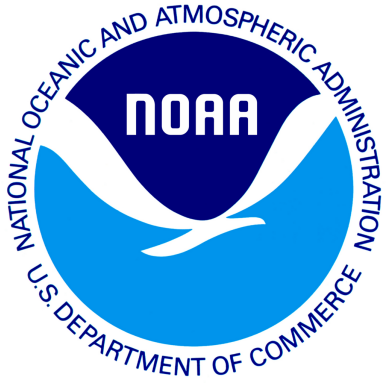

Gulf of Maine Atlantic cod

2014 Assessment Update 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 Gulf of Maine Atlantic cod (Gadus morhua) stock is an update of the existing 2010 benchmark assessment (NEFSC 2010). This assessment updates commercial and recreational fishery catch data, research survey indices of abundance, and the analytical assessment models through 2011 . Additionally, stock projections have been updated through 2015 . Reference points have not been updated. In what follows, there are two population assessment models, etc.

State of Stock: Gulf of Maine Atlantic cod (*Gadus morhua*) stock is overfished and overfishing is occurring (Figures 1-2) . Spawning stock biomass (SSB) in 2011 was estimated to be 9,903 (mt) which is 18% of the SSB_{MSY} proxy (54,743; Figure 1). The 2011 fully selected fishing mortality was estimated to be 0.86 which is 478% of the F_{MSY} proxy (0.18; Figure 2).

Table 1: Catch and status table for Gulf of Maine Atlantic cod. All weights are in (mt) recruitment is in (000s) and F_{Full} is the fishing mortality on fully selected ages.

	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
					Data					
Commercial Landings	3638	3866	3782	3558	3029	3990	5444	5953	5356	4598
Commercial Discards	1329	741	361	270	342	178	349	752	171	99
Recreational Landings	1255	1608	1151	1347	702	1042	1267	1357	1758	1799
Recreational Discards	287	282	201	267	194	317	315	292	384	334
Catch for Assessment	6509	6497	5496	5441	4268	5527	7375	8355	7670	6830
					Model Results					
Spawning Stock Biomass	11951	10005	8594	7213	6752	8725	10282	11457	11141	9903
F_{Full}	0.57	0.67	0.68	0.92	0.78	0.75	0.94	0.98	0.87	0.86
Recruits (age 1)	5171	1904	6304	3922	6590	5296	4513	3532	2177	1175

Table 2: An $F_{40\%}$ proxy was used for the overfishing threshold... More species specific information goes here... Intervals shown are 5^{th} and 95^{th} percentiles.

	2010	Current
F_{MSY}	0.1	0.18
SSB_{MSY} (mt)	61,218	54,743 (40,207 - 73,354)
MSY (mt)	10,392	9,399 (6,806 - 13,153)
Median age 1 recruitment (000's)	NA	4932
ABC	8500	7200

Projections: Short term projections sampled from a cumulative distribution function derived from ASAP estimated age 1 recruitment between 1982 and 2009. Recruitments in 2010 and 2011 were not included due to high variance. No retrospective adjustments was applied in the projections. The model adjusts projected recruitment when SSB falls below the ... More species

specific information here ....

Table 3: Short term projections of total fishery yield and spawning stock biomass for Gulf of Maine Atlantic cod based on a harvest scenario of fishing at 75% F_{MSY} between 2013 and 2015. Catch in 2012 has been estimated at 3,767 (mt). ... Species specific information goes here...

Year	Catch (mt)	SSB (mt)	F_{full}
2011	6830	9903	0.86
2012	3767	8995	0.46
2013	1249	9406	0.14
2014	1503	12143	0.14
2015	2030	16802	0.14

Special Comments:

- Since the middle 1990s the distribution of cod has become increasingly concentrated in the western part of the Gulf, with a gradual loss of cod from the coastal and central Gulf.
- Since the middle 2000s the fishing fleet has become particularly concentrated in a small region of the western Gulf due to a fince scale aggregation of cod in an area where their prey (sand lance) were increasingly available. This biases the fishery CPUE as an indicator of the abundance of the stock as a whole.
- If recent weak recruitment of Gulf cod continues, productivity and rebuilding of the stock will be less than projected.
- The NEFSC 2011 fall and 2012 spring survey abundance indices were the 4^{th} and lowest in their respective time series. The MADMF 2012 spring survey index was also the lowest in its time series. As the 2012 observations were not incorporated into the assessment, the projections are likely to be optomistic.

