draft working paper for peer review only

Atlantic halibut

2015 Assessment Update Report

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

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This assessment of the Atlantic halibut (Hippoglossus hippoglossus) stock is an update of the existing 2012 benchmark assessment (NEFSC 2010) and the last update assessment (NEFSC 2012). This assessment updates commercial fishery catch data, research survey indices of abundance, and the replacement yield assessment model through 2014. Additionally, stock projections have been updated through 2018. Reference points have not been updated.

State of Stock: Based on this updated assessment, Atlantic halibut (*Hippoglossus hippoglossus*) stock is unknown and unknown (Figures 1-2). Biomass (SSB) in 2014 was estimated to be 96,464 (mt) which is 199% of the biomass target (SSB_{MSY} *proxy* = 48,509; Figure 1). The 2014 fully selected fishing mortality was estimated to be 0.001 which is 1% of the overfishing threshold proxy (F_{MSY} *proxy* = 0.073; Figure 2).

Table 1: Catch and status table for Atlantic halibut. All weights are in (mt) and F_{Full} is the fishing mortality on fully selected ages.

	2007	2008	2009	2010	2011	2012	2013	2014
				Data				
Commercial landings	25	29	45	20	26	35	35	45
Commercial discards	30	34	54	24	31	42	42	54
CA landings	40	32	22	23	29	32	38	33
Catch for Assessment	95	96	121	67	86	109	115	132
				Model Results				
Biomass	96,641	96,607	96,578	96,527	96,538	96,528	96,497	96,464
F_{Full}	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001

Table 2: An F_{MSY} *proxy* ($F_{0.1}$) was used for the overfishing threshold. The biomass target and threshold were based on the B_{MSY} *proxy* (estimated carrying capacity), B_{Target}= B_{MSY} *proxy* and $B_{Threshold}$= $\frac{1}{2}$ B_{MSY} *proxy*.

	2012	Current
F_{MSY} *proxy*	0.073	0.073
SSB_{MSY} (mt)	48,509	48,509
MSY (mt)	3,546	3,546
Overfishing	No	Unknown
Overfished	Yes	Unknown

Projections: Short term projections were based on a constant F = F_{MSY} *proxy* = 0.073. Projections use the assessment model (replacement yield) and maintain all other model assumptions.

Table 3: Short term projections of catch and biomass for Atlantic halibut based on a harvest scenario of fishing at F_{MSY} *proxy*=0.073 between 2016 and 2018.

Year	Catch (mt)	SSB (mt)	F_{Full}
2015	124	96147	0.001
2016	7025	96156	0.073
2017	6521	89262	0.073
2018	6121	83788	0.073

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 used for Atlantic halibut is highly uncertain. It estimates one parameter, the initial biomass, and proceeds deterministically from 1800 to 2014. The model is highly sensitive to the initial biomass. The model is tuned to the survey index, which is inefficient for Atlantic halibut, catches very few animals and is therefore noisy. The RYM model assumes no immigration or emmigration and that the population both began, and tends to, equilibrium. These assumptions are unlikely to be true for Atlantic halibut. The model estimates a biomass that is approximately equal to unfished biomass, which is not credible. Catch has been very low for at least 100 years relative to the landings reported early in the time series, despite a strong market and high value relative to other groundfish.

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

  This assessment has no retrospective pattern (Mohn's ρ<0.001).

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

  Population projections for Atlantic halibut are uncertain because biomass cannot be reasonably determined using the current assessment 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 catch data were slightly altered due to the exclusion of catch made in international waters and the re-estiamtion of average discard ratio after 1998 (due to the incorporation of more years of data).

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

  The overfishing and overfished status of Atlantic halibut cannot be determined using the current assessment. This occurred because diagnostics showed the model was unreliable.

- 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 additional studies on stock structure, additional age and length data, a more precise and accurrate survey, and an investigation of alternate assessment models.

- Are there other important issues?

  Atlantic halibut are clearly depleted relative to their unfished state. Catches have been far below historical landings for more than 100 years, despite a lack of regulation before 1999 and a strong commercial market. The current assessment model implies that Atlantic halibut is near or above its unfished biomass and could support removals commensurate with MSY. The current assessment should probably not be used to inform management decisions.

