

draft working paper for peer review only



Atlantic halibut

2022 Management Track Assessment Report

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National Oceanic and Atmospheric Administration
National Marine Fisheries Service
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Woods Hole, Massachusetts

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This assessment of the Atlantic halibut (*Hippoglossus hippoglossus*) stock is an update of the existing 2019 plan B assessment (Rago, 2018). This assessment updates commercial fishery catch data, commercial and survey indices of abundance, and the First Second Derivative (FSD) model through 2021. Reference points are unknown and have not been updated.

State of Stock: Based on this updated assessment, Atlantic halibut (*Hippoglossus hippoglossus*) stock status cannot be determined analytically due to a lack of biological reference points associated with the FSD method. Biomass (SSB) in 2021 was unknown. The 2021 fully selected fishing mortality was unknown.

Table 1: Catch and status table for Atlantic halibut. All weights are in (mt).

	2014	2015	2016	2017	2018	2019	2020	2021
	<i>Data</i>							
Commercial discards	26	23	31	27	46	75	37	26
Commercial landings	45	62	68	64	54	50	48	39
CA landings	33	30	34	35	46	54	156	120
Catch for Assessment	104	115	133	125	146	178	240	185
	<i>Model Results</i>							
Catch Multiplier	1.02	1.18	1.02	1.02	0.94	0.84	0.92	0.87
Catch Advice	141	106	136	136	128	138	149	220

Table 2: There are no current reference points for Atlantic halibut which is on a 'plan B' assessment that does not allow for the estimation of reference points. Therefore the status of the stock relative to overfishing and overfished status is unknown. Note: based on NOAA policy, the Agency previously decided the stock status was overfished and overfishing not occurring.

	2019	2022
F_{MSY} proxy	NA	
SSB_{MSY} (mt)	NA	
MSY (mt)	NA	
<i>Overfishing</i>	Unknown	Unknown
<i>Overfished</i>	Unknown	Unknown

Projections: Short term projections are not possible using the FSD approach. The FSD approach is based on applying a multiplier to the catch from the previous year and cannot be projected beyond the catch time series. The catch multiplier for 2021 resulting from the FSD model is 0.87 and the estimated catch for 2021 is 185 mt, which results in catch advice of 160 mt for 2022. The FSD model is explained in (Rago, 2018) and additional information is available in a document called 'AtlanticHalibutMTexttras.pdf', both are available at [SASINF](#)

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).

The assessment model (FSD) used for Atlantic halibut is a 'plan B' assessment method. It uses recent trends in 3 abundance indices as well as recent changes in those trends to adjust the previous year's catch. For example, if the abundance indices are increasing, the catch will be adjusted up. If that increasing trend in abundance is increasing in magnitude over time, the adjustment to catch will be commensurately higher. The FSD method was rigorously tested in simulation (Rago, 2018) and should perform well for Atlantic halibut in the US. Sources of uncertainty in the FSD method include process error related to potential changes in stock

productivity over time, the choice of relative weights for the control parameters used in the model and the lag in information inherent in using change in trend as one of the control parameters, which requires dropping one data point from the regression fit to generate a comparison. Other sources of uncertainty include the observation error in the abundance indices. The FSD method also relies on the assumption that abundance can be described with linear dynamics, but that assumption should be relatively unimportant if the stock abundance is well below its theoretical carrying capacity.

- Does this assessment model have a retrospective pattern? If so, is the pattern minor, or major?

The FSD model does not support retrospective analysis.

- Based on this stock assessment, are population projections well determined or uncertain?

The FSD model provides catch advice in the year following the terminal year of the input data. It is not intended to project further ahead than one year. It is possible however to assume that catch in the year following the terminal year will equal the catch advice from the FSD model and that the population abundance indices will continue to follow the same trend and that the change in trend will be identical to the previous five years of data. These assumptions allow for a projection any number of years into the future. The relative quality of these projections degrades as the indices of abundance depart from the behavior of the most recent data available to the model.

- 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.

The loss of a survey data point in 2020 (Covid) resulted in the need to interpolate one survey index observation. The survey index value used in 2020 was equal to the average of the 2019 and 2021 values.

Catch efficiency studies and data are not used for the Atlantic halibut assessment because not enough Atlantic halibut are caught to provide a comparison between the gear types and produce estimate of catchability.