References:

Northeast Fisheries Science Center. 2013. 55^{th} Northeast Regional Stock Assessment Workshop (55^{th} SAW) Assessment Summary Report. US Dept Commer, Northeast Fish Sci Cent Ref Doc. 13-01; 41 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/

Northeast Fisheries Science Center. 2010. 52^{nd} Northeast Regional Stock Assessment Workshop (52^{nd} SAW) Assessment Summary Report. US Dept Commer, Northeast Fish Sci Cent Ref Doc. 10-01; 40 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/

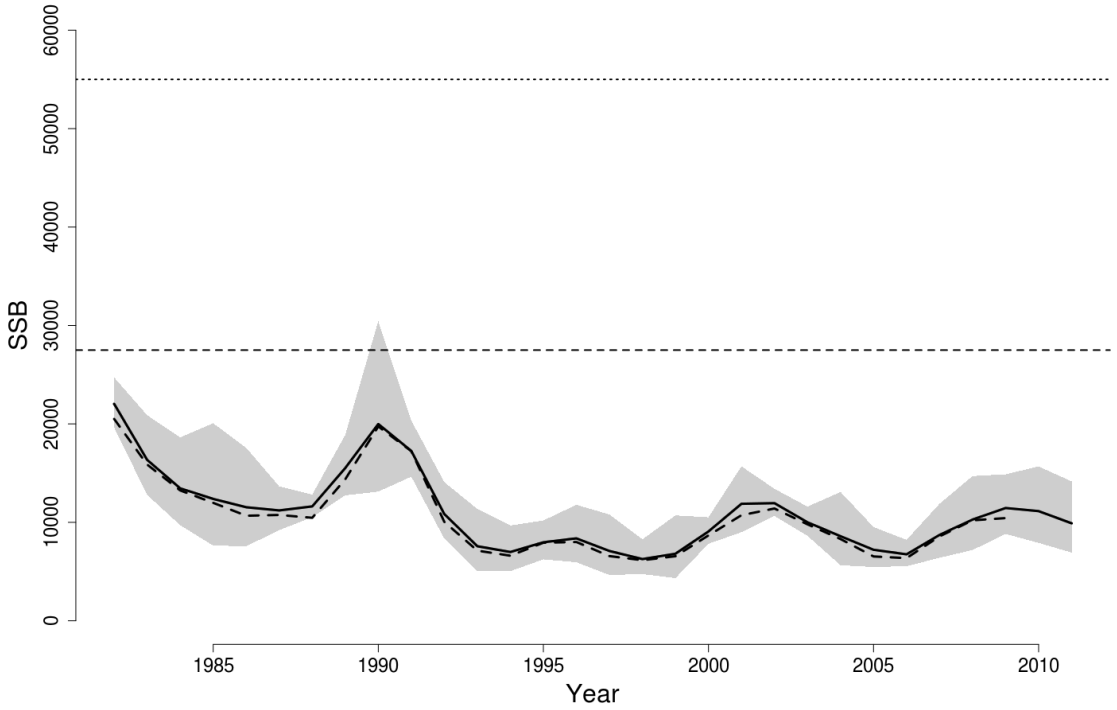

Figure 1: Estimated trends in the spawning stock biomass of Gulf of Maine Atlantic cod between 1982 and 2011 from the current (solid line) and previous (dashed line) assessment and the corresponding $SSB_{threshold}$ ($\frac{1}{2}$ SSB_{MSY}; horizontal dashed line) as well as SSB_{target} SSB_{MSY}; horizontal dotted line) based on the 2011 assessment. The 90% lognormal confidence intervals are shown.

