New England Fishery Management Council
50 WATER STREET | NEWBURYPORT, MASSACHUSETTS 01950 | PHONE 978 465 0492 | FAX 978 465 3116
E.F. "Terry" Stockwell, Chairman | Thomas A. Nies, *Executive Director*

MEMORANDUM

DATE: August 14, 2014

TO: Scientific and Statistical Committee (SSC)

FROM: Groundfish Plan Development Team (PDT)

CC: Groundfish Oversight Committee (OSC)

SUBJECT: **Georges Bank (GB) Yellowtail Flounder and Gulf of Maine (GOM) haddock ABCs**

The Groundfish Plan Development Team (PDT) discussed and/or completed analyses for:

1) Georges Bank (GB) yellowtail flounder ABCs/OFLs and **(2) Gulf of Maine (GOM) haddock ABCs/OFLs.**

1) Georges Bank (GB) yellowtail flounder ABCs/OFLs

TRAC Empirical Benchmark and Assessment

The Transboundary Resource Assessment Committee (TRAC) met April 14-18, 2014 in Woods Hole, MA to conduct an empirical benchmark assessment of the GB yellowtail flounder stock. A summary of the benchmark assessment can be found here: http://www.nefsc.noaa.gov/saw/trac/.

The TRAC then met June 23-26, 2014 in Woods Hole, MA to conduct assessments for Eastern Georges Bank (EGB) cod, EGB haddock, and GB yellowtail flounder. The final TRAC status reports (TSRs) from this meeting are available at http://www.nefsc.noaa.gov/saw/trac/.

TRAC results indicate that the GB yellowtail flounder stock biomass is low and productivity is poor. Furthermore, recent catch is low relative to the quota and biomass estimated by the surveys. In addition, the TAC has been reduced substantially in recent years due to declining stock conditions. Combined Canada and USA catches in 2013 were 218 mt, which is the lowest value in the time series beginning in 1935. All three (bottom trawl survey indices (NEFSC spring, NEFSC fall, and DFO winter) declined from already low values. Additionally, catch curve analyses indicates high total mortality rates ($Z>1$).

Due to poor model performance and other concerns, the TRAC agreed in June to no longer use a VPA assessment model to evaluate stock status or provide catch advice. As a result, no historical estimates of biomass, fishing mortality rate, or recruitment can be calculated for the stock. The April benchmark assessment did not establish a B_{MSY} proxy or any biomass threshold based on the surveys. Therefore, because the TRAC agreed to no longer use the VPA assessment model, the PDT notes that the current biological reference points, which are based on the VPA assessment model, are no longer applicable for evaluating stock status.

Catch Advice

In the absence of an assessment model, the TRAC recommended that two approaches for 2015 catch advice could be considered. The TRAC recommended that one approach be selected and used for the next 3 years to see if the stock responds:

1) A constant exploitation rate of 2%-16% per year, which would result in 2015 catch advice of 44 mt-354 mt (see page 4 of the 2014 TRAC Status Report).

OR

2) A constant quota of 400 mt per year or less (based on not increasing the quota relative to the 2014 quota, which was 400 mt, due to concerns about stock decline and comparisons to output from the constant exploitation rate approach above).

Future Work

For the next assessment in 2015, TRAC recommended adding a new term of reference that over the next three years that the TRAC would examine management strategy evaluation or harvest control rules for GB yellowtail flounder. The TMGC and Council have expressed interest in alternative catch setting strategies.

PDT Recommendation

The PDT reviewed the findings from the TRAC's recent 2014 GB yellowtail flounder assessment. The PDT remains concerned about the status of the GB yellowtail flounder stock. The TRAC results indicate that the stock has continued to decline, and total mortality remains high, despite large reductions in the catch limit in recent years and corresponding low catches.

The PDT discussed the trade-offs of the two catch setting strategies (see pages 4-5 of the TRAC status report) with respect to stock status and US fishery considerations. The PDT noted that the current annual catch setting process does not necessarily support the three year constant approach to setting catches that was recommended by the TRAC. Furthermore, the PDT indicated that selecting a specific exploitation rate or constant quota to use for the next three years would be difficult given the poor condition of this stock (i.e., low productivity, historic low catches, low survey indices, poor recruitment, and declines in condition).

The PDT does not support holding the quota constant at 400 mt for 3 years. In addition to concerns for this approach noted above, the PDT also questioned whether a catch of 400 mt in 2015 may be too high. Catches are at record lows and the survey indices and stock status continue to decline. Because the stock has not responded to recent catch reductions, the PDT

noted concerns for the technical basis of a 400 mt constant quota, and whether further reductions may be necessary to help elicit a positive response from the stock.