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

Stock status cannot be determined and remains unchanged. The stock is likely depleted relative to its virgin biomass based on estimates of historical landings, which were much higher than current landings. Rago in his 2018 report argued that overfishing was unlikely because the catch multiplier estimated in the FSD model had been greater than one for several years. The catch multiplier has now been less than one for four years, which would be consistent with recent overfishing. There is however, no way to determine stock status without reference points.

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

The Atlantic halibut assessment could be improved with more precise fishery independent indices of abundance, additional age and length composition data, and a better understanding of stock structure. These would allow for alternative assessment methods, and potential development of a more sophisticated stock assessment model.

- Are there other important issues?

Canadian catch in 2020 and 2021 in area 5Z (eastern Georges Bank) was 4 times higher than it has been in at least the last 20 years (see [SASINF](#)). Because this area is included in the calculation of catch in the FSD model, the recommended catch output (catch advice) for 2021 and 2022 is at or above status quo (circa 2017 - 2019). This result is counter to expectation given that the catch multiplier for each year since 2017 indicates a reduction in recommended catch is warranted (Table 1). Managers should be aware of this issue when recommending catch levels for Atlantic halibut.

References:

Rago, P.J. 2018. Halibut Assessment Report for 2017 for New England Fishery Management Council, January 24, 2018. Unpublished, online at [SASINF](#)