References:

Northeast Fisheries Science Center. 2012. Assessment or Data Updates of 13 Northeast Groundfish Stocks through 2010. US Dept Commer, Northeast Fish Sci Cent Ref Doc. 12-06; 789 p. Available from: National Marine Fisheries Service, 166 Water Street, Woods Hole, MA 02543-1026, or online at http://nefsc.noaa.gov/publications/

Col, L.A., Legault, C.M. 2009. The 2008 Assessment of Atlantic halibut in the Gulf of Maine Georges Bank region. US Dept Commer, Northeast Fish Sci Cent Ref Doc. 09-08; 39 p. Available from: National Marine Fisheries Service, 166 Water Street, Woods Hole, MA 02543-1026, or online at http://www.nefsc.noaa.gov/nefsc/publications/

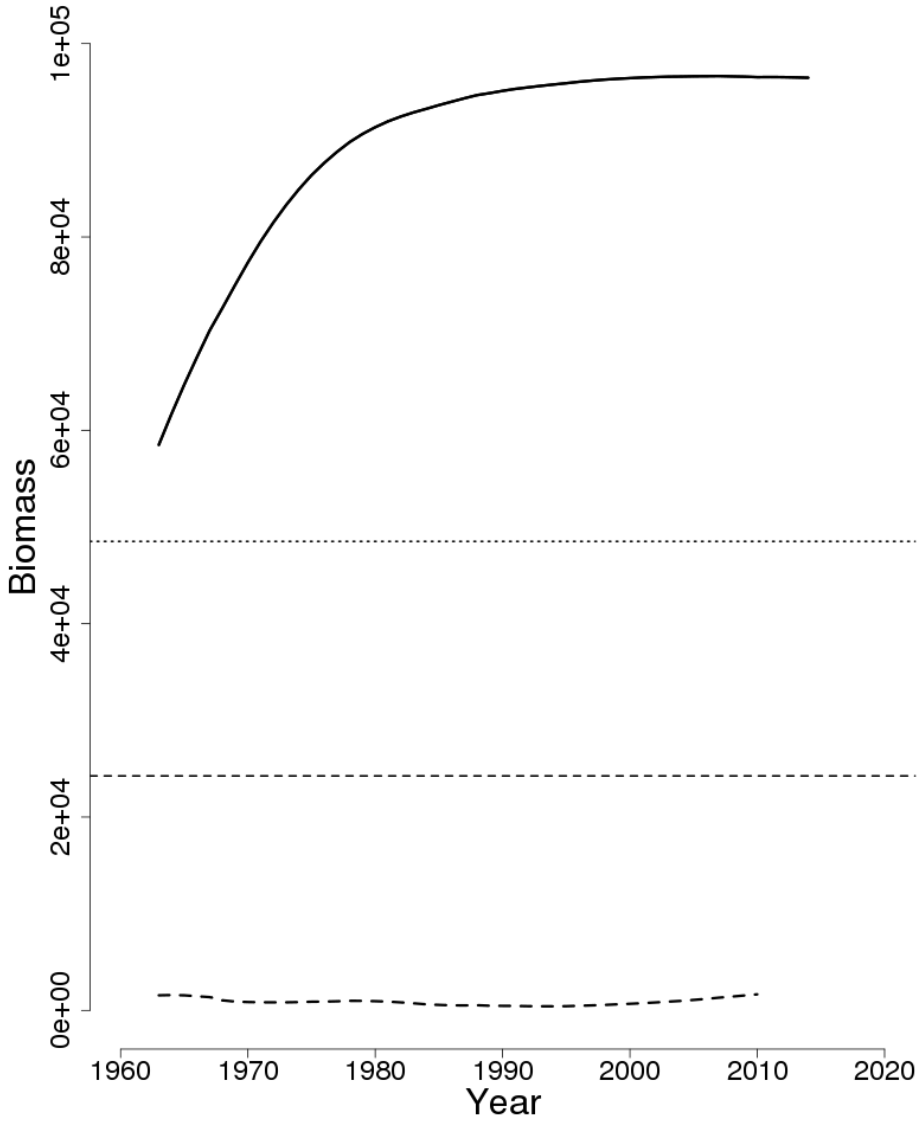

Figure 1: Estimated trends in the biomass of Atlantic halibut between 1963 and 2014 from the current (solid line) and previous (dashed line) assessment and the corresponding $B_{Threshold}$= $\frac{1}{2}$ B_{MSY} *proxy*(horizontal dashed line) as well as B_{Target} (B_{MSY} *proxy*; horizontal dotted line) based on the 2015 assessment.

