025 estimate is 0.03. Recruits per SSB in recent years have been the highest since 1978, within the context of record low SSB. However, this has not resulted in sustained increases in the number of fish at ages 3+. Estimated loss of aged 4+ fish continues to be high, with natural mortality (M) inferred to be the primary cause.

The June 2026 assessment was the second application of the new assessment framework developed for EGB cod (framework peer review meetings completed in May 2025). The new modelling framework implemented a Woods Hole Assessment Model (WHAM) for the EGB cod management area, with projections and reference point calculations completed in Management Strategy Evaluation toolkit (MSEtool). The model data inputs include three fleets, Canadian and U.S. reported fisheries (landings and discards from both), as well as a misallocated U.S. catch fleet, and three surveys (DFO Winter Survey including stratum 5Z9, NMFS Northeast Fisheries Science Center [NEFSC] bottom trawl Spring and Fall surveys). During the June 2026 peer review, the EGB cod model showed a poor fit to the 2025 NEFSC Fall Survey index. Concerns were noted about limited spatial coverage, particularly in areas where positive catches of cod have historically been observed. An exploratory review of environmental data (photoperiod and water stratification) also identified differences from those observed during the survey period in recent years, suggesting that the 2025 NEFSC Fall Survey may not have been fully comparable to previous years. Therefore, it was decided that, due to the changes in timing and spatial coverage, the 2025 NEFSC Fall Survey index be excluded from the model inputs. An additional minor change to data inputs was a modification made to the Canadian fishery weight at age (WAA) for 8-year old fish.

The model indicates that a high number of adult fish are disappearing from this stock in excess of fishery removals. This disappearance is primarily attributed to M. There are no indications that the high level of M will decrease substantially in the near future, and the high M appears to be the main factor limiting productivity for this stock. Long-term projections for biomass indicate that it is unlikely that stock status will improve under the current productivity dynamics, even in the absence of fishing. The contributing factors to the high level of M are unknown, but a shift in the ecosystem to higher temperatures and increased predation is commonly identified as a factor. It is also suggested that the observations of older fish in deeper waters at an earlier time than observed in the past is related to the shifting ecosystem conditions.

NMFS Georges Bank Cod Model

Based on the 2024 Management Track (MT) assessment of GB Atlantic cod conducted by NOAA Fisheries, the stock was overfished and overfishing was not occurring in 2023, the terminal year of the assessment. This assessment was the first MT following the 2023 Research Track (RT) assessment and implemented a WHAM model for the total Georges Bank cod footprint. The model included one fleet (combined U.S. and Canadian landings and discards), three surveys (DFO Winter Survey, NEFSC bottom trawl Spring and Fall surveys), and assumed age- and time-invariant M (0.29). SSB was low over the terminal four years of the assessment (2019-2023) with the terminal year estimate at an all-time low (SSB=2,668 mt in 2023). Recruitment is the largest source of uncertainty in this assessment. Recent (2018–2023) recruitment estimates were higher than those through most of the 2000–2010s. However, these relatively higher recruitment estimates did not result in higher SSB estimates which declined from 2018–2023, and the 2023 recruitment estimate was the second lowest over this period. Both suggest that lower SSB is likely to persist in the short term. Short term projections support this conclusion, but these are also driven by assumed fishing mortalities (F=0.152 in 2024 bridge year and F_{MSY} proxy=0.233 in subsequent years) that are higher than those estimated in recent years (F=0.13 in 2023). Insufficient port sampling, gaps in surveys and age truncation in terminal years of the NEFSC Fall Survey contribute to increased uncertainty when characterizing age composition for this stock.

DFO Eastern Georges Bank Haddock Model

Based on the June 2026 CSAS peer review of the Stock Assessment of haddock on EGB, the 2025 model-estimated SSB (12,835 mt) is above the limit reference point (LRP) with a very high probability of >99% and below the upper stock reference (USR) with a moderately high probability of 73%, placing the stock in the cautious zone. The estimated SSB has declined from 83,000 mt in 2016 to 12,835 mt in 2025, which is below the median of the time series. The 2020 and 2021 year-classes continue to contribute the most to the fishery and survey catches. The model estimates of age-1 recruitment in 2020 and 2021 are 75 million and 71 million, respectively. Fully-selected F was estimated to be 0.57 on average over the last five years with a decrease to 0.459 for 2025. The model estimated M (0.508) in recent years (2010–2025) continues to be high.

A sensitivity analysis was conducted with and without the 2025 NEFSC Fall Survey index. Although there was a reduction in the number of tows in the 2025 NEFSC Fall Survey, there were at least 2 tows for all of the survey strata included. Model diagnostics were similar between sensitivity runs, suggesting that the 2025 NEFSC Fall Survey data index was not influential and there was no justification to exclude it as a data input. For the past two assessments, data from the DFO Winter Survey stratum 5Z9 were included for the model inputs, resulting in improved model diagnostics (e.g., reduced residual patterns in the survey age composition data, and improved retrospective patterns for SSB, F, and recruitment).

M remains an uncertainty for the EGB haddock stock. The expectation was that, with the exit of the 2013 year-class and the reduction in overall stock biomass, the model-estimated M would decrease. Contrary to expectations, model-estimated M remains high. However, our understanding of the factors leading to high M in recent years is incomplete and is likely reflecting potential changes in additional factors including movement, catch reporting errors, ageing error, and misspecification of selectivity.

The DFO model assumes a low M in the historical time period followed by a high M estimated in a single time block from 2010–2025. The F_{ref}, based on $F_{40\%SPR}$, is calculated using a lower M of 0.2, which differs from what is assumed in the model and projections (M=0.508).

NMFS Georges Bank Haddock Model

The 2026 Management Track (MT) Assessment Peer Review of GB haddock led by NOAA Fisheries concluded that the stock was not overfished and overfishing was not occurring in 2025, the terminal year of data available for the assessment. The assessment used the WHAM framework based on work completed in the 2022 RT Assessment Peer Review for haddock, and updates the previous MT assessment completed in 2024. The 2026 MT implemented refinements in the WHAM model and updated commercial fishery catch data, research survey indices of abundance, weights and maturity at age, and reference points through 2025, as well as stock projections through 2031. SSB in 2025 was estimated to be 29,037 mt, which is about 109% of the biomass target (SSB_{MSY} proxy=26,615 mt). The 2025 average fishing mortality on ages 5–7 was estimated to be 0.21, which is about 78% of the overfishing threshold proxy (F_{MSY} proxy=0.27). The 2025 NEFSC Fall Survey index value was excluded based on a robust evaluation of models including and excluding the value that showed more stability and slightly better residuals in the model excluding that index value.

The spatial distribution of GB haddock has contracted and is less broadly distributed than a decade ago when the population was at an all-time high. This stock has produced several exceptionally strong year classes in the last 20 years (2003, 2010, 2013), but they have all aged out of the population, and abundance has returned to levels last observed in the early 2000s. Numerically, the 2020 and 2021 year classes account for 72% of the population. There are no signals from this stock assessment of strong incoming year classes, suggesting that near term catch will be reliant on the 2020 and 2021 year classes. An increase in maturity at age and weights at some ages were observed in the most recent 2 years, likely a result of decreased density-dependent pressures on growth.

NMFS Georges Bank Yellowtail Flounder Model

The 2025 Management Track (MT) Assessment of GB yellowtail flounder led by NOAA Fisheries concluded that the stock was overfished and overfishing was not occurring in 2024, the terminal year of data available for the assessment. This assessment was the first MT following the 2024 RT and implemented a WHAM model for the stock. This MT implemented refinements to the WHAM model and updated commercial fishery catch data, research survey indices of abundance, weights and maturity at age, environmental time series, and reference points through 2024, as well as stock projections through 2028. SSB in 2024 was estimated to be 713 mt which is about 10% of the biomass target (SSB_{MSY} proxy=7,072 mt). The 2024 fully-selected F was estimated to be 0.017 which is about 19% of the overfishing threshold proxy (F_{MSY} proxy=0.09).

CROSS-MODEL COMPARISONS

During the TSC discussions, several common themes were identified as contributing to differences in outputs from assessment models of the same species. Those themes include: (a) differences in spatial footprint of the assessments (i.e., GB vs EGB) with a variety of implications and impacts on the modeling and outputs, (b) differences in data inputs and model structure that affect scaling of the model results, (c) differences in projection assumptions and methods that affect projection outputs, and (d) differences in how "catch" is estimated and projected, including what the catch value represents. Below we summarize key points under each of these themes in comparisons of the two cod and two haddock assessments, as well as provide a high-level summary of the most influential differences. Tables A1.1 and A1.2 capture point-by-point comparisons between the models. In many cases, the impact of specific model differences has not been quantified, but some have been explored by assessment leads within their individual assessments. Tables A1.1 and A1.2 indicate which comparisons assessment leads felt were uncertain in terms of impact.

Cod Models Comparison

Summary: The most influential differences between the two cod models appear to be the impact of different spatial footprints on the fundamental dynamics being modeled and differences in how the catch value that is reported is estimated and what it represents. The inclusion of additional years of data in the EGB model is also likely to have an impact on 2023+ estimates and projections. The 2027 information is the first projected year for the EGB model and the third year projection from the total GB model.

Spatial footprint: The GB and EGB models have different spatial footprints and are capturing different dynamics of the population and fisheries. DFO GB model exploration during the DFO 5Z Assessment Framework (FW) review indicated that the bulk of the biomass was on EGB in recent years, while fishing pressure for the total GB was quite different from EGB fishing pressure. Thus, the dynamics being modeled by the GB and EGB models are quite different, and likely influence the differences in scale. The DFO EGB and exploratory total GB cod models in the FW had identical model structure, so larger biomass in the EGB model was thought to be primarily influenced by different spatial footprints. Consequently, the difference in scale between the current EGB and GB assessment models is likely also influenced by their spatial footprints and the underlying dynamics being modeled based on those different spatial footprints.

Scaling: Several factors are likely contributing to scaling differences between the model estimates, including the impact of different footprints on the models as described above. In addition, differences in M assumptions in the GB and EGB cod models may contribute to differences in scale. Finally, structural differences between the two models related to how uncertainty around data gaps is handled contribute to differences in model outputs.

Projections: Different assumptions in projections between assessments are layered on top of the scaling differences described above to result in different outputs reported in Table 1. There are differences in stanzas for recruitment, WAA, and maturity assumptions in the GB and EGB cod projections. The EGB model projects apparent M (unexplained changes in the numbers at age combined with Lorenzen M) as persisting in the future. The GB model projections propagate random effects on numbers at age (NAA RE) in WHAM. The inclusion of additional years of data in the EGB model is also likely to have an impact on 2023+ estimates and projections. The 2027 information is the first projected year for the EGB model and the third year projection from the total GB model.

Catch estimation: The values reported for catch in Table 1 for 2027 are derived from fundamentally different metrics. For the EGB cod model, the catch presented is the catch that results in an F of preventable decline (F_{pd}). That F is the maximum F associated with a very low probability (<5%) of preventable decline (decline relative to F=0 scenario) within two generations. The EGB cod reference point development and peer review indicated that there was no F that could bring the stock out of the critical zone, and therefore the reference point F_{pd} was chosen. For the GB cod model, the catch reported in 2027 is the catch that results in an F equal to the F_{MSY} proxy (F40%).

Haddock Models Comparison

Summary: The most influential differences between the two haddock models appear to be the difference in the footprint and assumptions regarding M and NAA RE.

Spatial footprint: The GB and EGB haddock models have different spatial footprints (EGB is approximately 25% of GB) and are capturing different dynamics of the population and fisheries. Due to multiple differences in model configuration, it is difficult to ascertain any specific impacts of spatial footprint on the model results. It is worth noting that the GB and EGB haddock models have different survey data inputs, which are influenced by spatial footprint. Specifically, the GB haddock model is not always able to use the DFO Winter Survey due to limited coverage for the GB footprint. Both models incorporate data from NEFSC Fall Survey strata 29 and 30 which include U.S. and Canadian waters. The GB model includes these strata as part of the GB stock area. The inclusion of these strata in the EGB model was a decision from the 2022 RT Assessment Peer Review for Haddock based on recent warming fall temperatures on the bank and evidence of increased movement to deeper waters during this time period. However, the Canadian catch from those areas is not included as an input for either model. The proportion of total overall survey area and catch in strata 29/30 differ between the two assessment spatial footprints.

Scaling: Several factors contribute to differences in scaling between the two models. The estimated magnitude of the 2020 and 2021 year classes in the EGB haddock assessment decreased with the addition of the 2024 and 2025 survey data, while the magnitude of those two year classes stabilized for the GB model. This contributes to different trends at the end of the time series for SSB estimates.

In addition, the models differ structurally in key assumptions and formulations. The EGB model estimates a relatively higher M for recent years, whereas the GB model assumes a constant M but implements a mechanism to account for natural variability in NAA over time. Those two structural differences of M assumptions and treatment of variability in NAA are likely the most influential structural differences that contribute to differences in model scale. The combination of these two differences impact survivorship of fish in the model and in turn result in scaling differences. Another factor impacting scaling is the implementation of the lognormal bias adjustment; EGB applies the lognormal adjustment and GB does not.

Recruitment estimates from the historic EGB model configuration reviewed at the 2022 haddock RT and the current GB haddock model configuration were compared at the 2026 GB haddock MT. These analyses indicated higher recruitment estimates from the EGB model than the GB model. This was exacerbated when the lognormal adjustment was not applied to the GB model. A direct comparison of recruitment estimates from the two current EGB and GB model configurations has not been conducted.

Projections: Different methodologies (WHAM vs MSEtool) and assumptions in projections between assessments are layered on top of the scaling differences described above to result in different outputs reported in Table 2. Notably, the EGB model estimated M is higher than the M applied in the GB model, although the GB model propagates the estimated NAA RE (those RE revert to a mean of zero within a few years). Additional differences include the number of years used to derive averages for selectivity, maturity, and WAA. Finally, methodology for projecting recruitment as well as the inherent highly variable recruitment in haddock introduce uncertainly in both models.

Catch estimation: The values reported for catch in Table 2 for 2027 represent different metrics. For the EGB haddock model, the reported values represent the catch that results in 25–75% risk of exceeding the F reference point, which is calculated based on $F_{40\%}$. For the GB haddock model, the catch reported in 2027 is the catch that results in an F equal to the F_{MSY} proxy, (also based on $F_{40\%}$), and the range reflects the uncertainty in that catch estimate—not the probability of exceeding the F_{MSY} proxy. While the underlying reference points ($F_{40\%}$) are similar between models, the reported values differ in what they represent: one reflects a range of risk (EGB) and the other reflects an estimate with uncertainty (GB). Additionally, the inputs for the estimation also differ in terms of selectivity patterns and stanzas used to derive $F_{40\%}$, as well as differences in the overall model scale.

ALLOCATION SHARES CALCULATION

The sharing allocation calculations for the transboundary resources of Atlantic cod, haddock, and yellowtail flounder on GB were updated with the 2025 DFO and NEFSC survey results to derive the 2027 fishing year allocations. For Atlantic cod and haddock, the sharing agreement is limited to the EGB management unit (DFO Statistical Unit Areas 5Zj and 5Zm; U.S. Statistical Areas 551, 552, 561, and 562). The management unit for yellowtail flounder encompasses the entire Georges Bank east of the Great South Channel (DFO Statistical Unit Areas 5Zh, 5Zj, 5Zm, and 5Zn; U.S. Statistical Areas 522, 525, 551, 552, 561, and 562).

The resource distributions in 2025 were: 26% U.S., 74% Canada, for Atlantic cod; 26% U.S., 74% Canada, for haddock; and 40% U.S., 60% Canada, for yellowtail flounder. The 2027 fishing year allocation shares calculation (calendar year for Canada; May 1, 2027 to April 30, 2028 for the U.S.), updated with the 2025 resource distributions, resulted in shares for Atlantic cod of 28% U.S., 72% Canada, for haddock of 28 U.S., 72% Canada, and for yellowtail flounder of 46% U.S., 54% Canada (Table 4).

During the TSC meeting, there was discussion of challenges with the 2025 Fall NEFSC Survey coverage and timing, with agreement that including data from that survey was consistent with how survey data have been included in the past. It was recognized that uncertainty in the terminal year data affects the calculation. However, it was noted that the previous TRAC process included peer review of the allocation shares process each year, which was deliberately excluded in the new process because the allocation shares process was well-established and based on bilateral negotiation. TSC discussion suggested that it may be useful to consider some approach to formally or informally review or discuss the annual allocation shares calculation, particularly in years with survey data challenges.

SURVEY-BASED DISTRIBUTION ANALYSIS

Given the Canadian and U.S. cod and haddock assessments have substantially different spatial footprints, it was decided for the purposes of the ISATS process that a survey-based distribution analysis would be used to estimate the proportion of GB biomass of each species within the EGB management area. The values produced from this analysis are applied to relate GB catch advice to the EGB management unit and are intended to inform, not constrain, management advice.

The survey-based distribution analysis in 2026 used the same methods as the apportionment analysis methods used in 2025. U.S. and Canadian survey data were updated through 2025 to update the 2026 management cycle survey-based distribution calculations for total Georges Bank (TGB) haddock (66% EGB, 34% western Georges Bank (WGB)) and TGB Atlantic cod (95% EGB, 5% WGB). The 2025 NEFSC Fall Survey was deemed to have sufficient spatial coverage on GB for inclusion in this analysis, with recognition that uncertainty in the terminal year data affects the calculation.

APPENDIX 1

Table A1.1. Comparison of model inputs and configurations for the NEFSC Georges Bank Cod and DFO eastern Georges Bank Cod assessments.

INPUTS	NEFSC GB COD	DFO EGB COD	LIKELY INFLUENCE OF INPUTS ON DIFFERENCES IN OUTPUTS
Model platform & version	WHAM 1.0.7.9000	WHAM1 & MSEtool	None
Footprint	GB	EGB	High -same description as last year
Model ages	1-9+	1-9+	None -same
M	Age- and time-invariant, M = 0.29	Lorenzen M estimated externally & PE from 2DAR1 NAA RE, decoupled from recruitment. Time and age varying.	High
Maturity	Estimated externally using state-space maturity model	Annually estimated curve based on DFO Winter and NMFS Spring surveys.	Uncertain -believed minimal
Weight at age (WAA)	1978-2023 Only Canadian WAA used 2021-2023 Rivard WAA used for Jan 1 and SSB Gaps prior to 2021 filled using 5 year rolling average	Fishery: Fleet specific WAA from the respective fleets. Jan 1 WAA: is from DFO survey. Survey WAAs come from their respective surveys.	Minimal (both models facing same challenge)
Fleets (and years)	1978-2023; 1 fleet: US landings + discards + Canadian landings + discards	3: US landings + discards; Canadian landings + discards US misallocated catch	Moderate -

Canadä

INPUTS	NEFSC GB COD	DFO EGB COD	LIKELY INFLUENCE OF INPUTS ON DIFFERENCES IN OUTPUTS
Fleet age comp	Dirichlet-multinomial (US missing since 2021)	Dirichlet-pool0 for the Can and US fleets; multinomial for the misallocated fleet. US age comps missing 2020+.	Uncertain -likely more impactful in years with many zeros
Surveys used (and years)	3 surveys: DFO spring (1987-2023, exclude 2022, do not use 5Z9 stratum), NEFSC spring (1978-2022, exclude 2020, 2023), NEFSC fall (1978-2023, exclude 2020)	3: DFO spring (1987-2025, include 5Z9), NEFSC spring (1978-2025, excl 2020 and 2023), NEFSC fall (1978-2025, exclude 2020 and 2025).	Minimal -often dropping same years for similar reasons; footprints make a difference
Survey index age comp	Dirichlet-multinomial	Dirichlet-pool0	Uncertain -likely more impactful in years with many zeros
Recruitment	AR1 Covariation decoupled from age 2+	Random Walk Covariation decoupled from age 2+	Minimal -structurally similar, not quantified
Fleet selectivity (incl RE)	Logistic 2 blocks: 1978-1993, 1994-2023	Logistic-2 blocks 1978-1993, 1994-2025	None-same
Survey index selectivity	DFO spring: Logistic, 1 block NEFSC spring: Logistic, 1 block NEFSC fall: age-specific, 1 block, ages 1-3 fixed at full selectivity	DFO winter Logistic 1 block; NEFSC spring logistic 1 block, NEFSC fall estimated at age 1 block; fixed age 2 = 0.8, age 3 = 1	None-very similar

INPUTS	NEFSC GB COD	DFO EGB COD	LIKELY INFLUENCE OF INPUTS ON DIFFERENCES IN OUTPUTS
Numbers at age Random Effects (NAA RE)	Full state space including 2dar1 RE on NAA (R decoupled from age 2+)	Full state space including combined 'Lorenzen M & PE (2dar1 RE on NAA, decoupled from age 2+)', interpreted as loss of fish from the population	None-(same)-note: interactions with M do matter in projections and interpretation
Fleet selectivity RE	No random effect	None	None-same
Lognormal adjustment	Off	Off	None-same
Initial NAA	Estimated	Estimated	None-same
Projection methods	5 year terminal average of maturity, WAA, terminal year fishery selectivity, NAA RE propagate in short term projections	WAA, Maturity and fishery selectivity-mean of the terminal 6 years. Recruitment, Lorenzen M&PE-drawn from distribution of terminal 6 years	High-inputs different, timeframe different, M assumption different; projection years also different (i.e., time since terminal year)
Reference points	5 year terminal average of maturity, WAA, terminal year fishery selectivity, time series mean R, use F40% as proxy for F_{MSY}	Full time series of recruitment Fref: F Preventable Decline (F_{pd}) LRP: threshold for negative surplus production (intersection of the lower 95% confidence interval of a GAM model fit to the historical surplus production versus SSB plot)	Not comparable

Table A1.2. Comparison of model inputs and configurations for the NEFSC Georges Bank Haddock and DFO eastern Georges Bank Haddock assessments.

INPUTS	NEFSC GB HADDOCK	DFO EGB HADDOCK	LIKELY INFLUENCE OF INPUTS ON DIFFERENCES IN OUTPUTS
Model platform & version	WHAM 1.09	WHAM 2.1.0	None
Footprint	GB	EGB	Unquantified effect - Both models are missing catch which could impact model; EGB is ~25% of GB in area. - EGB model includes the Fall survey data but not catch from 29/30. - GB model includes Spring and Fall survey data but not Canadian catch from 29/30. - Relative contribution of 29/30 to overall survey area differs between the two model footprints
Random effects-methods	Full state space including 2dar1 RE on NAA	No RE on NAA	Uncertain
Natural Mortality (M)-methods	Fixed at 0.2	Two blocks: 1969-2009 M=0.2; 2010+ M estimated in the model	High-as described last year
Fleets (and years)	1 (1931-2025)	1 (1969-2025)	None

INPUTS	NEFSC GB HADDOCK	DFO EGB HADDOCK	LIKELY INFLUENCE OF INPUTS ON DIFFERENCES IN OUTPUTS
Surveys used (and years)	NEFSC Spring (1968-2025) * drop 1973-1981 (no calibration); 2020 missing (COVID), 2023 (Strata 29&30 not sampled; day-only tows) NEFSC Fall (1963-2025) * 2020 missing (COVID) * 2025-dropped as non-representative DFO Winter (1987-2025) * drop 1993, 1994, 2005, 2006, 2010, 2012, 2015, 2017, 2018, 2020, 2021, 2022, 2023, 2024, 2025 (due to incomplete coverage)	NEFSC Spring:1-9+ 1969-1972, 1982-2025 (2020 missing, 2023 not used) NEFSC Fall: 1-9+; 1969-2025 (2020 missing) DFO Winter: 1-9+ 1987 - 2025	None-Minimal - GB doesn't use DFO survey and EGB does, not sure of impact; for years where DFO did cover whole Bank DFO tended to be higher, but relative trend has been consistent - EGB doesn't use 29/30 in spring, GB does - EGB does use 2025 fall, GB doesn't; minimal impact of including/excluding - EGB includes 5Z9 2010+
Fleet age comp	Logistic normal (miss 0)	Logistic normal (miss 0)	None (same)
Survey index age comp	Logistic normal (miss 0) for all	Logistic normal (miss 0)	None (same)
Maturity	6 stanzas: * 1939-1969 (historic) * 1970-2015 * 2016-2019 * 2021 * 2022-2023 * 2024-2024	Blocking of maturity, 1969-2015; 2016-2019; and 2020-2025	Minimal-Uncertain
Fishery weight at age (WAA)	1932-2025; ages 1-9+	1969-2025; ages 1-9+	None
CV on catch	0.2 (1931-1962); 0.1 (1963-2025)	0.1	None

INPUTS	NEFSC GB HADDOCK	DFO EGB HADDOCK	LIKELY INFLUENCE OF INPUTS ON DIFFERENCES IN OUTPUTS
CV on surveys	Calculated for each survey from SRS design	Calculated for each survey based on survey design	None
Selectivity on surveys	3 indices: Selectivity freely estimated at-age	Single block, time-invariant, age-specific selectivity for each survey. 1969-1972, 1982-2025, NMFS Spring Survey 1969-2025, NMFS Fall Survey 1987 – 2025, DFO Spring Survey	Uncertain
Numbers at age Random Effects (NAA RE)	2dar1 RE on NAA	None	Uncertain
Fleet selectivity (incl random effects [RE])	2 fleet blocks (1931-1962, no RE; 1963-2025 includes 2dar1 RE)	2 fleet blocks (1969-91; 92-2024). iid RE for the 2nd block	Minimal (2dar1 vs iid)
Recruitment	Random about mean Covariation decoupled from age 2+	Mean recruitment with log deviations estimated as fixed effects.	Uncertain-interactions with M
Catchability	1 q for each survey	1 q for each survey	None (same)
Lognormal adjustment	OFF	ON	Uncertain

INPUTS	**NEFSC GB HADDOCK**	**DFO EGB HADDOCK**	**LIKELY INFLUENCE OF INPUTS ON DIFFERENCES IN OUTPUTS**
Projections methods	WAA: Gaussian Markov Random Field (GMRF) model predicted for projection years R and NAA: process error propagated M: constant 0.20 F: F_{MSY} proxy 0.264 selectivity and maturity use 2 yr avg	WAA, M: model estimated average of terminal 3 years through 2025. R: generated from lognormal distribution with a mean recruitment and lognormal deviations from historical R F: F_{MSY} proxy -F_{ref}=0.325 ** projections in MSEtool not in WHAM	High-lots of differences
Reference points	Time series median recruitment F_{MSY}: $F_{40\%}$ proxy B threshold: 0.5 B_{MSY} 5-year average WAA, selectivity and maturity	Full time series of recruitment F_{ref}: $F_{40\%}$ proxy (calculated using M=0.2) LRP: $B_{recover}$ 1991-96	Not comparable
Likelihood (indices and age comps)	Lognormal for aggregate catch and indices; Logistic normal (treating 0 as missing) for catch and index age comp	Lognormal: fishery catch and survey indices Logistic normal (ignoring 0): catch and survey age comps	None (same)

APPENDIX 2

Table A2.1. Total allowable catch (TAC) and removals for eastern Georges Bank Atlantic cod for Canada and United States (U.S.) since 2016.

EGB ATLANTIC COD											
Calendar Year	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**
Canadian TAC (mt)	488	584	694	462	462	444.5	411	385	370	370	322
Canadian Removals (mt)	440	488	517	396	377	431	326	329	327	297	-
U.S. TAC (mt)	136	146	257	188	188	190.5	160	135	150	82	151
U.S. Removals (mt)	97	38	49	31	67	41	38	32	51	20	-
Total TAC (mt)	624	730	951	650	650	635	571	520	520	452*	473
Total Removals (mt)	537	526	565	428	444	487	364	361	378	317	-

* The 2024 TMGC negotiations ended with no agreement on Eastern Georges Bank (EGB) Cod for the 2025 fishing season. This number is based on the combined domestic decisions.

Table A2.2. Total allowable catch (TAC) and removals for eastern Georges Bank haddock for Canada and United States (U.S.) since 2016.

EGB HADDOCK											
Calendar Year	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**
Canadian TAC (mt)	21,830	20,500	24,000	15,000	13,800	7,614	7,473	2,320	6,900	5,854	3,752
Canadian Removals (mt)	11,943	13,385	12,221	14,160	11,052	7,002	5,150	2,507	5,898	4,694	-
U.S. TAC (mt)	15,170	29,500	16,000	15,000	16,200	6,486	6,627	1,520	3,100	1,556	998
U.S. Removals (mt)	466	295	274	594	683	524	335	332	311	226	-
Total TAC (mt)	37,000	50,000	40,000	30,000	30,000	14,100	14,100	3,840	10,000	7,410	4,750
Total Removals (mt)	12,409	13,679	12,495	14,735	11,735	7,526	5,485	2,840	6,219	4,920	-

APPENDIX 3

- Stock Assessment for Atlantic Cod (*Gadus morhua*) on Eastern Georges Bank in 2025
- Georges Bank Atlantic Cod 2024 Management Track Assessment Report
- Stock Assessment of Eastern Georges Bank Haddock (*Melanogrammus aeglefinus*) in 2025
- Georges Bank Atlantic Haddock 2026 Management Track Assessment Report
- June 2026 Management Track Peer Review Panel Report
- Georges Bank Yellowtail Flounder 2025 Management Track Assessment Report
- 2026 Georges Bank Resource Share Allocation for Haddock, Atlantic Cod, and Yellowtail Flounder
- 2026 Survey-based Distribution Results for Georges Bank Haddock and Atlantic Cod

This document is approved and in pre-publication with CSAS. As such, it is confidential in nature and cannot be distributed more broadly until published on the CSAS Website.

Fisheries and Oceans Canada / Pêches et Océans Canada
Ecosystems and Oceans Science / Sciences des écosystèmes et des océans

Maritimes Region

Canadian Science Advisory Secretariat
Science Advisory Report 2026/nnn

STOCK ASSESSMENT FOR ATLANTIC COD (*GADUS MORHUA*) ON EASTERN GEORGES BANK IN 2025

CONTEXT

The Fisheries Management Branch of Fisheries and Oceans Canada (DFO) has requested a review of resource status for eastern Georges Bank Atlantic Cod (*Gadus morhua*) in support of the decision-making process for the 2027 fishery. This Science Advisory Report is from the regional peer review of June 16–18, 2026 on the Stock Assessment of Atlantic Cod and Haddock on Eastern Georges Bank. Additional publications from this meeting will be posted on the Fisheries and Oceans Canada (DFO) Science Advisory Schedule as they become available.

SCIENCE ADVICE

Status

- The 2025 spawning stock biomass (SSB, 8,469 mt) is at 33% of the limit reference point (LRP; 26,847 mt), placing the stock in the critical zone with a very high probability (>99%).

Trends

- The 2025 SSB is 8,469 mt, which represents a minor increase from the series low of 8,273 mt in 2022.
- Fishing mortality (F) has remained below 0.05 since 2017 and the 2025 estimate is 0.03.
- In three of the last four years, recruits per unit of SSB have been the highest observed since 1978, despite record low SSB. However, this has not resulted in sustained increases in the number of adult fish (ages 3+).
- Apparent mortality for fish aged 4+ continues to be high.

Ecosystem and Climate Change Considerations

- The most commonly identified contributors to natural mortality (M) for Atlantic Cod in this region are high bottom-water temperatures and predation. Both have undergone substantial changes in recent years.
- The presence of older fish in deeper waters within the eastern Georges Bank management area indicates earlier post-spawning movement off the bank relative to the timing of the DFO Winter Ecosystem Research Vessel Survey. Although the mechanism for this shift has not been identified, it is likely related to ecosystem changes (e.g., temperature, predation, competition).

Stock Advice

- Projections of SSB for 2027 and 2028 are provided under various fishing scenarios. Given the long-term projection of biomass, it is unlikely that the SSB will exceed the LRP within two

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generations (2033), even in the absence of fishing. There is no fishing level which will improve stock outlook under current productivity dynamics.

- Catch advice for 2027 is 353 mt (F=0.05). This is based on F preventable decline (Fpd), which corresponds to the maximum F associated with a very low probability (<5%) of preventable decline (i.e., decline relative to F=0 scenario) in two generations (2033).

BASIS FOR ASSESSMENT

Assessment Details

Year Assessment Approach was Approved

2025 (Andrushchenko et al. 2026)

Assessment Type

Full assessment

Most Recent Assessment Date

1. Last Full Assessment: June 2025 (DFO 2025)
2. Last Interim-Year Update: July 2024 (DFO 2024)

Stock Assessment Approach

1. Broad category: single stock assessment model
2. Specific category: age structured state-space model

Ecosystem and Climate Change Assessment Approach

Implied and Linked: Ecosystem variables are indirectly accounted for in the advice. For example, the model incorporates unexplained changes in the numbers at age (thought to principally reflect changes in M), without clear knowledge of the specific environmental factors or mechanisms that might affect M over time. Changes in oceanographic conditions were considered in the context of data inputs and projection assumptions.

Stock Structure Assumption

Atlantic Cod on eastern Georges Bank is a single stock spanning United States of America (US) and Canadian waters. There is some mixing with adjacent stock units. In Canada, the stock is assessed as eastern Georges Bank (DFO statistical unit areas 5Zejm).

Reference Points

- Limit Reference Point (LRP): SSB below which surplus production is not significantly greater than zero (Andrushchenko et al. In Prep[1])
- Upper Stock Reference (USR): Not yet determined

[1] Andrushchenko, I.V., T.J. Barrett, N. Hebert, C.M. Clark, and E. Way-Nee. In Prep. 5Z Cod Assessment Framework: Projections and Reference Points. DFO Can. Sci. Advis. Sec. Res. Doc.

- Removal Reference (RR):
    - RR in critical zone: F=0.05 (F associated with a very low likelihood (<5%) of preventable decline).
    - RR in healthy or cautious zone: Not yet determined.
- Target Reference Point (TRP): Not available

Data

- DFO Winter Ecosystem Research Vessel (RV) Survey (1987–2025)
- US National Marine Fisheries Service (NMFS) Spring RV Survey (1978–2025; except 2020 and 2023)
- US NMFS Fall RV Survey (1978–2024; except 2020)
- Canadian fishery data (1978–2025)
- US fishery data (total removals 1978–2025; catch-at-age 1978–2020)

Data changes since most recent assessment: Due to changes in timing and coverage on the 2025 NMFS Fall Survey, an analysis was conducted to determine the impact of this 2025 survey data point on the model output and performance. The analysis is documented in Andrushchenko et al (In Prep[2]) and the decision was made to exclude the 2025 NMFS Fall Survey data point for this assessment.

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[2] Andrushchenko, I.V., N. Hebert, and E. Way-Nee. In Prep. Eastern Georges Bank Cod (*Gadus morhua*) Assessment to 2025. DFO Can. Sci. Advis. Sec. Res. Doc.

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ASSESSMENT

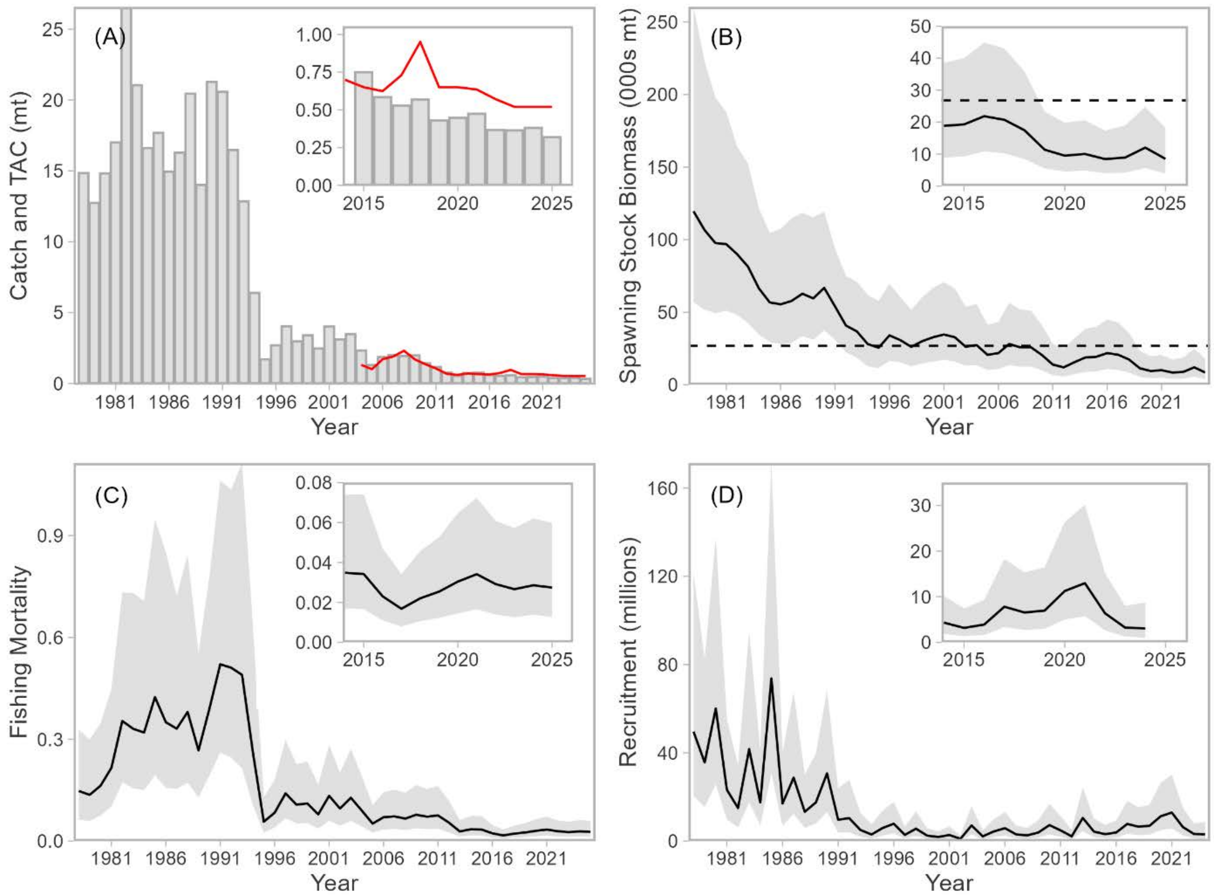

Figure 1. (A) Catch (bars) and total allowable catch (TAC, red solid line) for eastern Georges Bank Atlantic Cod, (B) spawning stock biomass (000s mt, solid black line) in relation to the 2026 limit reference point (26,847 mt, black dashed line), (C) instantaneous fully-selected fishing mortality (solid black line), and (D) recruitment (numbers in millions, solid black line) for the eastern Georges Bank model. Insets are included in all panels to provide a magnified view of recent years in time series. In panels B–D, the grey shading around the solid line represents 95% confidence intervals.