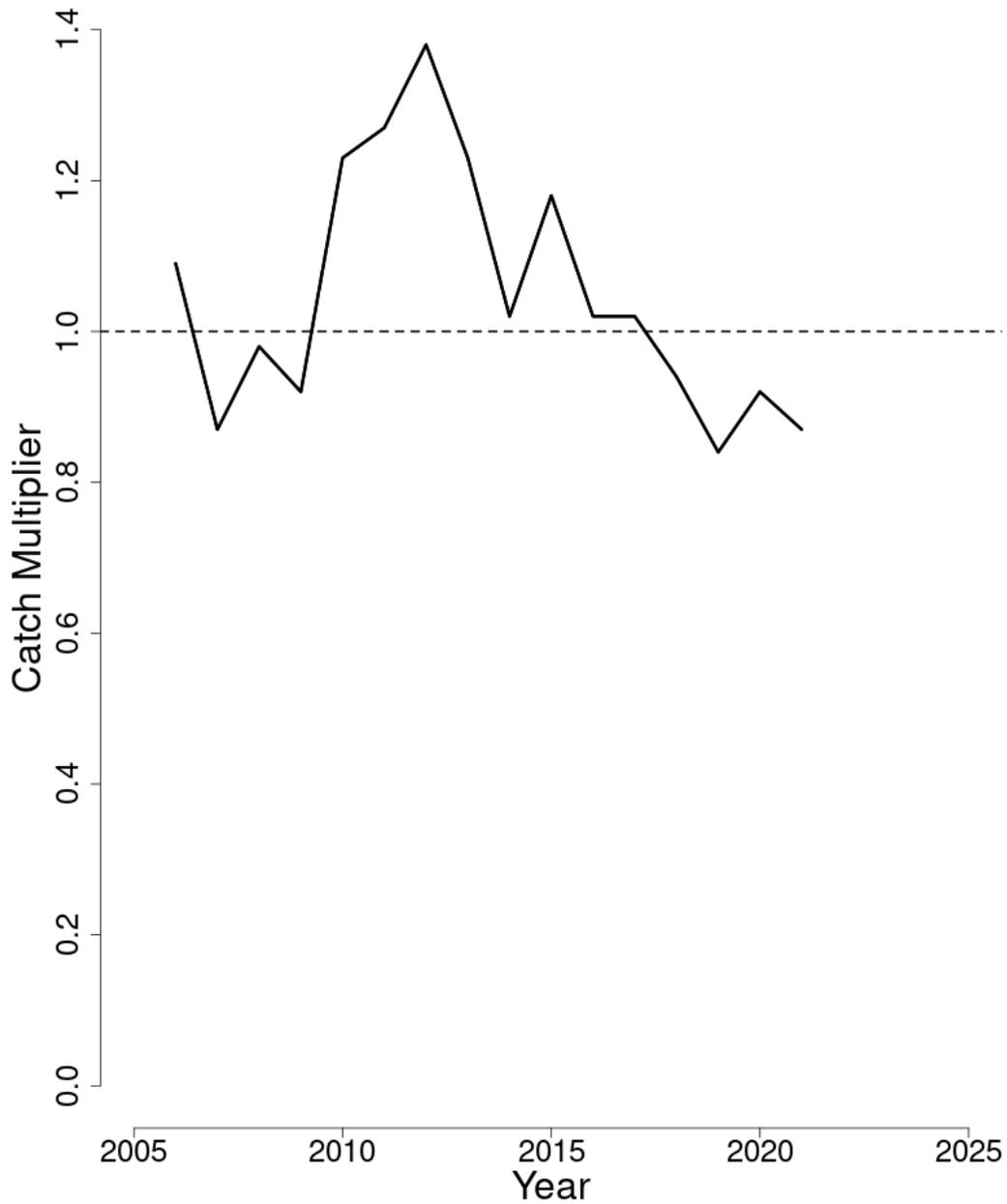


Figure 1: The catch multiplier resulting from the FSD model for Atlantic halibut between 2006 and 2022 from the current (solid line) assessment. A dashed line at 1 is added for reference.