The PDT supports setting catches for FY 2015 using a constant exploitation rate. This approach is tied directly to survey information and, as a result, the PDT concluded it provided greater technical merit compared to the 400 mt constant quota approach. The TRAC recommended an exploitation rate of up to 16%, which translates to 2015 catch advice of 354 mt (see Table 3 in the 2014 TRAC status report). The PDT considered 354 mt as an upper bound under this approach.

2. Gulf of Maine haddock ABCs/OFLs

2014 Benchmark Assessment

Overview

GOM haddock was assessed in July 2014 at the SARC 59 benchmark assessment using a statistical catch-at-age model (ASAP). The ASAP assessment model used was a change from the previous assessment's VPA formulation. Based on the results of the assessment, GOM haddock was not overfished and overfishing was not occurring in 2013. Spawning stock biomass (SSB) in 2013 was estimated to be 4,153 mt which is 101% of the SSB_{MSY} proxy (4,108 mt) (Figure 1). The 2013 fully selected fishing mortality is estimated to be 0.39 which is below the F_{MSY} proxy (0.46) (Figure 2). This marked a change in stock status from the 2012 update (not overfished but approaching an overfished condition and overfishing was occurring) to the current evaluation of not overfished and no overfishing, due primarily to the addition of three more years of fishery and survey data. The assessment results, updated with this new information, indicate that the change in status is driven by the estimate of the very strong 2010 year class, which is estimated to be 6.7 million age-1 fish (Figure 5).

Recreational Discards

In the 2014 assessment, recreational discards are assumed to have a 50% survival rate (Table 5; Figure 3). Recreational discards were not included in previous assessments due to the difficulties associated with estimating discards-at-age. Recreational discards were included in this assessment. Discards-at-age were constructed from contemporary (2004-2013) length frequencies collected from the fishery as well as hind-casted length frequencies generated from survey data. As there is no direct sampling of otoliths from the recreational fishery, age length keys were borrowed from surveys.

Haddock Spillover

Previously, the PDT conducted an analysis of haddock spillover from GB to the GOM haddock stock area. The analyses presented at SARC 59 were consistent with the PDT's findings that if spillover is occurring, the rate is low and is not being detected in the assessment diagnostics. Perhaps, this rate is considerably less than 1%, although the peer review suggested further research was needed for a precise estimate and therefore the peer review did not report this rate in their report. The risks to the GOM haddock stock of overestimating spillover are greater than

that of the GB haddock stock. The final assessment model does not account for spillover (Figure 7).

Catch Projections

The SARC panel recommended using the recruitment series (1977-2011) for short term projections through 2017 (Table 6). SAW 59 developed a final model (temp10 run) and a sensitivity model (temp 11 run) that constrained the size of the 2012 year class by lowering the CV from 1.0 to 0.5 on the recruitment deviations in 2013. This resulted in a change in recruitment from 16.6 million (highest in the time series) to 9 million fish (the second highest in the time series). Four different projections assuming 75%FMSY (0.35) from 2015-2017 were conducted:

- the final model (temp10 run) assuming 75%FMSY in 2014
- the final model (temp 10 run) assuming a catch of 500 mt in 2014
- a sensitive projection (temp11 run) assuming 75%FMSY in 2014
- a sensitive projection (temp11 run) assuming a catch of 500 mt in 2014

PDT Analysis, Results, and Discussion

Analysis: Methods to estimate catch in 2014

The PDT estimated the catch for 2014 using current catch information for 2014 and previous years' catch in the commercial and recreational fisheries with consideration of additional catch from recreational discards. The PDT used 500 mt (imputed catch) for 2014, as the best estimate of the removals for calendar year 2014 for ABC and OFL calculations. A summary of the approach is in Table 3. OFLs were calculated using the final (temp10) model.

Results: Candidate GOM haddock ABCs/OFLs

Table 1 summarizes the candidate ABCs from the final model (temp 10 run) assuming a catch of 500 mt in 2014 and the sensitivity projection (temp 11 run) assuming a catch of 500 mt in 2014. Table 2 provides the corresponding OFLs after imputing the candidate ABCs.

Table 1: Summary of candidate ABCs.

year	ABC (final)	ABC (sensitivity)
2015	1,454	1,051
2016	1,772	1,241
2017	2,125	1,423

Table 2: Summary of candidate OFLs

year	OFL (final)	OFL (sensitivity)
2015	1,871	1,871
2016	2,270	2,353
2017	2,707	2,928

Discussion: Comparison of ABCs

There are several sources of uncertainty in the 2014 assessment including the size of the 2012 yearclass (YC), the performance of the ASAP model formulation, and potential change in fishery selectivity.