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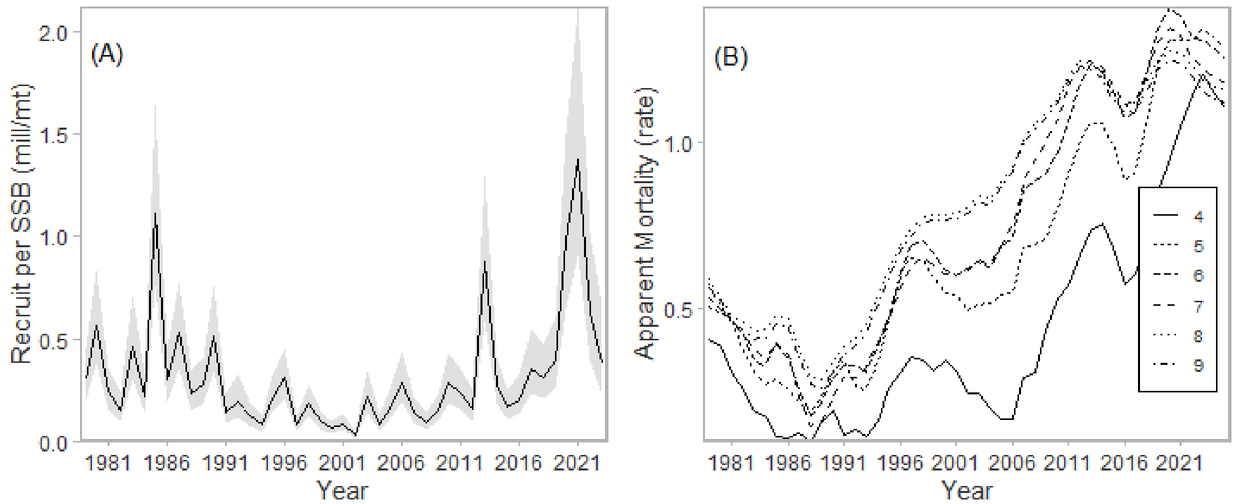

Figure 2. (A) Recruitment rate represented by solid black line (recruitment in millions over spawning stock biomass [SSB] in metric tonnes). Grey sharing represents 95% confidence intervals. (B) Instantaneous rate of apparent mortality at each age due to natural mortality and process error for ages 4+.

Stock Status and Trends

Biomass

Following a notable decrease in estimated SSB in the early 1990s, the stock declined gradually and reached a series low in 2022 (8,327 mt). SSB then increased slightly due to a strong year-class moving through the population but declined again to 8,469 mt in 2025. A temporary increase in SSB during the mid-2010s appears to have been caused by an influx and subsequent departure of fish from outside of the assessment unit (Figure 1B).

Fishing Mortality

Estimated F was higher in the 1980s (0.15–0.60) but declined throughout the 2000s and 2010s to a series low in 2017 (<0.02). Since then, F has remained below 0.05. The 2025 value is estimated at 0.03 (Figure 1C). Factors other than fishing mortality are currently the primary limits to stock productivity of eastern Georges Bank Atlantic Cod (Figure 2B).

Recruitment

Recruitment has remained low since the mid-1990s (Figure 1D). In recent years, recruits per SSB have been the highest observed since 1978, despite record-low SSB (Figure 1B, Figure 2A). However, the higher recruitment has not resulted in sustained increases in the number of adult fish (ages 3+).

Natural Mortality

Apparent mortality (combined annual M and unexplained changes in the numbers at age) for fish aged 4+ continues to be estimated at a high rate, especially for ages 6+ (Figure 2B). There are signs of a recent decrease from a record high level, but mortality remains the main factor limiting productivity for this stock.

Current Status

The estimated 2025 median SSB (8,469 mt) is at 32% of the LRP (26,847 mt), and there is a very high (>0.99) probability that the stock remains in the critical zone.

The eastern Georges Bank Atlantic Cod stock has declined since the 1990s and remains in the critical zone. Despite signs of improved recruitment and growth in the early 2020s, the productivity of the stock remains low with the annual rate of apparent mortality (combined annual M and unexplained changes in the numbers at age) for older ages remaining high (>1; i.e., annual mortality >60%). There is a very high probability that SSB remains in the critical zone in the projections under all fishing scenarios, including in the absence of fishing. Stock outlook is not expected to change in the future unless productivity improves.

History of Landings and Total Allowable Catch

Combined Canada/US removals (landings and discards) in 2025 were 317 mt, with a TAC of 452 mt (Table 1). Canadian removals decreased from 327 mt in 2024 to 297 mt in 2025, which is the lowest in the time series. US removals decreased from 51 mt in 2024 to 20 mt in 2025, and is the lowest in the time series.

Table 1. Canadian and US removals (landings and discards) and total allowable catch (TAC) for eastern Georges Bank Atlantic Cod. All removals and TAC are for calendar year (Jan 1–Dec 31) in metric tonnes (mt). Values in the 2004–2019 column are the annual average between 2004 and 2019.

Year	2004–2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Combined TAC (mt)	1,244	624	730	951	650	650	635	571	520	520	452
Canada removals (mt)	912	440	488	517	396	377	431	326	329	327	297
US removals (mt)	346	97	38	49	31	67	41	38	32	51	20

Ecosystem and Climate Change Considerations

The model indicates that a high number of adult fish are disappearing in excess of the number accounted for by fishery removals. During the framework, this disappearance was primarily attributed to M. The most commonly identified contributors to M for Atlantic Cod in this region are high temperature and predation (NEFSC 2023). Both of these have undergone substantial changes in recent years, with bottom temperature anomalies registering record highs on Georges Bank throughout the 2010s and the grey seal population which increased considerably over the past several decades.

The presence of older fish in deeper waters within the area indicates earlier movement off the bank after spawning. Although the mechanism for this shift has not been identified, it is likely related to ecosystem changes (e.g., temperature, predation, competition).

From 2015 to 2017, abundance increased suddenly across ages and is interpreted as movement of fish into and then out of Georges Bank from adjacent areas.

During the current assessment, potential interactions between oceanographic conditions (temperature, salinity) and survey timing were discussed. Spring bottom temperature anomalies on eastern Georges Bank have remained cooler in the last two years, and it is unclear whether these conditions will persist in the future. These changes were considered in the context of fish availability to surveys and migration patterns.

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Projections and Stock Advice

Given the long-term projection of biomass, it is highly unlikely that the estimated SSB will exceed the LRP within two generations (2033), even in the absence of fishing. Consequently, there is no fishing level which will improve stock outlook under current productivity dynamics.

Projections of SSB for 2027 and 2028 are provided under various fishing scenarios (Table 2). Projections assume that the 2026 TAC (473 mt) is removed in full during the 2026 fishing year, which equates to an F of 0.052. Projected SSB for 2028 is 5,742 mt. Catch advice is only provided for 2027 where removals of 353 mt (F=0.05) correspond to the maximum F associated with a very low probability (<5%) of preventable decline (i.e., decline relative to F=0 scenario) in two generations (2033).

Table 2. Projected spawning stock biomass (SSB), catch advice for 2027, fishing mortality (F), and associated probability of preventable decline under the various fishing scenarios. Fpd is F associated with <5% of preventable decline. Frecent is the median F of the last six years. mt=metric tonnes.

F Scenario	SSB (mt) 2027	Catch Advice (mt) 2027	F 2027	SSB (mt) 2028	Probability of Preventable Decline
Fpd	5,123	353	0.050	5,742	4.98%
Frecent	5,123	225	0.032	5,798	3.10%
No Fishing	5,123	0	0.000	5,891	0%

SOURCES OF UNCERTAINTY

Prior to 2010, the DFO Winter Ecosystem RV Survey did not extend into deeper waters within the eastern Georges Bank management unit. As a result, the current assessment assumes that the survey design prior to 2010 produced an index that was representative of total population trends at that time. It is uncertain whether this assumption is true and what the implications are on the model outputs. Accounting for the movement of fish within the eastern Georges Bank management unit requires further work.

Projections make assumptions about how various aspects of stock dynamics are expected to unfold in the near future and are informed by recent trends (e.g. growth, recruitment, mortality).

The absence of US fishery age composition since 2020 means the model assumes that the US fishery selectivity has not changed since then. It is uncertain if this assumption is true; however, the impact on assessment results is expected to be minimal, given the relatively small contribution of the US fishery to the total removals.

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SOURCES OF INFORMATION

Andrushchenko, I., Benoît, H.P., Clark, C.M., and Way-Nee, E. 2026. 5Z Cod Assessment Framework: Review of Modelling Approaches. DFO Can. Sci. Advis. Sec. Res. Doc. 2026/039. iv + 58 p.

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[NEFSC] Northeast Fisheries Science Centre. 2023. 2023 Atlantic Cod Research Track Assessment.US Dept Commer, Northeast Fish Sci Cent Ref Doc.

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draft working paper for peer review only

Georges Bank Atlantic cod

2024 Management Track Assessment Report

U.S. Department of Commerce
National Oceanic and Atmospheric Administration
National Marine Fisheries Service
Northeast Fisheries Science Center
Woods Hole, Massachusetts

Compiled 06-10-2024

This assessment of the Georges Bank Atlantic cod (Gadus morhua) stock is the first management track (MT) assessment following the 2023 research track (RT) assessment (NEFSC In Prep.) and adopts the new RT stock definition. This assessment updates the RT assessment model, catch and index data, and reference points through 2023. These updates included: recalibrated NEFSC indices, revised weight-at-age and Canadian commercial landings-at-age, and updating US landings and discards using the Catch Accounting and Monitoring System (CAMS). Additionally, short-term projections were updated through 2027.

State of Stock: Based on this updated assessment, the Georges Bank Atlantic cod (*Gadus morhua*) stock is overfished and overfishing is not occurring (Figures 1-2). Retrospective adjustments were not made to the model results because the retrospective pattern was minor. Spawning stock biomass (SSB) in 2023 was estimated to be 2,668 (mt) which is 32% of the biomass target (SSB_{MSY} *proxy* = 8,290; Figure 1). The 2023 fully selected fishing mortality was estimated to be 0.13 which is 56% of the overfishing threshold proxy (F_{MSY} *proxy* = 0.233; Figure 2).

Table 1: Catch and status table for Georges Bank Atlantic cod. All weights are in (mt) recruitment is in (000s) and F_{Full} is the fishing mortality on fully selected ages (9+). Model results are from the current updated WHAM assessment.

	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
					Data					
US Landings	842	783	626	196	221	236	216	174	87	80
US Discards	9	22	19	9	7	3	9	10	11	7
Canadian Landings	430	472	428	474	510	388	362	420	309	321
Canadian Scallop Discards	15	13	9	7	5	5	11	5	10	8
Canadian Groundfish Discards	13	7	3	7	2	3	4	6	7	0
Combined total catch (US and Canada)	1,310	1,298	1,085	693	745	634	603	615	423	417
					Model Results					
Spawning Stock Biomass	4,528	4,365	6,519	9,598	9,065	5,783	3,984	3,490	3,111	2,668
F_{Full}	0.3	0.28	0.182	0.066	0.081	0.107	0.137	0.156	0.131	0.13
Recruits	498	203	181	261	660	552	633	1,114	1,180	605

Table 2: Reference points estimated in the current Management Track assessment update. An $F_{40\%}$ proxy was used for the overfishing threshold and estimates are reported with 95% confidence bounds.

	2023	2024
F_{MSY} *proxy*		0.23 (0.22 - 0.25)
SSB_{MSY} (mt)		8290 (4678 - 14690)
MSY (mt)		1930 (1084 - 3438)
Median recruits (age 1) (000s)		646
Overfishing	Unknown	No
Overfished	Unknown	Yes

Projections: Short term projections of biomass and catch were conducted in WHAM (Stock and Miller, 2021) using the standard projection approach. Following the 2023 RT decision, projections used terminal year fishery selectivity and a recent 5 year average of the maturity ogive and weights-at-age. Interim catch in 2024 was assumed to be equal to catch in 2023 (417 mt), and fishing was projected at F_{MSY} *proxy* for 2025-2027. Retrospective adjustments were not applied in the projections because the retrospective pattern was minor.

Table 3: Short term projections of total fishery catch and spawning stock biomass for Georges Bank Atlantic cod based on a harvest scenario of fishing at F_{MSY} *proxy* between 2025 and 2027. Catch in 2024 was assumed to be 417 (mt).

Year	Catch (mt)	SSB (mt)	F_{Full}
2024	417	2486 (929 - 6653)	0.152
Year	Catch (mt)	SSB (mt)	F_{Full}
2025	518	2089 (499 - 8739)	0.233
2026	419	1658 (277 - 9937)	0.233
2027	400	1567 (170 - 14457)	0.233

Special Comments:

- What are the most important sources of uncertainty in this stock assessment? Explain, and describe qualitatively how they affect the assessment results (such as estimates of biomass, F, recruitment, and population projections).

  Recruitment is the largest source of uncertainty for this assessment. There were persistent trends in recruitment residuals that could not be fully resolved in this assessment. Additionally, insufficent port sampling, gaps in surveys, and age truncation in the NEFSC fall index terminal years make it more difficult to characterize age composition for this stock.

- Does this assessment model have a retrospective pattern? If so, is the pattern minor, or major? (A major retrospective pattern occurs when the adjusted SSB or F_{Full} lies outside of the approximate joint confidence region for SSB and F_{Full}).

  The 7-year Mohn's ρ, relative to SSB, was 0.389 in the RT assessment and was 0.19 in 2023. The 7-year Mohn's ρ, relative to F, was -0.238 in the RT assessment and was -0.134 in 2023. The retrospective pattern was considered minor in this assessment because the ρ adjusted estimates of 2023 SSB (SSB_ρ=2242) and 2023 F (F_ρ=0.15) were within the approximate 90% confidence regions around SSB (1,528 - 4,660) and F (0.073 - 0.233). Therefore, a retrospective adjustment was not made for the determination of stock status or projections of catch. No retrospective adjustment of spawning stock biomass or fishing mortality in 2023 was required.

- Based on this stock assessment, are population projections well determined or uncertain? If this stock is in a rebuilding plan, how do the projections compare to the rebuilding schedule?

  The reliability of population projections for Georges Bank Atlantic cod, can not be determined because of major differences between the data and methods used in the prior RT and current MT assessments. This includes a change in the survival process error assumptions, which impact how these errors propagate in projections. This stock is not yet in a rebuilding plan.

- Describe any changes that were made to the current stock assessment, beyond incorporating additional years of data and the effect these changes had on the assessment and stock status.

  Both spring and fall NEFSC bottom trawl indices were re-calibrated which had a large effect on model fit and diagnostics. Other updates with smaller effects included: updating US landings and discards in 2022-2023 from CAMS (including lobster discards) and revising WAA and Canadian commercial landings-at-age data for the entire time series. Specifications for estimating initial numbers-at-age and numbers-at-age random effects were also updated in this MT assessment. Exclusion of the lognormal adjustment for process and observation errors was adopted with minimal impacts on model fit, diagnostics and stock status, but had a relatively large impact on model results. In addition, the following data gaps occurred: the DFO spring index was not available in 2022 following a vessel change in that year, the NEFSC spring index was not available in 2023 due to sampling interruptions and insufficient nighttime sampling, and no US catch age composition was available in 2022-2023 due to insufficient port sampling so only Canadian catch composition was fit. All changes and their impacts on model fit and diagnostics are described at length in the supplemental materials.

- If the stock status has changed a lot since the previous assessment, explain why this occurred.
  This is the first MT assessment for the new Georges Bank Atlantic codstock definition, so official stock status was unknown prior to this assessment. However, the overfished status is consistent with the qualitatively determined stock status from the last Georges Bank cod MT assessment (NEFSC 2022) which was based on the prior stock definition.

- Provide qualitative statements describing the condition of the stock that relate to stock status.
  The Georges Bank Atlantic cod stock continues to show a truncated age structure and in the terminal two years of the assessment (2022-2023). All surveys indicate fewer old fish in recent years, but the age truncation is particularly evident in the NEFSC fall bottom trawl survey which did not observe any fish older than age 4 in the terminal two years of the assesesment. SSB estimates have remained low over the terminal four years of the assessment (2019-2023), with the 2023 estimate representing an all time low for the time series.

- Indicate what data or studies are currently lacking and which would be needed most to improve this stock assessment in the future.
  The Georges Bank Atlantic cod assessment could be improved with increased port sampling to characterize catch for all market categories.

- Are there other important issues?
  Survey sampling interruptions could be a potential problem if they persist in future years. Shifting the MT assessment timeline to spring (June) rather than fall (September) for this stock, resulted in shortened timeframes for compiling data and completing assessment models compared to prior years. If this timing is retained in future MT assessments, data delays may continue to limit model development.

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[NEFSC] Northeast Fisheries Science Center. 2022. Management Track Assessments Fall 2021. US Dept Commer, Northeast Fish Sci Cent Ref Doc. 22-07; 53 p.

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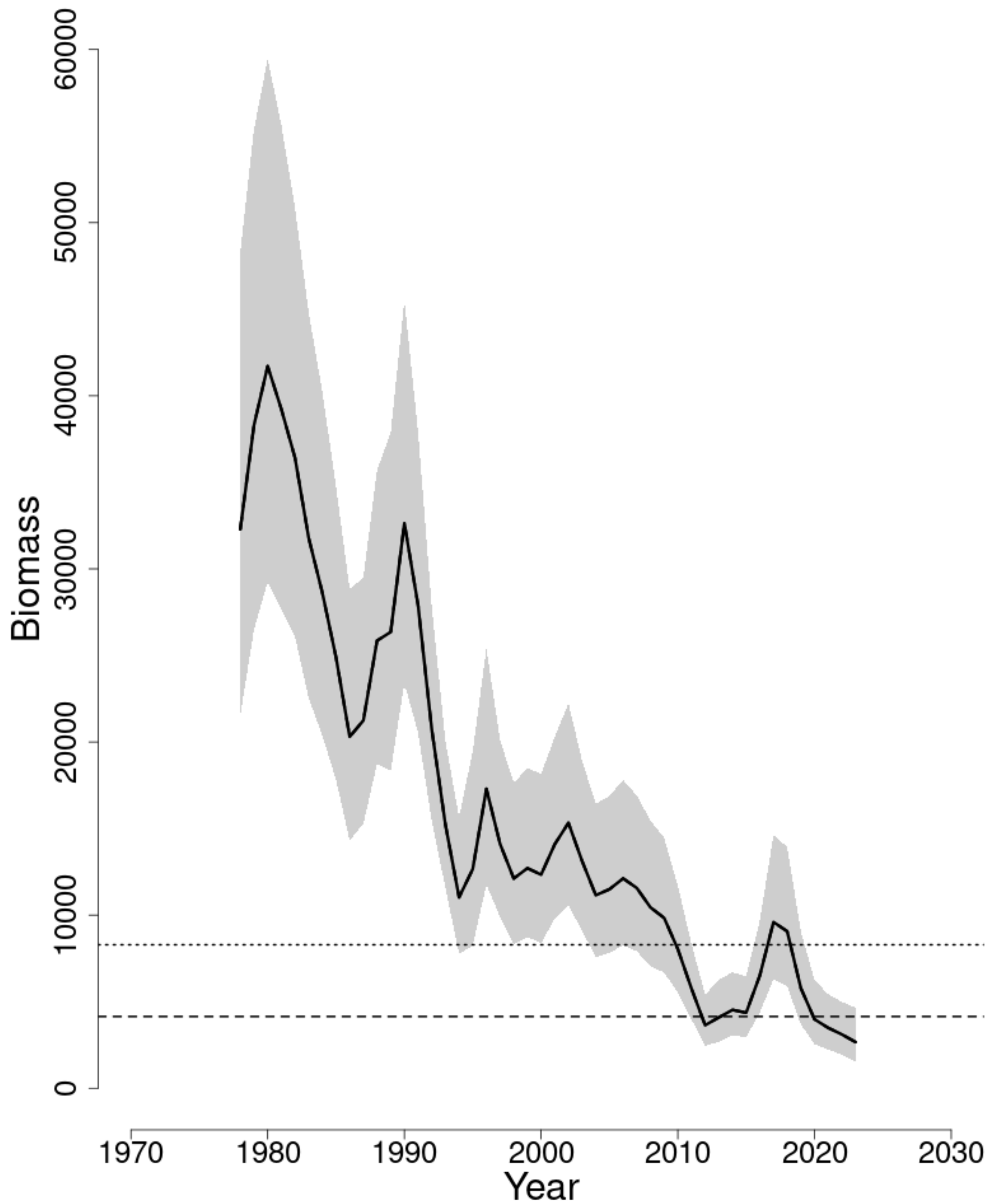

Figure 1: Trends in spawning stock biomass of Georges Bank Atlantic cod between 1978 and 2023 from the current Management Track (solid line). The corresponding $SSB_{Threshold}$ ($\frac{1}{2}$ SSB_{MSY} *proxy*; horizontal dashed line) as well as SSB_{Target} (SSB_{MSY} *proxy*; horizontal dotted line) are based on the 2024 assessment. The approximate 90% lognormal confidence intervals are shown.

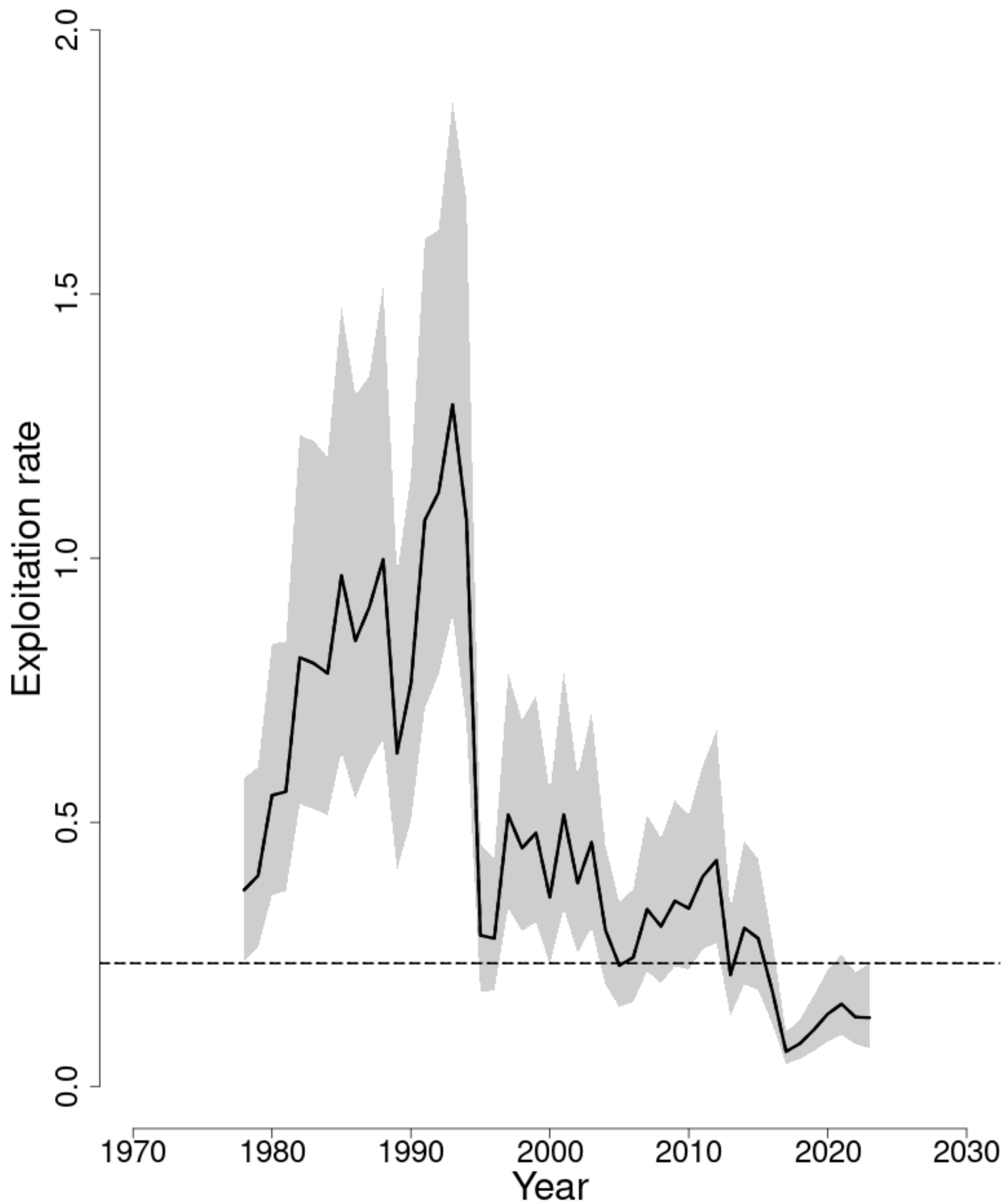

Figure 2: Trends in the fully selected fishing mortality (F_{Full}) of Georges Bank Atlantic cod between 1978 and 2023 from the current Management Track (solid line) and the corresponding $F_{Threshold}$ (F_{MSY} *proxy*=0.233; horizontal dashed line). The approximate 90% lognormal confidence intervals are shown.

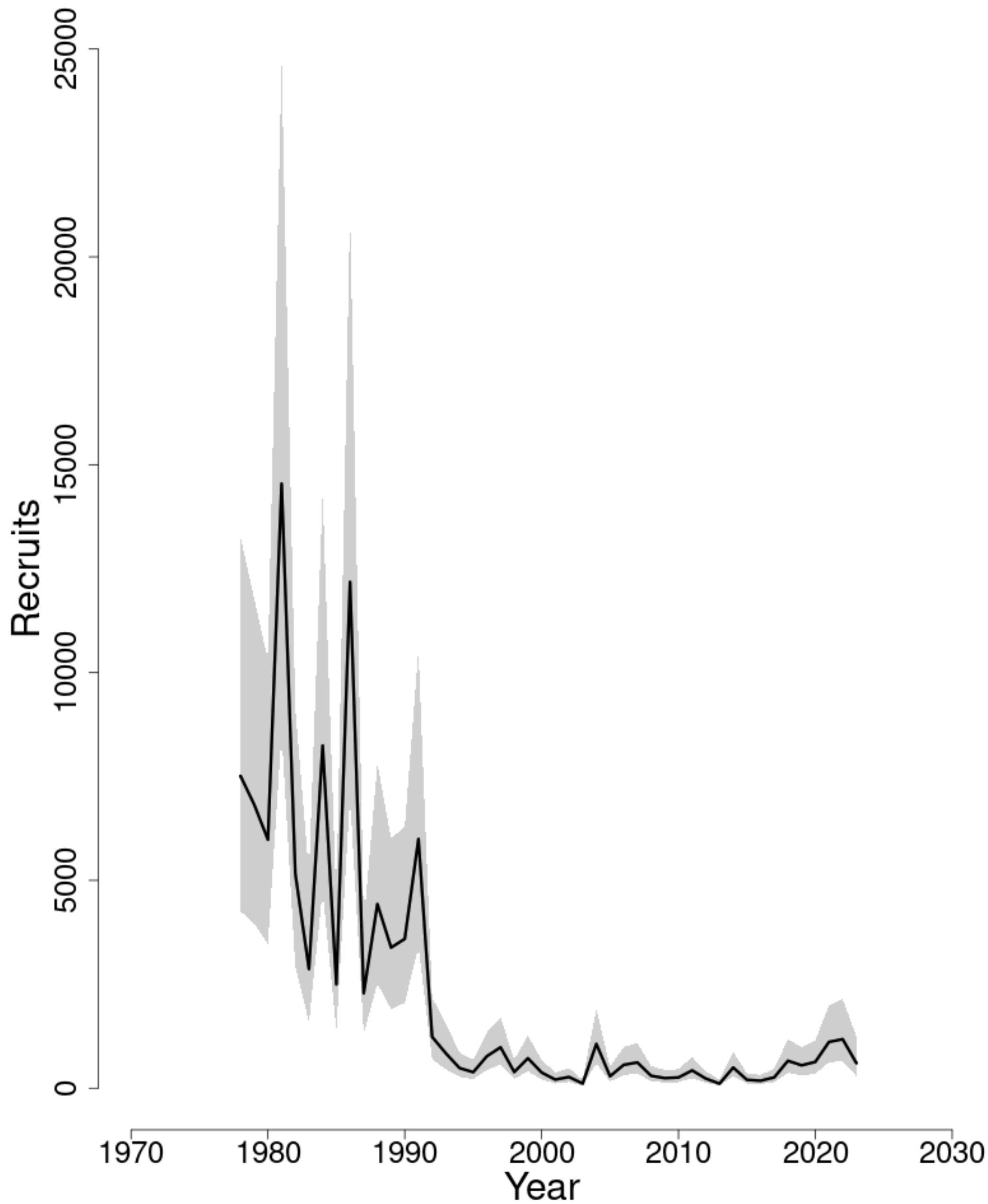

Figure 3: Trends in Recruits (000s) of Georges Bank Atlantic cod between 1978 and 2023 from the current Management Track (solid line). The approximate 90% lognormal confidence intervals are shown.

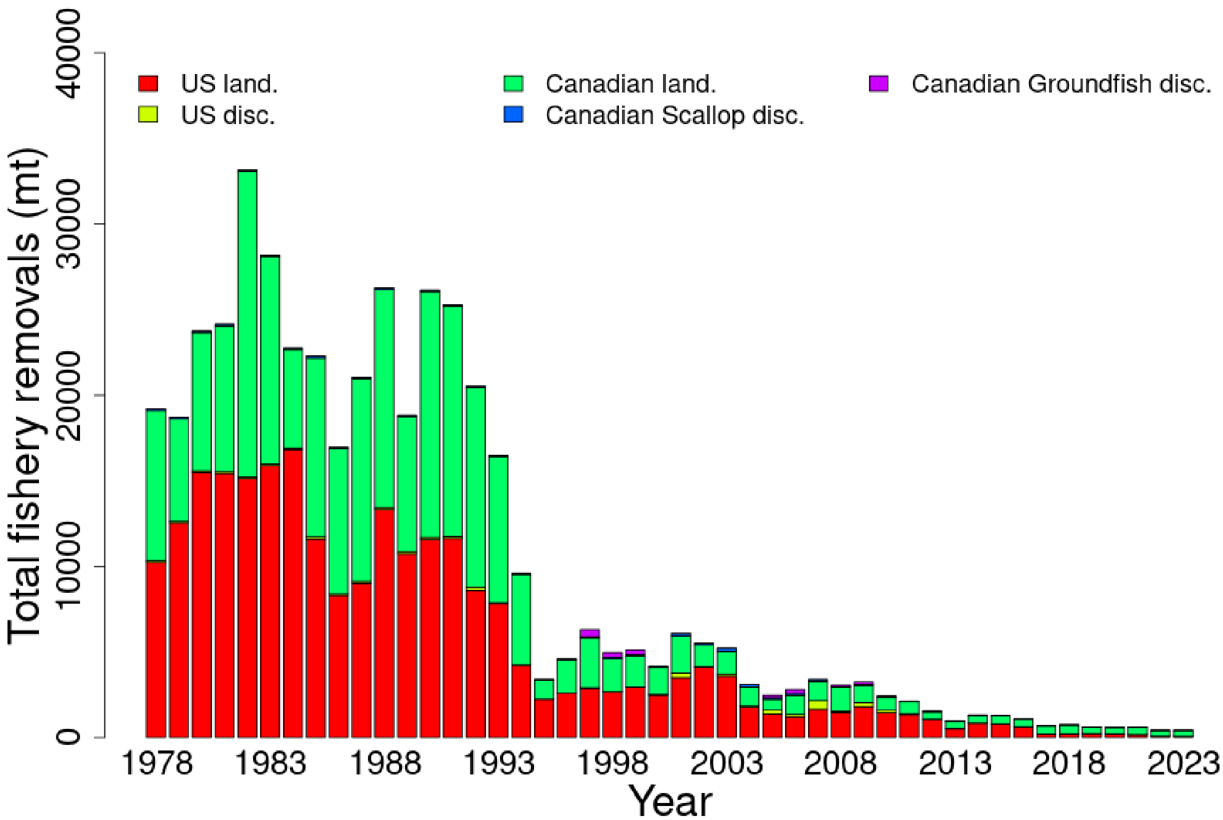

Figure 4: Total catch of Georges Bank Atlantic cod between 1978 and 2023 by fleet component (commercial US and Canadian) and disposition (landings and discards).

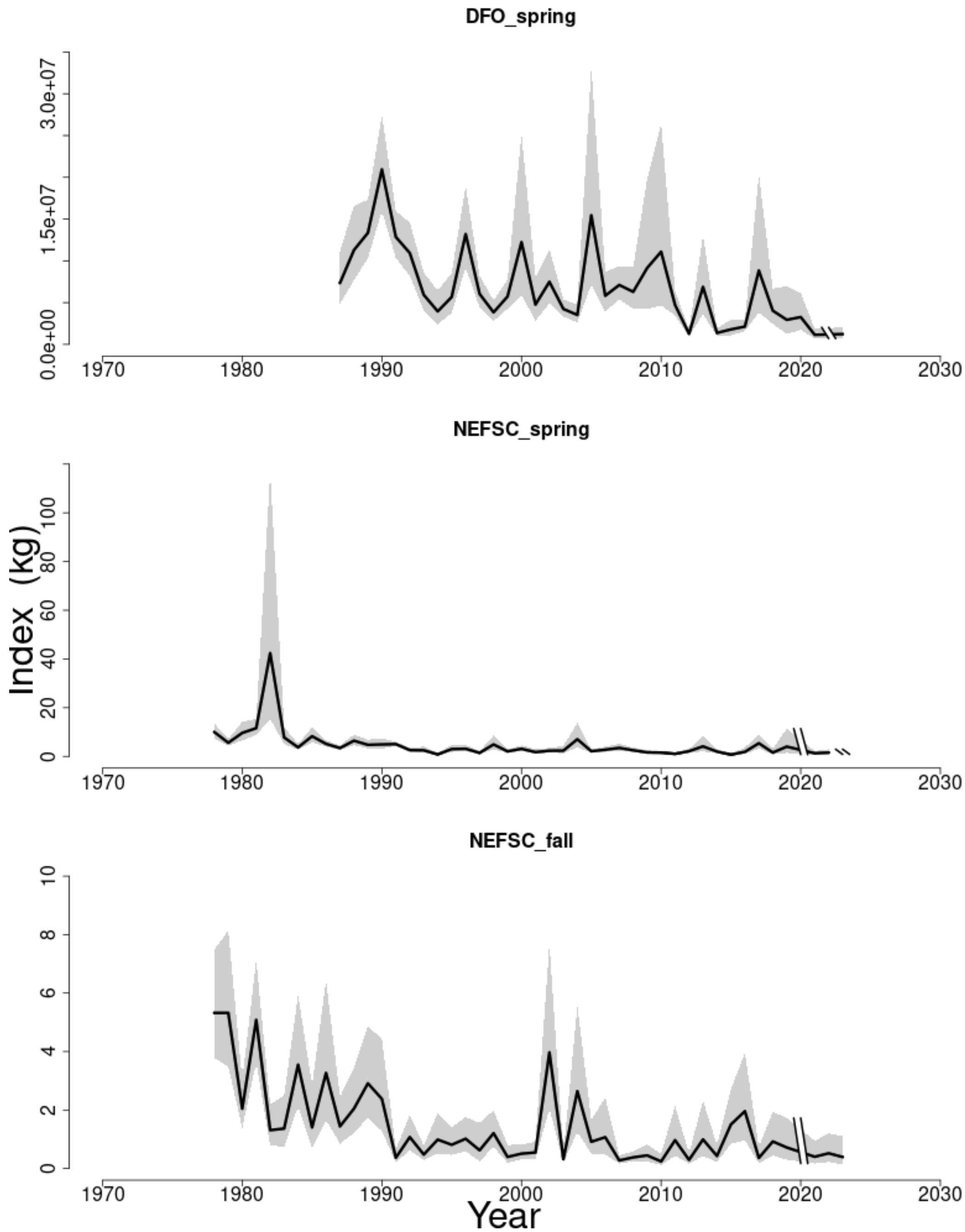

Figure 5: Indices of biomass for the Georges Bank Atlantic cod between 1978 and 2023 for the Department of Fisheries and Oceans Canada (DFO) spring (top), Northeast Fisheries Science Center (NEFSC) spring (middle) and fall (bottom) bottom trawl surveys. Gaps where data is not available are indicated by parallel breaks in the time series. The approximate 90% lognormal confidence intervals are shown.