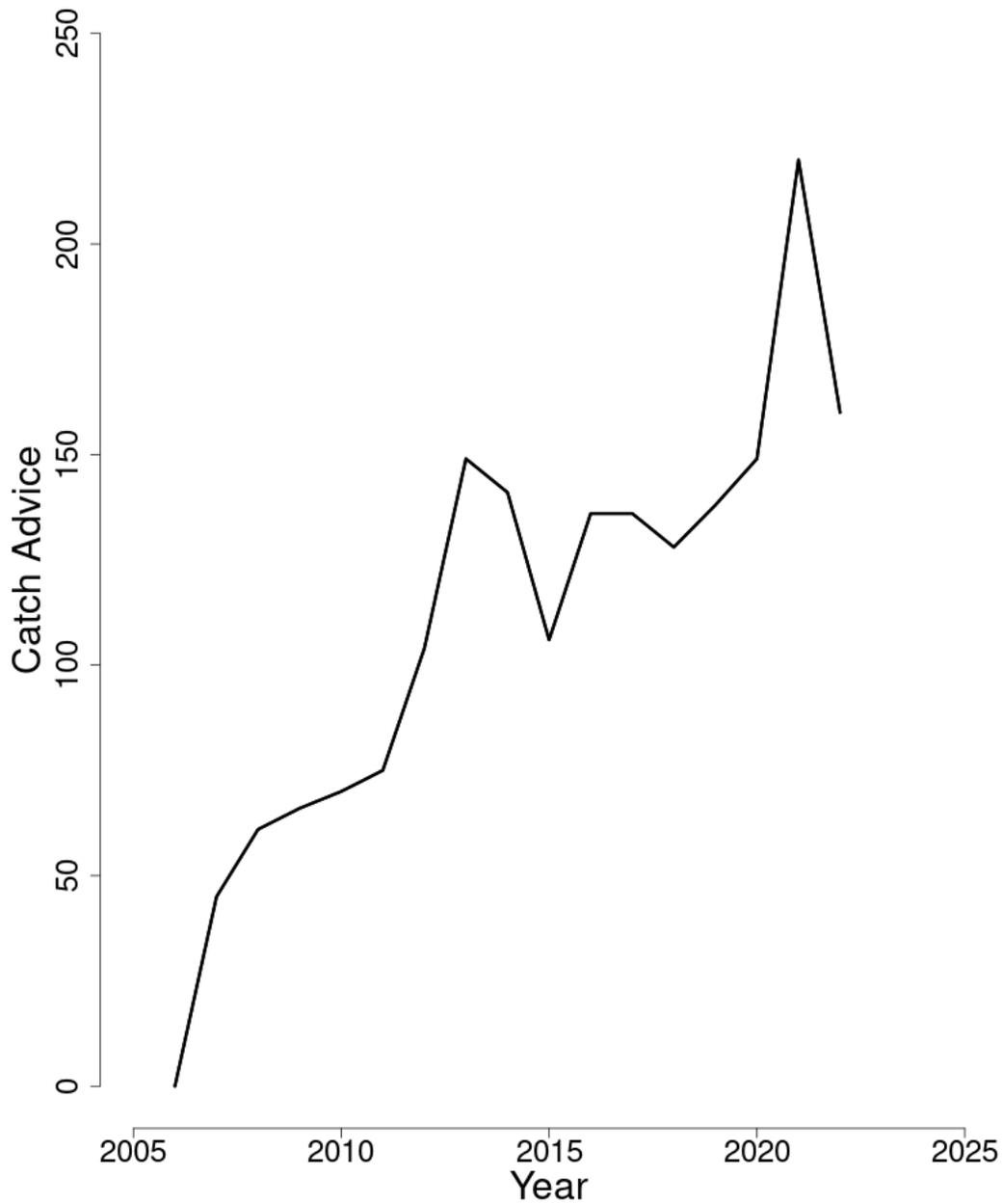


Figure 2: The catch advice resulting from multiplying catch and the catch multiplier from the FSD model for Atlantic halibut between 2006 and 2022 from the current assessment.

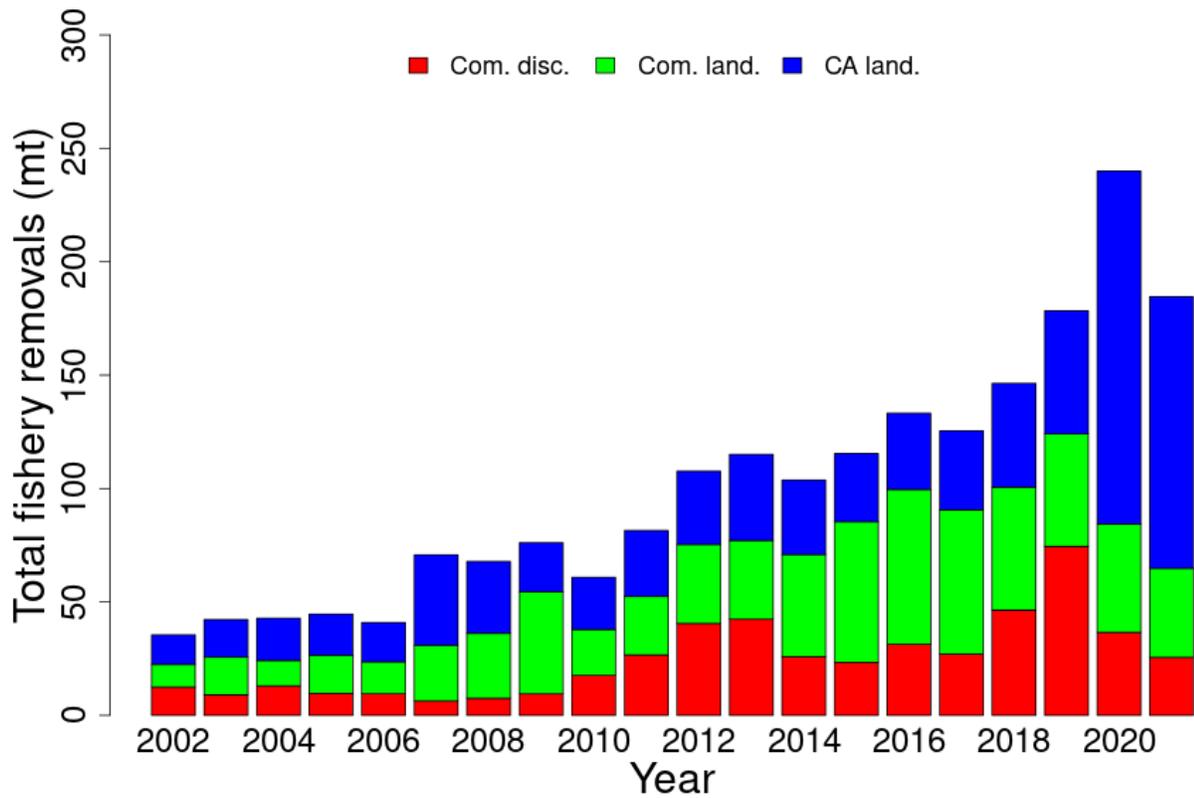


Figure 3: Total catch of Atlantic halibut between 2006 and 2022 by disposition (landings and discards).