The time series high 2012 recruitment estimate is based entirely on two survey data points (Figure 5). The PDT discussed the recruitment estimates for the two most recent promising year classes - the 2010 and 2012 YCs (Figure 4; Figure 6). The 2010 YC appears to be driving the recent increases in the GOM haddock stock. The projections are sensitive to the more recent years which lead to variation in the projected catches. Based on past experiences, projections tend to be overly optimistic. The 2015 groundfish updates should have a better idea of the catch stream, including two additional years of surveys. The 2012 YC should be recruiting to the recreational catches and the commercial catches in FY 2015.

The PDT cautions that this is the first time that the ASAP model formulation is being used for this stock. Therefore, the stability of the model and its performance remain the subject of future assessments. An evaluation of whether or not the model is an improvement over the past formulation would be possible after several updates to the model.

The PDT discussed that if changes in selectivity occurred (e.g., due to minimum fish size changes in the commercial and recreational fisheries); these may impact the projections. If for example the fishery selectivity has shifted to younger fish, mortality targets could be missed potentially resulting in negative biological consequences to the stock (e.g., if more smaller fish will be caught for a given quota). However, the PDT did not run the projections with a fixed quota and a change in fisheries selectivity to examine these concerns.

The PDT completed a consequence analysis between the final and sensitivity (Table 4). Selecting the final when the sensitivity is the true state of nature did result in overfishing ($F = 0.5 > FMSY = 0.46$). However regardless of whether overfishing may occur, SSB is still projected to be above BMSY.

PDT Recommendation

The PDT recommends that for the GOM haddock stock that the sensitivity projection run should be used for setting FY 2015-FY2017 ABCs. The PDT recommendation is a deviation from the projection that the SAW working group identified as the "most realistic", but the SARC panel did not indicate a preference between the two projection scenarios. There are several reasons for the PDT's recommendation. First, the PDT cautions on the strength of the 2012 YC as described above and also based on previous experiences with other stocks. Second, the PDT's consequence analysis suggests overfishing could occur if the 2012 year class is overestimated. The PDT notes that all the groundfish stocks are scheduled to be updated in 2015, and therefore the strength of the 2012 YC will be examined with additional survey information. Furthermore, increases in the GOM haddock spawning stock biomass are primarily driven by the recent 2010 YC, which appears to be similar in strength to the 2003 YC.

Table 3: Preliminary estimated 2013 and 2014 calendar year GOM haddock catch

Preliminary Estimated CY 2013 and 2014 NE Multispecies GOM Haddock Catch (mt)

	ACLs and sub-ACLs; (with accountability measures (AMs))							sub-components: No AMs	
Stock	**Total Groundfish**	Groundfish*	Landings	Discard	Recreational	Herring Fishery	Scallop Fishery	State Water	Other
	A to G	A+B+C	A	B	C	D	E	F	G
GOM Haddock									
2013	532.9	525.1	195.4	26.4	303.3	0.1		3.2	4.5
Jan - Jun 2013	325.8	323.1	144.9	19.5	158.7	0.0		1.2	1.5
Jul - Dec 2013	207.1	202.1	50.5	6.9	144.6	0.1		2.0	3.0
2014	300.6	289.2	199.5	17.6	72.1	0.1		4.7	6.7
Jan - Jun 2014	152.8	147.5	115.1	12.6	19.9	0.0		2.2	3.2
Jul - Dec 2014 (est)	147.8	141.7	84.5	5.1	52.2	0.1		2.5	3.5

Values in live weight

*Includes estimate of missing dealer reports

Source: NMFS Northeast Regional Office

July 22, 2014: Data Dates: July 15-17, 2014

These data are the best available to NOAA's National Marine Fisheries Service (NMFS). Data sources for this report include: (1) Vessels via VMS; (2) Vessels via vessel logbook reports; (3) Dealers via Dealer Electronic reporting. Differences with previous reports are due to corrections made to the database

Sector/Common Pool:	Jan 2013 -Jun 2014 commercial data from Data Matching and Imputation System Jul-Dec CY14 value = (Jul-Dec CY13 value)*(May-Jun CY14 value / May-Jun CY13 value)
Recreational	- CY13: FY12 actual catch through April, MRIP waves 3 through 6 for May through Dec. MRIP landings weights used. - CY14: MRIP landings by wave through April, sum of monthly average of FY13 and FY14 catch limit May through Dec.
Herring Fishery	- Actual/estimated based on quota monitoring reports
State Water and Other Subcomponent	- Sum of monthly average FY12 actual catch through April 2013 else monthly average of FY13 and FY14 catch limit

Table 4: Consequence table to compare the biological status risk to the GOM haddock stock over three years (2015-2017) between the final and sensitivity models (i.e., different assumptions about 2012 recruitment). These projections are all catch projections. Grayed out consequence blocks are the ideal cases when management is based on the true state of nature (i.e., no consequences). The risk of overfishing shown is identified in red when 2015-2017 catches are based on the final model and the true 2012 recruitment is based on the sensitivity model.