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Maritimes Region

Canadian Science Advisory Secretariat
Science Advisory Report 2026/nnn

STOCK ASSESSMENT OF EASTERN GEORGES BANK HADDOCK (*MELANOGRAMMUS AEGLEFINUS*) IN 2025

CONTEXT

The Fisheries Management Branch of Fisheries and Oceans Canada (DFO) has requested a review of resource status for eastern Georges Bank Haddock (*Melanogrammus aeglefinus*) in support of the decision-making process for the 2027 fishery. This Science Advisory Report is from the regional peer review of June 16–18, 2026 on the Stock Assessment of Atlantic Cod and Haddock on Eastern Georges Bank. Additional publications from this meeting will be posted on the Fisheries and Oceans Canada (DFO) Science Advisory Schedule as they become available.

SCIENCE ADVICE

Status

- The 2025 model-estimated spawning stock biomass (SSB; 12,835 mt) is above the limit reference point (LRP; 7,833 mt) with a very high probability (>99%) and below the upper stock reference (USR; 25,999 mt) with a moderately high probability (73%), placing the stock in the cautious zone.

Trends

- The SSB in 2025 was estimated at 12,835 mt, which is below the median value for the time series (21,688 mt, 1969–2025). This represents a decline of more than 50% from the 2024 SSB estimate.
- Model estimates of age-1 recruitment in 2020 and 2021 (75 million and 71 million, respectively) are above the median recruitment of 8.5 million; however, recruitment in more recent years has been comparatively low.
- Fishing mortality (F) estimates averaged 0.57 over the last five years. The 2025 estimate was 0.46, below the five-year average.
- The model-estimated natural mortality rate (M; 0.508) in the recent time period (2010–2025) continues to be high.

Ecosystem and Climate Change Considerations

- Higher estimates of M have been attributed to both density-dependent impacts of the 2013 year-class, and changes in habitat related to environmental conditions.
- The presence of Haddock in deeper water strata off eastern Georges Bank (EGB) indicates increased movement off the bank throughout the year, likely corresponding with ecosystem changes.

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Stock Advice

- Catch advice for 2027 ranged from 830–2,020 mt assuming full utilization of 2026 total allowable catch (TAC), and from 1,010–2,210 mt assuming partial utilization of 2026 TAC. These catch levels are based on the 25–75% risk of exceeding the fishing mortality reference level (F_{ref}).

BASIS FOR ASSESSMENT

Assessment Details

Data from the 5Z9 stratum for the DFO Ecosystem Winter Research Vessel (RV) Survey were added to the assessment model, improving some of the model diagnostics of the Base model. Additional improvements to the model were discussed during the meeting, and recommendations were made for future exploration.

Year Assessment Approach was Approved

2025 (Barrett and Barrett, In Prep[1])

Assessment Type

Full Assessment

Most Recent Assessment Date

1. Last Full Assessment: 2025 (DFO 2025)
2. Last Interim-Year Update: NA

Stock Assessment Approach

1. Broad category: Single stock assessment model
2. Specific category: Statistical catch-at-age

Ecosystem and Climate Change Assessment Approach

Implied and Linked: Ecosystem variables are indirectly accounted for in the advice. The model estimates M since 2010, that may capture both changes in density dependence and changing environmental conditions. Environmental data are evaluated outside of the model to qualitatively assess any recent changes that may impact the stock.

Stock Structure Assumption

The most recent review of stock structure (Kronlund et al. 2023) suggests Haddock on Georges Bank are a single stock. EGB Haddock are currently assessed as a single unit, although some mixing may exist with adjacent stock units. Based on the physical and oceanographic characteristics of Georges Bank, larval dispersal and adult movement are thought to be limited (Kronlund et al. 2023). Tagging studies have suggested seasonal mixing of Haddock between the Bay of Fundy, Gulf of Maine, Great South Channel, and Georges Bank, with movement

[1] Barrett, M.A. and T.J. Barrett. In prep. Stock Assessment of Haddock (*Melanogrammus aeglefinus*) on Eastern Georges Bank. DFO Can. Sci. Advis. Sec. Res. Doc.

varying yearly. When abundance is high, boundaries may become more continuous (Sosebee and Cadrin 2006).

Reference Points

- Limit Reference Point (LRP): 7,833 mt; $B_{recover}$ (minimum model-estimated SSB between 1991–1996 [SSB_{1993}] for each assessment; Wang and Carruthers 2025)
- Upper Stock Reference (USR): 25,999 mt; Rago-Razor method (minimum model-estimated SSB for which further increases in SSB did not produce markedly improved recruitment; Wang and Carruthers 2025)
- Removal Reference (RR): 0.325; $F_{40\%SPR}$ (fishing mortality rate at 40% spawning potential ratio; TRAC 2022)
- Target Reference Point (TRP): NA

Data

- DFO Winter Ecosystem Research Vessel (RV) Survey index (1987–2025)
- National Marine Fisheries Service (NMFS) Spring Survey (1968–1972; 1982–2025, except 2020 and 2023)
- NMFS Fall Survey (1963–2025, except 2020)
- Canadian commercial fishery data (1969–2025)
- United States of America (US) commercial fishery data (1969–2025)

Data changes: The DFO Winter RV Survey was conducted in 2022 and 2025 with a new vessel and gear. Conversion factors (Yin et al. In Prep[2]) were applied to make these data comparable to the time series. Data from 5Z9 were included from 2010–2025 for the DFO Winter RV Survey.

[2] Yin Y., Martin R., Brunsdon E., and Benoit, H. In Prep. Calibration of bottom trawl survey vessels: results of comparative fishing between the CCGS Teleost and CCGS John Cabot/ CCGS Captain Jacques Cartier on and around Georges Bank in 2022-2024. CSAS Reference Document 20XX/XX.

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ASSESSMENT

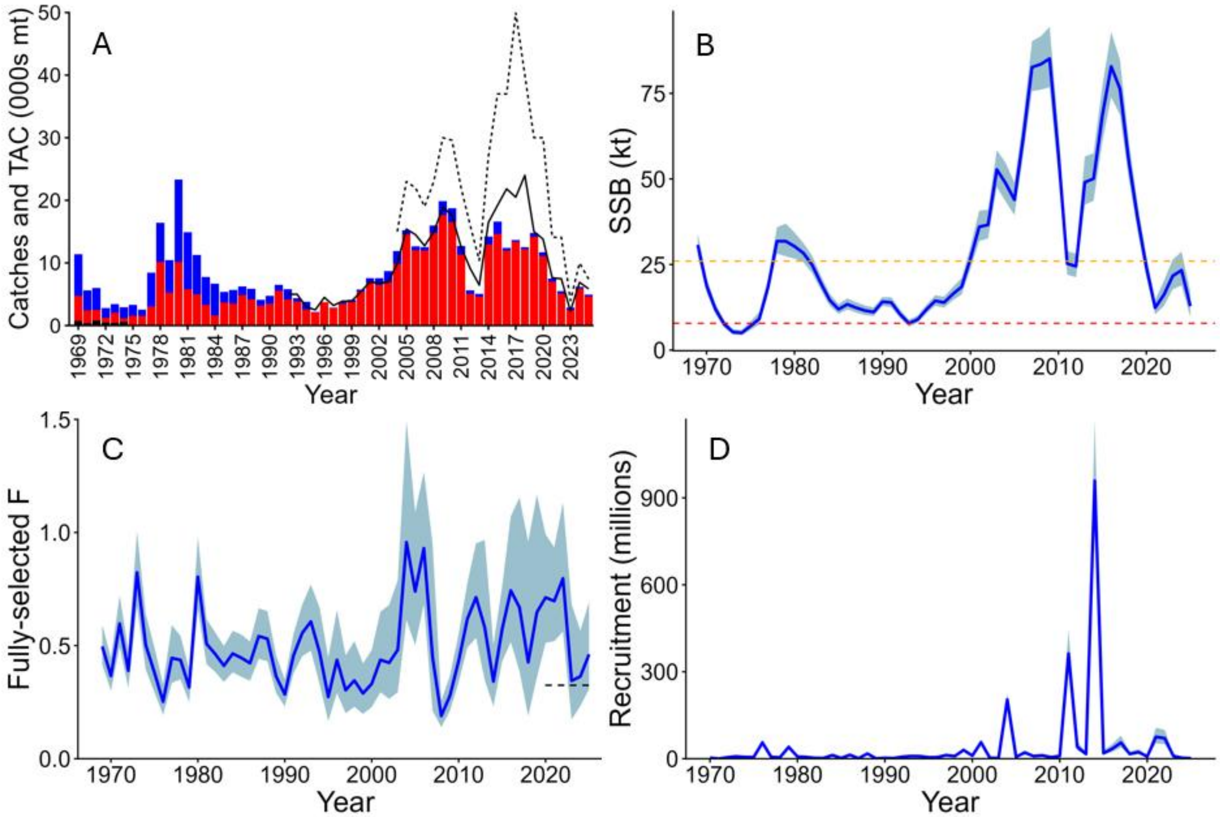

Figure 1. (A – upper left panel) Catch and total allowable catch (TAC) by country (blue-US; red-Canada; black-foreign).TAC is represented by the black line (dashed for total; solid for Canadian), (B – upper right panel) spawning stock biomass (SSB) in relation to the limit reference point (LRP; red) and upper stock reference (USR; orange), (C – bottom left panel) Fully-selected instantaneous fishing mortality rate (F) and fishery removal reference (dashed line, F_{ref} =0.325), and (D – bottom right panel) Recruitment (numbers at age-1; millions). 95% confidence intervals provided in light blue shading for Figures B–D.

Stock Status and Trends

Spawning Stock Biomass:

The current SSB estimate for 2025 is 12,835 mt, which is below the median SSB of 21,688 mt for the time series (1969–2025, Figure 1B). SSB has declined from 83,000 mt in 2016 to 12,000 mt in 2021, with a slight increase in SSB from 2022 to 2024. The 2025 estimated SSB decreased by more than 50% from the 2024 SSB estimate.

Recruitment:

Model-estimated recruitment at age-1 has fluctuated between 1.7 and 90 million since 1990, except for the strong year-classes. The recruitment of the 2003, 2010, and 2013 year-classes was 204, 362, and 959 million, respectively. The model estimates of age-1 recruitment in 2020 and 2021 are 75 and 71 million fish, respectively, exceeding the median recruitment of 8.5 million for the time series; however, recruitment in more recent years has been comparatively low (Figure 1D).

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Fishing Mortality:

Fully-selected F has varied throughout the time series, fluctuating between 0.18 in 2008 to 0.71 during the mid-2010s (Figure 1C). Fishing mortality (F) estimates averaged 0.57 over the last five years. The 2025 estimate was 0.46, below the five-year average.

Natural Mortality:

The trend in M continues to show an increase from the assumed historical level of 0.2 to the model estimated value of 0.508 in the recent time block (2010–2025; time- and age-invariant).

Current Status:

The 2025 model-estimated SSB (12,835 mt) is above the LRP with a very high probability (>99%) and below the USR with a moderately high probability (73%), placing the stock in the cautious zone.

History of Landings, Total Allowable Catch & Catch Advice

Combined Canada and US catches for EGB Haddock were 4,920 mt in 2025 (Figure 1A, Table 1). In 2025, the total catch represented 66% of the combined (Canada and US) TAC.

The Canadian catch decreased from 5,908 mt in 2024 to 4,694 mt in 2025. Discards of Haddock by the Canadian Scallop fishery were 13 mt in 2025, and have ranged between 4 mt and 186 mt over the time series. Canada caught 80% of its 5,854 mt TAC. In 2025, US catches were 226 mt, with US landings of 218 mt and 8 mt of estimated discards. The US caught 14.5% of its 1,556 mt TAC.

The 2021 year-class (age 4) was a major contributor to both the 2025 Canadian and US fishery catch (65% and 52% of fish by number, respectively), followed by the 2022 year-class (age 3; 18% by number) for Canada and the 2020 year-class for the US (age 5; 32% by number). Canadian catches peaked at lengths of 42.5 cm for otter trawl, 46.5 cm for longline, and 42.5 cm for scallop dredge gears. US catches peaked at lengths of 42 cm for landings and 36 cm for discards.

Table 1. Landings and total allowable catch (TAC) in metric tons (mt) by Canada and the US for the eastern Georges Bank Haddock fishery by calendar year (January 1–December 31). A dash (-) indicates data are not currently available.

Calendar Year	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026
Canadian TAC (mt)	21,830	20,500	24,000	15,000	13,800	7,614	7,473	2,320	6,900	5,854	3,752
Canadian Landings (mt)	11,935	13,377	12,216	14,156	11,045	6,997	5,143	2,499	5,889	4,681	-
Canadian Discards (mt)	8	8	5	4	7	5	7	8	9	13	-
US TAC (mt)	15,170	29,500	16,000	15,000	16,200	6,486	6,627	1,520	3,100	1,556	998
US Landings (mt)	341	214	253	544	633	518	327	299	285	218	-

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Calendar Year	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026
US Discards (mt)	125	81	21	50	50	6	8	33	26	8	-
Total TAC (mt)	37,000	50,000	40,000	30,000	30,000	14,100	14,100	3,840	10,000	7,410	4,750
Total Catch (mt)	12,409	13,679	12,495	14,735	11,735	7,526	5,485	2,840	6,219	4,920	-

Ecosystem and Climate Change Considerations

Higher M estimates in the model have been attributed to both density dependent impacts of the 2013 year-class (e.g., reduced growth, condition, spatial distribution expanded) and changes in habitat related to environmental conditions (e.g., movement, Friedland et al. 2015; Wang et al. 2021; Wang et al. 2024).

Haddock presence in deeper waters within the EGB management area indicates that fish movement off the bank may be occurring. Although the mechanism driving changes in movement has not been identified, it is likely related to ecosystem changes occurring in the EGB area (e.g., temperature, predation, competition). To account for changes in distribution observed in the spring, this assessment includes data from the 5Z9 stratum of the DFO Winter RV Survey.

Spring bottom temperature anomalies on EGB were below normal for 2025 and near average for 2026 compared to the standard time-period (1991–2020). During the 2025 DFO Winter RV Survey, a non-toxic plankton bloom was observed. The impacts of both lower bottom temperatures and the presence of the algal bloom on Haddock are unclear, but may partially explain lower fish catches in the area.

Projections

An estimate of catch for 2026 is required for the model projections. Two catch estimates for 2026 were considered: 1) full utilization of the 2026 TAC (4,750 mt), and 2) partial utilization of the 2026 TAC (3,750 mt). In the past 10 years, 38–74% of the annual TAC was utilized. This is largely driven by lower US catches relative to the US TAC and the Canadian fleet-share arrangements. Based on the recent history of US catches (approximately 350 mt average over the last 5 years), and further information from Resource Management related to fleet-share arrangements, 3,750 mt was selected as a best estimate for the partial utilization catch scenario.

Model projections predict a decline in SSB for 2026 and 2027. The 2021 and 2025 year-classes are projected to be the dominant contributors to fishery catch in 2027 (Barrett In Prep[3]).

Catch Advice

Catch advice for EGB Haddock is based on 25–75% risk of exceeding the fishing mortality reference level (F_{ref}; Tables 2a, 2b). Model-projected catch advice for the 2027 fishing year,

[3] Barrett, M.A. In Prep. Stock Assessment of Haddock (*Melanogrammus aeglefinus*) on Eastern Georges Bank for 2025. DFO Can. Sci. Advis. Sec. Res. Doc. 2026/nnn. iv + xx p.

based on an assumption of full utilization of the 2026 TAC (4,750 mt), ranges from 830-2,020 mt. An assumption of partial utilization of the 2026 TAC (3,750 mt) produces catch advice ranging from 1,010–2,210 mt. Projections of SSB_{2028} and the probabilities that SSB_{2028} will exceed the LRP and the USR are presented for the full-utilization and partial-utilization scenarios in Tables 2a and 2b, respectively.

Additional catch scenarios, requested by Resource Management include: 1) no fishing (0 mt), 2) 50% below the 2026 TAC (3,563 mt), and 3) 25% below the 2026 TAC (2,375 mt). The projected median SSB for Jan 1st, 2028 is provided for all of the catch scenarios in Tables 2a, 2b, and 3.

Figure 2 provides an illustration of projections for SSB_{2028} for 2027 TAC scenarios of 0 mt, 1,450 mt, and 3,563 mt in 2027. The SSB estimate is the same across the three scenarios for 2026 (reflects recorded catch from 2025), and 2027 (reflects partial utilization of TAC for 2026, 3,750).

Table 2a. Catch advice for eastern Georges Bank Haddock for 2027 with full utilization of the 2026 TAC (4,750 mt). Probabilities are based on spawning stock biomass (SSB) as of Jan 1st, 2028. LRP=limit reference point. USR=upper stock reference point. F_{ref}=fishing mortality reference point.

Full utilization of 2026 TAC-4,750 mt	**25% risk of exceeding F_{ref}**	**50% risk of exceeding F_{ref}**	**75% risk of exceeding F_{ref}**
2027 catch advice (mt)	830	1,290	2,020
SSB_{2028} (mt)	8,588	8,223	7,655
P(SSB_{2028}>LRP)	0.454	0.441	0.412
P(SSB_{2028}>USR)	0.188	0.185	0.174

Table 2b. Catch advice for eastern Georges Bank Haddock for 2027 with partial utilization of the 2026 TAC (3,750 mt). Probabilities are based on spawning stock biomass (SSB) as of Jan 1st, 2028. LRP=limit reference point. USR=upper stock reference point. F_{ref}=fishing mortality reference point.

Partial utilization of 2026 TAC-3,750 mt	**25% risk of exceeding F_{ref}**	**50% risk of exceeding F_{ref}**	**75% risk of exceeding F_{ref}**
2027 catch advice (mt)	1,010	1,430	2,210
SSB_{2028} (mt)	9,030	8,681	8,073
P(SSB_{2028}>LRP)	0.472	0.458	0.435
P(SSB_{2028}>USR)	0.194	0.189	0.182

Table 3. Projected 2028 spawning stock biomass (SSB_{2028}) under alternative total allowable catch (TAC) scenarios for 2027 fishing year. Probabilities of SSB_{2028} being above the limit reference point (LRP) and the upper stock reference (USR) are based on SSB as of January 1, 2028 and a partial utilization of the TAC in the 2026 fishing year (3,750 mt).

Alternative TAC Scenarios for 2027 Fishing Year	**SSB_{2028} (mt)**	**P(SSB_{2028}>LRP)**	**P(SSB_{2028}>USR)**
0 mt	9,847	0.521	0.206
2,375 mt*	7,944	0.430	0.180
3,563 mt**	7,050	0.392	0.168

*50% below the 2026 fishing year TAC.
**25% below the 2026 fishing year TAC.

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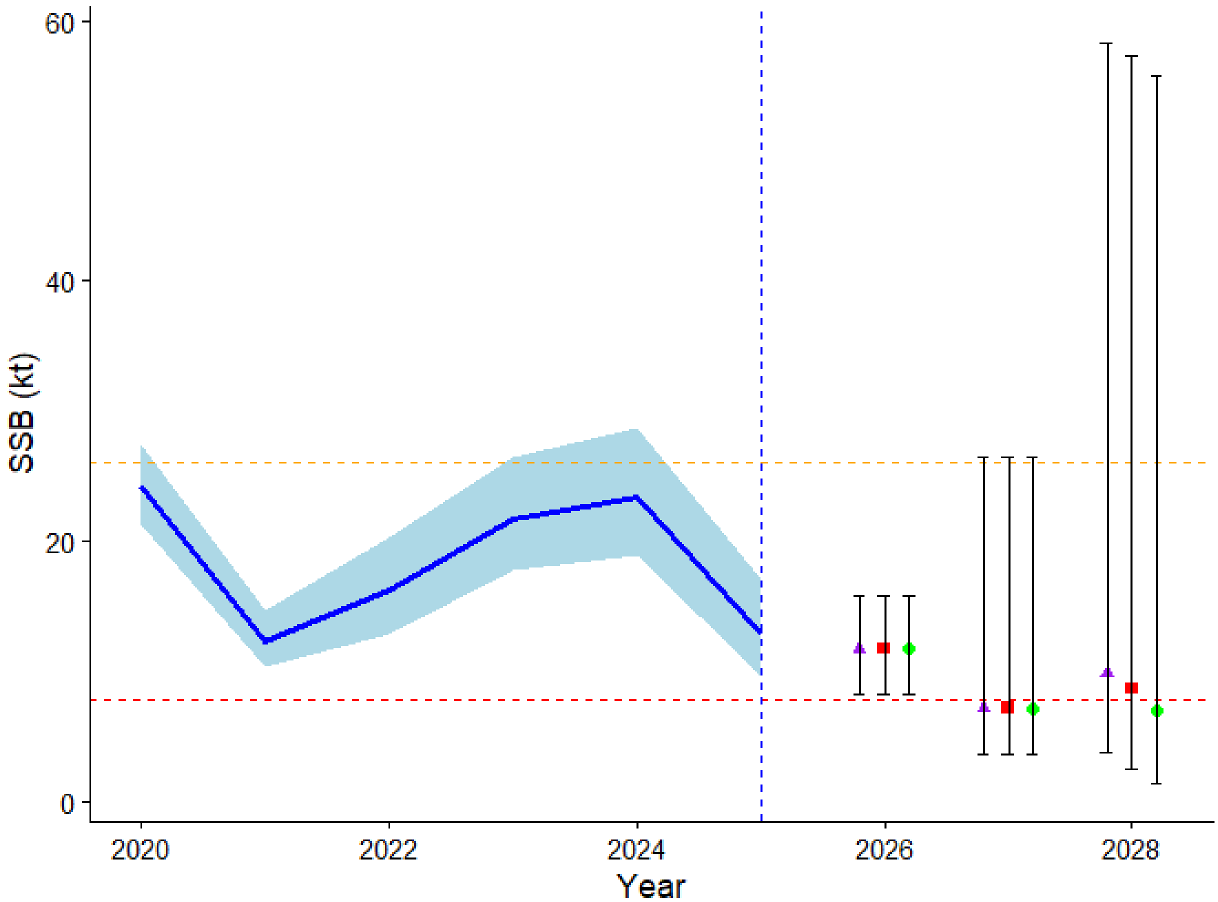

Figure 2. Spawning stock biomass (SSB) of eastern Georges Bank Haddock from 2020–2025, and projections for 2026–2028 based on three total allowable catch (TAC) scenarios for 2027 (No fishing-0 mt, purple triangles; 50% risk of exceeding F_{ref}-1,430 mt, red squares; and 25% reduction in TAC from 2026-3,563 mt, green circles). Projected values reflect the Jan 1st median SSB with error bars extended to the 5th and 95th percentiles with an assumed partial utilization of the 2026 TAC (3,750 mt).

SOURCES OF UNCERTAINTY

Natural mortality remains an uncertainty for the EGB Haddock stock. The expectation was that with the exit of the 2013 year-class and the reduction in overall stock biomass, the model-estimated M would decrease. Contrary to expectations, model-estimated M remains high. However, our understanding of the factors leading to high M in recent years is incomplete (e.g., migration, catch reporting and ageing errors, misspecification of selectivity). Additional uncertainties identified during the peer-review were related to the disconnect between the M used in the F_{ref} calculation and M used for projections.

The impact of the reduced spatial coverage and later timing of the 2025 NMFS Fall Survey on model performance was evaluated by excluding these data from the model. Excluding the 2025 NMFS Fall Survey data did not improve model performance. The inclusion of deepwater sets from stratum 5Z9 of the DFO Winter RV Survey was also evaluated. The model configuration accepted at peer review includes data from the 5Z9 stratum of the DFO Winter RV Survey, consistent with the previous assessment.

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DRAFT

draft working paper for peer review only

Georges Bank haddock

2026 Management Track Assessment Report

U.S. Department of Commerce
National Oceanic and Atmospheric Administration
National Marine Fisheries Service
Northeast Fisheries Science Center
Woods Hole, Massachusetts

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This assessment of the Georges Bank haddock (Melanogrammus aeglefinus) stock is an update of the 2024 management track assessment, which used the WHAM framework. Prior to the 2021 research track, the last benchmark for this stock was in 2008 (Brooks et al., 2008). Based on the previous update assessment in 2024 (NEFSC, 2024), the stock was not overfished, and overfishing was not occurring. This assessment updates commercial fishery catch data, research survey indices of abundance, weights and maturity at age, and the WHAM assessment model and reference points through 2025. Stock projections have been updated through 2031.

State of Stock: Based on this updated assessment, the Georges Bank haddock (*Melanogrammus aeglefinus*) stock is not overfished, and overfishing is not occurring (Figures 1-2). Retrospective adjustments were not made to the model results. Spawning stock biomass (SSB) in 2025 was estimated to be 29,037 (mt) which is 109% of the biomass target (SSB_{MSY} *proxy* = 26,615; Figure 1). The 2025 average fishing mortality on ages 5-7 was estimated to be 0.21 which is 78% of the overfishing threshold proxy (F_{MSY} *proxy* = 0.27; Figure 2). The F_{MSY} *proxy* is expressed as the average F on ages 5-7.

Table 1: Catch and status table for Georges Bank haddock. All weights are in (mt), recruitment is in (000s), and $\bar{F}_{5-7}$ is the average fishing mortality on ages 5 to 7. Model results are from the current updated WHAM assessment. A rho adjustment was not applied to values in this table.

	2018	2019	2020	2021	2022	2023	2024	2025
Data								
US Commercial discards	410	306	178	49	65	113	83	32
US Commercial landings	4,017	5,252	6,648	3,641	2,419	2,595	1,933	1,306
Canadian Catch	12,222	14,160	11,052	7,001	5,150	2,507	5,908	4,694
Catch for Assessment	16,647	19,719	17,878	10,691	7,634	5,214	7,924	6,032
Model Results								
Spawning Stock Biomass	96,774	77,640	50,913	29,998	32,181	30,044	31,732	29,037
$\bar{F}_{5-7}$	0.24	0.33	0.42	0.4	0.4	0.28	0.33	0.21
Recruits (age 1)	12,282	14,863	7,381	58,137	31,840	8,991	2,903	2,284

Table 2: Comparison of reference points estimated from the 2024 WHAM assessment and from the current 2026 WHAM assessment update. An $F_{40\%}$ proxy was used for the overfishing threshold. The medians and 95% probability intervals are reported for MSY, SSBMSY, and RMSY, based on WHAM projections with fishing mortality fixed at $F_{40\%}$.

	2024	2026
F_{MSY} *proxy*	0.264	0.269
SSB_{MSY} (mt)	24,225	26,615 (14,398 - 49,199)
MSY (mt)	5,766	6,023 (3,252 - 11,154)
Median recruits (age 1) (000s)	16,841	15,767 (437 - 568,918)
Overfishing	No	No
Overfished	No	No

Projections: Short term projections were conducted in WHAM, which propagates uncertainty in the processes of recruitment and transitions between numbers at age. For projection specifications, the Plan Development Team supplied an estimate of total catch for 2026, and fishing mortality was set equal to F40%SPR for 2027-2031. Annual fishery selectivity and maturity were fixed at a recent 2 year average (2024-2025 values), following analyses and decisions made at the 2021 research track. Weights at age for catch and SSB that were predicted from a Gaussian Markov Random Field (GMRF) model, rather than a recent 2 year average, were preferred by the peer reviewers at the 2022 and 2024 management track assessment, and were used in the projections summarized in this report. The GMRF projected weights for 2024 and 2025 from the previous management track were compared to observed values in those years. They were not more accurate than the 2 year average for 2024 and 2025, but projecting them forward 6 years showed negligible difference between the two approaches. Retrospective adjustments were not applied. The Overfished threshold is 13,308 mt, and the stock is not projected to drop below this value in the next 6 years.

Table 3: Short term projections of total fishery catch and spawning stock biomass (with 95% CI) for Georges Bank haddock based on a harvest scenario of fishing at 100% F_{MSY} *proxy* between 2027 and 2031. Catch in 2026 was assumed to be 5,768 mt (estimate provided by the Groundfish Plan Development Team).

Year	Catch (mt)	SSB (mt)	$\bar{F}_{5-7}$
2026	5,768	25,281 (9,775 - 65,382)	0.247 (0.090 - 0.675)

Year	Catch (mt)	SSB (mt)	$\bar{F}_{5-7}$
2027	5,277 (1,524 - 18,271)	21,828 (6,359 - 74,926)	0.27
2028	4,640 (1,230 - 17,511)	19,804 (5,174 - 75,810)	0.27
2029	4,498 (973 - 20,785)	19,818 (4,053 - 96,904)	0.27
2030	4,659 (769 - 28,245)	20,956 (3,246 - 135,301)	0.27
2031	4,888 (645 - 37,014)	22,157 (2,772 - 177,110)	0.27

Special Comments:

- What are the most important sources of uncertainty in this stock assessment? Explain, and describe qualitatively how they affect the assessment results (such as estimates of biomass, F, recruitment, and population projections).

  One source of uncertainty was whether to include the Fall 2025 index value. Only about half the number of tows were taken compared to an average year, and the timing extended quite late compared to recent years, raising concerns about representativeness for this stock. A robust array of analyses and diagnostics were examined for models that included or excluded the Fall 2025 index value. The model that dropped the Fall 2025 index was more stable and had slightly better residuals in recent years for several of the time series. Another source of uncertainty is the weight at age in projections. Model weights at age are a complex synthesis of biology, gear selectivity and proportion of catch due to each gear, and time of year when removals are made. While the GMRF method has done well in the last 2 assessments, it did not perform as well in this assessment because weights at age had an up-down pattern that was better fit by a 2 year average (which split the difference). Comparing projected weights at age for 6 years (2026-2031) showed negligible differences between GMRF, 2 year average and also a 5 year average. Given the similar projection results, the GMRF was retained.

- Does this assessment model have a retrospective pattern? If so, is the pattern minor, or major? (A major retrospective pattern occurs when the adjusted SSB or $\bar{F}_{5-7}$ lies outside of the approximate joint confidence region for SSB and $\bar{F}_{5-7}$).

  The 7-year Mohn's ρ, relative to SSB, was 0.50 in the 2024 assessment and was 0.59 in 2025. The 7-year Mohn's ρ, relative to F, was -0.37 in the 2024 assessment and was -0.40 in 2025. There was a minor retrospective pattern for this assessment because the ρ adjusted estimates of 2025 SSB (SSB_ρ=29,037) and 2025 F (F_ρ=0.21) were inside the estimated 95% confidence regions around SSB (16,839 - 50,070) and F (0.114 - 0.388). The adjusted estimates fell on the boundary of the 90% CI. Although the Mohn's ρ, values increased slightly from the last assessment, no retrospective adjustment was made for either the determination of stock status or for projections of catch in 2026. Several sensitivity models were tested and compared to the base model; these models agreed in trend and magnitude, yet had much smaller values for Mohn's ρ. This result argues against adjusting for a retrospective pattern. A new diagnostic that examined Mohn's ρ values in self-tests also supported this decision.

- Based on this stock assessment, are population projections well determined or uncertain? If this stock is in a rebuilding plan, how do the projections compare to the rebuilding schedule?
  Confidence intervals are quite wide in the projection years. As noted in the first bullet, population projections for Georges Bank haddock are uncertain due to future values of weights at age. Large estimates of process error contribute to wide confidence intervals in the projections. This stock is not in a rebuilding plan.

- Describe any changes that were made to the current stock assessment, beyond incorporating additional years of data and the affect these changes had on the assessment and stock status.
  Two years of additional data were incorporated in the Georges Bank haddock assessment for this update. No model structure changes were made for this update.

- If the stock status has changed a lot since the previous assessment, explain why this occurred.
  The stock status of Georges Bank haddock has not changed. The reported scale of the population, and of the reference points, are consistent with the last assessment.

- Provide qualitative statements describing the condition of the stock that relate to stock status.
  The spatial distribution of Georges Bank haddock has contracted and is less broadly distributed than a decade ago when the population was at an all time high. This stock has produced several exceptionally strong year classes in the last 20 years (2003, 2010, 2013), but they have all aged out of the population and abundance has returned to levels last observed in the early 2000s. Numerically, the 2020 and 2021 year classes account for 72% of the population. An increase in maturity at age and weights at some ages were observed in the most recent 2 years, likely a result of decreased density-dependent pressures on growth.

- Indicate what data or studies are currently lacking and which would be needed most to improve this stock assessment in the future.
  The new approaches to evaluating retrospective patterns are intriguing and further exploration is encouraged. The research track assessment in 2021 for Georges Bank haddock strongly recommended studies to collect data to re-estimate gutted to whole weight conversion factors, as well as measuring individual fish weight in addition to the length and otolith sampling performed on commercially landed fish. Nearly two years worth of data have been collected, although some sampling gaps remain. Research continues on this project.

- Are there other important issues?
  There are no signals from this stock assessment of strong incoming year classes, suggesting that near term catch will be reliant on the 2020 and 2021 year classes.

References:

Brooks, E.N, M.L. Traver, S.J. Sutherland, L. Van Eeckhaute, and L. Col. 2008. In. Northeast Fisheries Science Center. 2008. Assessment of 19 Northeast Groundfish Stocks through 2007: Report of the 3rd Groundfish Assessment Review Meeting (GARM III), Northeast Fisheries Science Center, Woods Hole, Massachusetts, August 4-8, 2008. US Dep Commer, NOAA Fisheries, Northeast Fish Sci Cent Ref Doc. 08-15; 884 p + xvii. http://www.nefsc.noaa.gov/publications/crd/crd0815/

NEFSC. 2024. Management Track Assessments Fall 2024. US Dept Commer, Northeast Fish Sci Cent Tech Memo. (not available yet)

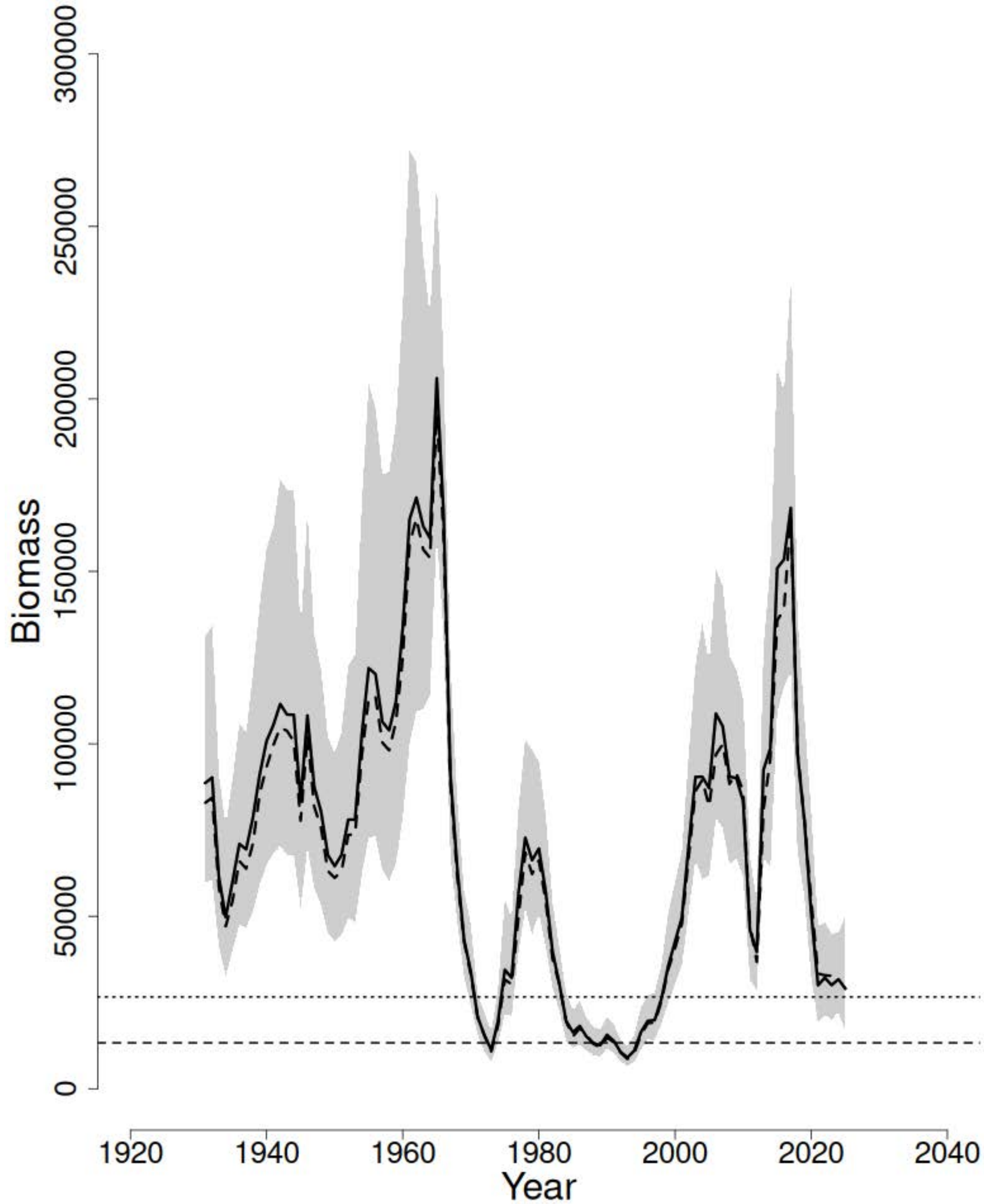

Figure 1: Trends in spawning stock biomass of Georges Bank haddock between 1931 and 2025 from the current (solid line) and previous (dashed line) 2024 assessment and the corresponding $SSB_{Threshold}$ ($\frac{1}{2}$ SSB_{MSY} *proxy*; horizontal dashed line) as well as SSB_{Target} (SSB_{MSY} *proxy*; horizontal dotted line) based on the current 2026 assessment. The 95% confidence intervals are shown.