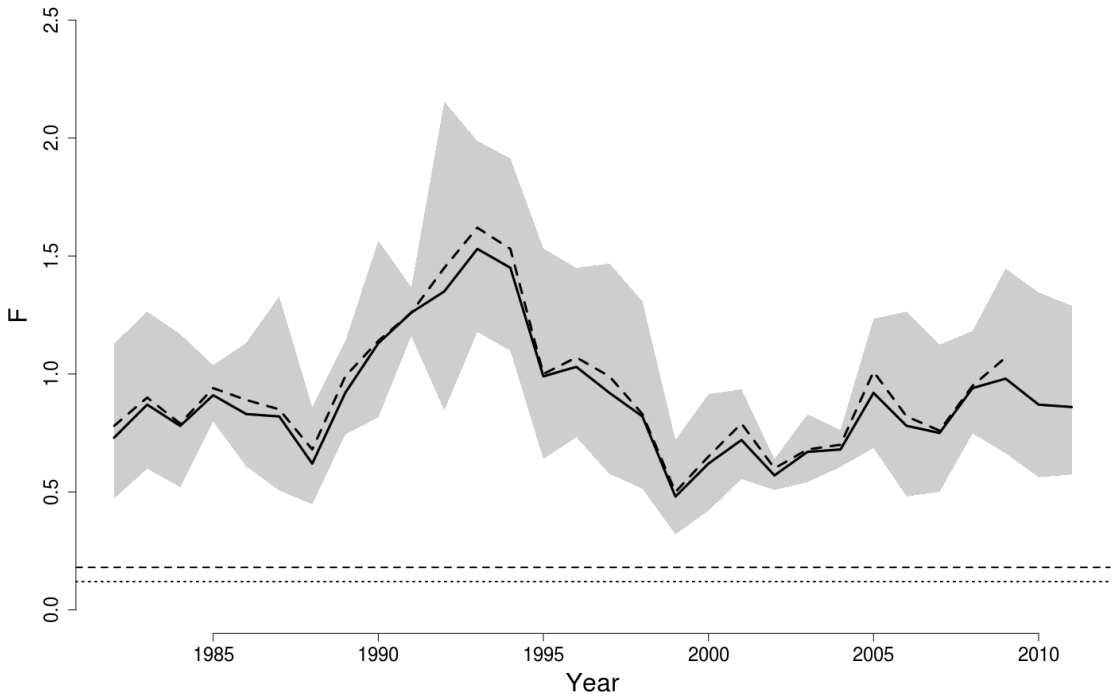

Figure 2: Estimated trends in the fully selected fishing mortality (F_{Full}) of Gulf of Maine Atlantic cod between 1982 and 2011 from the current (solid line) and previous (dashed line) assessment and the corresponding $F_{threshold}$ (0.18; dashed line) as well as F_{target} (0.8 * F_{MSY}; dotted line) based on the 2011 assessment. The 90% lognormal confidence intervals are shown.