Biological status risk over the three years		**state of nature**							
		final				*sensitivity*			
		75%Fmsy final model catch in final model				*75%Fmsy final model catch in sensitivity model*			
			F	catch	SSB		F	catch	SSB
management catch	*final*	2014	0.20	500	6472	2014	0.25	500	5050
		2015	0.35	1454	10605	2015	0.50	1454	7133
		2016	0.35	1772	11719	2016	0.55	1772	7238
		2017	0.35	2125	10920	2017	0.65	2125	6326
		75%Fmsy sensitivity catch in final model				*75%Fmsy sensitivity catch in sensitivity model*			
			F	catch	SSB		F	catch	SSB
	sensitivity	2014	0.20	500	6472	2014	0.25	500	5050
		2015	0.25	1051	10699	2015	0.35	1051	7234
		2016	0.23	1241	12216	2016	0.35	1241	7745
		2017	0.21	1423	11933	2017	0.35	1423	7335

Selected Tables and Figure from the Draft 2014 Benchmark GOM Haddock Assessment and Assessment Summary Report

Table 5: Estimates of Gulf of Maine haddock catch (mt) by fleet (commercial, recreational) and disposition from 1977 to 2013. Recreational discard estimates do not account for post-release mortality. ***Missing values indicate that estimates are not available for those years. See pp. 76, Table A.8, Draft Stock Assessment.***

Year	US recreational discards (mt)	US recreational harvest (mt)	US commercial discards (mt)	US commercial landings (mt)	Foreign landings (mt)	Total removals	
						100% mortality of recreational discards	50% mortality of recreational discards
1977				3,230.1	26.0	3,256.1	3,256.1
1978				4,382.5	641.0	5,023.5	5,023.5
1979				4,130.6	257.0	4,387.6	4,387.6
1980				6,317.6	203.0	6,520.6	6,520.6
1981	0.0	38.2		5,713.3	513.0	6,264.5	6,264.5
1982	0.0	23.0	6.4	5,634.3	1,278.0	6,941.7	6,941.7
1983	0.0	52.7	6.5	5,593.4	2,003.0	7,655.6	7,655.6
1984	0.6	52.3	11.0	2,792.8	1,245.0	4,101.7	4,101.4
1985	0.0	21.6	16.5	2,259.1	791.0	3,088.2	3,088.2
1986	0.2	51.8	16.4	1,628.9	225.0	1,922.3	1,922.2
1987	0.0	39.2	23.9	846.3	0.0	909.4	909.4
1988	1.3	20.1		418.0	0.0	439.4	438.8
1989	2.6	13.1	5.0	265.1	0.0	285.9	284.6
1990	0.1	5.3	2.0	465.0	0.0	472.4	472.4
1991	0.0	0.3	2.8	443.5	0.0	446.6	446.6
1992	0.0	0.0	8.0	313.4	0.0	321.4	321.4
1993	0.0	0.6	13.3	193.0	0.0	206.9	206.9
1994	0.9	3.3	61.1	121.9	0.0	187.1	186.7
1995	27.4	124.1	87.7	178.2	0.0	417.4	403.7
1996	6.4	5.7	78.2	253.8	0.0	344.2	341.0
1997	10.5	30.2	378.7	623.7	0.0	1,043.2	1,037.9
1998	7.0	45.6	16.6	922.6	0.0	991.9	988.4
1999	9.8	17.8	2.3	569.1	0.0	599.0	594.1
2000	60.4	128.1	27.9	799.3	0.0	1,015.7	985.5
2001	86.8	169.3	12.9	1,006.8	0.0	1,275.8	1,232.4
2002	177.3	135.3	18.6	1,009.2	0.0	1,340.4	1,251.8
2003	257.4	173.9	17.7	1,026.4	0.0	1,475.4	1,346.7
2004	72.9	312.6	11.7	947.2	0.0	1,344.4	1,307.9
2005	72.0	538.1	25.0	977.7	0.0	1,612.7	1,576.7
2006	131.0	447.4	31.5	622.5	0.0	1,232.4	1,166.9
2007	91.4	572.7	46.9	677.9	0.0	1,388.9	1,343.2
2008	144.1	536.6	10.3	542.7	0.0	1,233.6	1,161.6
2009	48.8	408.6	12.3	500.3	0.0	970.0	945.6
2010	37.1	314.0	3.0	622.6	0.0	976.7	958.1
2011	22.4	228.8	5.6	498.6	0.0	755.3	744.2
2012	107.3	251.2	17.7	416.6	0.0	792.7	739.1
2013	413.9	241.1	32.3	212.0	0.0	899.4	692.4