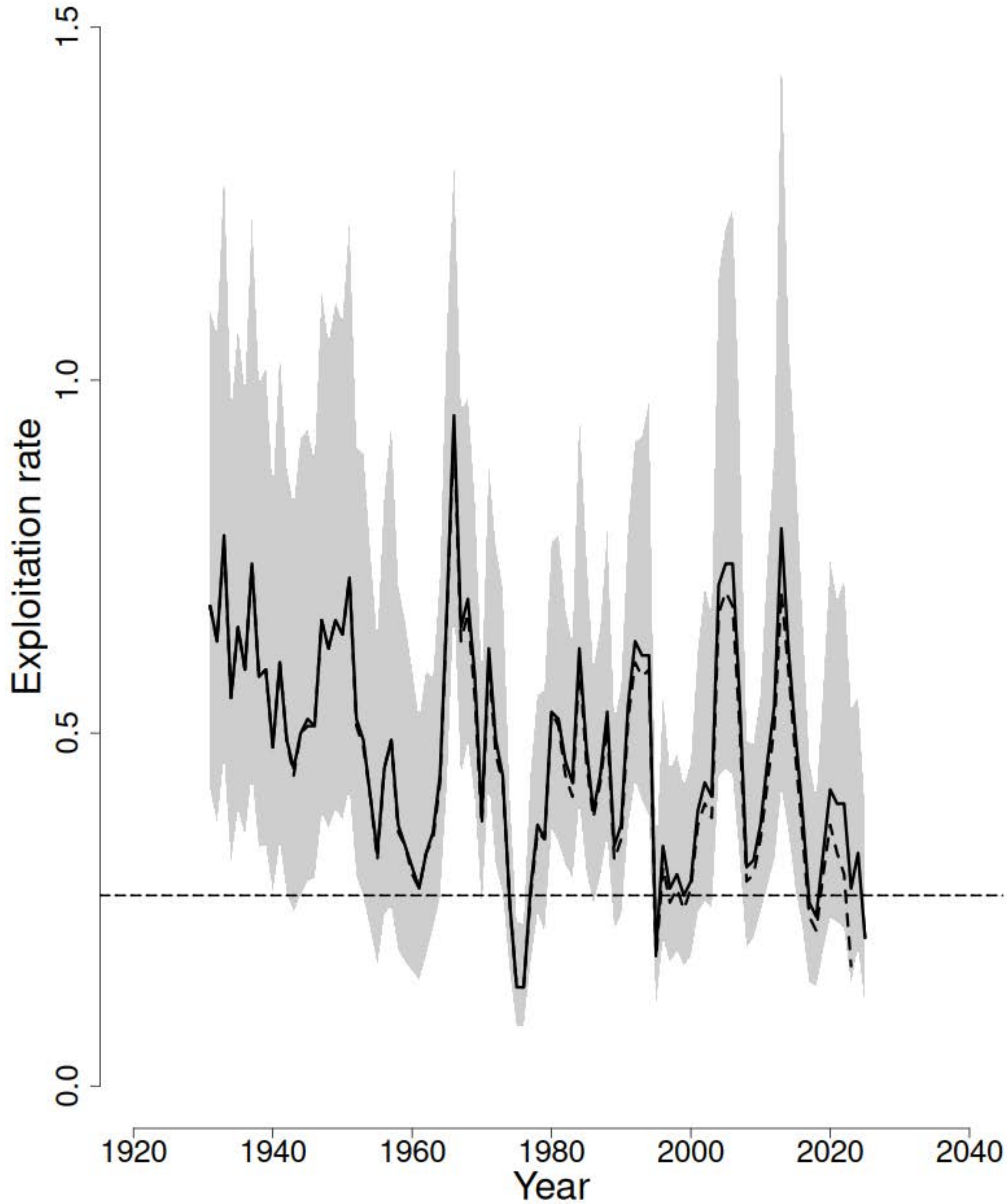

Figure 2: Trends in the average fishing mortality ($\bar{F}_{5-7}$) of Georges Bank haddock between 1931 and 2025 from the current (solid line) and previous (dashed line) 2024 assessment and the corresponding $F_{Threshold}$ (F_{MSY} *proxy*=0.27; horizontal dashed line) based on the current 2026 assessment. $\bar{F}_{5-7}$ was adjusted for a retrospective pattern and the adjustment is shown in red. The 95% confidence intervals are shown.

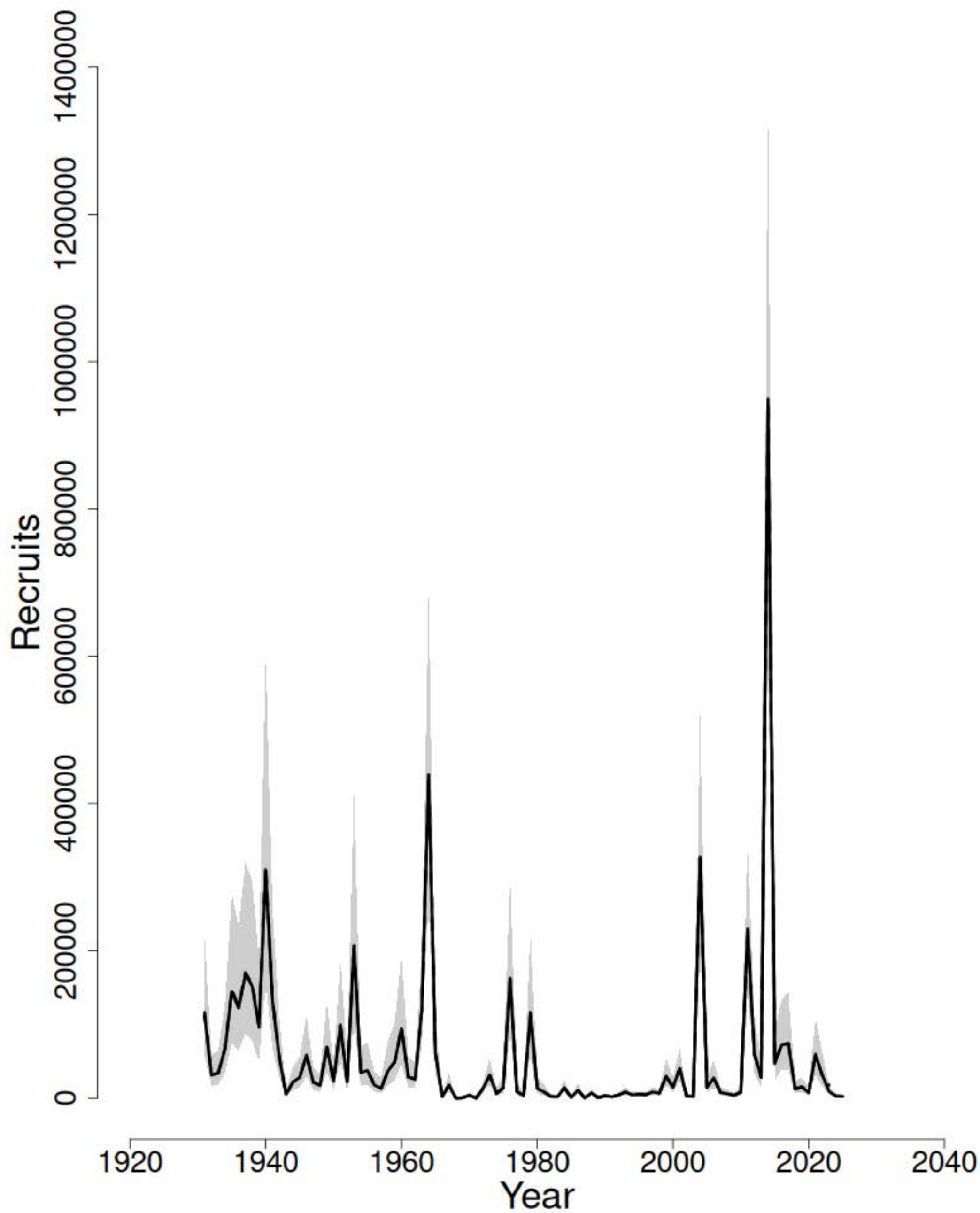

Figure 3: Trends in Recruits (age 1) (000s) of Georges Bank haddock between 1931 and 2025 from the current (solid line) and previous (dashed line) assessment. The 95% confidence intervals are shown.

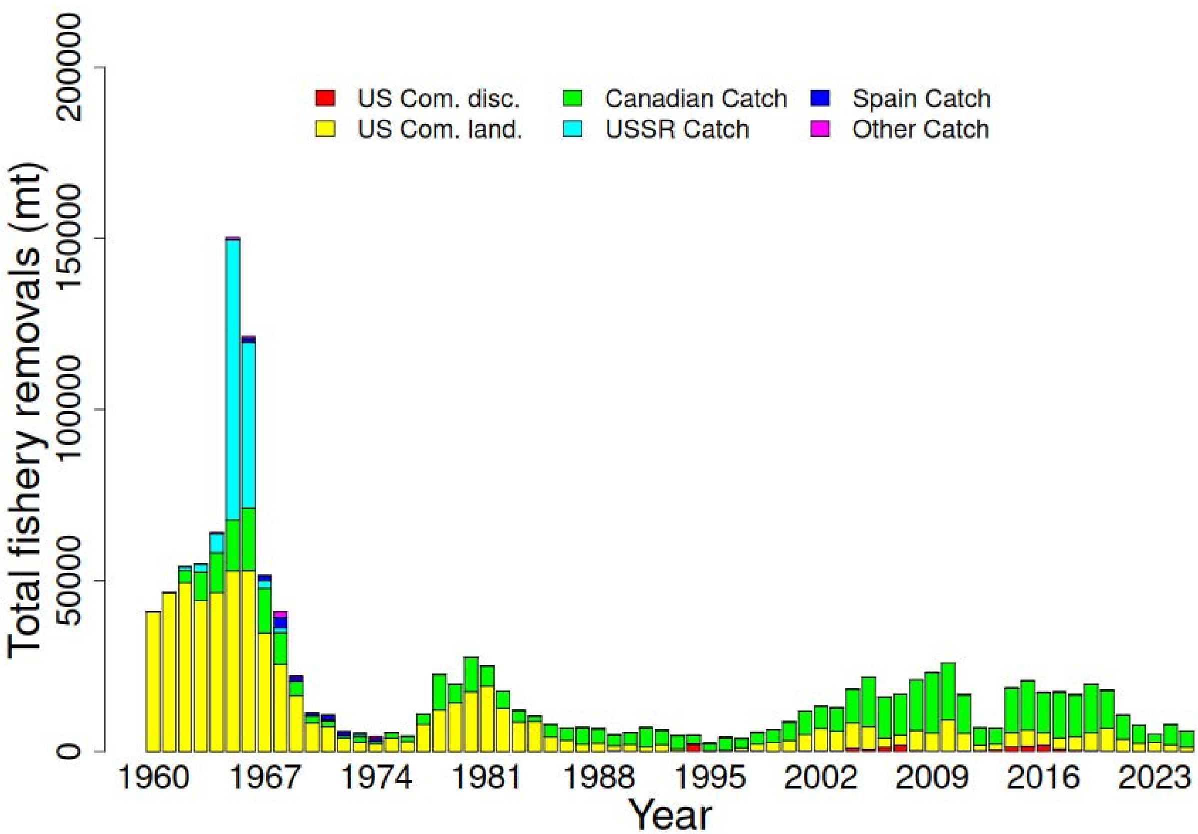

Figure 4: Total catch of Georges Bank haddock between 1931 and 2025 by fleet (US Commercial, Canadian, or foreign fleet) and disposition (landings and discards).

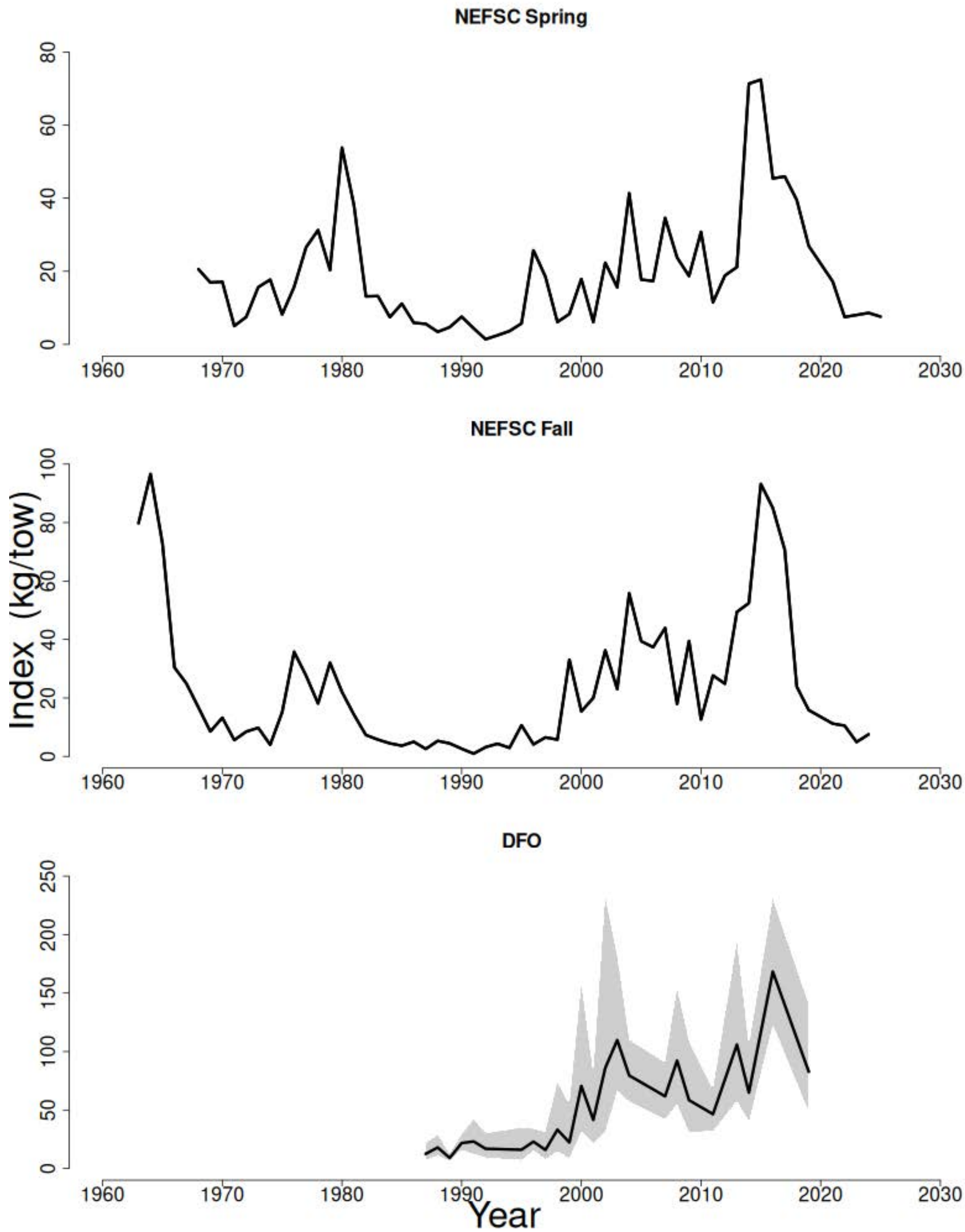

Figure 5: Indices of biomass (Mean kg/tow) for the Georges Bank haddock stock between 1963 and 2025 for the Northeast Fisheries Science Center (NEFSC) spring and fall bottom trawl surveys and the DFO winter bottom trawl survey. The approximate 95% lognormal confidence intervals are shown for DFO only. Confidence bounds for the new length-based biomass calibration are not yet available.

June 2026 Management Track
Peer Review Panel Report

Richard Merrick (Chair)[1], Tim Barrett[2], Lisa Kerr[3] , Holly Kindsvater[4]

[1]NOAA Fisheries (retired), [2]Fisheries and Oceans Canada, [3]University of Maine,
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Executive Summary

The June 2026 Management Track (MT) peer review Panel (Panel) reviewed two stock assessments: Georges Bank haddock (*Melanogrammus aeglefinus*) and Atlantic herring (*Clupea harengus*). The Panel met in person in the USGS' Woods Hole Coastal and Marine Science Center in Falmouth, MA with hybrid capabilities on June 29-30, 2026. The Panel was to determine whether each completed MT Assessment was technically sufficient to a) evaluate stock status, b) provide scientific catch advice, and c) successfully address the assessment Terms of Reference (Appendix A).

Attendance at the meeting is provided in Appendix B, and the agenda for the peer review is available in Appendix C. An explanation of the major acronyms used in the report is provided in Appendix D.

Table 1 presents a list of the stocks, name of the assessment lead, and conclusions about stock status. Table 2 presents a summary of recommendations by stock made by the Panel.

We thank Kristan Blackhart (Population Dynamics Branch Chief) and Brian Hopper (Assessment Process Lead, Resource Evaluation and Assessment Division) for their support during the meeting and to Liz Brooks and Jon Deroba of the staff of the Population Dynamics Branch for the open and collaborative spirit with which they engaged the Panel.

Our thanks also extend to numerous NEFSC staff for taking extensive notes during the meeting, and who, along with Jamie Cournane and Robin Frede of the New England Fishery Management Council, provided context and additional background.

Georges Bank Haddock

The Panel concluded that the 2026 assessment update for Georges Bank haddock is technically sufficient to evaluate stock status and provide scientific advice and meets most of the Terms of Reference for the stock's assessment except for TORs 5 and 6 which were partially met. The assessment represents Best Scientific Information Available (BSIA) for this stock for management purposes.

The 2026 assessment of the Georges Bank haddock (*Melanogrammus aeglefinus*) stock is an update of the 2024 management track assessment, which used the Woods Hole Assessment Model (WHAM) framework. Prior to the 2022 research track, the last benchmark for this stock was in 2008 (Brooks et al., 2008).

This assessment updates commercial fishery catch data, research survey indices of abundance, weights- and maturity-at-age, and the WHAM assessment model and reference points through 2025. Based on this assessment, the stock was not overfished and overfishing was not occurring.

Stock projections have been updated through 2031. However, the Panel found that the high uncertainty in the stock's terminal year abundance estimate and the moderately strong retrospective pattern suggest projections beyond one or two years should be considered to be highly uncertain. The Panel feels it is extremely risky to set catch advice that would lead to fishing down the 2020 year class and the 2021 year class without confirming another recruitment year.

Atlantic Herring

The Panel concluded that the 2026 assessment update for Atlantic herring is technically sufficient to evaluate stock status and provide scientific advice and meets most of the Terms of Reference for the stock's assessment except for TOR 5 which was partially met. The assessment represents Best Scientific Information Available (BSIA) for this stock for management purposes.

This 2026 assessment of the Atlantic herring (*Clupea harengus*) stock is the first application of the WHAM assessment platform following the 2025 research track assessment (NEFSC 2025). The last management track assessment was in 2024 and was conducted using the ASAP model. Based on that assessment, the stock was overfished but overfishing was not occurring.

This assessment updated fishery catch data, survey indices, life history parameters (e.g., weights-at-age), and the WHAM assessment model and reference points (BRPs) through 2025. Stock projections have been updated through 2031.

The change in assessment platforms from the 2024 management track makes comparisons among the assessments inappropriate. Several relatively minor changes have been made since the research track. Namely, a revised Canadian catch time series was used, a different approach was used for input effective sample sizes, and spawning stock biomass weight-at-age values were corrected. The Panel found that the inability to account for the annual variability and downward trend in the numbers-at-age random effect deviations in the projections undermined confidence in the model projections.

Table 1. Stocks reviewed *at June 2026 Management Track Assessment Peer Review meeting.*

Stock	Assessment Lead	Peer Review Panel Conclusion on Stock Status
Georges Bank haddock	Liz Brooks	Stock is not overfished and overfishing is not occurring
Atlantic herring	Jonathan Deroba	Stock is overfished and overfishing is not occurring

Table 2. Summary of Peer Review Panel recommendations by stock from June 2026 Track Assessment Peer Review meeting.

Stock	Peer Review Panel Recommendations
Georges Bank haddock	● Evaluate how density dependence, environmental change and other factors produce changes in GB haddock indices used in the assessment ● Evaluate the effect of decreasing WAA on selectivity-at-age ● Continue investigating retrospective patterns and diagnostics in state-space models ● Evaluate whether conditioning on the random effects is influencing the retro observed in self-tests ● Evaluate factors that could provide for the stability of SSB estimates in the face of declining survey indices and primarily negative NAA random effect deviations in the last 5 years ● Continue evaluation of appropriate methods for scaling recruitment in the calculation of reference points for this stock and development of dynamic BRPs ● Continue to conduct studies to evaluate gutted:whole conversion factors and length-weight for commercial landings ● Continue to characterize differences in the separate Georges Bank and eastern Georges Bank WHAM models
Atlantic herring	● Conduct sensitivity analysis to evaluate how different CVs (and perhaps misreporting) of the Canadian weir catch influence model estimates

Stock	Peer Review Panel Recommendations
	● Develop estimates of the portion of catches in the fixed and mobile gears catches that come from US and Canadian stocks ● Continue work on the development of the VAST model to integrate state and federal surveys particularly with respect to use of surveys that include information on age-1 fish (ME-NH survey) ● Continue exploring use of the seabird diet data as an index of age-1 abundance ● Continue exploration of survey data to determine whether Atlantic herring distribution has changed ● Investigate the potential for autocorrelation in annual recruitment, as well as explore covariate(s) aliased in the NAA random effects and determine which is having the most effect on interannual patterns. ● Continue exploration of recruitment stanzas underlying reference points for Atlantic herring ● Reconsider the appropriateness of F40% for an F% more responsive to the changes in productivity that herring are experiencing. ● Revisit decisions on random effects as additional years of data are added as model diagnostics may support alternative configurations as new information is added. ● Review use of geometric mean recruitment of the full time series to inform projections, rather than more recent conditions.

Georges Bank Haddock

Summary

The Panel concluded that the 2026 assessment update for Georges Bank haddock is technically sufficient to evaluate stock status and provide scientific advice and meets most of the Terms of Reference for the stock's assessment except for TORs 5 and 6 which were partially met. The assessment represents Best Scientific Information Available (BSIA) for this stock for management purposes.

This 2026 assessment of the Georges Bank haddock (*Melanogrammus aeglefinus*) stock is an update of the 2024 management track assessment[1], which used the Woods Hole Assessment Model (WHAM) framework. Prior to the 2021-22 research track, the last benchmark for this stock was in 2008 (Brooks et al., 2008)[2]. Based on the previous update assessment in 2024, the stock was not overfished and overfishing was not occurring.

This assessment updates commercial fishery catch data, research survey indices of abundance, weights- and maturity-at-age, and the WHAM assessment model and reference points through 2025. Stock projections have been updated through 2031.

TOR 1. Estimate catch from all sources including landings and discards.

This TOR was Met.

US Commercial discards and landings (from CAMS), Canadian discards and landings, and the associated catch-at-age and weight-at-age (WAA) were all updated through 2025. There are striking patterns of decline in the catch WAA for this stock that warrant further examination to understand these patterns (see recommendations in TOR 2).

The Panel accepted these data as presented.

TOR 2. Evaluate indices used in the assessment (e.g., indices of relative or absolute abundance, recruitment, state surveys, age-length data, etc.).

This TOR was Met.

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[1] NEFSC. 2024. Georges Bank haddock management track assessment report. Unpubl. rpt; 9 pp. Avail, NEFSC, 166 Water Street, Woods Hole, MA 02540

[2] Brooks, E.N, M.L. Traver, S.J. Sutherland, L. Van Eeckhaute, and L. Col. 2008. In. Northeast Fisheries Science Center. 2008. Assessment of 19 Northeast Groundfish Stocks through 2007: Report of the 3rd Groundfish Assessment Review Meeting (GARM III), Northeast Fisheries Science Center, Woods Hole, Massachusetts, August 4-8, 2008. US Dep Commer, NOAA Fisheries, Northeast Fish Sci Cent Ref Doc. 08-15; 884 p + xvii.http://www.nefsc.noaa.gov/publications/crd/crd0815/

Three surveys inform this assessment (NEFSC fall bottom trawl survey (BTS), NEFSC spring BTS, and the DFO BTS). As with the MT24 assessment for the stock, the Spring 2023 BTS was excluded because tows were only conducted in daylight and two strata were not sampled (both of which would bias the results).

Similarly, the appropriateness of including the fall 2025 BTS in the assessment was investigated. Survey sampling was considerably lower than previous years and extended much later in the year. Stratum contributions were also very different compared to recent years and the estimated CV is likely overly precise because some strata had a single tow and a variance could not be calculated for these strata. However, environmental conditions, and both the proportion and location of positive tows were similar to recent survey years, and dropping the terminal year survey could increase uncertainty and model instability. A robust array of analyses and diagnostics were examined for models that included or excluded the Fall BTS 2025 index value. Based on the model diagnostics (CVs, residuals, retrospective pattern, and self-tests) the Analyst recommended the survey be excluded from the assessment. The Panel concluded that this was a reasonable decision.

The Panel recommended additional research on density dependent growth for this stock. There are striking patterns of declining weight-at-age (WAA) for this stock in recent decades that do not appear solely explained by density, as spawning stock biomass (SSB) was high in the last decade, but the decline in WAA began well before this peak in biomass. In addition, the relative stability of growth at early periods of high abundance suggests that there is some interaction between density dependent and independent drivers (e.g., changing ocean conditions) in the recent period. Further research to understand drivers of WAA patterns, and relationship with size-at-age, maturity-at-age, and recruitment is recommended.

Time-varying selectivity patterns may interact with temporal changes in WAA. Additional research is needed to better characterize selectivity across seasons in the bottom trawl survey, as well as age-specific selectivity patterns, to improve understanding of these interactions and their implications for stock assessment.

The Panel made two Research Recommendations:

- Evaluate how density dependence, environmental change and other factors produce changes (as aliased through model parameters/inputs) in the GB haddock fishery independent data that informs the assessment (e.g., indices of relative abundance, recruitment, WAA, age-length data, etc.).
- Evaluate the effect of decreasing WAA on selectivity-at-age.

TOR 3. Estimate annual fishing mortality, recruitment and stock biomass (both total and spawning stock) as possible (depending on the assessment method) for the time series using the approved assessment method and estimate their uncertainty. Include retrospective analyses if possible (both historical and within-model) to allow a comparison with previous assessment results and projections, and to examine model fit.

a. Include bridge runs to sequentially document each change from the previously accepted model to the updated model proposed for this peer review.

b. Prepare a backup assessment approach that would serve as an alternative for providing scientific advice to management if the analytical assessment were to not pass review

This TOR was Met.

The WHAM model used for MT26 was the same as was used for MT24: age composition likelihood was treated as logistic normal, survey years with 0 catch were treated as missing, natural mortality was set to 0.2 for all years/ages, and process error transitions in NAA were modeled as autocorrelated by age and year (2DAR1). Therefore, no bridge run was necessary. As approved in the 2022 Research Track assessment for the stock, the backup plan is an empirical, index-based approach broadly known as *Ismooth*.

This TOR was the subject of the majority of the discussion by the Panel.

The Panel was concerned that the retrospective pattern in this assessment has strengthened over time, and although the Analyst suggested no retrospective adjustment is currently required, the Mohn's rho-adjusted point estimate is approaching the limit of the model's unadjusted 90% confidence interval. This suggests a strong and persistent retrospective pattern that may warrant correction in future assessments if the trend continues. The positive Mohn's rho indicates a tendency for the model to overestimate SSB and underestimate fishing mortality (F) in terminal years.

In addition, the model incorporates random effects on numbers-at-age (NAA), which can absorb process error. These random effects are predominantly negative in recent years, suggesting systematic adjustments to the model fit at the end of the time series. Further investigation is needed to evaluate the interaction between the NAA random effects and the retrospective pattern to determine how these processes jointly influence model scaling and terminal-year estimates.

The Panel was also concerned about the biological reality of the stability of SSB over the past 5 years while the survey indices, the NAA deviations (downward trends in 2-4 year olds) in terminal years continue to decline and the reliance on “paper fish” in out years.

Additionally, the Panel was interested in whether the difficulty of sampling smaller year classes when there are bumper year classes affects the model, and how changing WAA affects fleet selectivity patterns at age in the model.

Based on this discussion the Panel had several Research Recommendations:

- Continue investigating retrospective patterns and diagnostics in state-space models (e.g., consider the utility of tests other than the 90% CI for the necessity of Mohn's rho adjustments to SSB so as to balance impacts of changes in magnitude vs. statistical precision).
- Evaluate whether conditioning on the random effects is influencing the retro observed in self-tests (e.g., if there is a misspecification in the fleet selectivity then this could be carried forward to the self-tests resulting in the observed retro in the self-tests). An alternative structure of self-tests that doesn't condition on the primary sources of process variation (recruitment deviations, age-2+ NAA deviations, and fleet selectivity) could allow for more robust testing of the hypothesis that the model is unstable due to large year classes.
- Evaluate factors that could provide for the stability of SSB estimates in the face of the last 5 years of declining survey indices and NAA deviations. The NAA deviations act as "sponges" soaking up unaccounted for observation or process error (e.g., survivorship, selectivity, migration, unaccounted for catch). Continued work to diagnose the most likely drivers of patterns in NAA deviations could inform more robust projections.

TOR 4. Re-estimate or update the BRP's as defined by the management track level and recommend stock status. Also, provide qualitative descriptions of stock status based on simple indicators/metrics (e.g., age- and size-structure, temporal trends in population size or recruitment indices, etc.).

This TOR was Met.

Retrospective adjustments were not made to the model results. Spawning stock biomass (SSB) in 2025 was estimated to be 29,037 mt which is 109% of the biomass target (SSB_{MSY} proxy = 26,615). The 2025 average fishing mortality on ages 5-7 was estimated to be 0.21 which is 78% of the overfishing threshold proxy (F_{MSY} proxy = 0.27). The F_{MSY} proxy is expressed as the average F on ages 5-7.

The Panel accepted this TOR noting that the choice of median recruitment was highly influential on the reference points. The Panel concurred with the Analyst's stock status determination. Nonetheless the Panel provides the following Research Recommendation:

- Continued evaluation of appropriate methods for scaling recruitment in the calculation of reference points for this stock and development of dynamic biological reference points.

The Panel suggests the Analyst provide the dynamic reference points from WHAM for this stock. These would be informative given the substantial changes in WAA and selectivity for this stock.

Based on this Management Track Assessment, the recommended stock status is not overfished and overfishing is not occurring.

TOR 5. Conduct short-term stock projections when appropriate.

This TOR was Partially Met because projections beyond 2028 had such high uncertainty they were not deemed to be useful for management.

Short-term projections were conducted in WHAM, which propagates uncertainty in the processes of recruitment and transitions between numbers-at-age. For projection specifications, the NEFMC's Plan Development Team supplied an estimate of total catch for 2026, and fishing mortality was set equal to $F_{40\%SPR}$ for 2027-2031. Annual fishery selectivity and maturity were fixed at a recent 2 year average (2024-2025 values), following analyses and decisions made at the 2021 research track. Weights-at-age for catch and SSB that were predicted from a Gaussian Markov Random Field (GMRF) model, rather than a recent 2 year average, were preferred by the peer reviewers at the 2022 and 2024 management track assessment and were used in the projections submitted here for peer review.

The Panel was concerned about the high uncertainty in the terminal year of the assessment, the retrospective pattern for SSB and recruitment, and that years 3 and beyond relied largely on "paper fish". **As a result, the Panel concluded that while projections for 2027-28 were reasonable, projections beyond this had such high uncertainty as to not be useful for management.**

TOR 6. Respond to any review Panel comments or SSC concerns from the most recent prior research or management track assessment.

This TOR was Met however the Panel was concerned there was no response to additional Research Recommendations from the 2024 MT and SSC

The single previous research recommendation discussed was for studies to be conducted evaluating the gutted:whole fish conversion factors and length-weight ratio for commercial landings. A collaborative project between the NEFSC and GARFO was recently funded and is ongoing. Nearly 2 years of data have been collected, but some temporal/spatial gaps remain.

The Panel was concerned that all Research Recommendations from the SSC (4 RR) and 2024 MT peer review (3 RR) were not tabled in this review, While we are grateful that the Analyst provided responses to the SSC RR, we **suggest** that all future MT peer reviews address a complete list of recent Research Recommendations during the meeting.

The Analyst proposed that research continue investigating retrospective patterns and diagnostics in state-space models. The Panel agreed with these recommendations by the Analyst and included them in their list of Research Recommendations.

Additional Discussion – US and Canadian Georges Bank haddock assessments

The Analyst provided a comparison between the NMFS Georges Bank haddock and DFO's eastern Georges Bank assessments through 2024. The table contrasting the US Georges Bank haddock WHAM and the Canadian DFO eastern Georges Bank haddock WHAM was highly useful, and the Panel recommended this be forwarded (with current result) to the US-Canada Transboundary Management Guidance Committee (TMGC) for their consideration and understanding of the differences between the two assessment models results. Presently the two WHAMs are similar but differ in several important aspects (e.g., the US model has process error on the numbers-at-age transitions and the Canadian model estimates an age-invariant natural mortality rate in the time block beginning in 2010; the Canadian model uses the DFO survey in recent years; The US model estimates recruitment as random deviations from a mean with the log normal adjustment off and the Canadian model estimates recruitment as fixed effects and projects recruitment as random samples from the historical distribution of recruitment estimates (mean and variance) with estimated autocorrelation) suggesting there could be some scaling differences introduced by the current models.

The comparison of SSB estimates from 2002-2021 of US and Canadian was highly informative, in that it indicated that the EGB assessment typically accounted for 50% or more of the stock size the US model estimated for the entire Bank.

The Panel suggested the Analysts continue to pursue characterization of differences in the GB/EGB models, as they provide multiple realizations of stock status and provide additional advice to managers for their decision making.

Research Recommendations from the Panel

The Panel recommended that between now and the next MT assessment, the NEFSC should:

1. Evaluate how density dependence, environmental change and other factors produce changes (as aliased through model parameters/inputs) in GB haddock indices used in the assessment (e.g., indices of relative or absolute abundance, recruitment, age-length data, etc.).
2. Evaluate the effect of decreasing WAA on selectivity-at-age.
3. Continue investigating retrospective patterns and diagnostics in state-space models (e.g., consider the utility of tests other than the 90% CI for the necessity of Mohn's rho adjustments to SSB so as to balance impacts of changes in magnitude vs. statistical precision)
4. Evaluate whether conditioning on the random effects is influencing the retro observed in self-tests (e.g., if there is a misspecification in the fleet selectivity then this could be carried forward to the self-tests resulting in the observed retro in the self-tests). An alternative structure of self-tests that doesn't condition on the primary sources of process variation (recruitment deviations, age-2+ NAA deviations, and fleet selectivity) could allow for more robust testing of the hypothesis that the model is unstable due to large year classes.

5. Evaluate factors that could provide for the stability of SSB estimates in the face of the last 5 years of declining survey indices and NAA deviations. The NAA deviations act as “sponges” soaking up unaccounted for observation or process error (e.g., survivorship, selectivity, migration, unaccounted for catch). Continued work to diagnose the most likely drivers of patterns in NAA deviations could inform more robust projections.
6. Continue evaluation of appropriate methods for scaling recruitment in the calculation of reference points for this stock and development of dynamic biological reference points.
7. Continue to conduct studies to evaluate gutted:whole conversion factors and length-weight for commercial landings.
8. Continue to characterize differences in the separate Georges Bank and eastern Georges Bank WHAM models, such that their multiple realizations of stock status may provide additional advice to managers (TMGC) for their decision making.