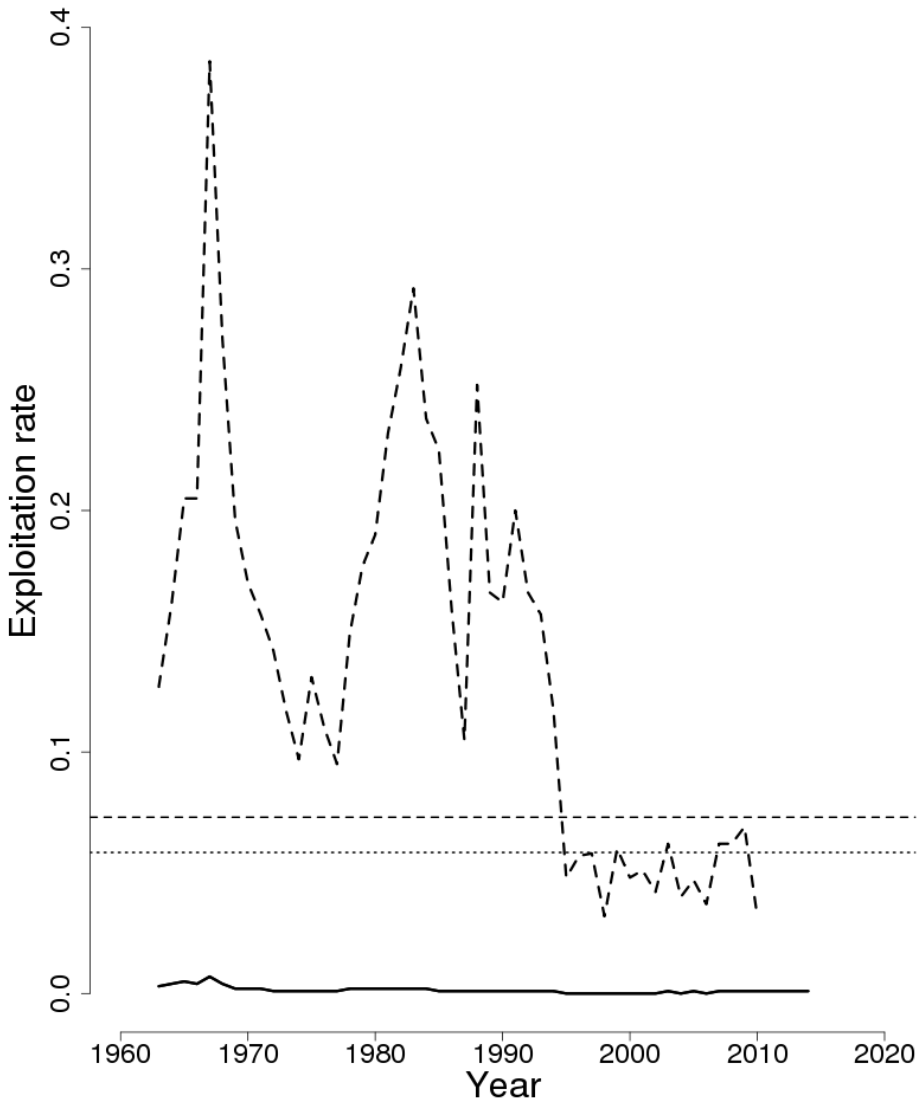

Figure 2: Estimated trends in the fully selected fishing mortality (F_{Full}) of Atlantic halibut between 1963 and 2014 from the current (solid line) and previous (dashed line) assessment and the corresponding $F_{Threshold}$ (0.073; horizontal dashed line) as well as F_{Target} (0.8 * F_{MSY} *proxy*; dotted line) based on the 2015 assessment.