Table 6: Short-term projections of total fishery yield and spawning stock biomass for Gulf of Maine haddock based on a harvest scenario of a) fishing at 75% $F_{40\%}$ between 2014 and 2017 and b) an assumed catch of 500 mt in 2014 and fishing at 75% $F_{40\%}$ between 2015 and 2017. Projections are shown based on two different population models to highlight the sensitivity of catch projections to the size of the 2012 year class. Projection results are shown for the base ASAP model (ASAP_final_temp10) and a sensitivity model that constrains the size of the terminal year class (ASAP_final_temp11). *See pp. 163, Table A.95, Draft Stock Assessment.*

Year	Input	ASAP_final_temp10 (1977-2011 recruitment)						
		Catch (mt)		Spawning stock biomass (mt)		Harvest strategy	F_{full}	
2013	Catch input/model result	692		4,153	(2,690 - 6,043)		0.39	(0.24 - 0.60)
2014	Projection	844	(554 - 1,250)	6,396	(4,308 - 9,315)	75% of $F_{40\%}$	0.35	
2015	Projection	1,399	(911 - 2,102)	10,313	(6,768 - 15,681)	75% of $F_{40\%}$	0.35	
2016	Projection	1,722	(1,129 - 2,620)	11,463	(7,464 - 17,521)	75% of $F_{40\%}$	0.35	
2017	Projection	2,078	(1,348 - 3,202)	10,747	(6,982 - 16,226)	75% of $F_{40\%}$	0.35	
2013	Catch input/model result	692		4,153	(2,690 - 6,043)		0.39	(0.24 - 0.60)
2014	Imputed catch	500		6,472	(4,328 - 9,473)		0.20	(0.13 - 0.31)
2015	Projection	1,454	(924 - 2,214)	10,605	(6,854 - 16,241)	75% of $F_{40\%}$	0.35	
2016	Projection	1,772	(1,139 - 2,720)	11,709	(7,545 - 18,018)	75% of $F_{40\%}$	0.35	
2017	Projection	2,125	(1,360 - 3,288)	10,923	(7,056 - 16,574)	75% of $F_{40\%}$	0.35	

Year	Input	ASAP_final_temp11 (1977-2011 recruitment)						
		Catch (mt)		Spawning stock biomass (mt)		Harvest strategy	F_{full}	
2013	Catch input/model result	692		3,643	(2,500 - 5,089)		0.43	(0.28 - 0.67)
2014	Projection	677	(438 - 993)	5,008	(3,354 - 7,105)	75% of $F_{40\%}$	0.35	
2015	Projection	1,022	(677 - 1,487)	7,066	(4,781 - 10,116)	75% of $F_{40\%}$	0.35	
2016	Projection	1,213	(822 - 1,754)	7,604	(5,195 - 10,882)	75% of $F_{40\%}$	0.35	
2017	Projection	1,399	(948 - 2,048)	7,235	(4,928 - 10,596)	75% of $F_{40\%}$	0.35	
2013	Catch input/model result	692		3,643	(2,500 - 5,089)		0.43	(0.28 - 0.67)
2014	Imputed catch	500		5,050	(3,345 - 7,213)		0.25	(0.17 - 0.40)
2015	Projection	1,051	(671 - 1,565)	7,230	(4,749 - 10,502)	75% of $F_{40\%}$	0.35	
2016	Projection	1,241	(816 - 1,824)	7,732	(5,182 - 11,165)	75% of $F_{40\%}$	0.35	
2017	Projection	1,423	(944 - 2,102)	7,321	(4,931 - 10,781)	75% of $F_{40\%}$	0.35	

Figure 1: Estimated trends in the spawning stock biomass of Gulf of Maine haddock between 1977 and 2013 and the corresponding $SSB_{threshold}$ (1/2 SSB_{MSY}) based on the 2014 assessment. ***See pp. 9, Figure A2, Assessment Summary Report.***