Atlantic Herring

Summary

The Panel concluded that the 2026 assessment update for Atlantic herring is technically sufficient to evaluate stock status and provide scientific advice and meets most of the Terms of Reference for the stock's assessment except for TORs 5 which was partially met. The assessment represents Best Scientific Information Available (BSIA) for this stock for management purposes.

This 2026 assessment of the Atlantic herring (*Clupea harengus*) stock is the first application of the WHAM assessment platform following the 2025 research track assessment (NEFSC 2025)[3]. The last management track assessment was in 2024 and was conducted using the ASAP model[4].

This assessment updated fishery catch data, survey indices, and some life history parameters (e.g., weights-at-age), and the WHAM assessment model and reference points (BRPs) through 2025. Stock projections have been updated through 2031. Based on this assessment, the stock is overfished but overfishing is not occurring.

The change in assessment platforms from the 2024 management track makes comparisons with past assessments inappropriate. Several relatively minor changes have been made since the research track. A revised Canadian catch time series was used, a different approach was used for input effective sample sizes, and spawning stock biomass weight-at-age values were corrected.

TOR 1. Estimate catch from all sources including landings and discards.

This TOR was Met.

US and Canadian commercial discards, landings, and age composition were updated through 2025. US landings data were drawn from CAMS since 2020. Discards have only been available since 1996 but generally constitute <1% of landings. Note that the time series of Canadian landings has been revised since previous assessments.

While the Panel agreed the TOR was met there was concern regarding the Canadian catch data. First, the fixed gear (weir) catch data is of unknown quality (i.e., there is no estimate of variance and there is some evidence of misreporting). Secondly, there is an assumption that the only catch of the US stock in Canadian waters is in the fixed gear fishery, when it is likely there is also catch (of unknown scale) in the larger mobile gear (purse seine) fishery. Fish from the Canadian Atlantic herring stock may also be caught in the US fisheries. Underlying these concerns is a high uncertainty regarding mixing of

[3] NEFSC. 2025. Atlantic herring research track assessment report. US Dept. of Commerce, NEFSC Tech Memo. 335; 91pp.

[4] NEFSC. 2024. Atlantic herring management track assessment report. Unpubl. rpt; 9 pp. Avail. NEFSC, 166 Water Street, Woods Hole, MA.

US and Canadian herring fisheries and the extent to which these are mixed-stock fisheries.

Revisiting treatment of Canadian catch in this stock assessment could improve its quality. In particular, the stock identification information that underlies the assumption that these are US fish warrants an update to identify source population of these catches. Consequently, the Panel provided two Research Recommendations:

- Conduct sensitivity analysis to evaluate how different CVs (and perhaps misreporting) of the Canadian weir catch influence model estimates
- Develop estimates of the portion of catches in the fixed and mobile gear catches that come from the US and Canadian stocks.

TOR 2. Evaluate indices used in the assessment (e.g., indices of relative or absolute abundance, recruitment, state surveys, age-length data, etc.).

This TOR was Met

The four surveys currently used in the 2026 assessment model included the NEFSC Spring (1968-2025) and Fall (1963-2025) Bottom Trawl surveys (BTS), the Summer (Shrimp) survey (1980s-2023) and the Acoustic survey (1998-2025) conducted as part of the Fall BT survey. The former three surveys focus on the near-bottom distribution and abundance of herring, while the latter quantifies fish throughout the water column.

These surveys have shown consistent cohort tracking even as they have declined since 2009, reflecting broader declines in abundance. They drive the indices necessary for the assessment - age composition, abundance, and spatial distribution.

The Panel was concerned that none of the current trawl surveys provide data on age-1 abundance, which is problematic for such a short-lived stock. Not incorporating the ME-NH survey (which samples small herring better than the NEFSC bottom trawl surveys) or the seabird diet index contributes to the loss of this information.

There was also concern that there may have been shifts in distribution. Comments from the Community Engagement session and Industry testimony in this review indicated that herring are being caught at different times, in different areas, in deeper water, and in smaller aggregations. All of this suggests the potential for time-varying catchability that could introduce sampling bias in the trawl surveys between years.

The Panel Recommended the following actions:

- Continue work on the development of the VAST model to integrate state and federal surveys particularly with respect to use of surveys that include information on age-1 fish (ME-NH survey). Development of model-based indices for this stock could also address potential for time varying catchability.

- Continue exploring use of the seabird diet data as an index of age-1 abundance (the Panel acknowledges the preceding RR is a more fruitful use of Analyst's time)
- Continue exploration of survey data to determine whether Atlantic herring distribution has changed

The Panel considered the first of these Recommendations to be a priority to address before the next Management Track assessment.

TOR 3. Estimate annual fishing mortality, recruitment and stock biomass (both total and spawning stock) as possible (depending on the assessment method) for the time series using the approved assessment method and estimate their uncertainty. Include retrospective analyses if possible (both historical and within-model) to allow a comparison with previous assessment results and projections, and to examine model fit.

> **a. Include bridge runs to sequentially document each change from the previously accepted model to the updated model proposed for this peer review.**
>
> **b. Prepare a backup assessment approach that would serve as an alternative for providing scientific advice to management if the analytical assessment were to not pass review**

This TOR was Met but the underlying patterns in the NAA random effects require further investigation to improve attribution of process error and that the structural assumptions (e.g., no correlation across years) be revisited before the next MT assessment.

The Panel recognized that continued poor recruitment and negative numbers-at-age random effects (e.g., poor survival) in recent years is the main issue driving stock abundance. The challenge in attributing the process that is being accounted for in NAA deviations undermined confidence in the results of the model regarding current abundance and projections. The high CV on recruitment and results of self-test indicate high uncertainty in estimates.

Key concerns are the pattern observed in the numbers-at-age (NAA) random effects (i.e., strong correlation among ages) and lack of support for a correlation among years. The unusual highly correlated negative NAAs for ages 2-7 could be related to the spike in recruitment in 2019 identified by WHAM, which was not present in the 2024 MT assessment in ASAP. The Panel discussed that these NAA deviations could be artefacts that are highly influential on scaling of population estimates and may warrant re-evaluation. Specifically the underlying annual variability shown in the NAA deviations suggest there could be a covariate being aliased that has a significant effect on interannual patterns of the NAA deviations or that a signal in the input data (e.g., age-composition data or survey index data) is leading to strong annual signal that is lost in subsequent years. This uncertainty is compounded by the recent gaps in data due to missing Spring 2023 BTS data and 2024-2025 shrimp surveys, on top of recent changes in the catch reporting (switch to CAMS) and the sparse port sampling of weight-at-age. These gaps contribute to the challenge of not being able to attribute the negative NAA deviations to a process. The 2025 RT had similar concerns and the Panel hopes to see progress on the treatment of NAAs after this MT assessment.

The Panel recommends that in the future Analysts revisit the assumption of no temporal autocorrelation in recruitment deviations across years. Because the projected population dynamics are sensitive to these assumptions, revisiting the treatment of NAA random effects and the temporal structure of recruitment as additional data are added to the assessment could have substantial implications for stock assessment results and projections. Currently, the panel discussed that this uncertainty could lead to issues with scaling of population abundance in the assessment (TOR4) and in projections (TOR5).

More work is needed to correctly attribute the uncertainty that is being captured by the NAA process error. Consequently, the Panel provided a second Major Research Recommendation for herring to address before the next Management Track assessment:

- Investigate the potential for autocorrelation in annual recruitment, as well as explore covariate(s) aliased in the NAA random effects and determine which is having the most effect on interannual patterns. Further exploration of the possible drivers of process error patterns in numbers-at-age random effects that suggest poor survival across ages.

The Panel understands from the Analyst that exploring longer lags is currently not available in WHAM; nonetheless, this remains an issue with assessment which ultimately needs to be addressed.

TOR 4. Re-estimate or update the BRP's as defined by the management track level and recommend stock status. Also, provide qualitative descriptions of stock status based on simple indicators/metrics (e.g., age- and size-structure, temporal trends in population size or recruitment indices, etc.).

This TOR was Met

Retrospective adjustments were not necessary (SSB Mohn's rho = 0.22 and F Mohn's rho = -0.04). Spawning stock biomass (SSB) in 2025 was estimated to be 35,258 (mt) which is 19% of the biomass target (SSB_{MSY} proxy = 188,214). The 2025 average mobile fleet fishing mortality for ages 7-8 (fully selected) was estimated to be 0.121 which is 44% of the overfishing threshold proxy (F_{MSY} proxy = 0.272).

Reference points were calculated using the spawning potential ratio (SPR) 40% proxy approach, with $F_{40\%}$ used as a proxy for F_{MSY} and $SSB_{F40\%}$ as a proxy for SSB_{MSY}. A key concern is the scaling of these reference points for herring, particularly the recruitment assumptions underlying the estimation. It is unclear whether the resulting SSB_{MSY} proxy appropriately reflects the stock's productivity and whether $F_{40\%}$ remains a good proxy for F_{MSY} given the evidence for a regime change for many of the stocks in this region.

The Panel highlighted that decisions made in model fitting (TOR 3) have large implications for reference points. Prevailing conditions are negative in recent years for herring, as indicated by negative NAA deviations and recruitment deviations, but with no year effect selected for in the model this means these conditions do not propagate into reference point calculations. While this is consistent with decisions made at the research track, this may not be representative of prevailing conditions for this stock.

Though the Panel accepted the Analyst's results, they provided the following Research Recommendations:

- Investigate dynamic reference points for Atlantic herring, including work on fitting dynamic stock-recruit relationships, alternative specification of random effects or inclusion of covariates in the model, or short-term approaches to revise recruitment assumptions (e.g., truncation of time series).
- Reconsider the appropriateness of $F_{40\%}$ for an F% more responsive to the changes in productivity that herring are experiencing.

Note that this recommendation may apply to a number of assessed stocks using the default $F_{40\%}$ proxy.

Based on this Management Track Assessment, the recommended stock status is overfished but overfishing is not occurring.

TOR 5. Conduct short-term stock projections when appropriate.

This TOR was Partially Met as the Panel considered the OFLs (or F_{msy}) and ABC projections based on the RT methodology to be useful but likely to be overly optimistic especially in light of the sensitivity analyses

The projection results applied the harvest (ABC) control rule described in Amendment 8 of the herring Fishery Management Plan to the mobile fleet. The fixed gear catches are assumed constant during the projection period and equaled 5,283 mt/year. This fixed gear catch equals the sum of the ten year (2016-2025) averages of the Canadian (5,130 mt) and US (152 mt) fixed gear catches. The US fixed gear includes catches from stop seines, weirs, and pound nets. The reported F_{7-8} are averaged over ages 7-8, which are fully selected by the mobile fleet (trawls and purse seine) fleet. Projected recruitment continued the independent and identically distributed process estimated by WHAM. NAA random effects were not carried forward into the projection period due to lack of an autocorrelation across years in the model.

These projections indicate rapid increases in SSB and catch given the reduction in fishing with the application of the control rule. This pattern is driven by several factors, including the use of the geometric mean recruitment of the full time series and the absence of autocorrelation across years, such that recent negative NAA deviations and recruitment deviations do not inform projections. Both the RT Panel and this MT Panel believe the SSB estimates and catch projections are likely overestimated.

Estimated negative random effects on numbers-at-age (NAA), which represent additional fish losses beyond those accounted for by fishing and natural mortality, are not assumed to be autocorrelated across years and do not continue into the projection period. As a result, recent cohorts experience higher projected survival than is evident in WHAM outputs and thus contribute substantially to future SSB in the projections.

This TOR was particularly affected by the structure of the NAA random effects expressed under TOR 3. The Analyst presented a sensitivity analysis using the average of the NAA deviations estimated for the most recent 5 years that provided an alternative scenario with significant impact on projections. The Panel saw this analysis as useful and agreed both projections should be provided for management decisions. The Panel considered the OFLs (or F_{msy}) and ABC projections based on the RT methodology likely to be overly optimistic especially in light of the sensitivity analysis which better reflects prevailing conditions for the NAA deviations. The Panel also noted issues with the approach used in the sensitivity analysis (e.g., not consistent with the model, the 5-year average of the NAA deviations does not propagate the high interannual variability in the deviations). **After considerable discussion, the Panel concluded that the PDT and SSC should view the projections and sensitivity analysis as context for catch advice setting but that each has challenges that limit their utility.**

The Panel provided the following Research Recommendations:

- Revisit decisions on random effects (TOR 3) as additional years of data are added as model diagnostics may support alternative configurations as new information is added.
- Revisit use of the geometric mean recruitment of the full time series to inform projections, rather than more recent conditions.

TOR 6. Respond to any review Panel comments or SSC concerns from the most recent prior research or management track assessment.

This TOR was Met.

The Analyst reviewed the status of a dozen Research Recommendations from the 2025 Atlantic herring Research Track. Little progress had been made to date in part because of the short time since the RT was concluded but also because of the lack of resources to conduct the research. The Panel encourages the NEFSC to continue working on these items.

The Analyst also reviewed and responded to comments provided as part of the 2025 Community engagement session on Atlantic herring. Issues raised there included changes in herring migration timing, interactions between the distribution/abundance of menhaden, mackerel, and herring, herring stock structure and the treatment of

Canadian catches. Again research for many of these topics was in progress. The Panel commended the Analyst for bringing these items forward in the peer review.

Additional Discussion - Public Comments

The Panel received public comments from six representatives of the herring fishing fleet. Industry concerns about the status of the Atlantic herring stock and this assessment generally focused on changes in the distribution of herring and the impact that a further reduction in the catch advice would have on industry. With respect to the former, commenters felt that herring had moved deeper offshore (but lots of small fish inshore) and may not have been accessible to the NEFSC BT survey as in previous year's surveys. The second set of comments on the impact of the assessment suggested the reduced catch advice that would arise from the assessment's proposed 2027 OFL/ABC would severely limit fleet activities. At least two of the speakers suggested that the SSC consider averaging catch advice over the five projection years.

A full description of the comments are provided to the NEFSC via the rapporteurs' notes.

Research Recommendations from the Panel

The Panel recommended that between now and the next MT assessment, the NEFSC should:

1. Conduct sensitivity analysis to evaluate how different CVs (and perhaps misreporting) of the Canadian weir catch influence model estimates
2. Develop estimates of the portion of catches in the fixed and mobile gears catches that come from the US and Canadian stocks
3. Continue work on the development of the VAST model to integrate state and federal surveys particularly with respect to use of surveys that include information on age-1 fish (ME-NH survey). Development of model-based indices for this stock could also address potential for time varying catchability.
4. Continue exploring use of the seabird diet data as an index of age-1 abundance (the Panel acknowledges that RR3 is a more fruitful use of Analyst's time)
5. Continue exploration of survey data to determine whether Atlantic herring distribution has changed
6. Investigate the potential for autocorrelation in annual recruitment, as well as explore covariate(s) aliased in the NAA random effects and determine which is having the most effect on interannual patterns.
7. Investigate dynamic reference points for Atlantic herring, including work on fitting dynamic stock-recruit relationships, alternative specification of random effects or inclusion of covariates in model, or short-term approaches to revise recruitment assumptions (e.g., truncation of time series)
8. Reconsider the appropriateness of $F_{40\%}$ for an F% more responsive to the changes in productivity that herring are experiencing.

9. Revisit decisions on random effects (TOR 3) as additional years of data are added as model diagnostics may support alternative configurations as new information is added.
10. Revisit use of the geometric mean recruitment of the full time series to inform projections, rather than more recent conditions.

Recommendations 3, and 6 were considered by the Panel to be the most important and should be addressed prior to the next Management Track assessment for the stock.

Additionally, the Panel suggested this stock be prioritized for consideration in the upcoming Research Track on projection methodologies.

Appendix A.

Management Track Assessment Terms of Reference

1. Estimate catch from all sources including landings and discards.

2. Evaluate indices used in the assessment (e.g., indices of relative or absolute abundance, recruitment, state surveys, age-length data, etc.).

3. Estimate annual fishing mortality, recruitment, and stock biomass (both total and spawning stock) as possible (depending on the assessment method) for the time series using the approved assessment method and estimate their uncertainty. Include retrospective analyses if possible (both historical and within-model) to allow a comparison with previous assessment results and projections, and to examine model fit.

    a. Include bridge runs to sequentially document each change from the previously accepted model to the updated model proposed for this peer review.

    b. Prepare a backup assessment approach that would serve as an alternative for providing scientific advice to management if the analytical assessment were to not pass review.

4. Re-estimate or update the BRP's as defined by the management track level and recommend stock status. Also, provide qualitative descriptions of stock status based on simple indicators/metrics (e.g., age- and size-structure, temporal trends in population size or recruitment indices, etc.).

5. Conduct short-term stock projections when appropriate.

6. Respond to any review Panel comments or SSC concerns from the most recent prior research or management track assessment.

Appendix B.

June Management Track Peer Review Meeting Attendance
June 29-30, 2026

ASMFC - Atlantic States Marine Fisheries Commission
GARFO - Greater Atlantic Regional Fisheries Office
MAFMC - Mid-Atlantic Fisheries Management Council
NEFMC - New England Fisheries Management Council
NEFSC - Northeast Fisheries Science Center

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Richard Merrick - Chair, NOAA Fisheries (retired), NEFMC Scientific and Statistical Committee
Tim Barrett - Panel, Fisheries and Oceans Canada, ASFMC appointee
Lisa Kerr - Panel, University of Maine, NEFMC Scientific and Statistical Committee
Holly Kindsvater - Panel, Virginia Polytechnic Institute and State University, MAFMC Scientific and Statistical Committee

Larry Alade, NEFSC
Melanie Barrett, Fisheries and Oceans Canada
David Benson
Kristan Blackhart, NEFSC
Jessica Blaylock, NEFSC
Jason Boucher, NEFSC
Emily Bodell, NEFMC
Bonnie Brady, New England Fishermen's Stewardship Association
Liz Brooks, NEFSC
Carly Burns, NOAA Affiliate
Steve Cadrin, University of Massachusetts Dartmouth
Patrick Campfield, ASMFC
Jui-Han Chang, NEFSC
Ethan Chase, fisherman
Matt Cieri, Maine Department of Marine Resources
Jamie Cournane, NEFMC
Kiersten Curti, NEFSC
Jess Daniels, New England Fish Company
Micah Dean, Massachusetts Division of Marine Fisheries
Dustin Delano, fisherman
Jonathan Deroba, NEFSC
Jason Didden, MAFMC
Tara Dolan, Massachusetts Division of Marine Fisheries
Alex Dunn, NEFMC
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Corrin Flora, North Carolina Division of Marine Fisheries
Robin Frede, NEFMC
Mark Grant, NEFMC
Melanie Griffin, Massachusetts Division of Marine Fisheries
Alex Hansell, NEFSC
Amanda Hart, NEFSC
Daniel Hennen, NEFSC
Nathan Hebert, Fisheries and Oceans Canada
Daniel Hocking, GARFO
Cameron Hodgdon, NEFSC
Brian Hooper, NEFSC
Andrew Joyce, F/V Providian
Jeff Kaelin, Lund's Fisheries
Raymond Kane, Cape Cod Fishermen's Alliance
Rick Kasten
Zack Klyver, NEFMC Atlantic Herring Advisory Panel
Chris Legault, NEFSC
Brian Linton, NEFSC
Andy Lipsky, NEFSC
Bill Lucy, Long Island Soundkeeper
Declan McCormick, Maine Department of Marine Resources
Kathryn MacDonald, Fisheries and Oceans Canada
Mitch McDonald, NOAA Office of General Counsel
Tara McIntyre, Fisheries and Oceans Canada
Conor McManus, NEFSC
Timothy Miller, NEFSC
Allison Murphy, GARFO
Paul Nitschke, NEFSC
Carrie Nordeen, GARFO
Jackie O'Dell, Northeast Seafood Coalition
Cate O'Keefe, NEFMC
Danilee Palmer, GARFO
Charles Perretti, NEFSC
Michelle Raber, F/V Providian
Suzannah Raber, F/V Providian
Ryan Raber, Ocean Spray
Marianne Randell, GARFO
Kaitlin Rogers, NEFSC
Elizabeth Roros, University of Massachusetts Dartmouth
Melissa Smith, Maine Department of Marine Resources
Liz Sullivan, GARFO
Spencer Talmage, GARFO
Mary Beth Tooley, O'Hara Corporation
Samuel Truesdell, NEFSC
Kaitlynn Wade, University of North Carolina
Megan Ware, Maine Department of Marine Resources

Peter Whelan, fisherman
Kelly Whitmore, Massachusetts Division of Marine Fisheries
Antony Wood, NEFSC

Appendix C.

June 2026 Management Track Peer Review Agenda

**All times are approximate and may be changed at the discretion of the Peer Review Panel chair. The meeting is open to the public.*

Monday, June 29, 2026

Time	**Stock**	**Subject**	**Presenter**
9:00 a.m.		Welcome/Logistics Conduct of Meeting	Brian Hooper Kristan Blackhart Panel Chair
9:15 a.m.	Georges Bank Haddock	Terms of Reference (TOR) Review & Panel Questions	Liz Brooks Panel
10:30 a.m.		***Break***	
10:45 a.m.	Georges Bank Haddock	TOR Review & Panel Questions, continued	
11:45 a.m.	Georges Bank Haddock	Public Comment	Public
12:00 p.m.		***Lunch***	
1:00 p.m.	Georges Bank Haddock	Panel Deliberations	Panel
2:15 p.m.	Georges Bank Haddock	Panel Conclusions / Recommendations and Final Stock Wrap Up	Panel
3:00 p.m.		Closed Panel Writing Session	
5:00 p.m.		***Adjourn***	

Tuesday, June 30, 2026

Time	**Stock**	**Subject**	**Presenter**
9:00 a.m.		Welcome/Logistics	Brian Hooper Panel Chair
9:05 a.m.	Atlantic Herring	TOR Review & Panel Questions	Jonathan Deroba Panel
10:30 a.m.	Atlantic Herring	Public Comment	Public

Time	Stock	Subject	Presenter
10:45 a.m.		***Break***	
11:00 a.m.	Atlantic Herring	Panel Deliberations	Panel
11:30 a.m.	Atlantic Herring	Panel Conclusions / Recommendations and Final Stock Wrap Up	Panel
12:00 p.m.		***Lunch***	
1:00 p.m.	All stocks	Final Meeting Wrap Up, if needed (else closed Panel writing session)	Panel
3:00 p.m.		Closed Panel Writing Session	
5:00 p.m.		***Adjourn***	

Appendix D.

Acronyms Used in This Report

ABC - acceptable biological catch
ASAP - Age Structured Assessment Program
AWG - Assessment Working Group
BLLS - Bottom Long Line Survey
BRP - biological reference point
BTS - bottom trawl survey
CAMS - Catch Accounting and Monitoring System
CI - confidence interval
CV - coefficient of variation
DFO - (Department of) Fisheries and Oceans Canada
EGB - eastern Georges Bank
F - Fishing mortality
GARFO - Greater Atlantic Regional Fisheries Office
GB - Georges Bank
GMRF - Gaussian Markov Random Field
M - natural mortality
ME - Maine
MT - Management Track
NAA - numbers-at-age
NEFSC - Northeast Fisheries Science Center
NEFMC - New England Fishery Management Council
NH - New Hampshire
NRCC - Northeast Region Coordinating Council
OFL - Overfishing Limit
PDT - Plan Development Team
RE - random effects
RR - research recommendation
RT - Research Track
RTSC - Research Track Steering Committee
SSB - spawning stock biomass
SSC - Scientific and Statistical Committee
SSRT - State Space Research Track
TMGC - Transboundary Management Guidance Committee
USGS - United States Geological Survey
VAST - Vector Autoregressive Spatio-Temporal
WAA - weight-at-age
WHAM - Woods Hole Assessment Model

draft working paper for peer review only

Georges Bank Yellowtail Flounder

2025 Management Track Assessment Report

U.S. Department of Commerce
National Oceanic and Atmospheric Administration
National Marine Fisheries Service
Northeast Fisheries Science Center
Woods Hole, Massachusetts

Compiled 09-26-2025

This assessment of the Georges Bank Yellowtail Flounder (Limanda ferruginea) stock is a management track assessment update of the 2024 research track assessment (NEFSC 2024). This assessment updates commercial fishery catch data, survey indices of abundance, and the analytical Woods Hole Assessment Model (WHAM) and reference points through 2024. Additionally, stock projections have been updated through 2028.

State of Stock: Based on this assessment, the Georges Bank Yellowtail Flounder (*Limanda ferruginea*) stock is overfished and overfishing is not occurring (Figures 1-2). Spawning stock biomass (SSB) in 2024 was estimated to be 713 (mt) which is 10% of the biomass target (SSB_{MSY} *proxy* = 7,072; Figure 1). The 2024 fully selected fishing mortality was estimated to be 0.017 which is 19% of the overfishing threshold proxy (F_{MSY} = 0.09; Figure 2).

Table 1: Catch and status table for Georges Bank Yellowtail Flounder. All weights are in (mt), recruitment is in (000s), and F_{Full} is the fishing mortality on fully selected ages (ages 4-6). Model results are from the updated WHAM assessment.

	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Data										
US landings	63	26	35	32	3	5	1	0	0	1
US discards	41	7	57	11	2	57	47	10	20	6
Canadian landings	3	1	0	0	0	0	0	1	0	0
Canadian discards	11	10	2	3	4	6	4	3	5	5
Catch for Assessment	118	44	95	45	8	68	51	15	25	12
Model Results										
Spawning Stock Biomass	3,324	2,330	1,401	910	747	445	841	614	633	713
F_{Full}	0.088	0.03	0.082	0.063	0.011	0.216	0.068	0.023	0.039	0.017
Recruits (age 1)	5,143	2,514	2,524	4,495	8,455	1,742	519	1,387	508	534

Table 2: Comparison of reference points estimated in the last management track and from the current management track assessment. The previous management track assessment was an empirical approach so biological reference points could not bet estimated. FMSY was used for the overfishing threshold.

	2024	2025
F_{MSY}		0.09
SSB_{MSY} (mt)		7,072 (2,700 - 18,521)
MSY (mt)		597 (23 - 2,440)
Mean recruits (age 1) (000s)		31,190
Overfishing	Unknown	No
Overfished	Unknown	Yes

Projections: Short term projections were conducted in WHAM. For projections, 2025 catch was provided by the NEFMC Groundfish Plan Development Team. The maturity ogive is constant and an average of the most recent two years is used for mean weights-at-age in the projection period. The correlation structure is continued for fishery selectivity. Average bottom water temperature, as determined by an updated change point analysis, since 2009 is used to inform recruitment deviations from a Beverton-Holt stock recruit fuction. All methods are consistent with those defined in the research track.

Table 3: Short term projections of total fishery catch and spawning stock biomass for Georges Bank Yellowtail Flounder based on a harvest scenario of fishing at F_{MSY} between 2026 and 2028. Catch in 2025 was assumed to be 22 (mt).

Year	Catch (mt)	SSB (mt)	F_{Full}
2025	22	655 (230 - 1,860)	0.034

Year	Catch (mt)	SSB (mt)	F_{Full}
2026	57	646 (190 - 2,198)	0.09
2027	57	654 (180 - 2,374)	0.09
2028	60	699 (181 - 2,707)	0.09

Special Comments:

- What are the most important sources of uncertainty in this stock assessment? Explain, and describe qualitatively how they affect the assessment results (such as estimates of biomass, F, recruitment, and population projections).

  Low catch rates in the fishery-independent surveys make it difficult to track cohorts and to estimate changes in maturity and growth. There are limited demographic samples from commercial landings; however, landings remain low. Calibration factors are not available for the 2022 DFO survey. The 2023 spring NEFSC survey is treated as missing because it only sampled during daylight hours.

- Does this assessment model have a retrospective pattern? If so, is the pattern minor, or major? (A major retrospective pattern occurs when the adjusted SSB or F_{Full} lies outside of the approximate joint confidence region for SSB and F_{Full}).

  The 7-year Mohn's ρ was not available from previous assessments because an empirical approach was used. The 7-year Mohn's ρ, relative to SSB, is 0.042 in the current assessment. The 7-year Mohn's ρ, relative to F, is 0.007 in the current assessment. There was not a major retrospective pattern for this assessment because the ρ adjusted estimates of 2024 SSB (SSB_ρ=684) and 2024 F (F_ρ=0.017) were inside the approximate 90% confidence regions around SSB (491 - 1,034) and F (0.012 - 0.025).

- Based on this stock assessment, are population projections well determined or uncertain? If this stock is in a rebuilding plan, how do the projections compare to the rebuilding schedule?

  It is uncertain if population projections for Georges Bank Yellowtail Flounder, are well determined because this is the first management track to use this projection methodolgy. Previously, annual harvest advice for this stock was based on index-based methods developed under the Transboundary Resources Assessment Committee (TRAC). This method did not produce projections. This stock is in a rebuilding plan with a target date of 2032.

- Describe any changes that were made to the current stock assessment, beyond incorporating additional years of data and the effect these changes had on the assessment and stock status.

  A new model platform, WHAM, was used that was peer reviewed as part of the Yellowtail Flounder research track. The maturity ogive was updated, which had a minimial effect on the assessment and stock status.

- If the stock status has changed a lot since the previous assessment, explain why this occurred.

  Stock status of Georges Bank Yellowtail Flounder was not formally determined during the research track and status of the stock has been unknown since 2014.

- Provide qualitative statements describing the condition of the stock that relate to stock status.

  The most recent survey values remain low. Recent fishery catches remain well below the quota. Stock biomass is low and productivity is poor.

- Indicate what data or studies are currently lacking and which would be needed most to improve this stock assessment in the future.

  The stock assessment just completed a research track in 2024 and the assessment performs well. Future studies could focus on mechanistic drivers of process error patterns to improve communication of results.

- Are there other important issues?

  Management track reference points are based on current environmental conditions and thus, they are not directly comparable to past spawning stock biomass and fishing mortality rates. Supplementary material is available on the Stock Assessment Supplementary Information website (SASINF).

References:

Northeast Fisheries Science Center (In Progress). 2024. Management Track Assessments Fall 2024. US Dept Commer, Northeast Fish Sci Cent Tech Memo. 350; 167p.+xv. Available from: National Marine Fisheries Service, 166 Water Street, Woods Hole, MA 02543-1026. Available at: https://apps-nefsc.fisheries.noaa.gov/saw/sasi.php

Northeast Fisheries Science Center (In Progress). Report of the 2024 Yellowtail Flounder Research Track Assessment working group. Available at: https://apps-nefsc.fisheries.noaa.gov/saw/sasi.php

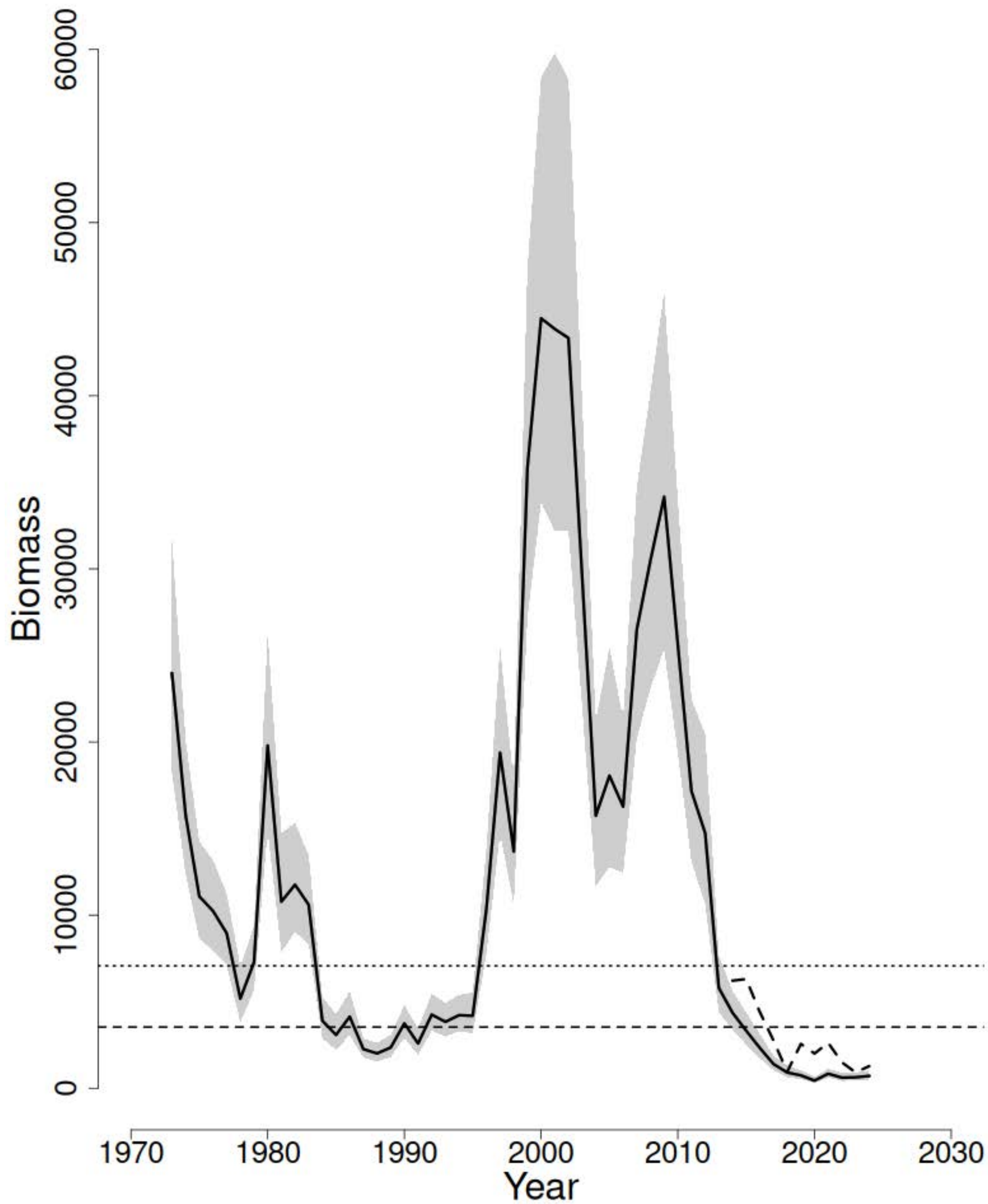

Figure 1: Trends in spawning stock biomass of Georges Bank Yellowtail Flounder between 1973 and 2024 from the current (solid line) and previous empirical (dashed line) assessments and the corresponding $SSB_{Threshold}$ ($\frac{1}{2}$ SSB_{MSY} *proxy*; horizontal dashed line) as well as SSB_{Target} (SSB_{MSY} *proxy*; horizontal dotted line) based on the 2025 assessment. The approximate 90% lognormal confidence intervals are shown. Management track reference points are based on current environmental conditions and thus, they are not directly comparable to past spawning stock biomass values.

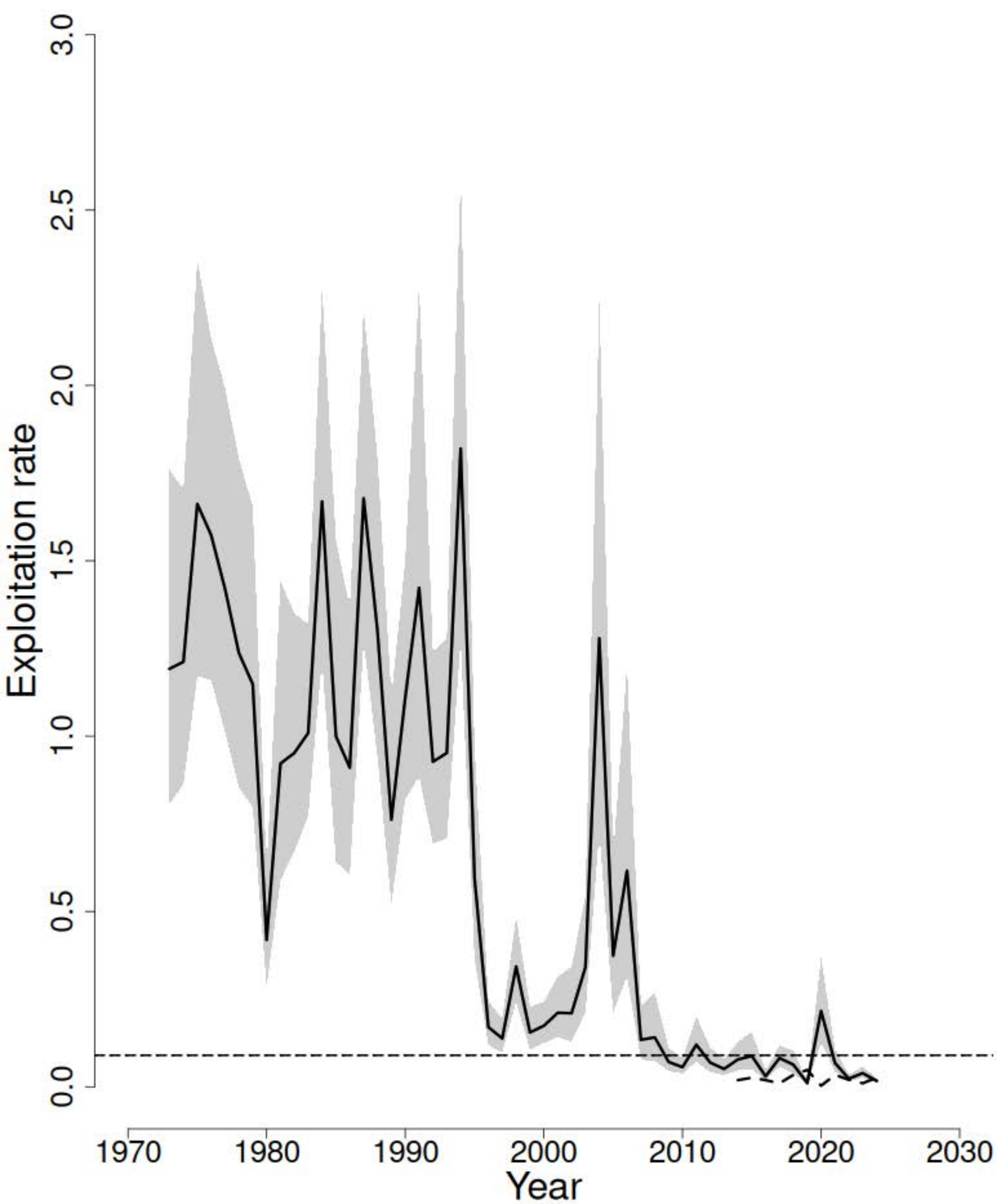

Figure 2: Trends in the fully selected fishing mortality (F_{Full}) of Georges Bank Yellowtail Flounder between 1973 and 2024 from the current (solid line) and previous empirical (dashed line) assessments and the corresponding $F_{Threshold}$ (F_{MSY}=0.09; horizontal dashed line) based on the 2025 assessment. The approximate 90% lognormal confidence intervals are shown. Management track reference points are based on current environmental conditions and thus, they are not directly comparable to past fishing mortality rates.

