draft working paper for peer review only

Gulf of Maine haddock

2015 Assessment Update Report

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

Compiled September 2015

This assessment of the Gulf of Maine haddock (Melanogrammus aeglefinus) stock is an operational update of the existing 2014 benchmark ASAP assessment (NEFSC 2014). Based on the previous assessment, the stock was not overfished, and overfishing was not ocurring. This assessment updates commercial fishery catch data, research survey indices of abundance, and the analytical ASAP assessment models and reference points through 2014. Additionally, stock projections have been updated through 2018

State of Stock: Based on this updated assessment, the Gulf of Maine haddock (*Melanogrammus aeglefinus*) stock is not overfished and overfishing is not occurring (Figures 1-2). Spawning stock biomass (SSB) in 2014 was estimated to be 10,325 (mt) which is 223% of the biomass target (SSB_{MSY} *proxy* = 4,623; Figure 1). The 2014 fully selected fishing mortality was estimated to be 0.257 which is 55% of the overfishing threshold proxy (F_{MSY} *proxy* = 0.468; Figure 2).

Table 1: Catch and status table for Gulf of Maine haddock. All weights are in (mt) recruitment is in (000s) and F_{Full} is the fully selected fishing mortality. Model results are from the current updated ASAP assessment.

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
					Data					
Recreational discards	36	66	46	72	24	19	11	54	250	371
Recreational landings	538	447	573	537	409	314	229	251	299	314
Commercial discards	25	32	47	10	12	3	6	18	32	22
Commercial landings	978	622	678	543	500	623	499	417	212	314
Foreign landings	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Catch for Assessment	1,577	1,167	1,343	1,162	946	958	744	739	793	1,021
					Model Results					
Spawning Stock Biomass	8,848	8,219	7,271	6,369	5,735	4,877	4,086	4,551	6,907	10,325
F_{Full}	0.264	0.226	0.322	0.298	0.247	0.287	0.26	0.337	0.296	0.257
Recruits $age1$	451	1,325	1,541	279	438	1,345	11,547	3,930	18,186	26,457

Table 2: Comparison of reference points estimated in an earlier assessment and from the current assessment update. An $F_{40\%}$ proxy was used for the overfishing threshold and was based on long-term stochastic projections.

	2014	Current
F_{MSY} *proxy*	0.46	0.468 (0.391 - 0.547)
SSB_{MSY} (mt)	4,108	4,623 (2,036 - 9,283)
MSY (mt)	955	1,083 (489 - 2,148)
Median recruits (age 1) (000s)	1,121	1,335
Overfishing	No	No
Overfished	No	No

Projections: Short term projections of median total fishery yield and spawning stock biomass

for Gulf of Maine haddock were conducted based on a harvest scenario of fishing at the FMSY proxy between 2016 and 2018. Catch in 2015 has been estimated at 885 mt. Recruitment was sampled from a cumulative distribution function of recruitment estimates from ASAP age-1 recruitment estimates from 1977-2012. The age-1 estimate in 2015 was generated from the geometric mean of the 1977-2014 recruitment series. The annual fishery selectivity, maturity ogive, and mean weights at age used in the projections were estimated from the most recent 5 year averages; retrospective adjustments were not applied in the projections.

Table 3: Short term projections of total fishery catch and spawning stock biomass for Gulf of Maine haddock based on a harvest scenario of fishing at F_{MSY} *proxy* between 2016 and 2018. Catch in 2015 was assumed to be 885 (mt).

Year	Catch (mt)	SSB (mt)	F_{Full}
2015	885	18,026	0.131
2016	4,717	25,352	0.468
2017	5,614	24,623	0.468
2018	5,642	20,371	0.468

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 largest source of uncertainty in the assessment is the estimated size of the 2012 and 2013 yearclasses. Based on the estimated selectivity patterns, these year classes are projected to be 30% selected to the fishery in 2016 and 2017 respectively. However, recent changes to the commercial and recreational minimum retention size may result in these year classes recruiting to the fishery sooner than projected.

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

  This assessment does not exhibit a retrospective pattern. Mohn's rho values on SSB (-0.04) and F (0.03) are small.

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

  Population projections for Gulf of Maine haddock, are reasonably well determined. The projected boimass from the last assessment is below the confidence bounds of the biomass estimated in the current assessment; however, this is primarily due to the positive rescaling of the population size that occured from turning the ASAP model likelihood constants option off (see below).

- 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.

  Recreational catch estimates from 2004-2014 were re-estimated as part of this update to account for updates to the MRIP data. Additionally, the ASAP model was revised by turning

the likelihood constants off; sensitivity runs on SAW/SARC 59 model suggest minor positive rescaling of recruitment and SSB, negative rescaling of F.