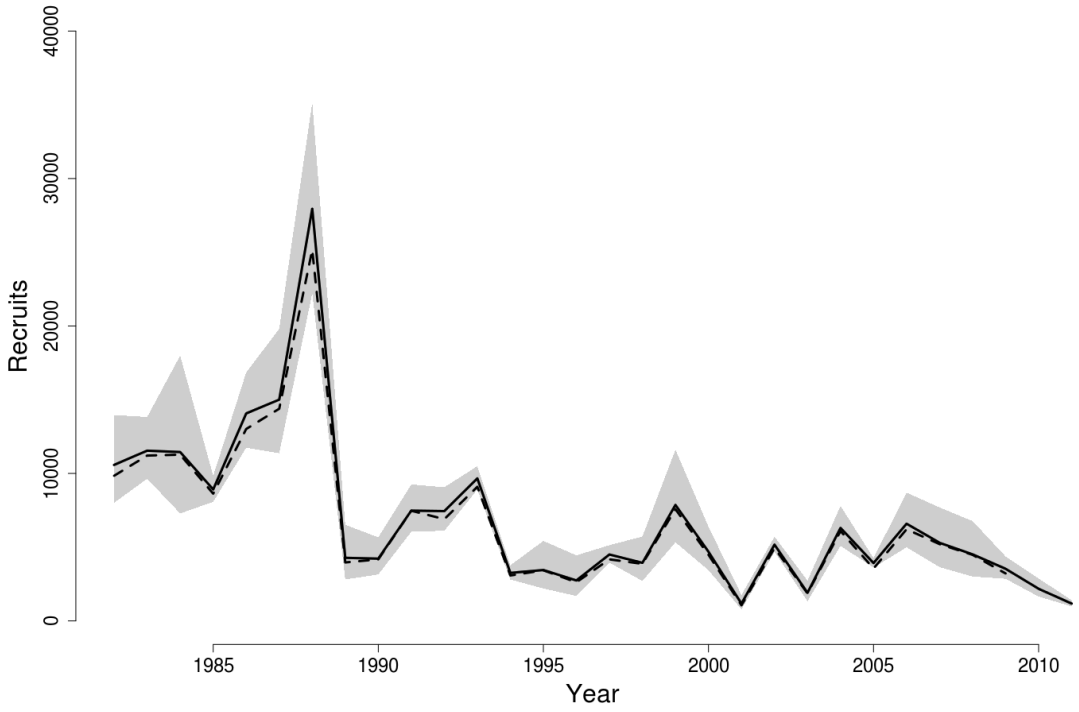

Figure 3: Estimated trends in age 1 recruitment (000s) of Gulf of Maine Atlantic cod between 1982 and 2011 from the current (solid line) and previous (dashed line) assessment. The 90% lognormal confidence intervals are shown.

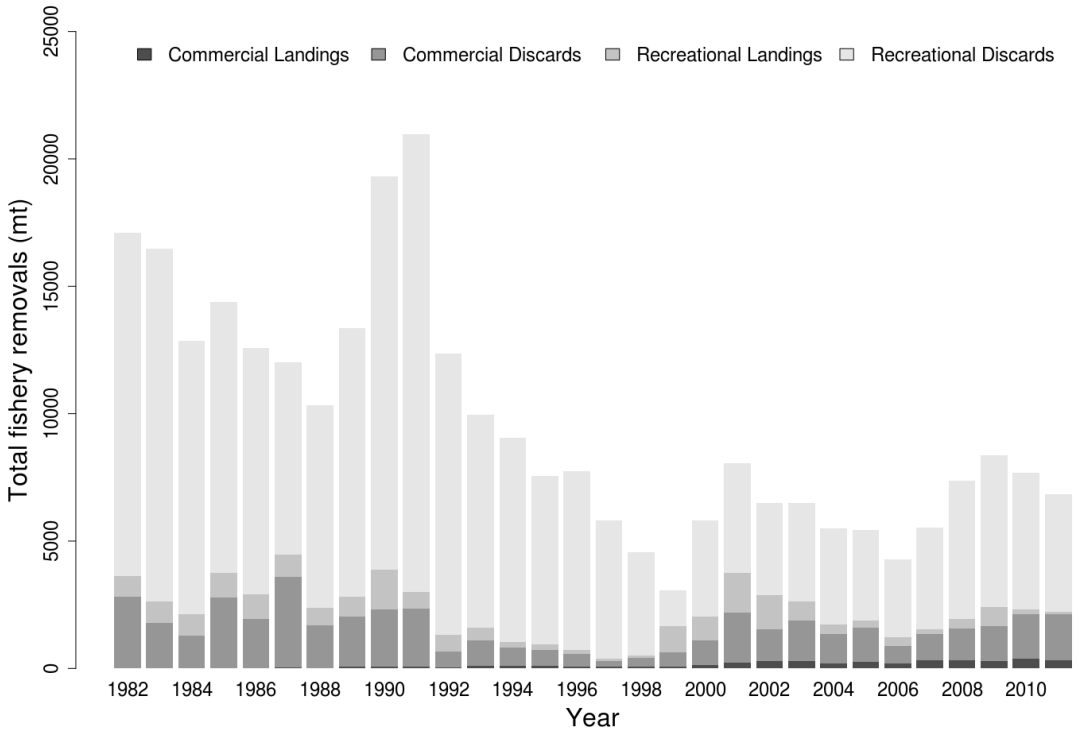

Figure 4: Total catch of Gulf of Maine Atlantic cod between 1982 and 2011 by fleet (commercial and recreational) and disposition (landings and discards).