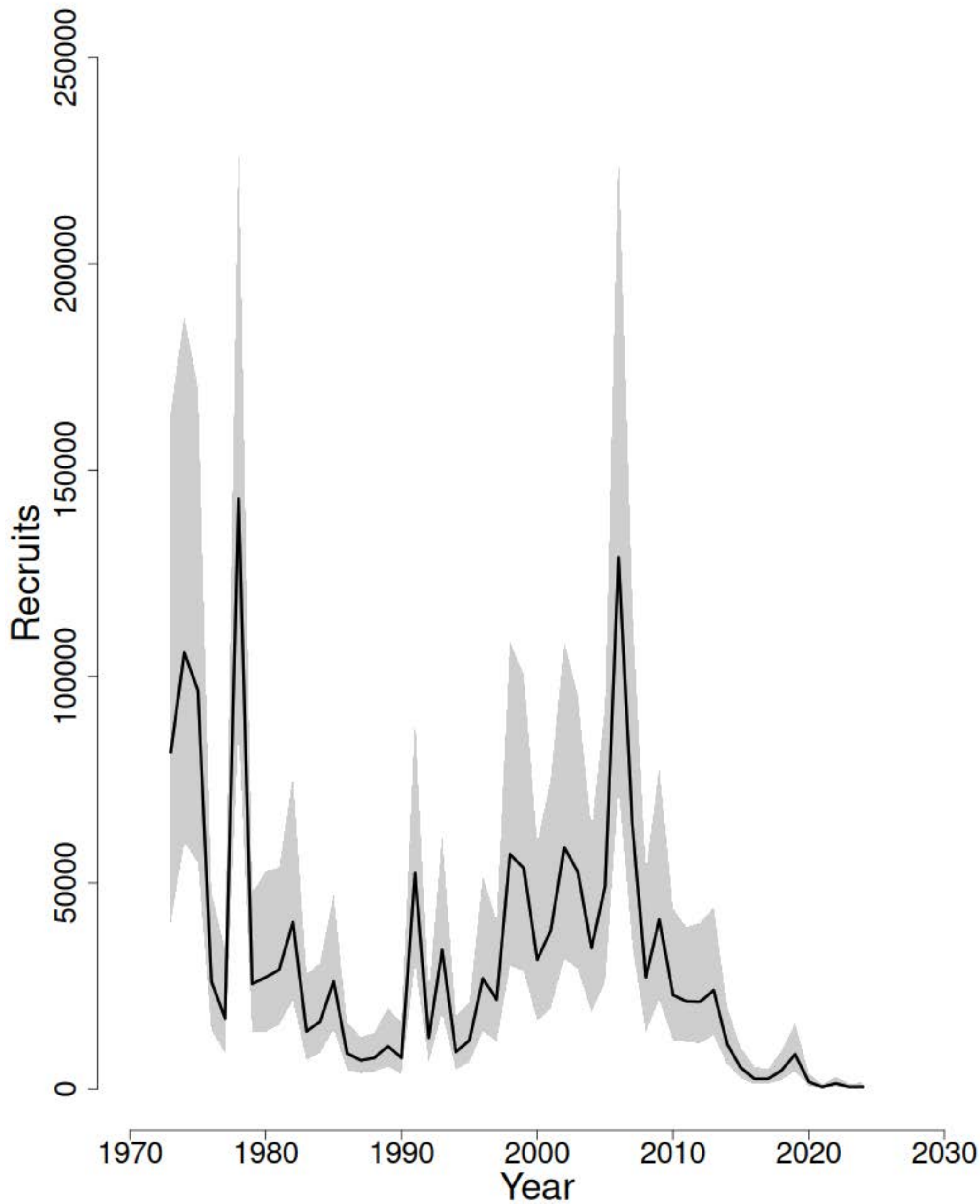

Figure 3: Trends in Recruits (age 1) (000s) of Georges Bank Yellowtail Flounder between 1973 and 2024 from the current (solid line) assessment. The approximate 90% lognormal confidence intervals are shown.

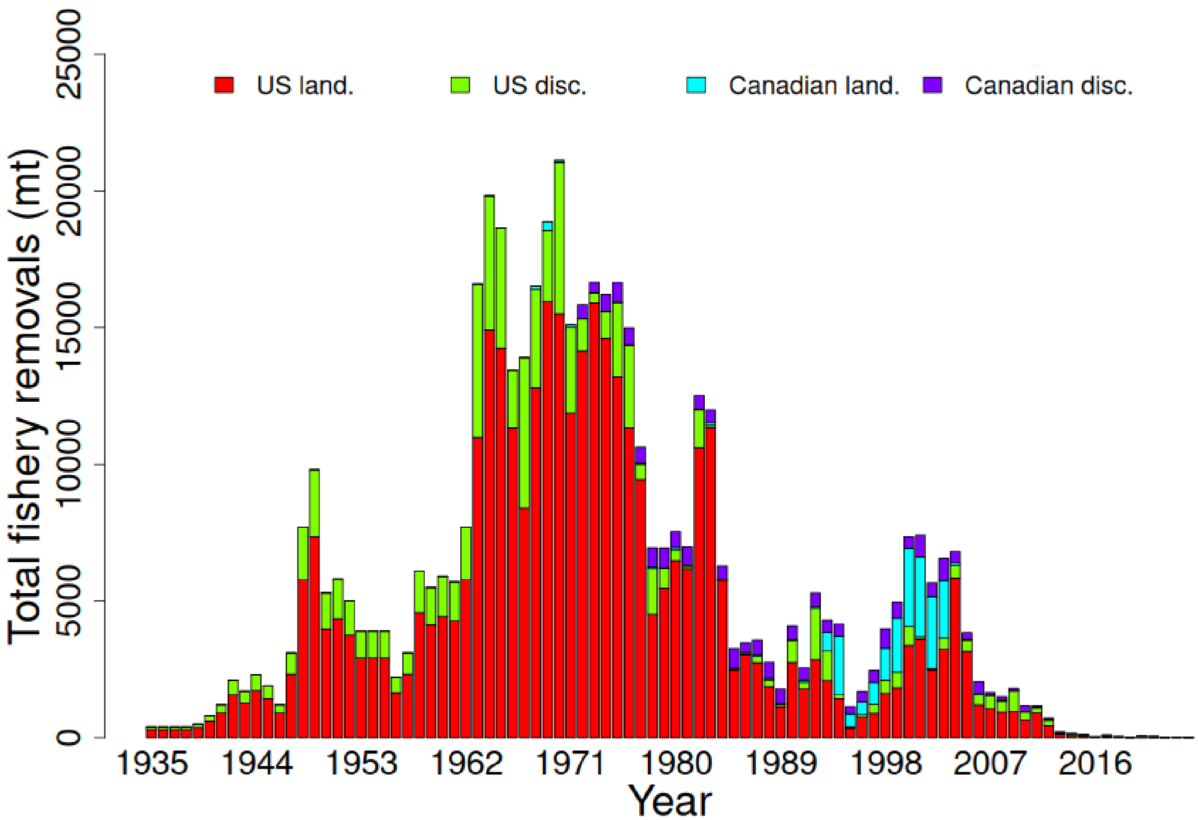

Figure 4: Total catch of Georges Bank Yellowtail Flounder between 1973 and 2024 by country (US, Canada) and disposition (landings and discards).

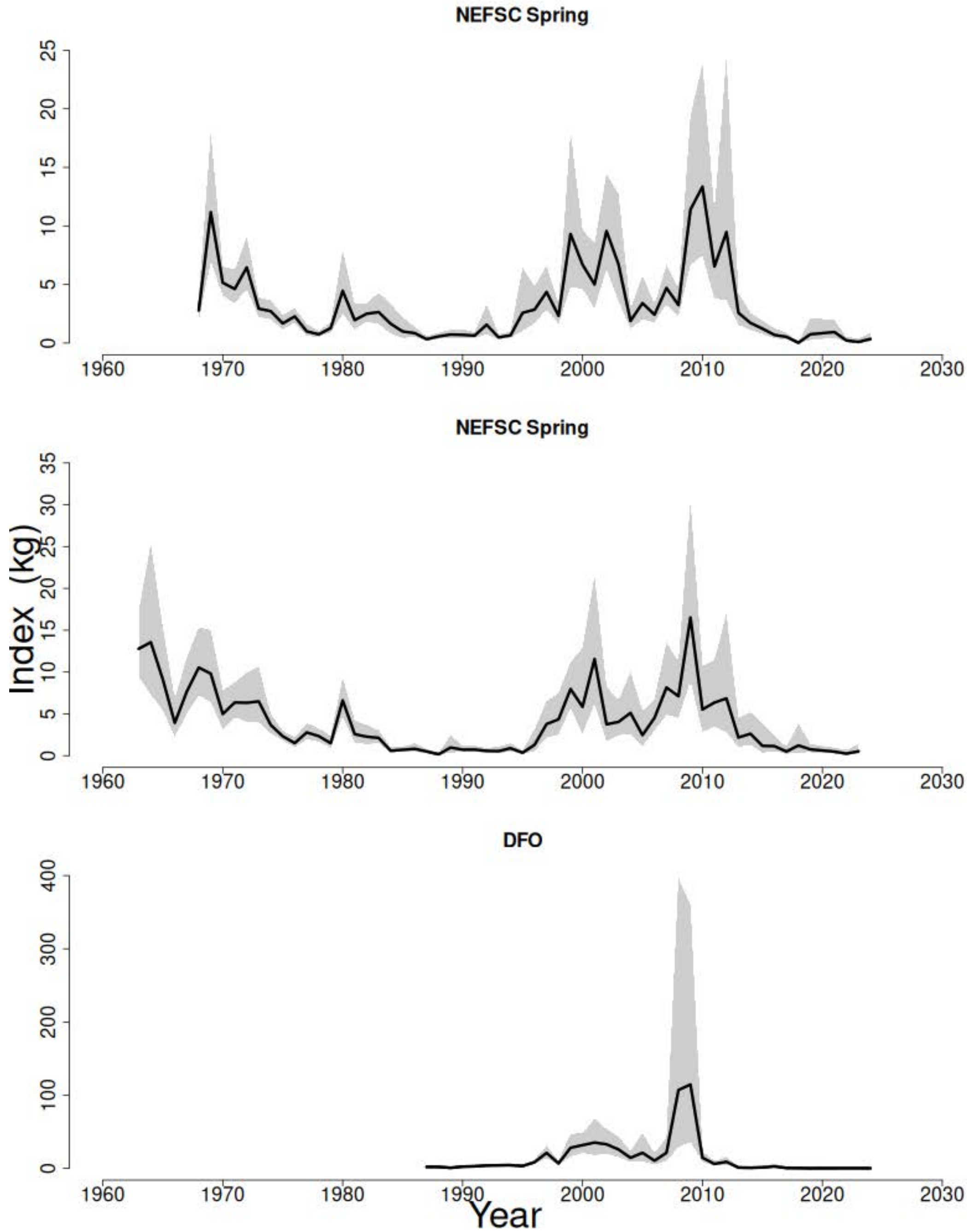

Figure 5: Indices of biomass for the Georges Bank Yellowtail Flounder between 1963 and 2024 for the Northeast Fisheries Science Center (NEFSC) spring, NEFSC fall and Fisheries and Oceans Canada (DFO) time series. The approximate 90% lognormal confidence intervals are shown.

2026 Georges Bank resource share allocation for haddock, Atlantic cod, and yellowtail flounder

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Abstract

This report uses US and Canadian survey data updated through 2025 to update the 2026 management cycle Eastern Georges Bank (EGB) resource share allocations for haddock (72% Canada, 28% US), Atlantic cod (72% Canada, 28% US), and yellowtail flounder (54% Canada, 46% US). Haddock and Atlantic cod allocations match due to rounding but reflect species-specific analysis as outlined below. The 2025 NEFSC fall survey was deemed to have sufficient spatial coverage on GB for inclusion in this analysis, depite technical and weather delays that impacted survey operation and a brief summary of NEFSC survey coverage is included herein.

Introduction

The Transboundary Management Guidance Committee (TMGC) supports the management of Atlantic cod, haddock and yellowtail flounder on Georges Bank (GB). The TMGC management unit for haddock and Atlantic cod is restricted only to Eastern Georges Bank (EGB; Figures 1 - 2) while the TMGC management unit for yellowtail flounder covers the Total Georges Bank (TGB) footprint (Figures 3 - 4). Resource shares within the TMGC management unit are allocated between Canadan and the U.S. using methods established by the

TMGC (Andrushchenko et al., 2023). This document outlines these allocation methods (Section 1) and updates them to generate 2026 management cycle allocation shares (Section 2). A brief analysis of the NEFSC survey coverage is also provided in Section 3.

1 Methods

Resource share allocation was calculated using the following formula agreed upon by the TMGC which considers both resource utilization and distribution by country:

$$\%Share_{country} = \alpha_{year}\%Utilization_{country,year} + \beta_{year}\%Distribution_{country,year}$$

Where α_{year} is the weighting for utilization in each year and β_{year} is the weighting for distribution in each year. Together α_{year} and β_{year} sum to one. The percent share allocation to each country for the terminal year of data is provided to the TMGC for advice setting.

1.1 Resource utilization (α_{year})

The utilization weighting (α_{year}) was initially set at 40% when the sharing agreement was first implemented in 2003, with a planned 5% decrease until this weighting reached 10% in 2010. Since 2010, the utilization weighting has been kept at 10%. The TMGC set the initial utilization weighting equal to the percentage of total landings attributed to each country during a reference period from 1967-1994.

1.2 Resource distribution (β_{year})

The distribution weighting (β_{year}) was initially set at 60% when the sharing agreement was first implemented in 2003, with planned 5% increases to reach 90% in 2010 and has since been kept at 90%. The distribution weighting is the terminal year (here 2025) LOESS smoothed percentage of average swept area survey biomass in each country. Three surveys were used in resource allocation share calculations to characterize resource distribution: two U.S. surveys (Northeast Fishery Science Center, NEFSC, spring and fall bottom trawl surveys; Figures 1 - 3) and one Canadian survey (Department of Fisheries and Oceans, DFO, winter/spring survey; Figures 2 - 4). The following steps were implemented to calculate resource distribution weighting.

Steps 1-4 were applied only to the two U.S. surveys (NEFSC spring, NEFSC fall) to calculate the proportion of survey swept area biomass in the Canadian and the U.S. sections of the TMGC management area (EGB for haddock and Atlantic cod, TGB for yellowtail flounder) over time. Canada calculated similar proportions for the DFO spring survey.

1. Surveys were post-stratified to the U.S. and Canadian portions of the TMGC management unit for each stock (Figures 1 - 3). Stratum 13 was not post-stratified to the western U.S. boundary of the yellowtail flounder management unit and instead all tows that occurred within this stratum were used in resource distribution calculations. See Figures 8 - 10 for terminal year (2025) NEFSC survey tows.

2. A mean biomass per tow was calculated for each stratum or sub-stratum. Stratum or sub-stratum with no tows were assumed to have a mean biomass per tow of zero.

3. The swept area biomass for each stratum or sub-stratum was calculated by expanding the mean biomass per tow to the number of towable units within each stratum or sub-stratum, assuming a standard tow size and areas in Table 2.

4. The proportion of swept area biomass in each country was calculated by first summing the swept area biomass across strata and sub-strata in each country and then comparing country totals to the total swept area biomass within the TMGC management unit. This provides a time series of survey biomass proportions in Canada and the U.S. for each survey.

5. Canada used a similar approach to calculate the proportion of DFO winter/spring survey swept area biomass in Canada and the U.S., using available data from strata 5Z1-5Z8 (Figures 2 - 4).

Steps 6-8 were applied to generate final resource share allocations using the three survey proportion time series available for each species.

6. Survey biomass proportions in Canada and the U.S. were combined by averaging annual (i.e. calendar year) proportions across surveys to provide a single unsmoothed biomass distribution time series. However, a different averaging approach was applied to Atlantic cod.

   - Atlantic cod: First, the NEFSC spring and DFO winter/spring surveys were averaged, and second this combined spring series was averaged with the NEFSC fall survey proportions to weight seasons equally
   - Haddock and yellowtail flounder: All three surveys were averaged, giving equal weight to each
   - If a survey biomass proportion could not be calculated in a given year (e.g. due to insufficient spatial coverage or survey disruption), then an average was calculated over the remaining surveys. If there were fewer than two surveys available to characterize allocation in a given year and species, then a recent two year average of the survey biomass proportions was used to fill the gap.
     - In 2020, NEFSC spring and fall sampling did not occur so a 2 year recent average (2018-2019) for each survey biomass proportion was used in this year

to avoid using a single survey (DFO winter/spring) to characterize resource distribution in this year.

- The 2023 NEFSC spring survey did not have sufficient day and night sampling coverage for inclusion in the U.S. domestic assessments, but spatial coverage on GB was generally sufficient to calculate the relative proportion of survey biomass in U.S. and Canadian portions of the TMGC management unit.

7. A LOESS smooth algorithm was applied to the most recent 33 years of combined survey biomass proportions to calculate the final resource allocation percentage. See Figures 5 - 7 for 2026 smoothed time series.

   - Smoothed values greater than 100 percent were capped at 100 and negative percentages were capped at zero percent.

8. The smoothed survey biomass distribution for the terminal year of data (here 2025) represents the 2026 resource distribution β_{year}) used in the resource share allocation formula.

2 Allocation results

The above allocation methodology (Section 1) was applied to haddock, Atlantic cod, and yellowtail flounder data for 1993 - 2025 to generate 2026 management cycle resource share allocation (Table 1). Survey and Loess smoothed resource distributions (Figures 5 - 7) used in calculations are provided in Tables 3 - 5. Haddock and Atlantic cod allocations match due to rounding but reflect species-specific analysis as outlined above.

3 Research updates

The 2025 NEFSC fall survey experienced technical and weather delays that resulted in reduced sampling coverage and a shift in sampling timing later in the year (Figures 11 - 13). Despite these changes, spatial coverage (Figures 8 - 10) was sufficient to include the NEFSC fall survey in this analysis (see also Hart, 2026 for similar analysis for the entire U.S. domestic assessment unit, i.e. EGB and WGB combined). Lower sampling coverage increased the distribution uncertainty in the fall for all three species because the analysis was based on fewer data points than in prior years, but this was particularly evident for Atlantic cod because the NEFSC fall survey had small, infrequent survey catches and that more strongly influenced allocation calculations due to equal season weighting for this species.

4 Tables and figures

Table 1: Resource share allocations formula inputs and 2026 management cycle allocations (bold).

Terminal data year	Species	Country	Percent utilization	Percent distribution	Resource share allocation
2025	Haddock	Canada	55	74	**72**
2025	Haddock	US	45	26	**28**
2025	Cod	Canada	60	74	**72**
2025	Cod	US	40	26	**28**
2025	Yellowtail	Canada	2	60	**54**
2025	Yellowtail	US	98	40	**46**

Table 2: Towable area within Fisheries and Oceans (DFO) and National Marine Fisheries Service (NMFS) survey strata on Georges Bank in square nautical miles. Stratum on Eastern Georges Bank (EGB) reflect the Atlantic cod and haddock management unit, and the yellowtail flounder management unit also includes some strata on Western Georges Bank (WGB). Reproduced from Table 2 in Andrushchenko et al., 2023.

Survey	Stratum	Canada EGB	US EGB	US WGB
DFO	5Z1	795	0	0
DFO	5Z2	1252	0	0
DFO	5Z3	0	1504	791
DFO	5Z4	0	1350	1729
NMFS	1130	0	0	2374
NMFS	1140	0	0	656
NMFS	1150	0	0	230
NMFS	1160	1553	1427	0
NMFS	1170	284	76	0
NMFS	1180	127	45	0
NMFS	1190	0	1059	1395
NMFS	1200	0	335	886
NMFS	1210	210	78	136
NMFS	1220	125	106	223

Table 3: Resource percent distribution for Georges Bank haddock on either side of the international boundary between the USA and Canada. Percent distribution is reported for the National Marine Fisheries Service (NMFS) spring and fall surveys, the Fisheries and Oceans Canada (DFO) winter/spring survey, a combined survey distribution and the loess smoothed distribution (bold) used for resource share allocation calculations in the 2026 management cycle. Only the most recent 33 years used in resource share allocation calculations are provided. NMFS 2020 values are an average of the prior two years (2018-2019) due to the cancellation of survey activities in this year.

	NMFS fall		NMFS spring		DFO		Combined surveys		Loess smoothed	
Year	%CAN	%USA	%CAN	%USA	%CAN	%USA	%CAN	%USA	%CAN	%USA
1993	100	0	94	6	64	36	86	14	89	11
1994	92	8	100	0	99	1	97	3	88	12
1995	100	0	61	39	98	2	87	13	88	12
1996	100	0	14	86	94	6	69	31	87	13
1997	100	0	92	8	90	10	94	6	86	14
1998	99	1	89	11	100	0	96	4	85	15
1999	100	0	41	59	97	3	79	21	84	16
2000	99	1	42	58	80	20	74	26	81	19
2001	96	4	80	20	95	5	91	9	78	22
2002	98	2	33	67	69	31	67	33	76	24
2003	75	25	77	23	74	26	75	25	74	26
2004	86	14	34	66	93	7	71	29	71	29
2005	78	22	50	50	87	13	72	28	69	31
2006	94	6	46	54	59	41	66	34	66	34
2007	65	35	36	64	86	14	62	38	64	36
2008	100	0	12	88	67	33	60	40	62	38
2009	47	53	27	73	100	0	58	42	61	39
2010	76	24	34	66	65	35	58	42	60	40
2011	73	27	63	37	75	25	71	29	58	42
2012	96	4	37	63	44	56	59	41	57	43
2013	30	70	48	52	44	56	41	59	53	47
2014	54	46	27	73	97	3	59	41	51	49
2015	25	75	14	86	15	85	18	82	50	50
2016	86	14	47	53	70	30	68	32	49	51
2017	63	37	27	73	38	62	43	57	50	50
2018	69	31	22	78	38	62	43	57	52	48
2019	57	43	46	54	88	12	64	36	54	46
2020	63	37	34	66	54	46	51	49	59	41
2021	99	1	12	88	71	29	61	39	66	34
2022	99	1	58	42	76	24	78	22	68	32
2023	100	0	59	41	98	2	86	14	71	29
2024	97	3	31	69	88	12	72	28	73	27
2025	57	43	77	23	58	42	64	36	**74**	**26**

Table 4: Resource percent distribution for Georges Bank Atlantic cod on either side of the international boundary between the USA and Canada. Percent distribution is reported for the National Marine Fisheries Service (NMFS) spring and fall surveys, the Fisheries and Oceans Canada (DFO) winter/spring survey, a combined survey distribution and the loess smoothed distribution (bold) used for resource share allocation calculations in the 2026 management cycle. Only the most recent 33 years used in resource share allocation calculations are provided. NMFS 2020 values are an average of the prior two years (2018-2019) due to the cancellation of survey activities in this year.

	NMFS fall		NMFS spring		DFO		Combined surveys		Loess smoothed	
Year	%CAN	%USA	%CAN	%USA	%CAN	%USA	%CAN	%USA	%CAN	%USA
1993	100	0	41	59	61	39	76	24	80	20
1994	96	4	73	27	96	4	90	10	81	19
1995	94	6	87	13	52	48	82	18	83	17
1996	95	5	58	42	73	27	80	20	84	16
1997	100	0	62	38	70	30	83	17	84	16
1998	100	0	96	4	88	12	96	4	84	16
1999	97	3	53	47	77	23	81	19	85	15
2000	100	0	48	52	69	31	79	21	85	15
2001	97	3	74	26	95	5	90	10	84	16
2002	98	2	63	37	95	5	88	12	84	16
2003	80	20	71	29	69	31	75	25	82	18
2004	99	1	82	18	87	13	92	8	79	21
2005	93	7	57	43	34	66	69	31	77	23
2006	97	3	31	69	69	31	73	27	77	23
2007	81	19	40	60	87	13	72	28	79	21
2008	100	0	57	43	91	9	87	13	80	20
2009	99	1	76	24	100	0	93	7	82	18
2010	96	4	51	49	34	66	69	31	83	17
2011	97	3	81	19	92	8	92	8	82	18
2012	82	18	58	42	71	29	73	27	81	19
2013	97	3	77	23	78	22	87	13	81	19
2014	94	6	36	64	86	14	77	23	79	21
2015	92	8	61	39	91	9	84	16	77	23
2016	40	60	94	6	83	17	64	36	75	25
2017	100	0	60	40	36	64	74	26	73	27
2018	98	2	33	67	70	30	74	26	73	27
2019	48	52	91	9	92	8	70	30	73	27
2020	73	27	62	38	94	6	76	24	74	26
2021	98	2	29	71	80	20	76	24	74	26
2022	94	6	11	89	75	25	69	31	74	26
2023	100	0	62	38	79	21	85	15	74	26
2024	57	43	54	46	74	26	60	40	74	26
2025	100	0	26	74	85	15	78	22	**74**	**26**

Table 5: Resource percent distribution for Georges Bank yellowtail flounder on either side of the international boundary between the USA and Canada. Percent distribution is reported for the National Marine Fisheries Service (NMFS) spring and fall surveys, the Fisheries and Oceans Canada (DFO) winter/spring survey, a combined survey distribution and the loess smoothed distribution (bold) used for resource share allocation calculations in the 2026 management cycle. Only the most recent 33 years used in resource share allocation calculations are provided. NMFS 2020 values are an average of the prior two years (2018-2019) due to the cancellation of survey activities in this year.

	NMFS fall		NMFS spring		DFO		Combined surveys		Loess smoothed	
Year	%CAN	%USA	%CAN	%USA	%CAN	%USA	%CAN	%USA	%CAN	%USA
1993	79	21	62	38	64	36	68	32	60	40
1994	70	30	57	43	21	79	49	51	57	43
1995	56	44	71	29	40	60	56	44	54	46
1996	15	85	54	46	53	47	41	59	52	48
1997	49	51	85	15	25	75	53	47	50	50
1998	62	38	36	64	60	40	53	47	48	52
1999	50	50	67	33	39	61	52	48	46	54
2000	16	84	62	38	38	62	39	61	44	56
2001	20	80	46	54	25	75	30	70	43	57
2002	48	52	60	40	25	75	44	56	41	59
2003	34	66	85	15	36	64	52	48	40	60
2004	3	97	59	41	63	37	42	58	38	62
2005	48	52	31	69	8	92	29	71	36	64
2006	8	92	42	58	12	88	21	79	36	64
2007	12	88	66	34	24	76	34	66	40	60
2008	48	52	62	38	98	2	70	30	44	56
2009	6	94	50	50	100	0	52	48	45	55
2010	30	70	44	56	94	6	56	44	42	58
2011	26	74	4	96	13	87	14	86	37	63
2012	7	93	11	89	21	79	13	87	33	67
2013	23	77	58	42	67	33	49	51	31	69
2014	29	71	16	84	34	66	27	73	32	68
2015	83	17	21	79	18	82	41	59	32	68
2016	45	55	28	72	15	85	29	71	32	68
2017	15	85	20	80	32	68	22	78	34	66
2018	25	75	43	57	36	64	35	65	37	63
2019	65	35	24	76	68	32	52	48	42	58
2020	45	55	34	66	45	55	41	59	49	51
2021	44	56	36	64	88	12	56	44	52	48
2022	86	14	69	31	50	50	69	31	53	47
2023	59	41	20	80	49	51	43	57	56	44
2024	40	60	70	30	41	59	50	50	58	42
2025	26	74	77	23	100	0	68	32	**60**	**40**

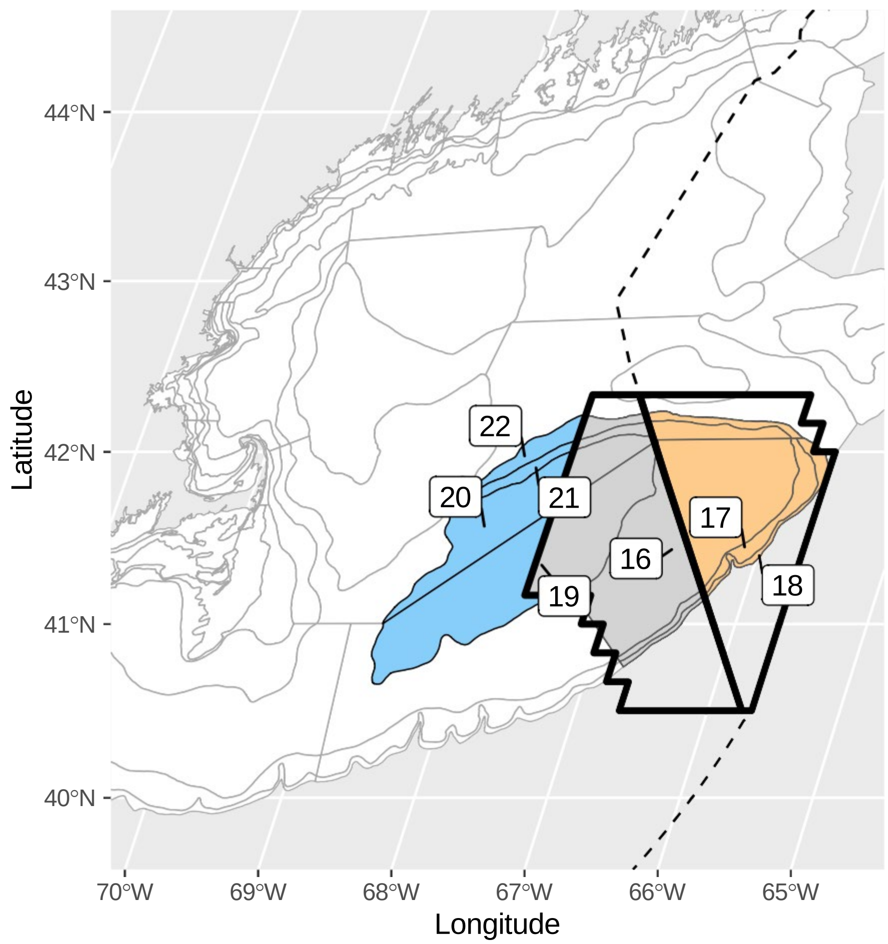

Figure 1: Northeast Fishery Science Center (NEFSC) bottom trawl survey strata used in resource distribution calculations for Atlantic cod and haddock, strata were post-stratified to the TMGC management unit (thick black line) and only tows within the Canadian (orange) and U.S. (gray) portions of the management unit were included in calculations (i.e. tows in blue portion excluded).

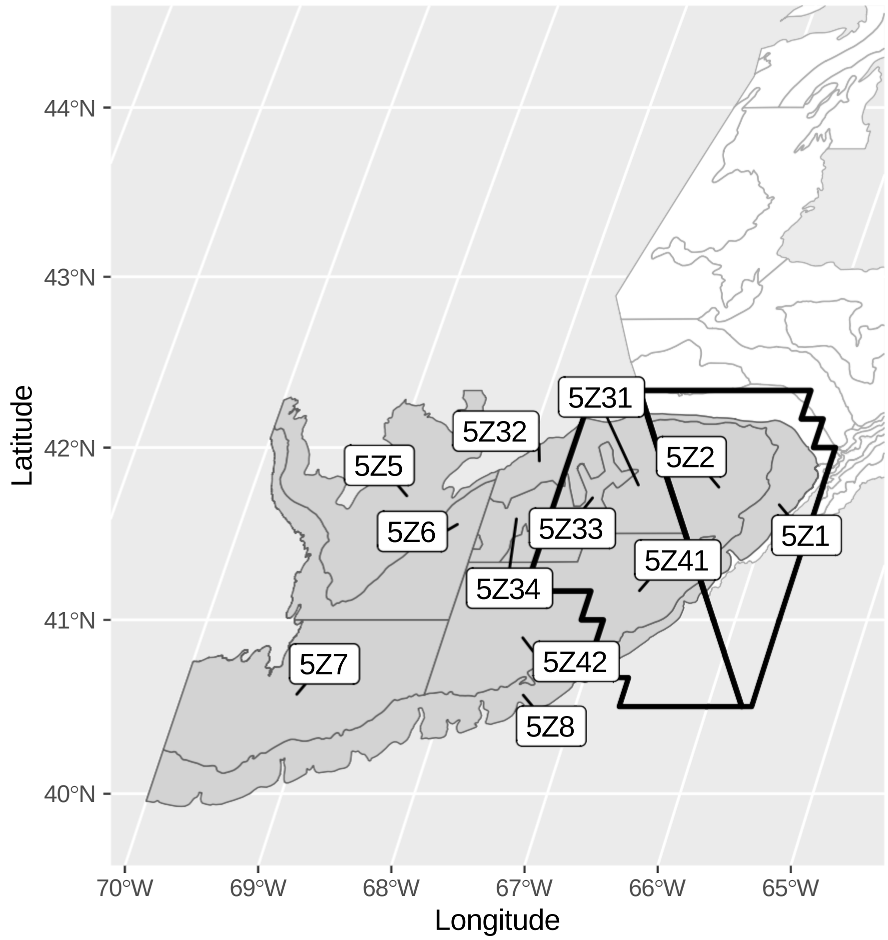

Figure 2: Department of Fisheries and Oceans bottom trawl survey strata (gray) used in resource distribution calculations calculations for Atlantic cod and haddock only tows from these strata that fell within the TMGC management unit (thick black line) were used in calculations.

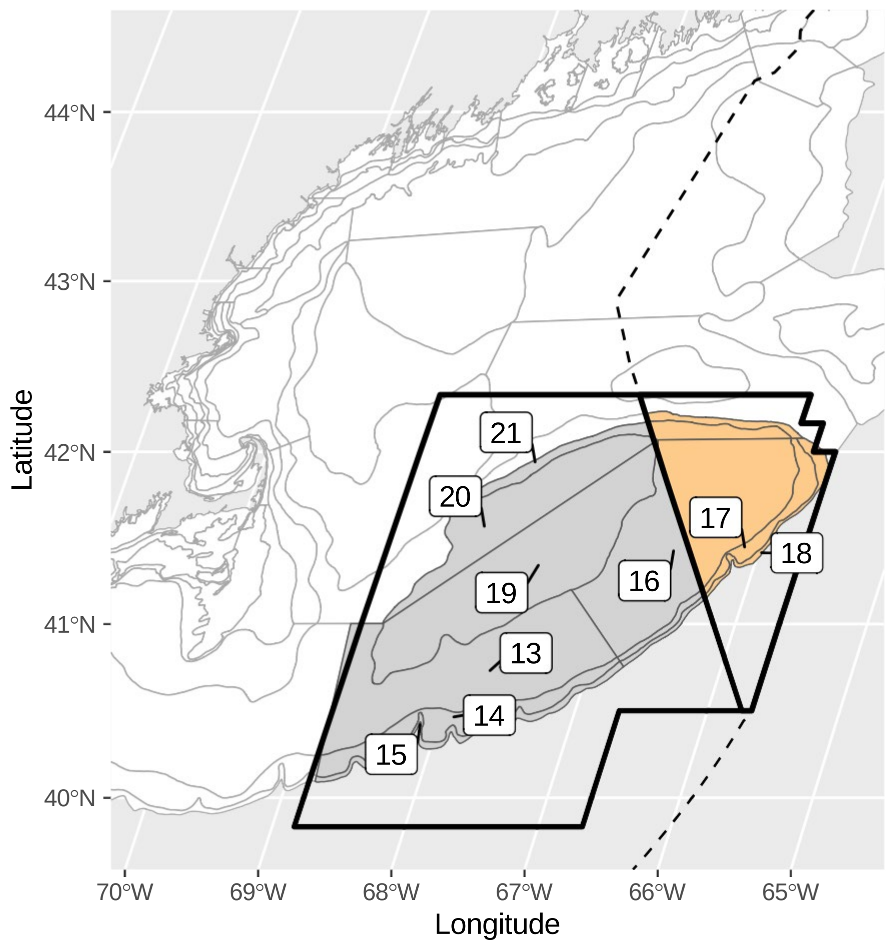

Figure 3: Northeast Fishery Science Center (NEFSC) bottom trawl survey strata used in resource distribution calculations for yellowtail flounder, all tows within the Canadian (orange) and U.S. (gray) portions of the TMGC management unit (thick black line) were used in calculations.