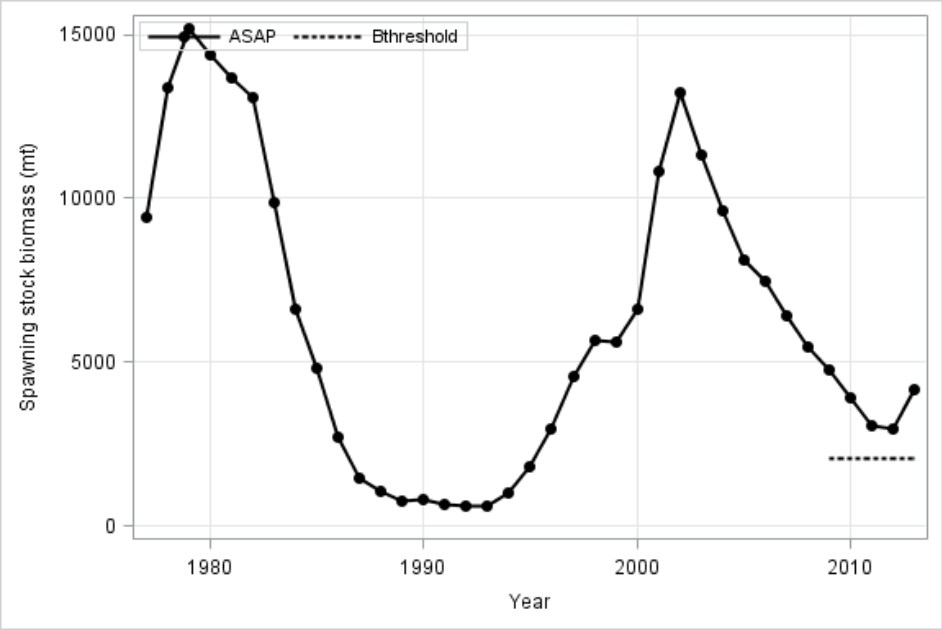


Figure 2: Estimated trends in the fully selected fishing mortality (F_{full}) of Gulf of Maine haddock between 1977 and 2013, and the corresponding FMSY based on the 2014 assessment. ***See pp. 10, Figure A3 Assessment Summary Report.***

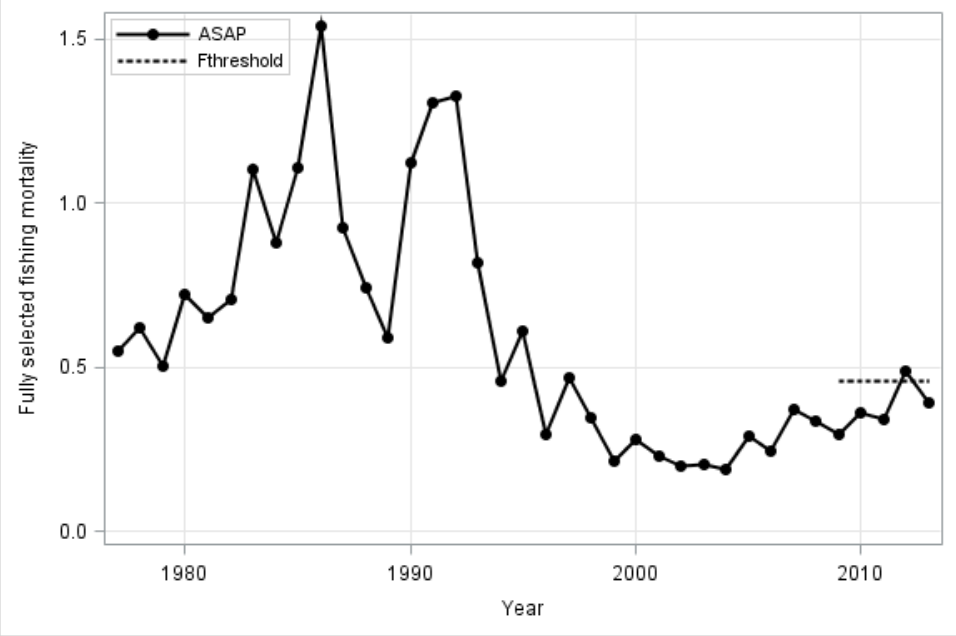


Figure 3: Total catch of Gulf of Maine haddock from 1977 to 2013 by fleet (commercial and recreational) and disposition (landed, discarded). ***See pp. 13, Figure A6, Assessment Summary Report.***