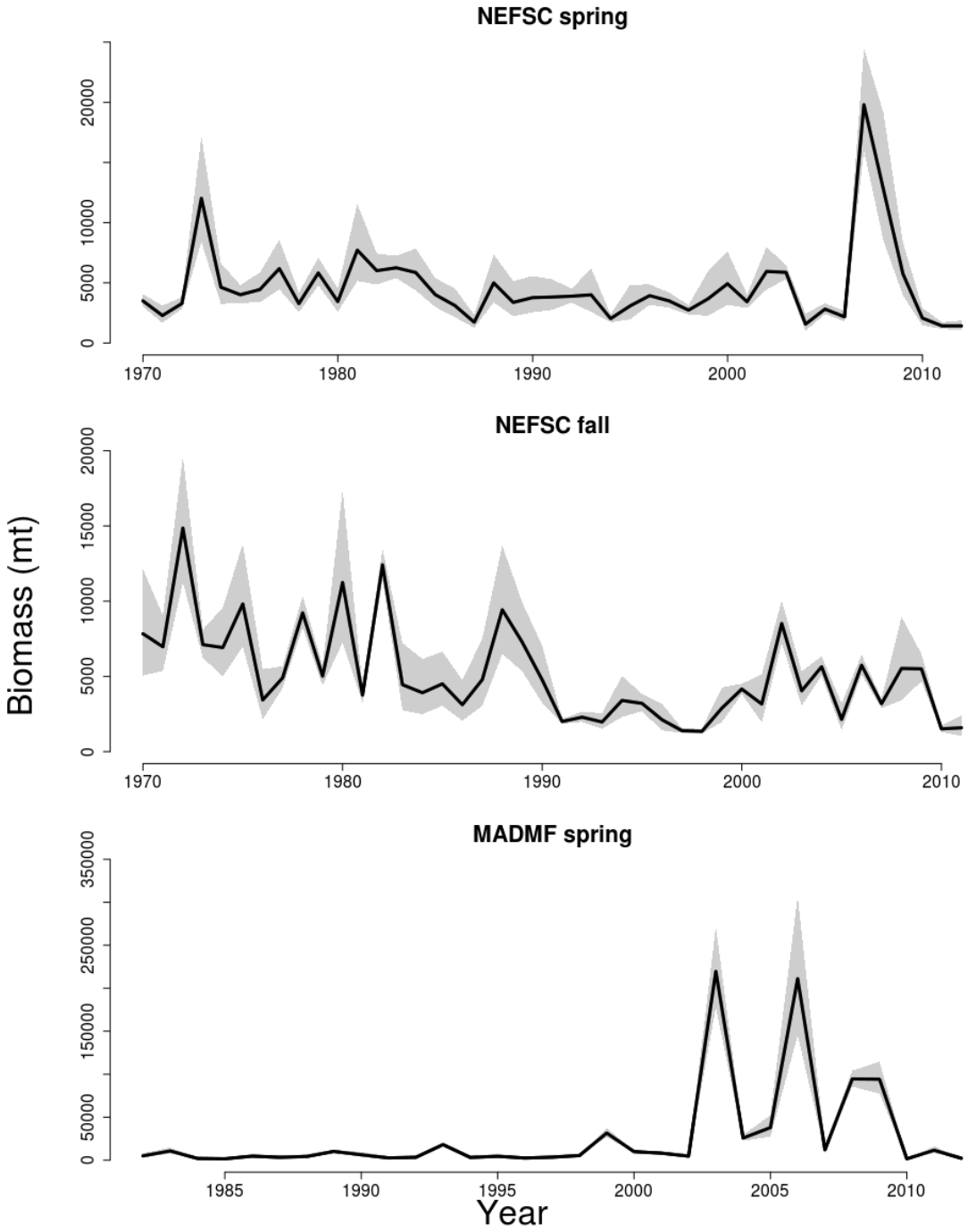

Figure 5: Indices of biomass for the Gulf of Maine Atlantic cod between 1970 and 2012 for the Northeast Fisheries Science Center (NEFSC) spring and fall bottom trawl surveys and Massachusetts Department of Marine Fisheries (MADMF) spring bottom trawl survey. The 90% lognormal confidence intervals are shown.