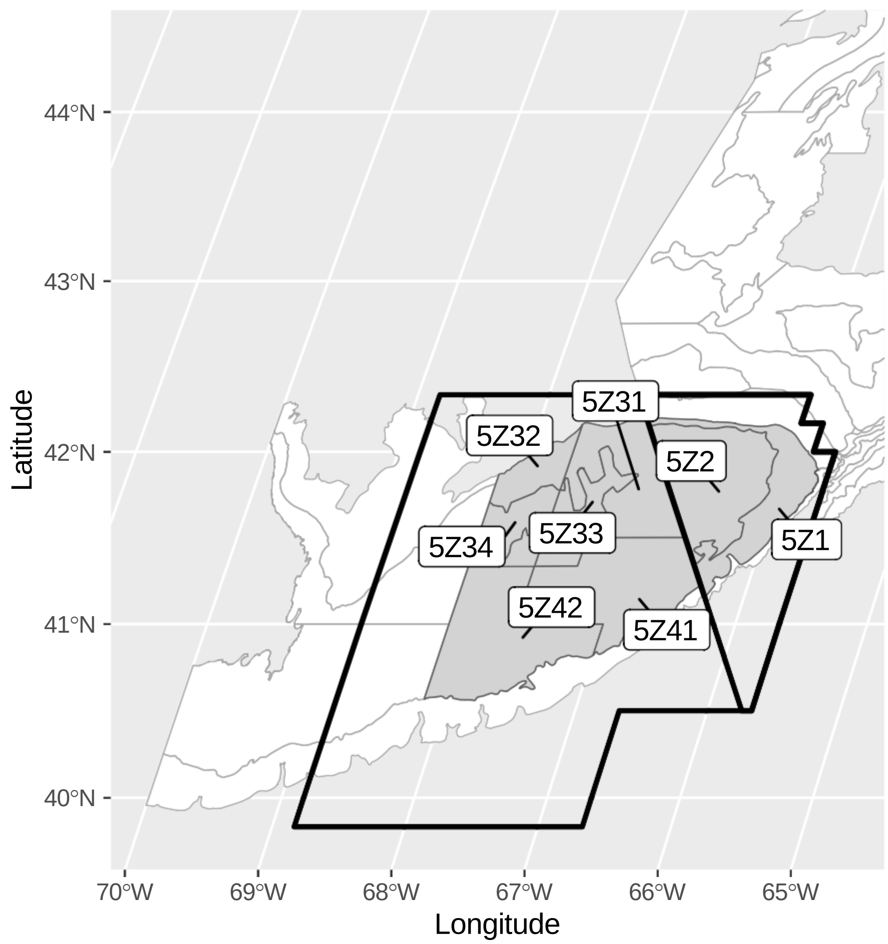

Figure 4: Department of Fisheries and Oceans bottom trawl survey strata (gray) used in resource distribution calculations calculations for yellowtail flounder, all tows within the highlighted strata were considered part of the TMGC management unit (thick black line) and were used in calculations.

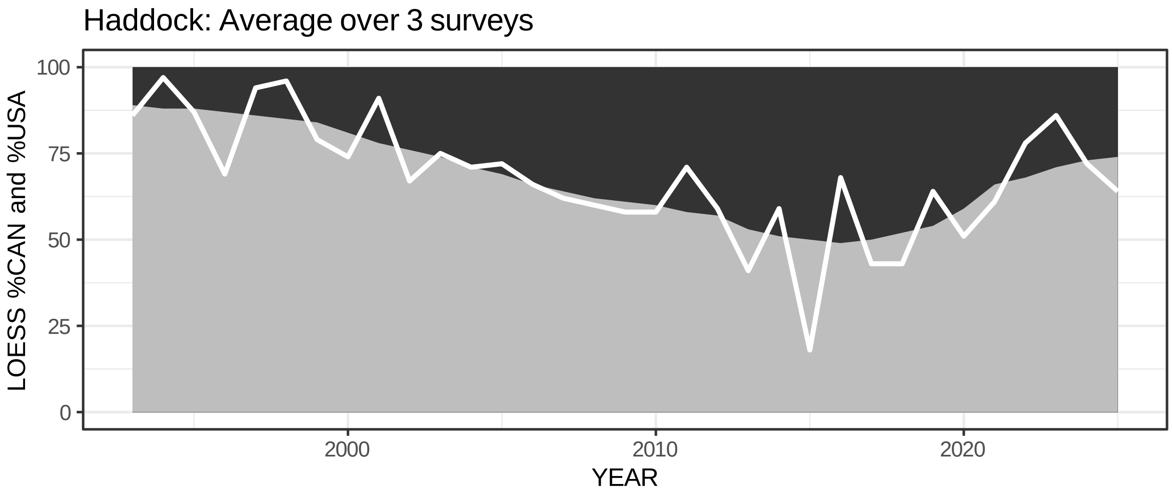

Figure 5: LOESS smoothed survey biomass distribution for haddock in Canada (light gray) and the U.S. (black) portions of the TMGC management unit, terminal smoothed value is the 2026 management cycle resource distribution used in resource share allocation calculations. Resouce distribution values were constrained between 0-100% and were be rounded to 0% or 100% if the terminal smoothed value fell outside of this range.

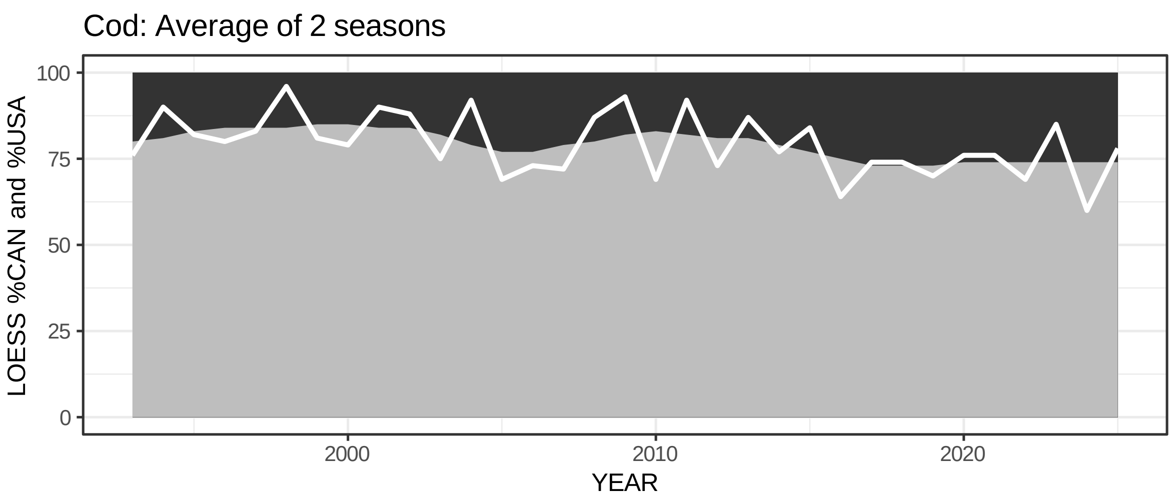

Figure 6: LOESS smoothed survey biomass distribution for Atlantic cod in Canada (light gray) and the U.S. (black) portions of the TMGC management unit, terminal smoothed value is the 2026 management cycle resource distribution used in resource share allocation calculations. Resouce distribution values were constrained between 0-100% and were be rounded to 0% or 100% if the terminal smoothed value fell outside of this range..

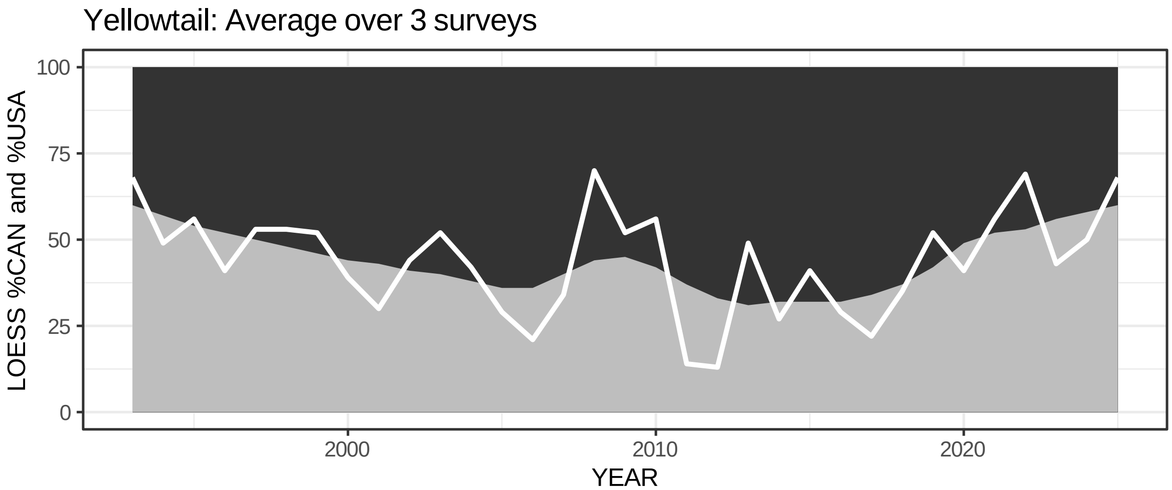

Figure 7: LOESS smoothed survey biomass distribution for yellowtail flounder in Canada (light gray) and the U.S. (black) portions of the TMGC management unit, terminal smoothed value is the 2026 management cycle resource distribution used in resource share allocation calculations. Resouce distribution values were constrained between 0-100% and were be rounded to 0% or 100% if the terminal smoothed value fell outside of this range..

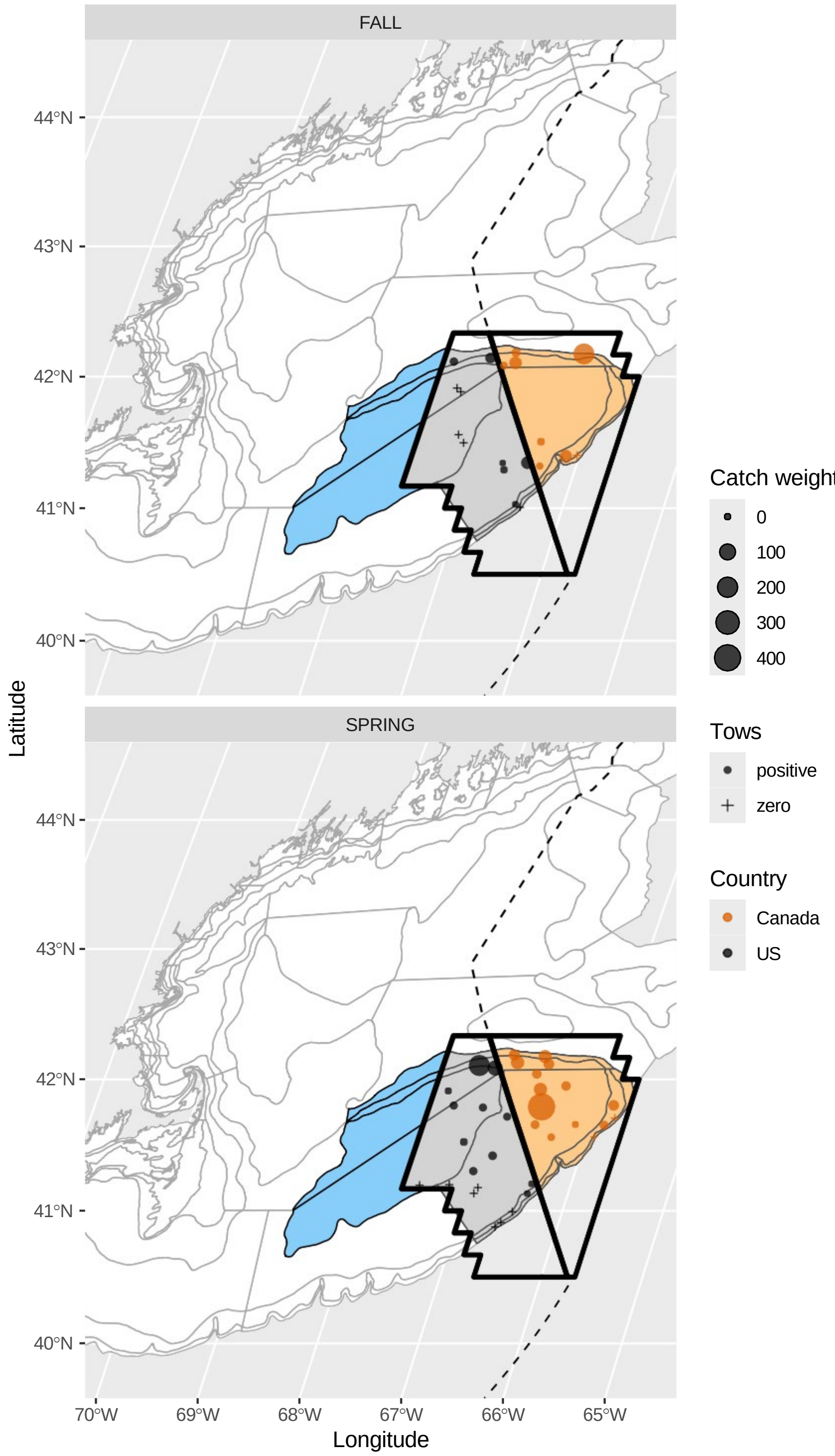

Figure 8: Distribution of 2025 Northeast Fishery Science Center (NEFSC) bottom trawl survey tows for Georges Bank haddock within the Canadian (orange) and U.S. (gray) portions of the TMGC management unit (thick black line).

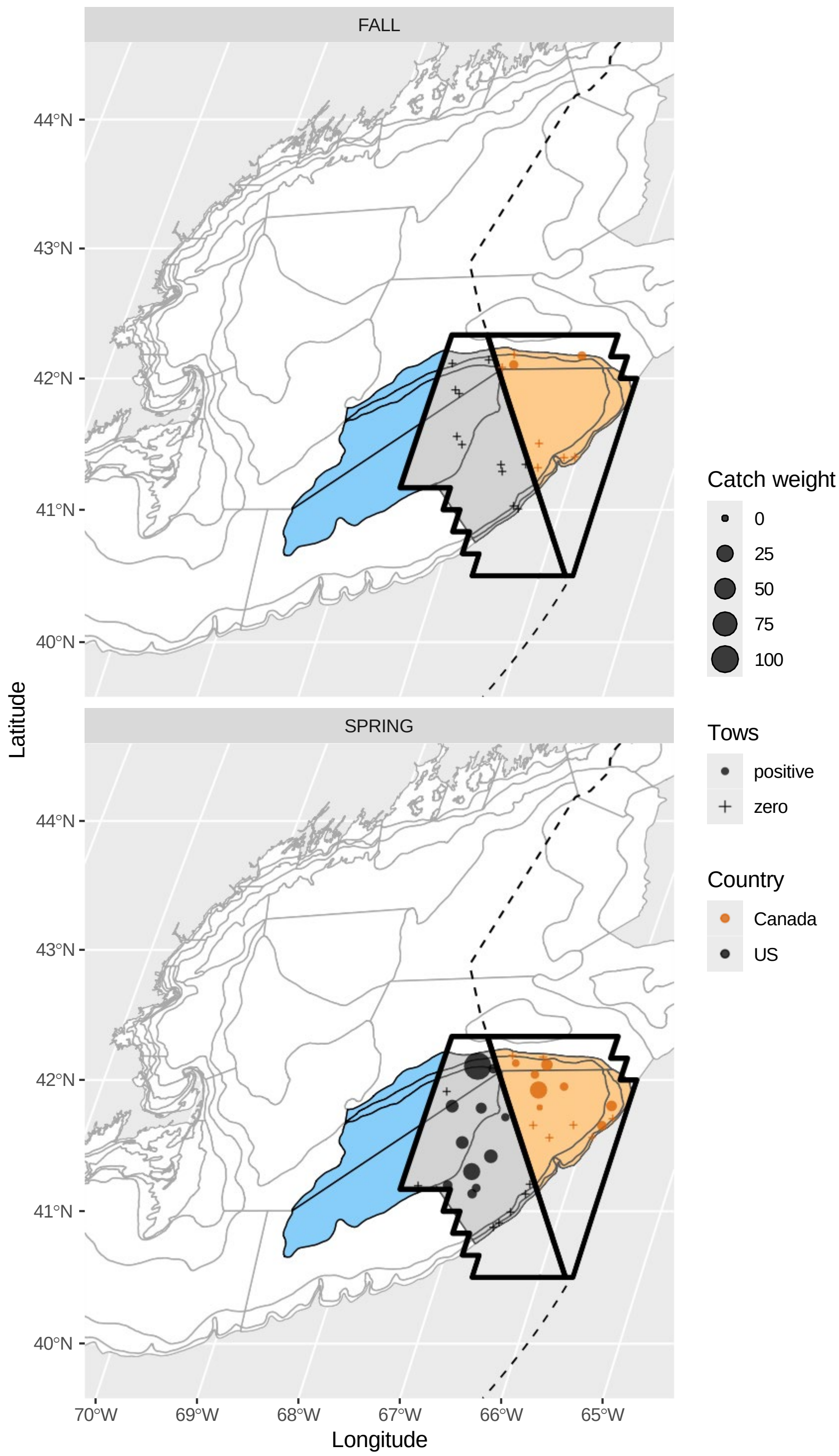

Figure 9: Distribution of 2025 Northeast Fishery Science Center (NEFSC) bottom trawl survey tows for Georges Bank Atlantic cod within the Canadian (orange) and U.S. (gray) portions of the TMGC management unit (thick black line).

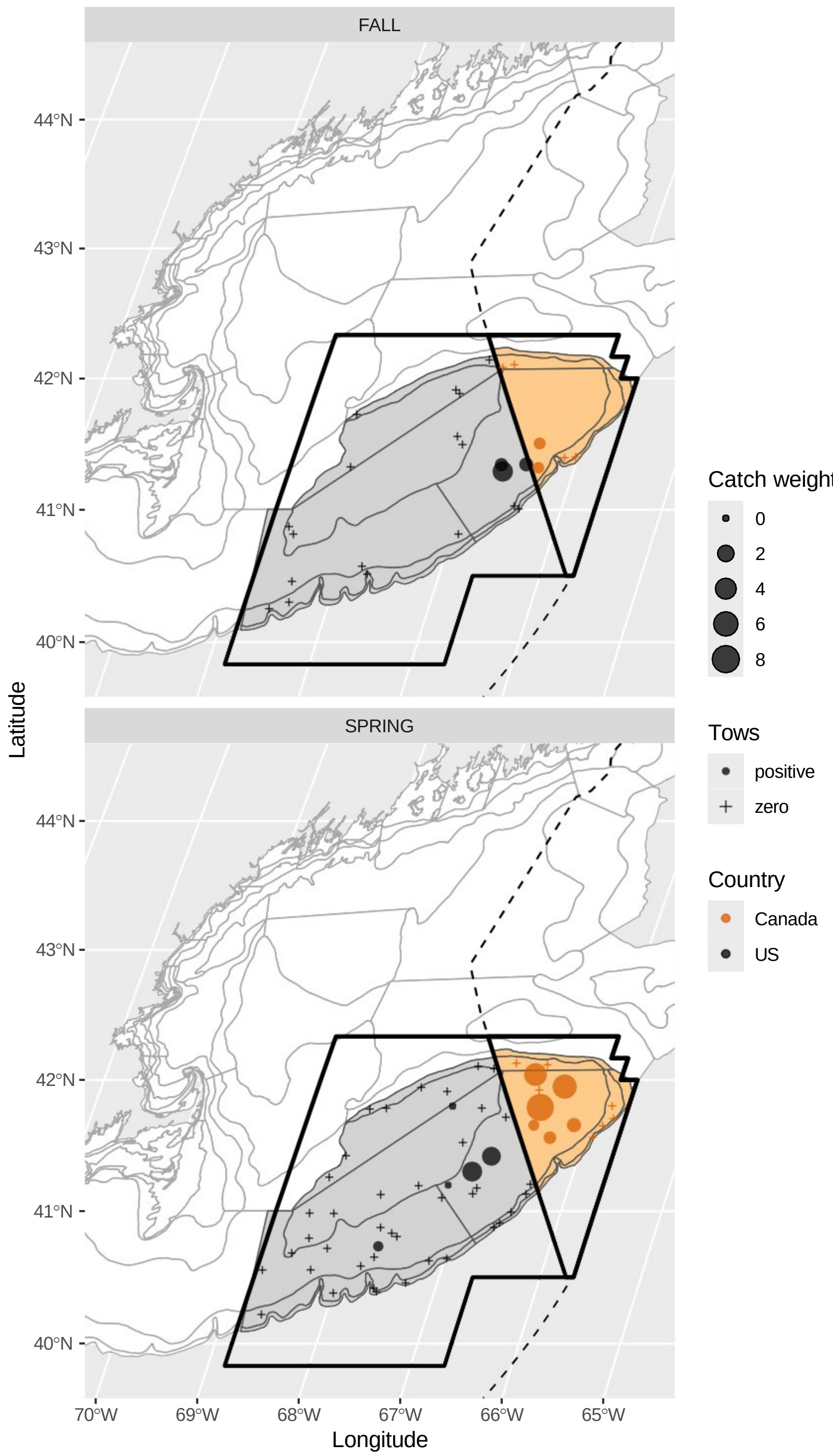

Figure 10: Distribution of 2025 Northeast Fishery Science Center (NEFSC) bottom trawl survey tows for Georges Bank yellowtail flounder within the Canadian (orange) and U.S. (gray) portions of the TMGC management unit (thick black line).

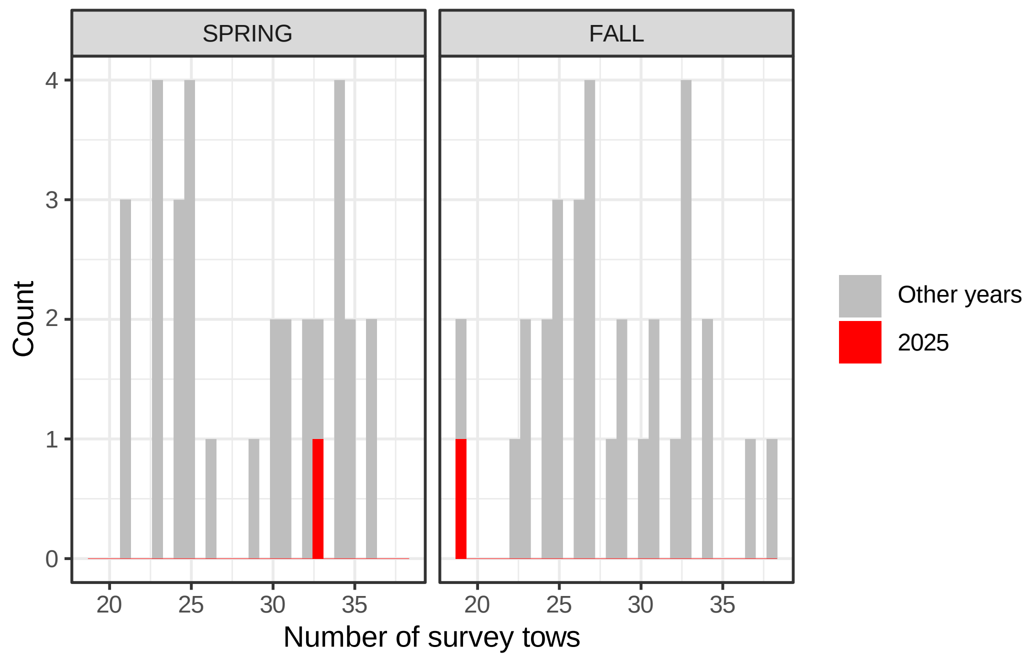

Figure 11: Distribution of completed NEFSC bottom trawl tows in GB haddock and Atlantic cod TMGC management footprint over time. 2025 sampling completion (highlighted in red) was 100% and 56% of the sampling completed in the prior year (2024) for SPRING and FALL NEFSC surveys respectively.

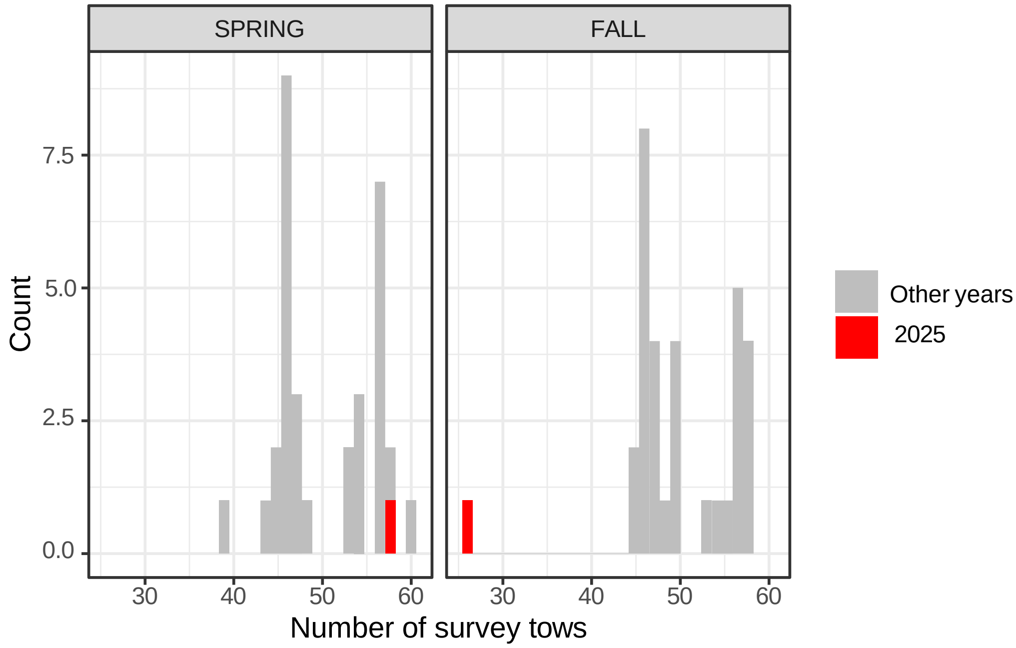

Figure 12: Distribution of completed NEFSC bottom trawl tows in GB yellowtail flounder TMGC management footprint over time. 2025 sampling completion (highlighted in red) was 102% and 45% of the sampling completed in the prior year (2024) for SPRING and FALL NEFSC surveys respectively.

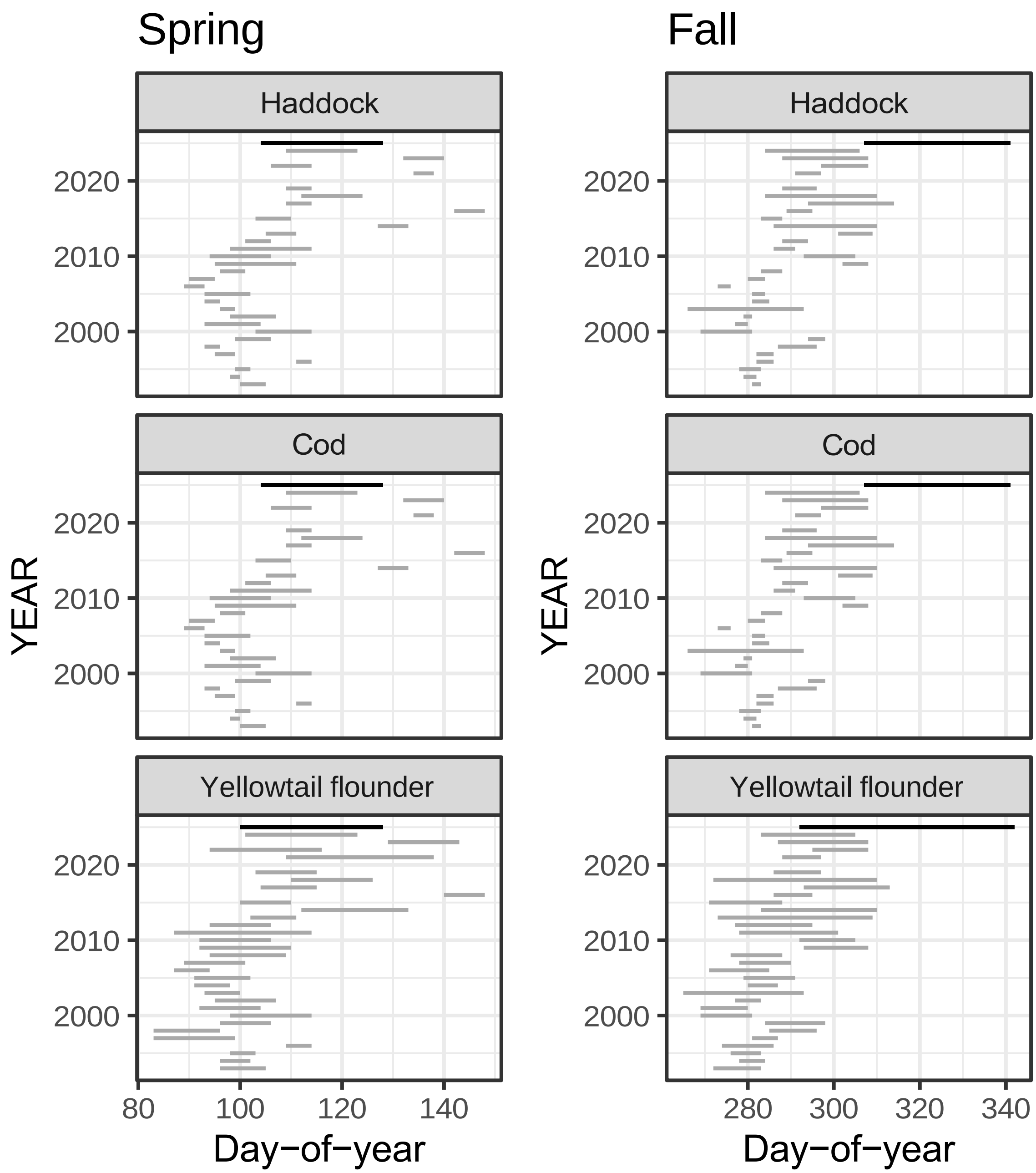

Figure 13: Day-of-year range for NEFSC spring (left) and fall (right) survey tows collected within the TMGC management for Georges Bank Atlantic cod (top row), haddock (middle row) and yellowtail flounder (bottom row) for all years used in allocation calculations (gray bars showing days between first and last survey sample) and 2025 sampling day-of-year range highlighted in black.

5 References

Andrushchenko, I. A., Brooks, E. N., & Way-Nee, E. (2023). *Allocation shares for Canada and the USA of the transboundary resources of Atlantic cod, haddock, and yellowtail flounder on Georges Bank through fishing year 2023.* (Transboundary Resources Assessment Committee Reference Document 2022/01.).

Hart, A. (2026). *Survey-based distribution results for Georges Bank haddock and Atlantic cod*.

2026 Survey-based distribution results for Georges Bank haddock and Atlantic cod

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Abstract

Historically, there was agreement between the spatial footprint of stock assessments used by the Transboundary Management Guidance Committee (TMGC) and the corresponding management unit for Atlantic cod, haddock, and yellowtail flounder on Georges Bank. Beginning in 2024, the TMGC began using domestic Canadian and US stock assessments to inform management so a survey-based distribution method was developed to reconcile different spatial footprints between the TMGC management unit and the US Total Georges Bank (TGB) assessments for haddock and Atlantic cod. This report uses US and Canadian survey data updated through 2025 to update the 2026 management cycle survey-based distribution calculations for TGB haddock (66% EGB, 34% WGB) and TGB Atlantic cod (95% EGB, 5% WGB). The 2025 NEFSC fall survey was deemed to have sufficient spatial coverage on GB for inclusion in this analysis, depite technical and weather delays that impacted survey operation. Survey-based distribution methods used in 2026 were not revised in relative to those used in 2025.

Introduction

The Transboundary Management Guidance Committee (TMGC) supports the management of Atlantic cod, haddock and yellowtail flounder on Georges Bank (GB). The TMGC management unit for haddock and Atlantic cod is restricted only to Eastern Georges Bank (EGB) while the management unit for yellowtail flounder covers the Total Georges Bank (TGB) footprint. Historically, the TMGC relied on stock assessments developed by the Transboundary

Resources Assessment Committee (TRAC) to provide advice on the same spatial footprint as the management unit for each stock. Beginning in 2024 the TMGC instead started to utilize domestic Canadian and US assessments to support transboundary management. The US domestic TGB yellowtail flounder assessment provides advice on the same spatial footprint as the TMGC management unit, but US domestic assessments for TGB Atlantic cod and TGB haddock both cover different TGB footprints. This difference necessitated the development of a new method to inform how TGB advice from these U.S. domestic assessments are applied to EGB and Western Georges Bank (WGB) management units based on survey distribution analyses. Advice is then subject to a further country allocation process established by the TMGC to allocate advice within the EGB management unit between Canada and the U.S. (Andrushchenko et al., 2023).

This document outlines the survey-based distribution methods for US domestic TGB haddock and Atlantic cod (Section 1), provides survey-based distribution results for the 2026 management cycle (Section 2), and documents research recommendations that have been addressed since the last management cycle (Section 3).

1 Methods

Survey-based distribution methods developed and peer reviewed during the 2024 management cycle were closely aligned with methods developed by the TRAC to allocate catch between the US and Canada within the EGB management unit. TGB cod survey-based distribution analyses uses two US surveys (Northeast Fishery Science Center, NEFSC, spring and fall bottom trawl surveys, Figure 1) and one Canadian survey (Department of Fisheries and Oceans, DFO, winter/spring survey, Figure 2). TGB haddock survey-based distribution is calculated using only the two US surveys, as the DFO winter/spring survey does not consistently cover the full TGB area for haddock (i.e. more limited sampling coverage in WGB for this stock). The following steps were implemented to calculate the survey-based distributions between the EGB management unit and WGB.

Steps 1-4 were applied only to the two US surveys (NEFSC spring, NEFSC fall) to calculate the proportion of TGB swept area biomass in EGB and WGB over time for each survey. Canada calculated similar proportions for the DFO winter/spring survey.

1. Surveys were post-stratified to EGB and WGB for each stock (Figures 3 - 4). Strata and sub-strata assignments to EGB and WGB largely aligned with those used for TMGC resource allocation calculations (Andrushchenko et al., 2023), but several new (i.e. strata not historically used for TMGC resource allocation calculations) were incorporated to post-stratify survey data for the TGB haddock footprint (Table 1).

2. A mean biomass per tow was calculated for each stratum or sub-stratum. Stratum or sub-stratum with no tows were assumed to have a mean biomass per tow of zero, adopting the same assumption used in TMGC resource allocations.

3. The swept area biomass for each stratum or sub-stratum was calculated by expanding the mean biomass per tow to the number of towable units within each stratum or sub-stratum, assuming a standard tow size.

4. The proportion of TGB swept area biomass in each region was calculated by first summing the swept area biomass across strata and sub-strata in each region (EGB or WGB) and then comparing regional totals to the TGB swept area biomass. This provides a time series of biomass proportions in EGB and WGB for each survey.

5. Canada used a similar approach to calculate the proportion of TGB swept area biomass in EGB and WGB for the DFO winter/spring survey, using available data from strata 5Z1-5Z8 (Figure 2). More recent (2010+) sampling in stratum 5Z9 was excluded from these calculations as this strata was not part of the negotiated strata established for EGB allocation methods.

Steps 6-8 were applied to generate final survey-based distributions using the relevant survey proportions of TGB swept area in the EGB management unit and WGB (DFO winter/spring, NMFS spring and fall surveys for cod, NMFS spring and fall surveys for haddock).

6. Survey biomass proportions in EGB and WGB were combined by averaging annual (i.e. calendar year) proportions across surveys to provide a single unsmoothed biomass distribution time series.