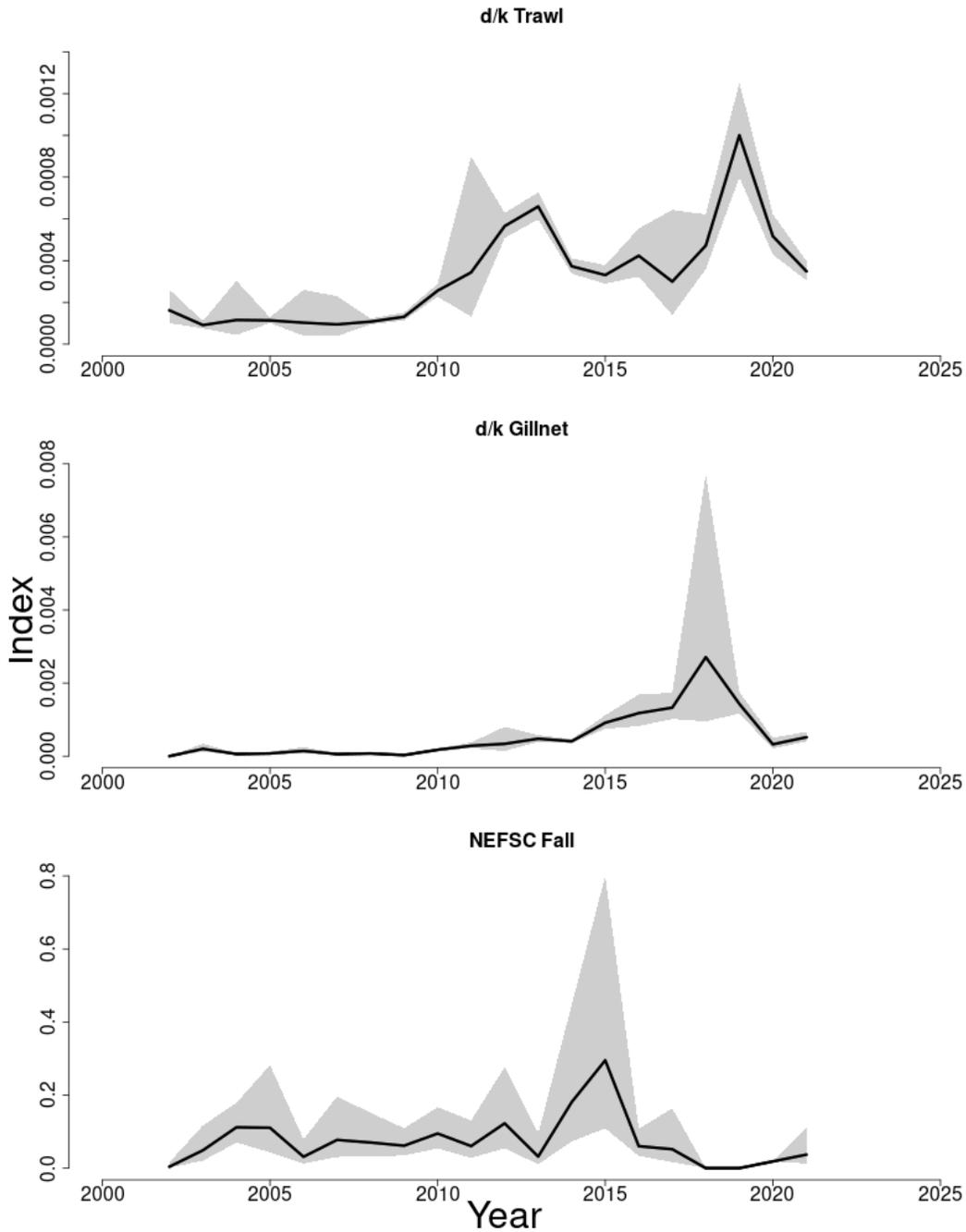


Figure 4: Indices of biomass for the Atlantic halibut between 2002 and 2021 for the Northeast Fisheries Science Center (NEFSC) fall bottom trawl survey and 2 discard ratio estimators. Discard mortality is assumed to be 0.76 for trawl gear and 0.3 for gillnet gear. The 2020 NEFSC fall bottom trawl value was interpolated as the mean of the 2019 and 2021 values. The 90% lognormal confidence intervals are shown.