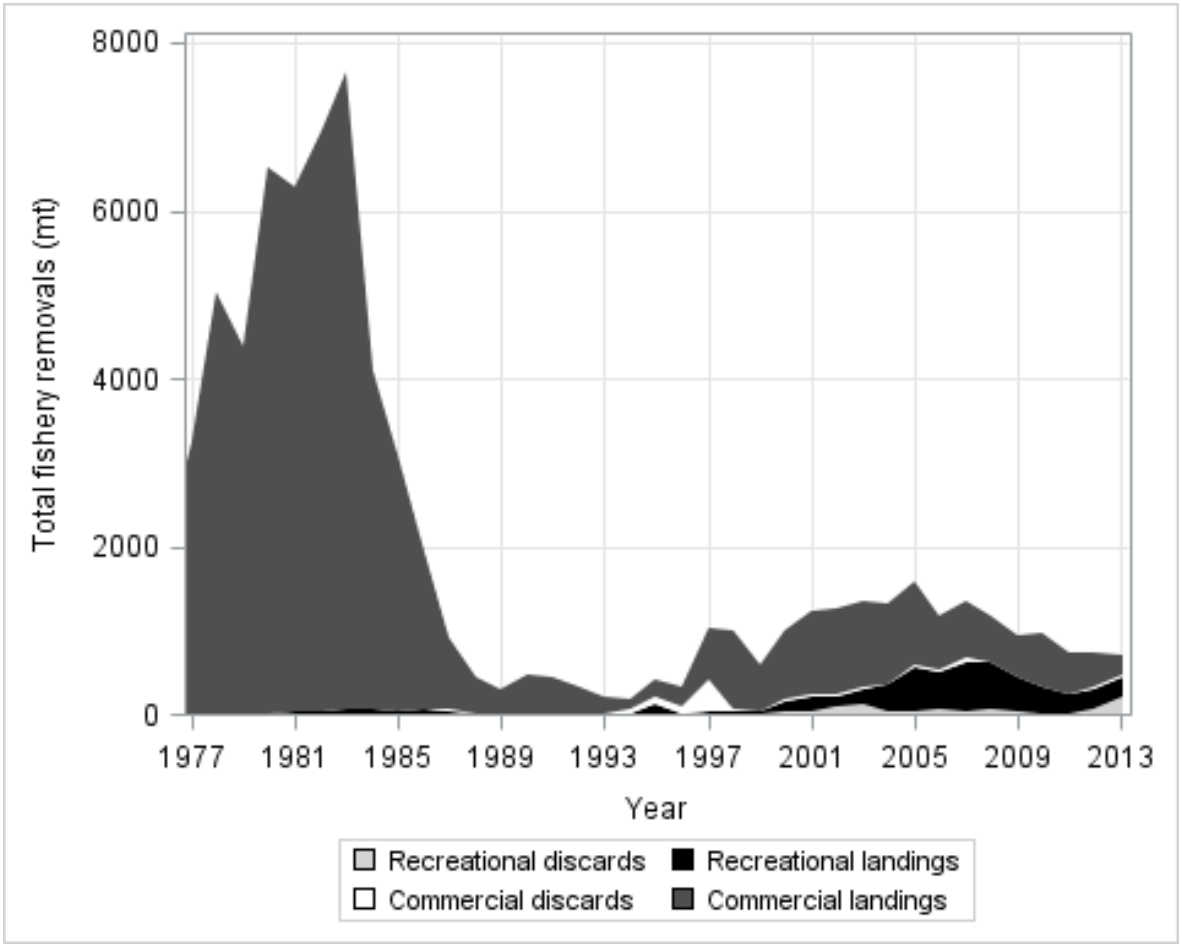


Figure 4: Numbers-at-age from NEFSC spring and fall bottom trawl survey from 1963 to 2014 for Gulf of Maine haddock. Note that the spring survey did not begin until 1968. ***See pp. 260 Figure A97 from the Draft Stock Assessment, as updated with the spring 2014 survey.***