   - TGB cod averaged three surveys, giving equal weight to each: US NEFSC spring, US NEFSC fall, DFO winter/spring
   - TGB haddock averaged two surveys, giving equal weight to each: US NEFSC spring, US NEFSC fall
   - If a survey biomass proportion could not be calculated in a given year (e.g. due to insufficient spatial coverage or survey disruption), then an average was calculated over the remaining surveys. If there were fewer than two surveys available to characterize survey-based distribution in a given year and species, then a recent two year average of the survey biomass proportions was used to fill the gap.
     – In 2020, NEFSC spring and fall sampling did not occur so a 2 year recent average (2018-2019) for each survey biomass proportion was used in this year to avoid using a single survey (DFO winter/spring) to characterize resource distribution in this year.
   - The 2023 NEFSC spring survey did not have sufficient day and night sampling coverage for inclusion in the US domestic assessments, but spatial coverage on GB was generally sufficient to calculate the relative proportion of survey biomass in WGB and EGB. All survey strata were sampled within the TGB cod footprint, but two strata (29 and 30) were not sampled within the TGB haddock footprint. Consequently, survey-based distribution calculations assumed no haddock biomass

was located in these unsampled strata, which could lead to underprediction of WGB haddock biomass. However, the proportion of WGB haddock biomass was still higher than the prior two years despite the sampling gap so the index was used (i.e. NEFSC spring 2023 survey data was not treated as missing) in haddock survey-based distribution calculations.

- In years where the DFO winter/spring survey did not sample on WGB, this index was excluded from survey-based distribution calculations for Atlantic cod, but partial coverage in 2024-2025 were still included.

7. A LOESS smooth algorithm was applied to the most recent 33 years of combined survey biomass porportions to calculate the final resource survey-based distribution percentage. Settings for this smoothing were unchanged from those used in the TMGC resource allocation calculations (Andrushchenko et al., 2023).

   - Smoothed values greater than 100 percent were capped at 100 and negative percentages were capped at zero percent.

8. The smoothed survey biomass distribution for the terminal year of data (here 2025) represents the 2026 management cycle survey-based distribution result for the EGB management unit and WGB. This result is used to inform how TGB advice from U.S. domestic assessments are applied to the EGB management unit which is then subject to a further resource allocation process established by the TMGC.

2 Survey-based distribution results

The above survey-based distribution methodology (Section 1) was applied to TGB haddock and Atlantic cod data for 1993-2025 to generate 2026 management cycle survey-based distribution results (Table 2). Survey-based distribution results reflect the terminal year LOESS smoothed survey biomass for TGB haddock (Figure 5) and cod (Figure 6). Figures 7 - 8 show the distribution of terminal year (2025) NEFSC survey tows for TGB haddock and cod respectively.

3 Research updates

No changes were made to the survey-based distribution methods used in 2026 relative to those used in 2025.

The 2025 NEFSC fall survey experienced technical and weather delays that resulted in reduced sampling coverage and a shift in sampling timing later in the year (Figures 9 - 11). Despite these changes, spatial coverage (Figures 7 - 8) was sufficient to include the NEFSC fall survey in this analysis (see also Hart, 2026 for similar analysis in TMGC management unit). Lower sampling coverage increased the distribution uncertainty in the fall for both GB haddock and Atlantic cod because the analysis was based on fewer data points than in prior years, but this was particularly evident for Atlantic cod because the NEFSC fall survey had small, infrequent survey catches and that more strongly impacted the distribution of fall survey biomass in the terminal year (2025). The increase in survey-based distribution on WGB for Atlantic cod in 2025 was driven by a single positive NEFSC fall survey tow which contained 41% of the observed Atlantic cod fall survey biomass. In contrast, the 2025 NEFSC spring survey saw 0% of observed spring survey biomass on WGB and the 2025 DFO winter/spring saw 4% of observed DFO survey biomass on WGB.

4 Figures and tables

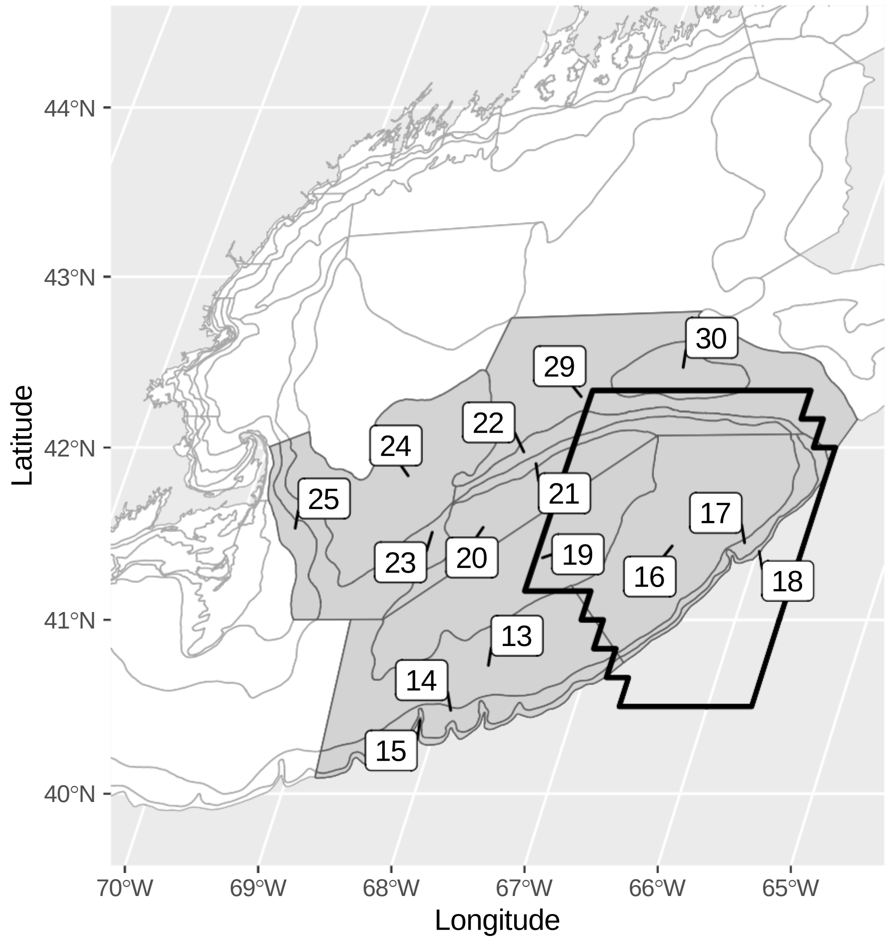

Figure 1: Northeast Fishery Science Center bottom trawl survey strata (gray) used in survey-based distribution calculations for Total Georges Bank (TGB) cod or haddock with the footprint of the TMGC Eastern Georges Bank management unit (thick black line).

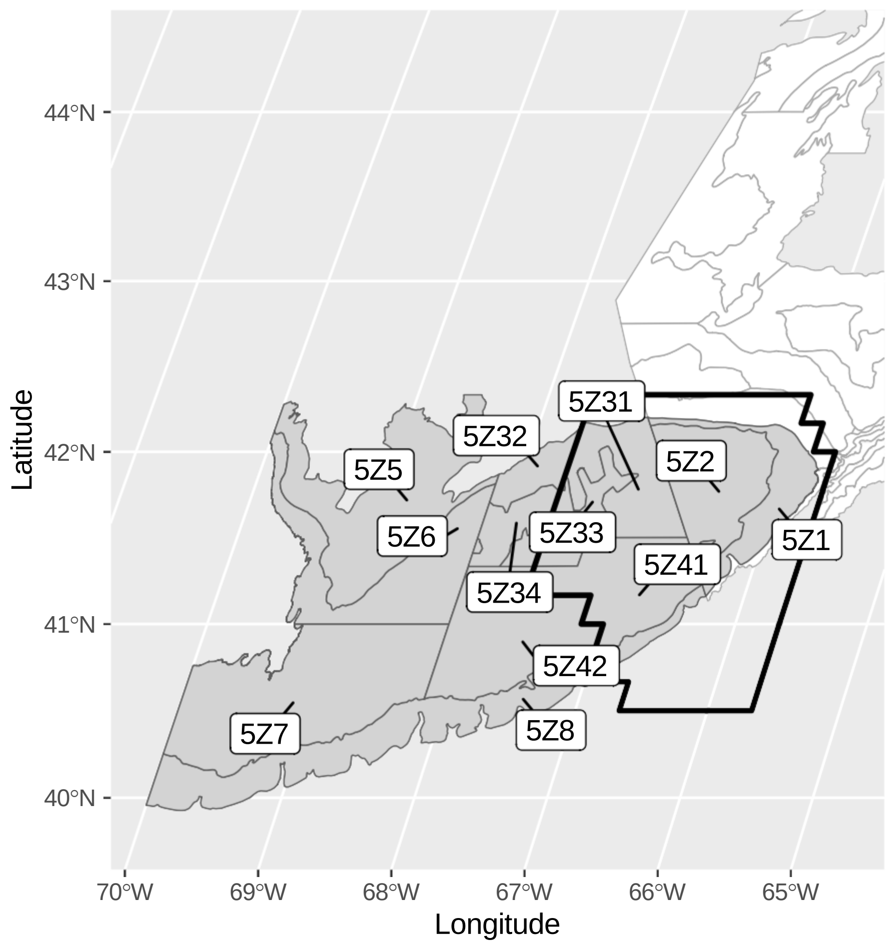

Figure 2: Department of Fisheries and Oceans bottom trawl survey strata (gray) used in survey-based distribution calculations for Total Georges Bank (TGB) cod or haddock with the footprint of the TMGC Eastern Georges Bank management unit (thick black line).

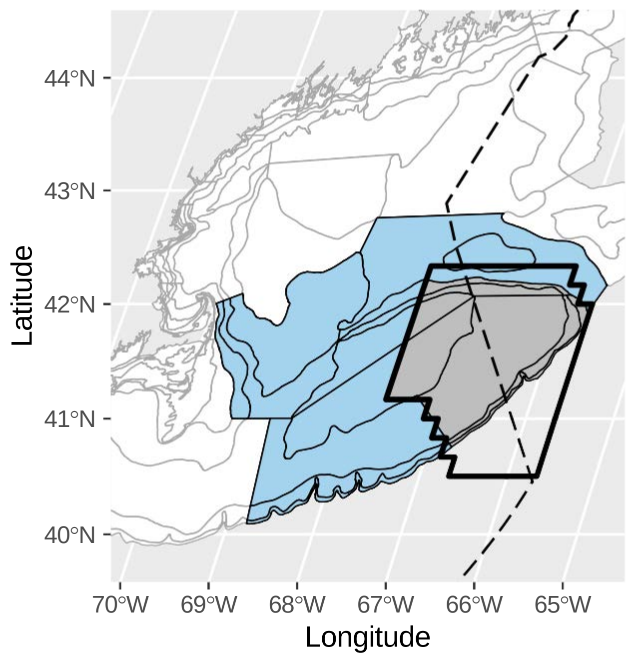

Figure 3: Northeast Fishery Science Center bottom trawl survey footprint used in domestic US Georges Bank haddock assessment, spatially divided between Western Georges Bank strata (blue) and Eastern Georges Bank strata (gray) that fall within the EGB management unit (thick black line). The EEZ is denoted by the dotted black line.

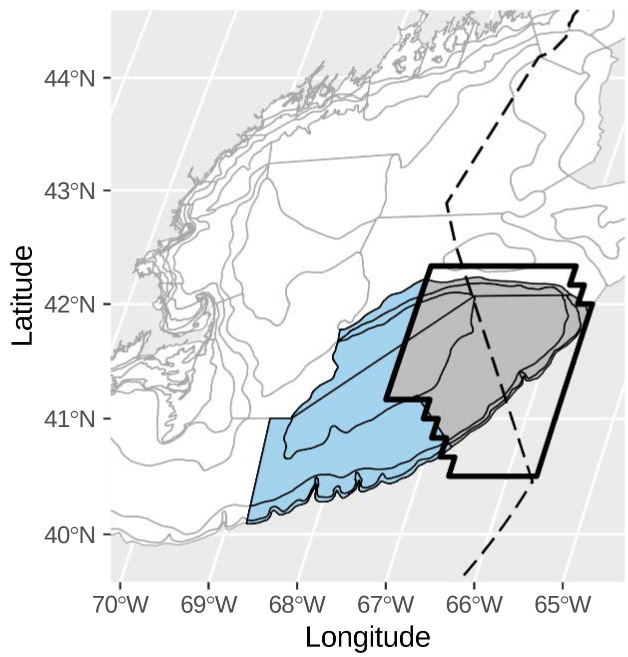

Figure 4: Northeast Fishery Science Center bottom trawl survey footprint used in domestic US Georges Bank Atlantic cod assessment, spatially divided between Western Georges Bank strata (blue) and Eastern Georges Bank strata (gray) that fall within the EGB management unit (thick black line). The EEZ is denoted by the dotted black line.

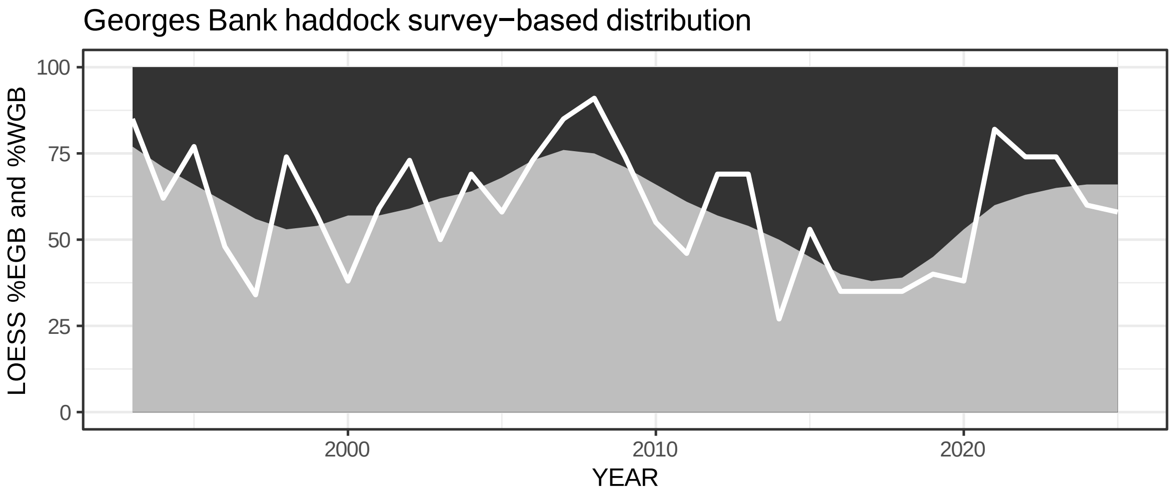

Figure 5: LOESS smoothed survey biomass distribution for Georges Bank haddock in EGB (light gray) and WGB (black), terminal smoothed value is the 2026 management cycle survey-based distribution. Final survey-based distribution values were constrained between 0-100% and were rounded to 0% or 100% if the terminal smoothed value fell outside of this range.

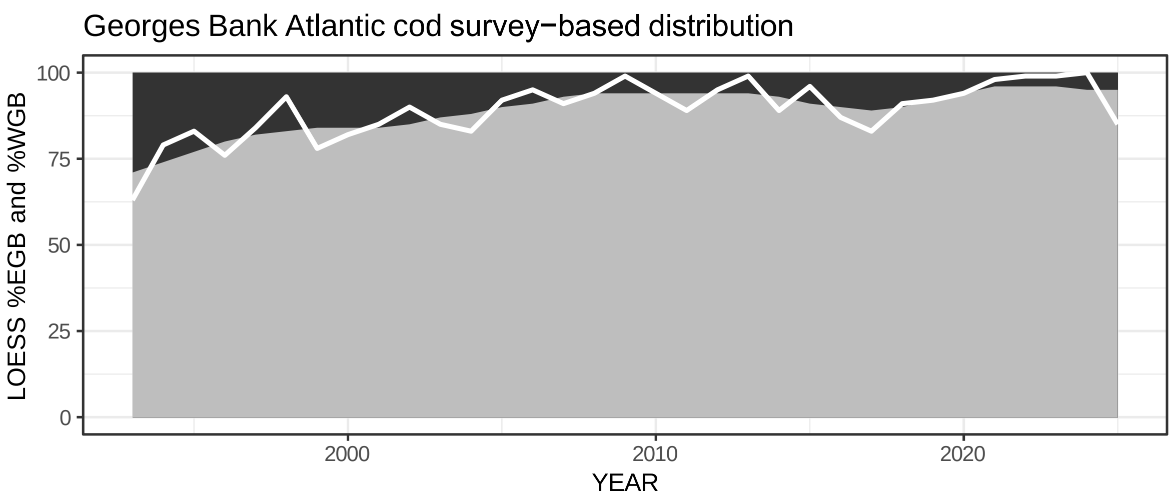

Figure 6: LOESS smoothed survey biomass distribution for Georges Bank Atlantic cod in EGB (light gray) and WGB (black), terminal smoothed value is the 2026 management cycle survey-based distribution. Final survey-based distribution values were constrained between 0-100% and were rounded to 0% or 100% if the terminal smoothed value fell outside of this range.

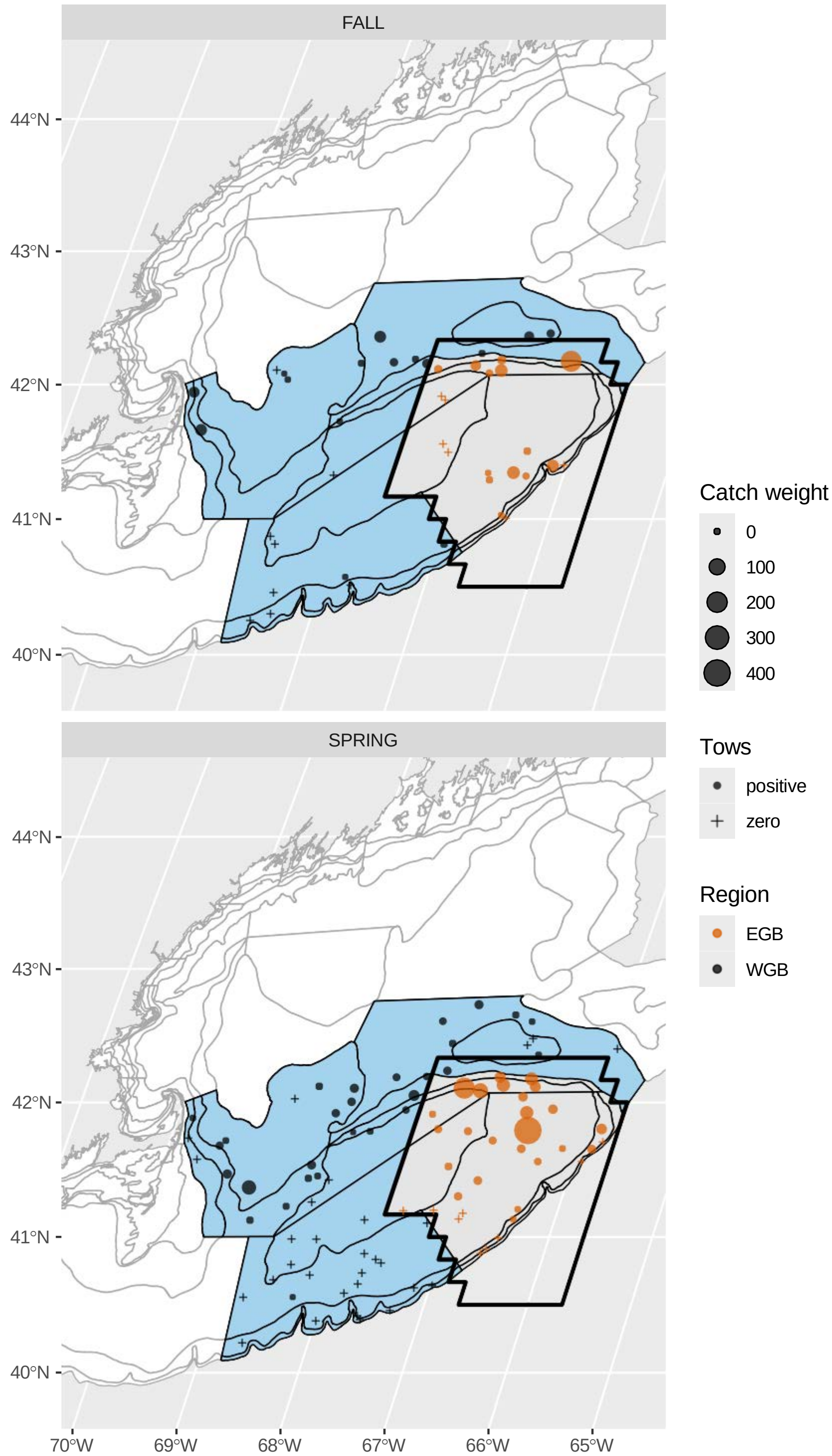

Figure 7: Distribution of 2025 Northeast Fishery Science Center (NEFSC) bottom trawl survey tows for Georges Bank haddock within Western Georges Bank (blue strata, black points) and Eastern Georges Bank (gray strata, orange points). The Eastern Georges Bank management unit is defined by the thick black line.

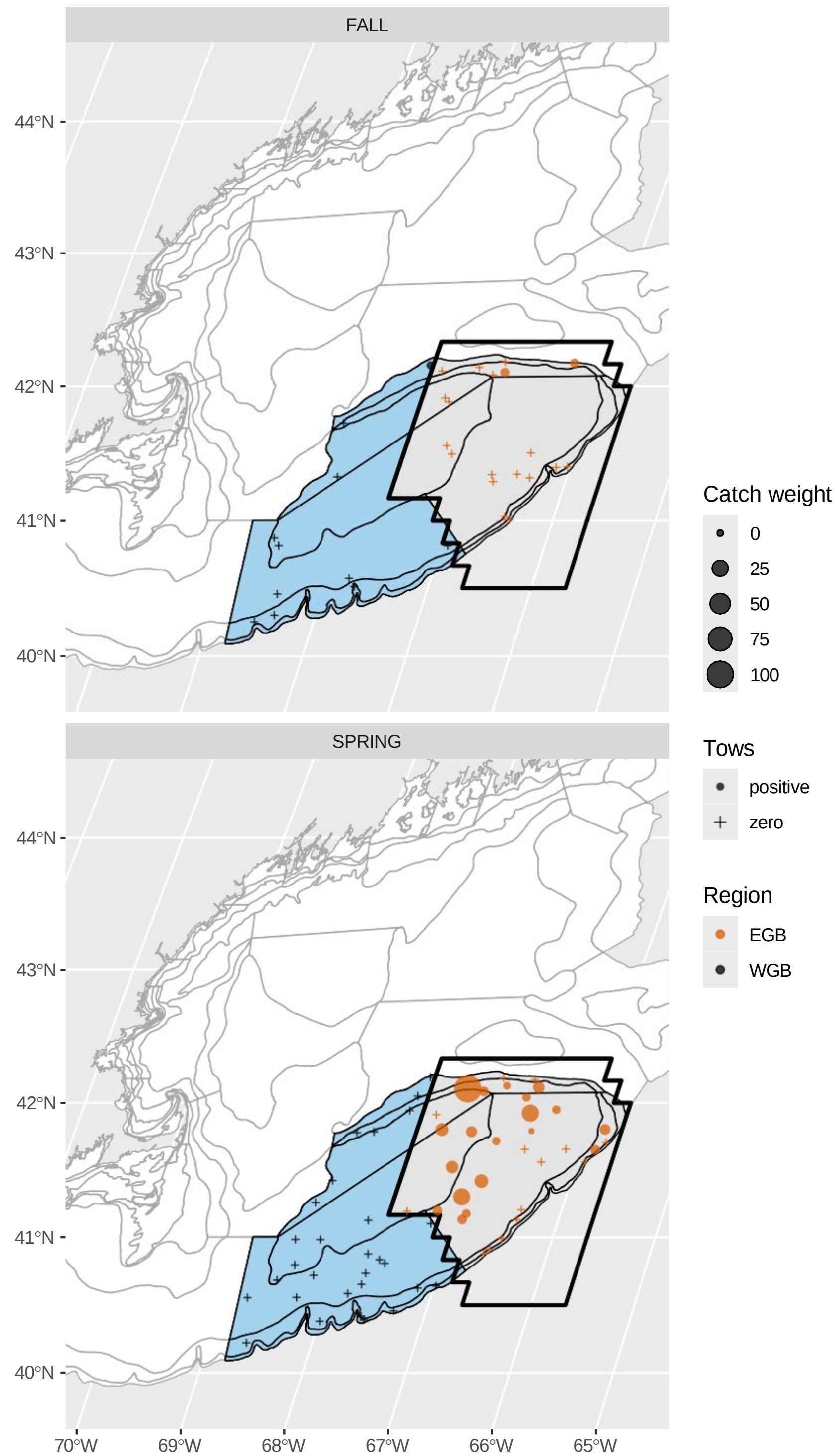

Figure 8: Distribution of 2025 Northeast Fishery Science Center (NEFSC) bottom trawl survey tows for Georges Bank Atlantic cod within Western Georges Bank (blue strata, black points) and Eastern Georges Bank (gray strata, orange points). The Eastern Georges Bank management unit is defined by the thick black line.

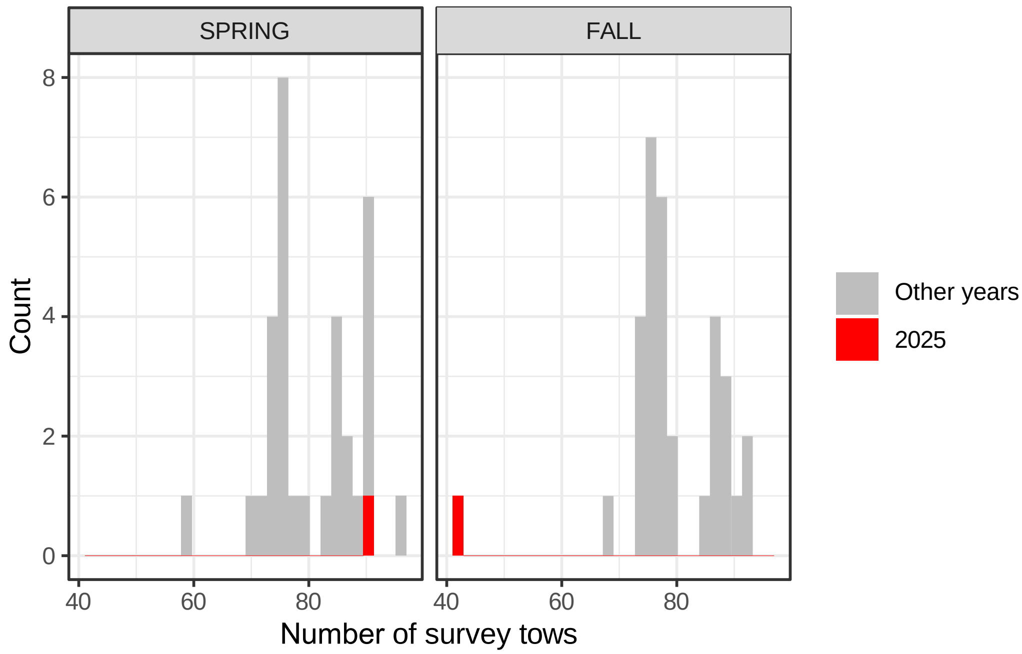

Figure 9: Distribution of completed NEFSC bottom trawl tows in GB haddock stock footprint over time. 2025 sampling completion (highlighted in red) was 99% and 45% of the sampling completed in the prior year (2024) for SPRING and FALL NEFSC surveys respectively.

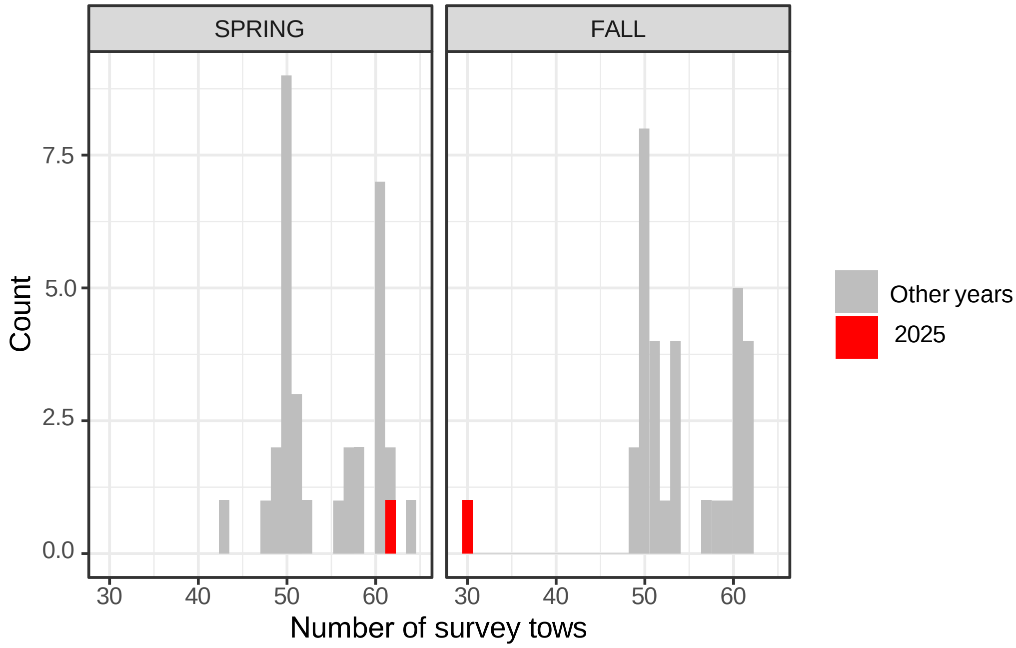

Figure 10: Distribution of completed NEFSC bottom trawl tows in GB Atlantic cod stock footprint over time. 2025 sampling completion (highlighted in red) was 102% and 48% of the sampling completed in the prior year (2024) for SPRING and FALL NEFSC surveys respectively.

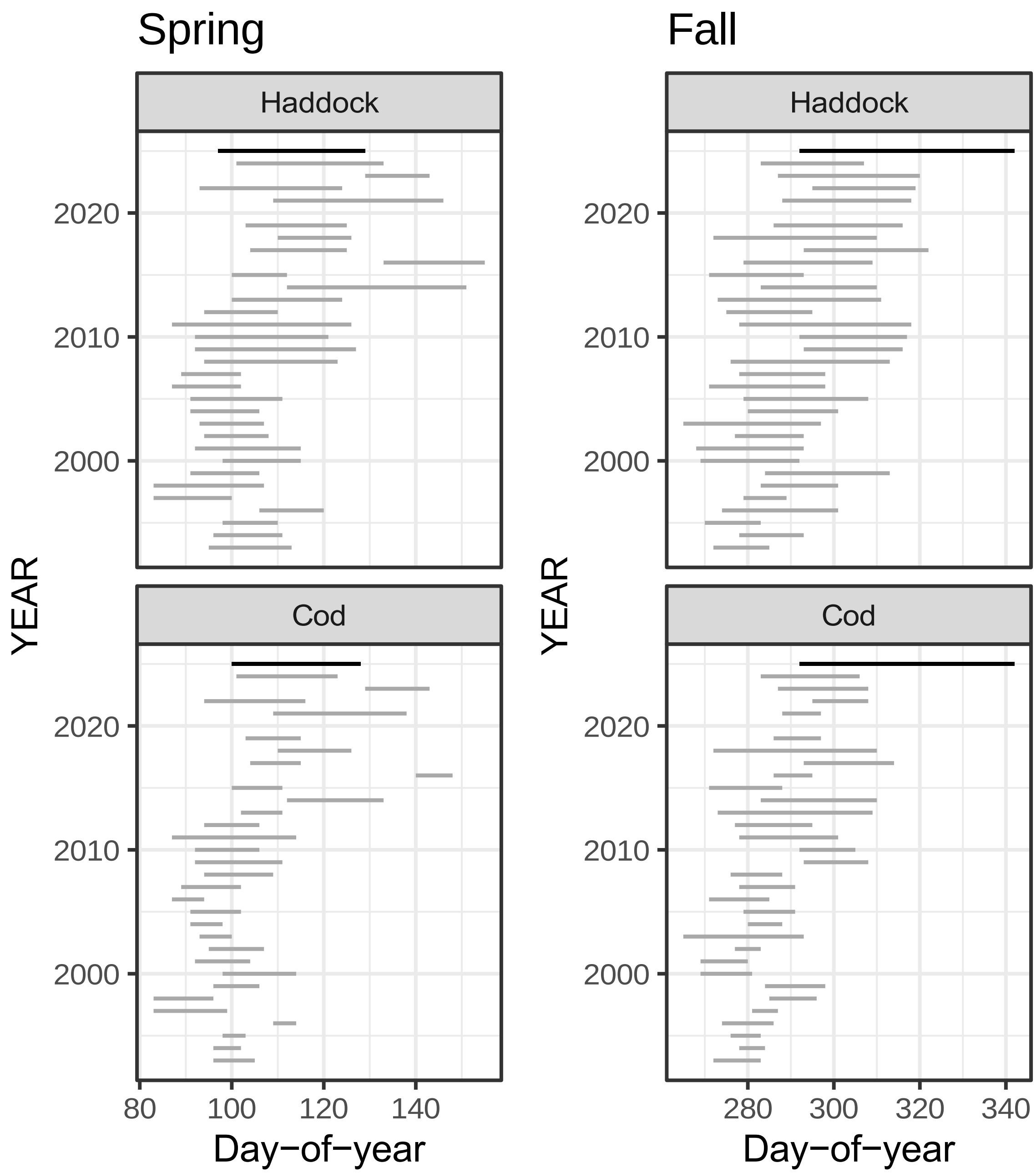

Figure 11: Day-of-year range for NEFSC spring (left) and fall (right) survey tows collected within the US domestic assessment footprint for Georges Bank Atlantic cod (top) and haddock (bottom) for all years used in survey-based distribution calculations (gray bars showing days between first and last survey sample). 2025 sampling day-of-year range is highlighted in black.

Table 1: Area of NEFSC bottom trawl survey strata in Canada EGB, US EGB, and US WGB. Haddock strata that were first incorporated into survey-based distribution calculations during the 2025 management cycle (i.e. were not historically considered in US and Canada resource allocation calculations) are shown in bold.

STRATUM	Survey	Country	Region	Area_nm
13	NMFS	Canada	EGB	0
13	NMFS	US	EGB	0
13	NMFS	US	WGB	2374
14	NMFS	Canada	EGB	0
14	NMFS	US	EGB	0
14	NMFS	US	WGB	656
15	NMFS	Canada	EGB	0
15	NMFS	US	EGB	0
15	NMFS	US	WGB	230
16	NMFS	Canada	EGB	1553
16	NMFS	US	EGB	1427
16	NMFS	US	WGB	0
17	NMFS	Canada	EGB	284
17	NMFS	US	EGB	76
17	NMFS	US	WGB	0
18	NMFS	Canada	EGB	127
18	NMFS	US	EGB	45
18	NMFS	US	WGB	0
19	NMFS	Canada	EGB	0
19	NMFS	US	EGB	1059
19	NMFS	US	WGB	1395
20	NMFS	Canada	EGB	0
20	NMFS	US	EGB	335
20	NMFS	US	WGB	886
21	NMFS	Canada	EGB	210
21	NMFS	US	EGB	78
21	NMFS	US	WGB	136
22	NMFS	Canada	EGB	125
22	NMFS	US	EGB	106
22	NMFS	US	WGB	223
23	**NMFS**	**US**	**EGB**	**0**
23	**NMFS**	**Canada**	**EGB**	**0**
23	**NMFS**	**US**	**WGB**	**1016**

24	**NMFS**	**US**	**EGB**	**0**
24	**NMFS**	**Canada**	**EGB**	**0**
24	**NMFS**	**US**	**WGB**	**2569**
25	**NMFS**	**US**	**EGB**	**0**
25	**NMFS**	**Canada**	**EGB**	**0**
25	**NMFS**	**US**	**WGB**	**390**
29	**NMFS**	**US**	**EGB**	**0**
29	**NMFS**	**Canada**	**EGB**	**0**
29	**NMFS**	**US**	**WGB**	**3245**
30	**NMFS**	**US**	**EGB**	**0**
30	**NMFS**	**Canada**	**EGB**	**0**
30	**NMFS**	**US**	**WGB**	**619**

Table 2: Survey-based distribution results for Georges Bank haddock and Atlantic cod stocks for the 2026 management cycle.

Stock	Region	distribution_result	Terminal Year
TGB Cod	EGB	95	2025
TGB Cod	WGB	5	2025
TGB Haddock	EGB	66	2025
TGB Haddock	WGB	34	2025

5 References

Andrushchenko, I. A., Brooks, E. N., & Way-Nee, E. (2023). *Allocation shares for Canada and the USA of the transboundary resources of Atlantic cod, haddock, and yellowtail flounder on Georges Bank through fishing year 2023.* (Transboundary Resources Assessment Committee Reference Document 2022/01.).

Hart, A. (2026). *2026 Georges Bank resource share allocation for haddock and Atlantic cod.*