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

  There has been no change in stock status since the previous SAW/SARC 59 assessment (2014) relative to estimated biomass.

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

  Currently the assessment assumes 50% survival of haddock discarded in the recreational fishery. Directed field research would improve this estimate.

- Are there other important issues?

  None.

References:

Northeast Fisheries Science Center. 2014. 59^{th} Northeast Regional Stock Assessment Workshop (59^{th} SAW) Assessment Report. US Dept Commer, Northeast Fish Sci Cent Ref Doc. 14-09; 782 p. Available from: National Marine Fisheries Service, 166 Water Street, Woods Hole, MA 02543-1026

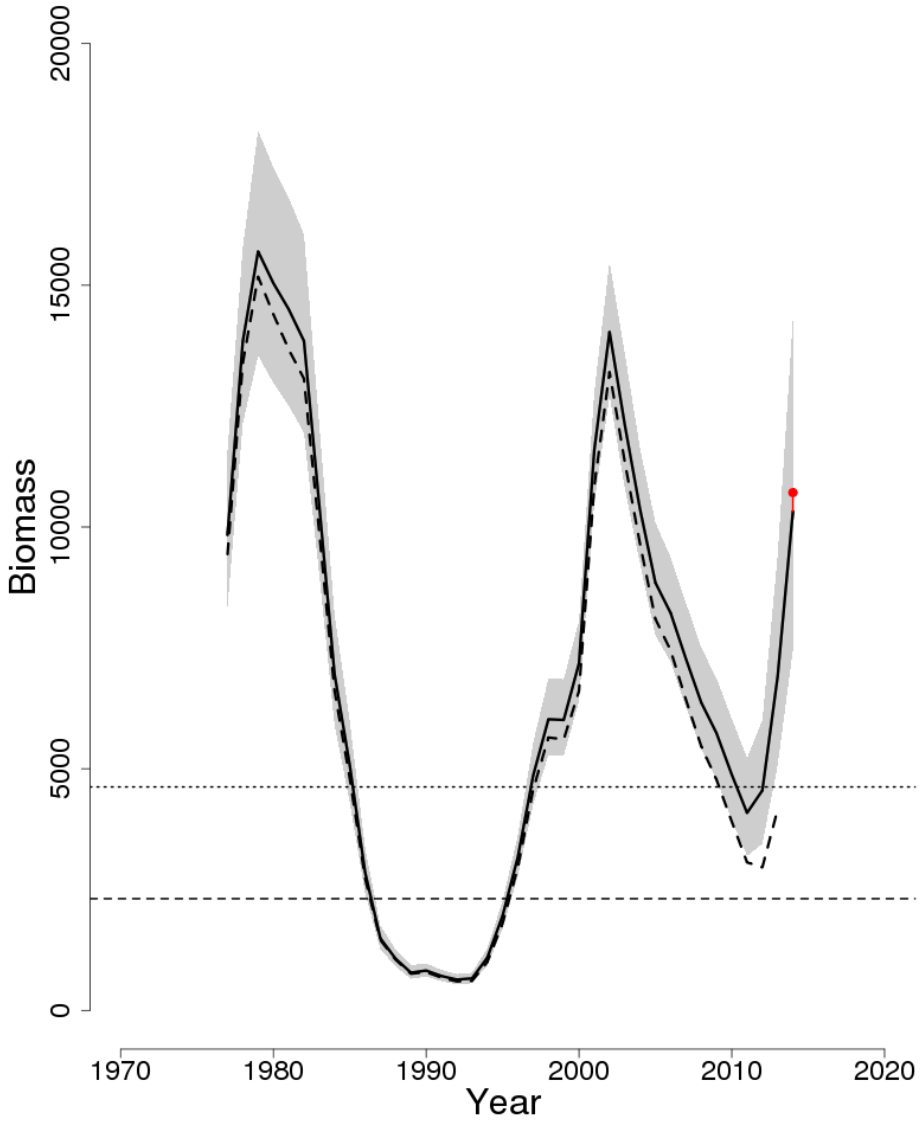

Figure 1: Trends in spawning stock biomass of Gulf of Maine haddock between 1977 and 2014 from the current (solid line) and previous (dashed line) assessment and the corresponding $SSB_{Threshold}$ ($\frac{1}{2}$ SSB_{MSY} *proxy*; horizontal dashed line) as well as SSB_{Target} (SSB_{MSY} *proxy*; horizontal dotted line) based on the 2015 assessment. Biomass was adjusted for a retrospective pattern and the adjustment is shown in red. The approximate 90% lognormal confidence intervals are shown.