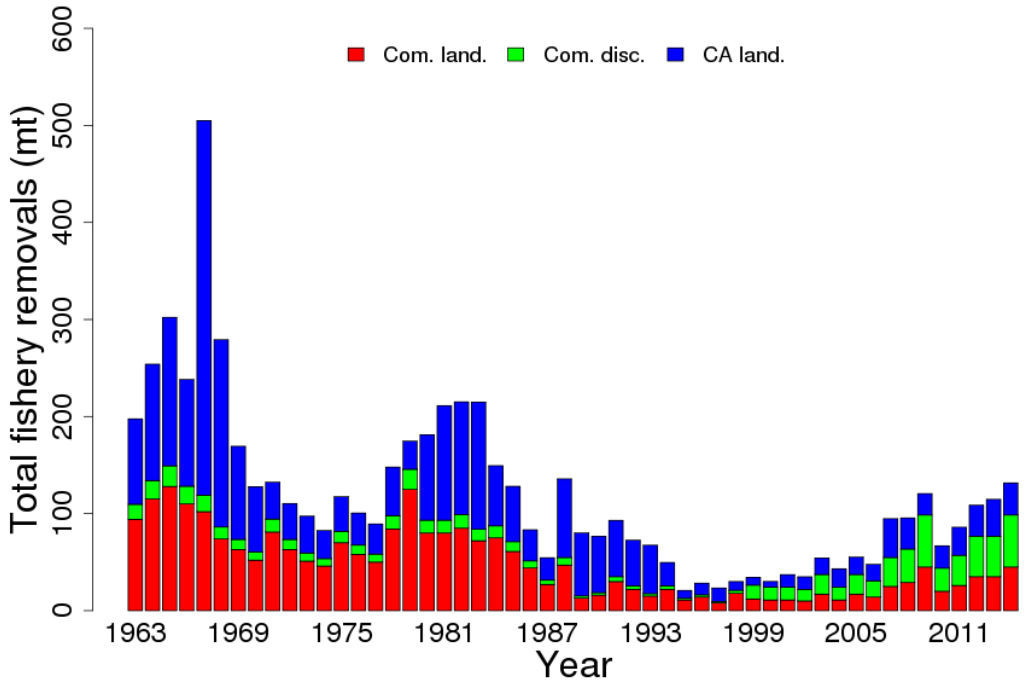

Figure 3: Total catch of Atlantic halibut between 1963 and 2014 by disposition (landings and discards).

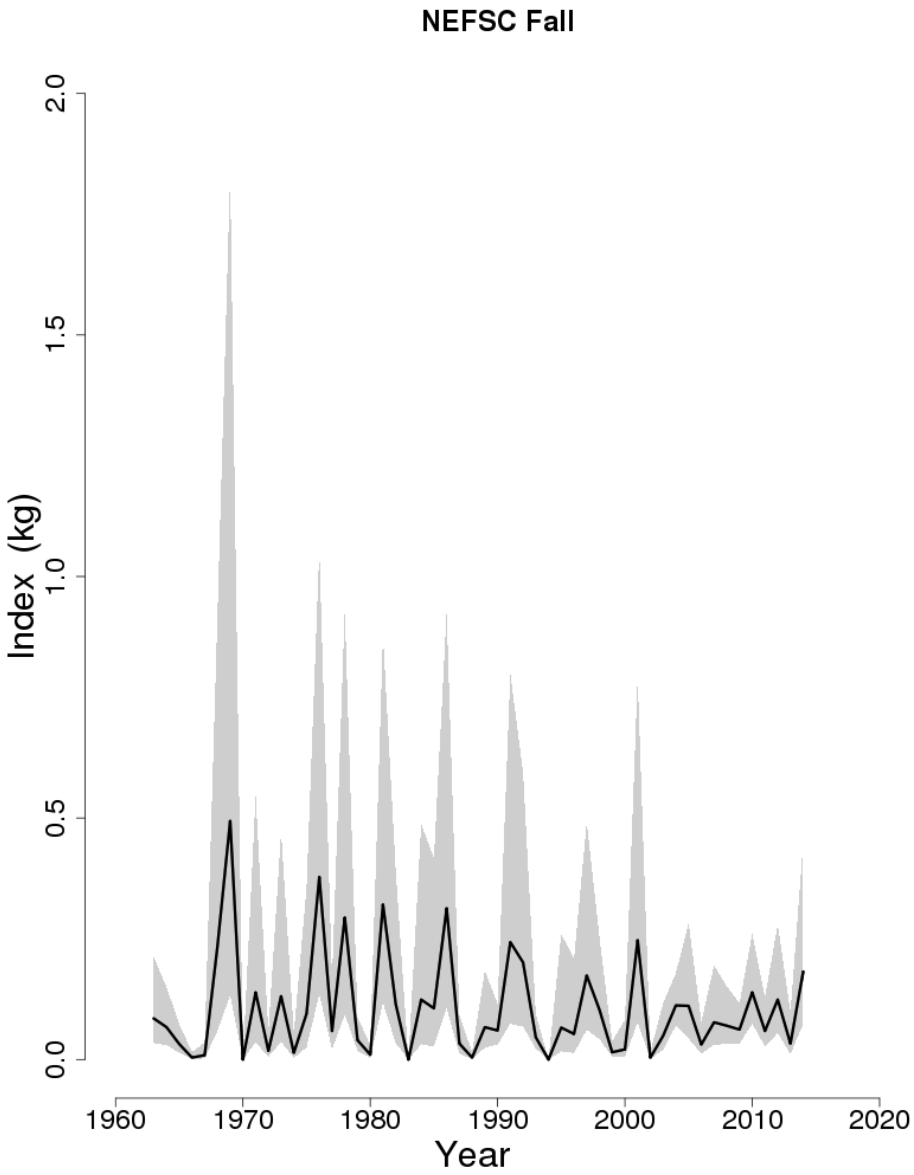

Figure 4: Indices of biomass for the Atlantic halibut between 1963 and 2014 for the Northeast Fisheries Science Center (NEFSC) fall bottom trawl survey. The 90% lognormal confidence intervals are shown.