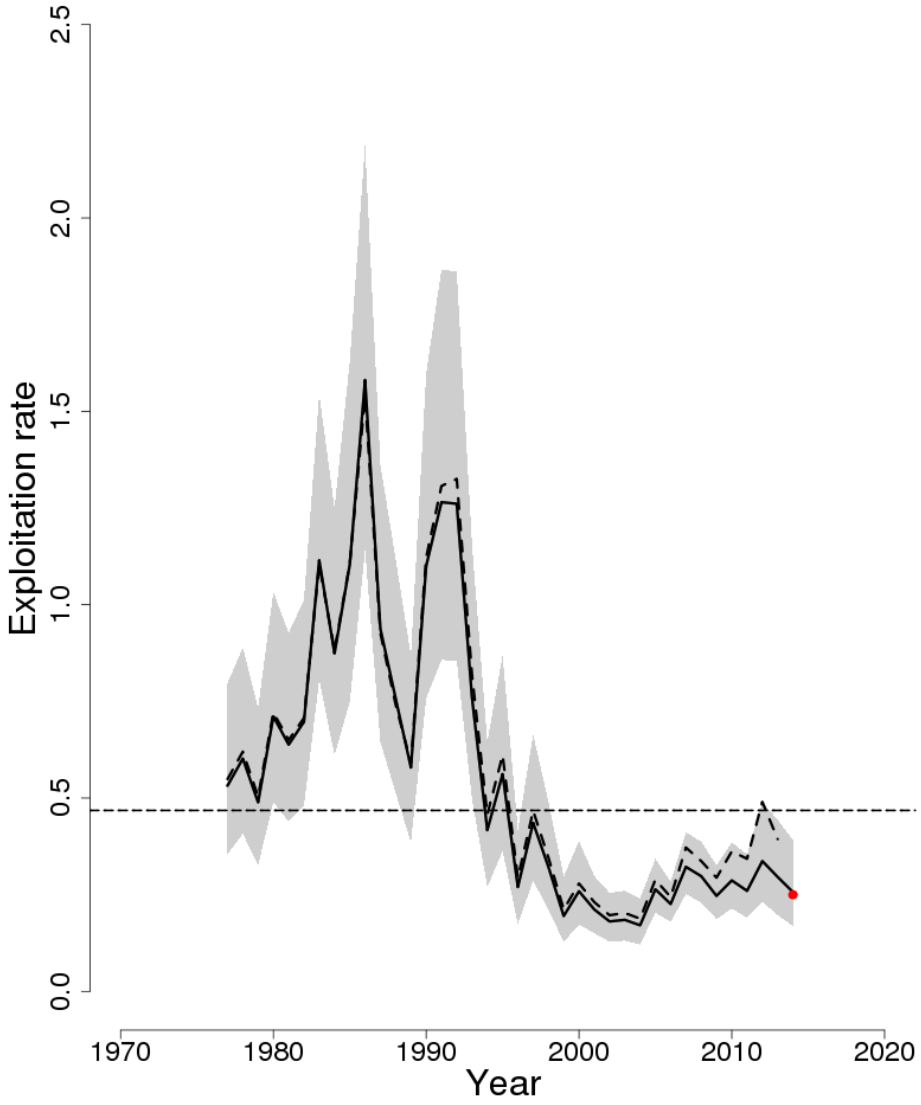

Figure 2: Trends in the fully selected fishing mortality (F_{Full}) of Gulf of Maine haddock between 1977 and 2014 from the current (solid line) and previous (dashed line) assessment and the corresponding $F_{Threshold}$ (F_{MSY} *proxy*=0.468; horizontal dashed line) from the 2015 assessment model. F_{Full} was adjusted for a retrospective pattern and the adjustment is shown in red. The approximate 90% lognormal confidence intervals are shown.

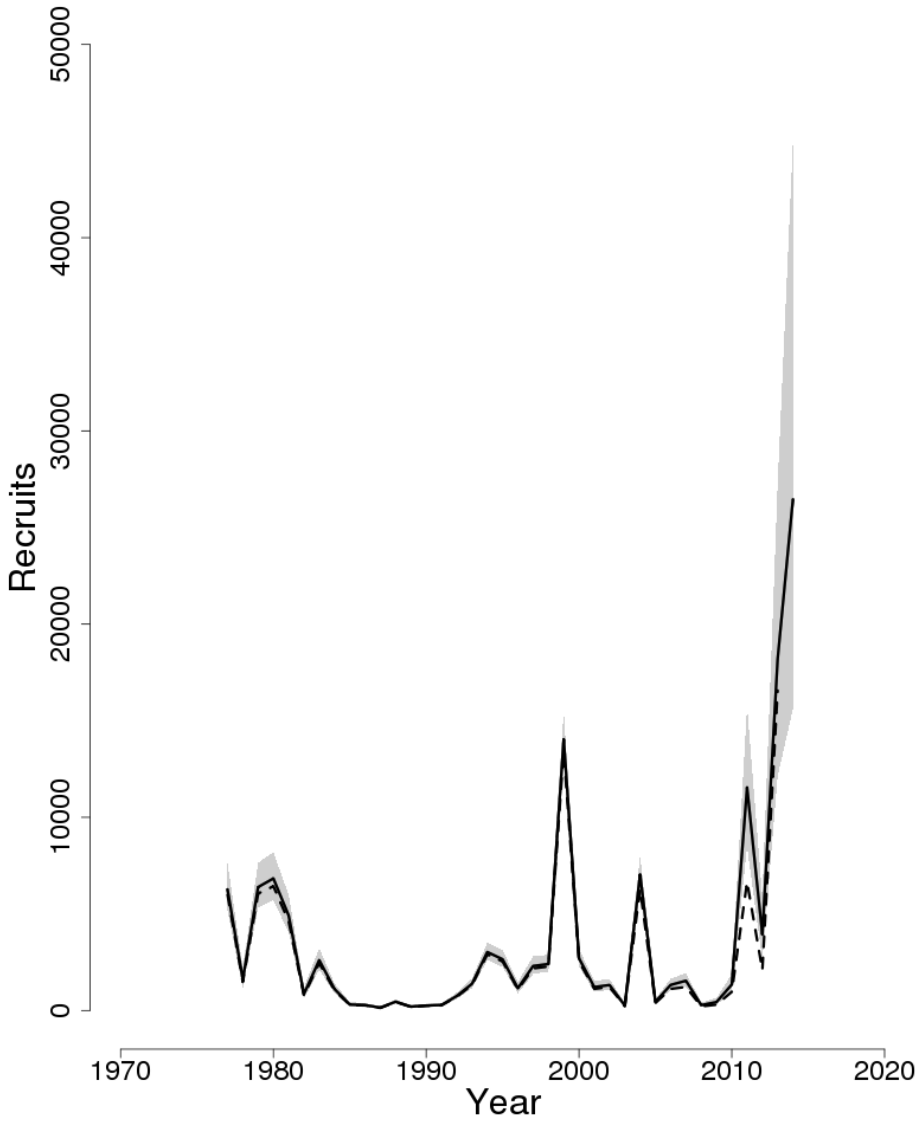

Figure 3: Trends in Recruits (age 1) (000s) of Gulf of Maine haddock between 1977 and 2014 from the current (solid line) and previous (dashed line) assessment. The approximate 90% lognormal confidence intervals are shown.

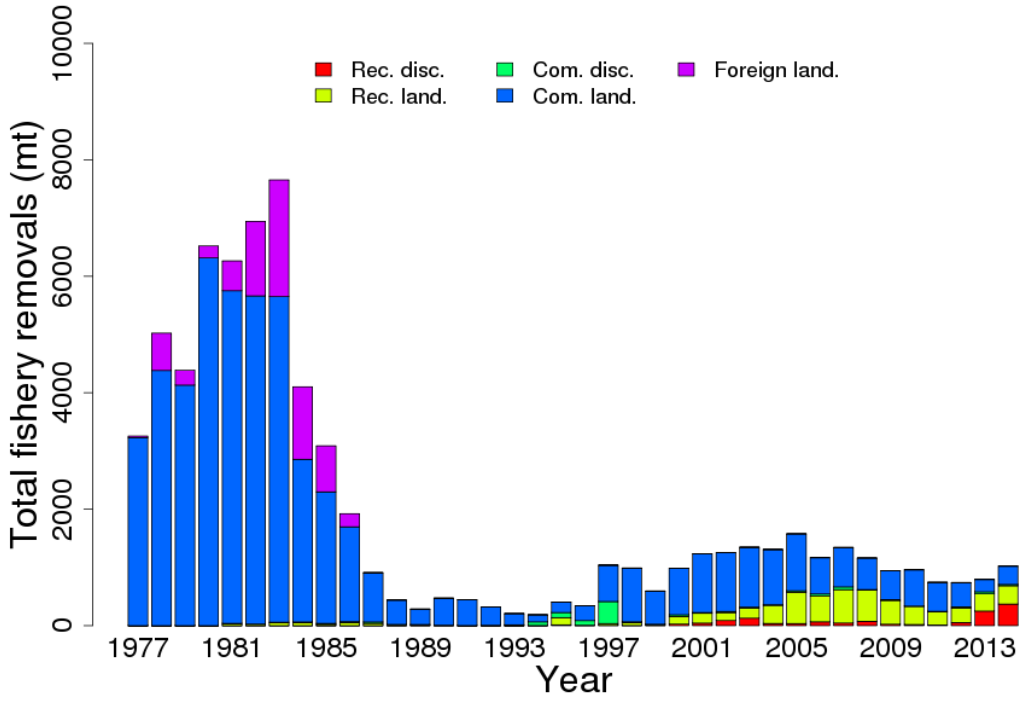

Figure 4: Total catch of Gulf of Maine haddock between 1977 and 2014 by fleet (commercial, recreational, or foreign) and disposition (landings and discards).

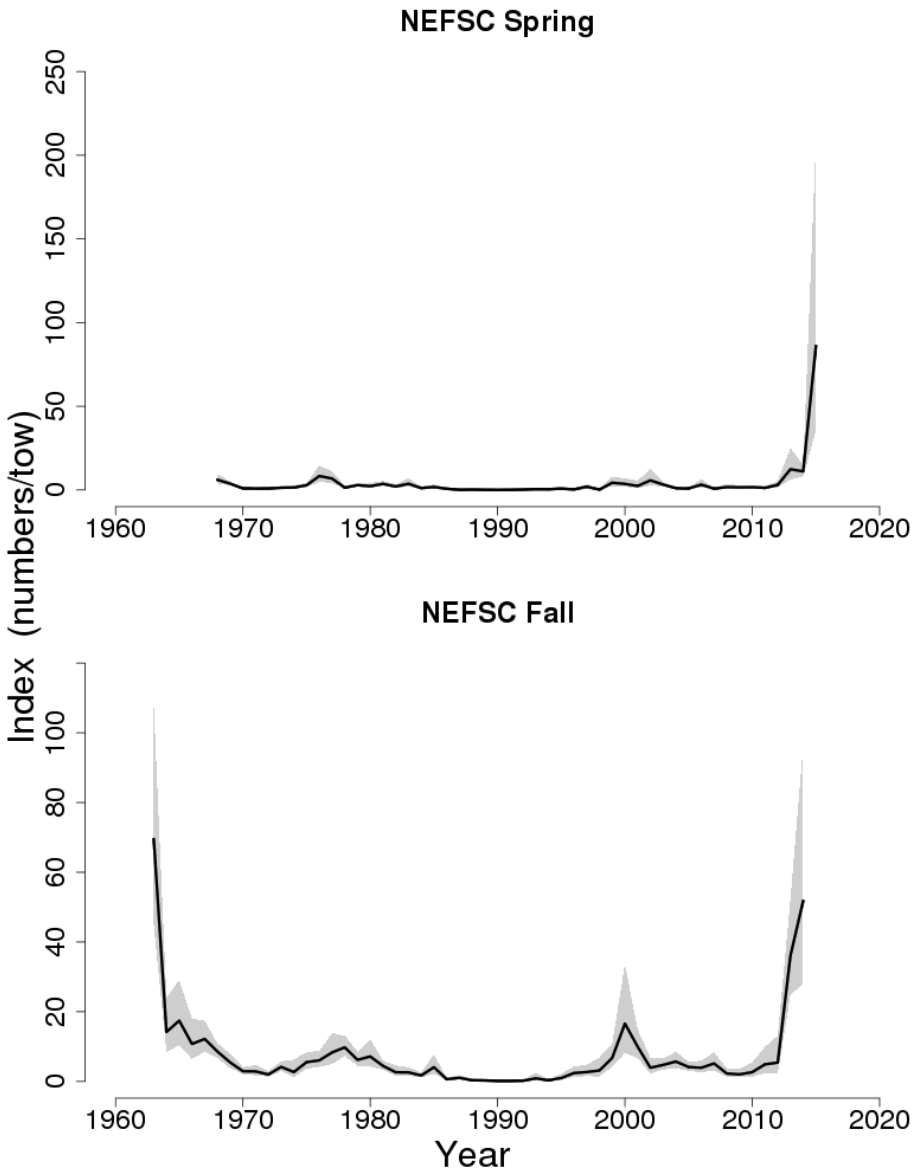

Figure 5: Indices of biomass for the Gulf of Maine haddock between 1963 and 2015 for the Northeast Fisheries Science Center (NEFSC) spring and fall bottom trawl surveys. The approximate 90% lognormal confidence intervals are shown.