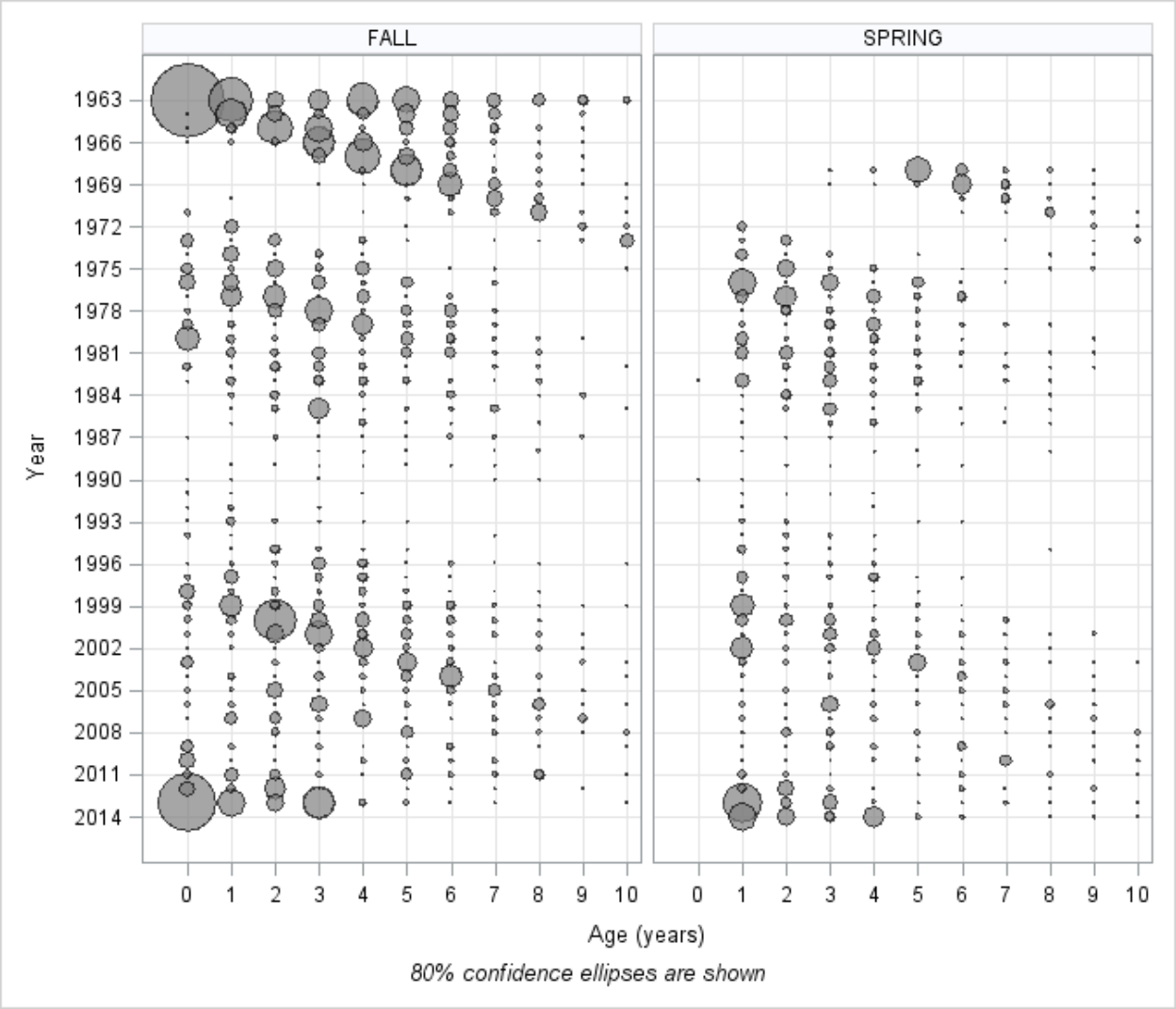


Figure 5: Estimated trends in age 1 recruitment (000s fish) of Gulf of Maine haddock between 1977 and 2013 based on the 2014 assessment. ***See pp. 15, Figure A8, Assessment Summary Report.***

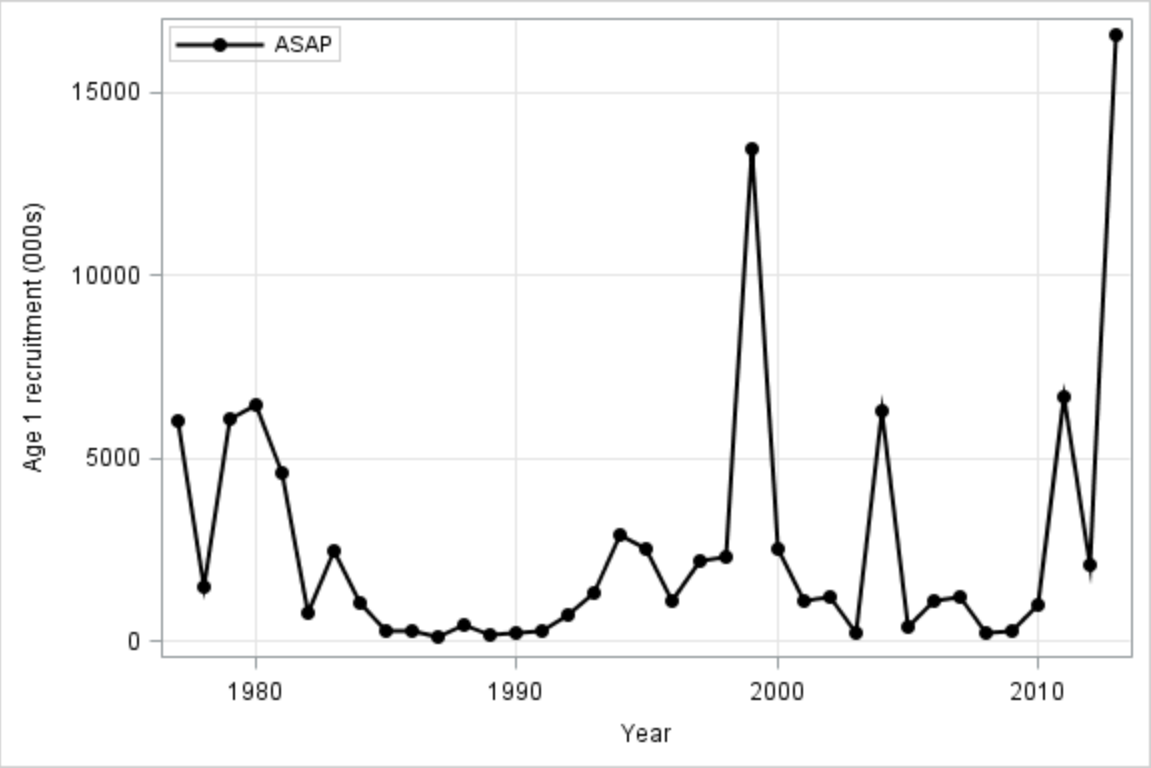
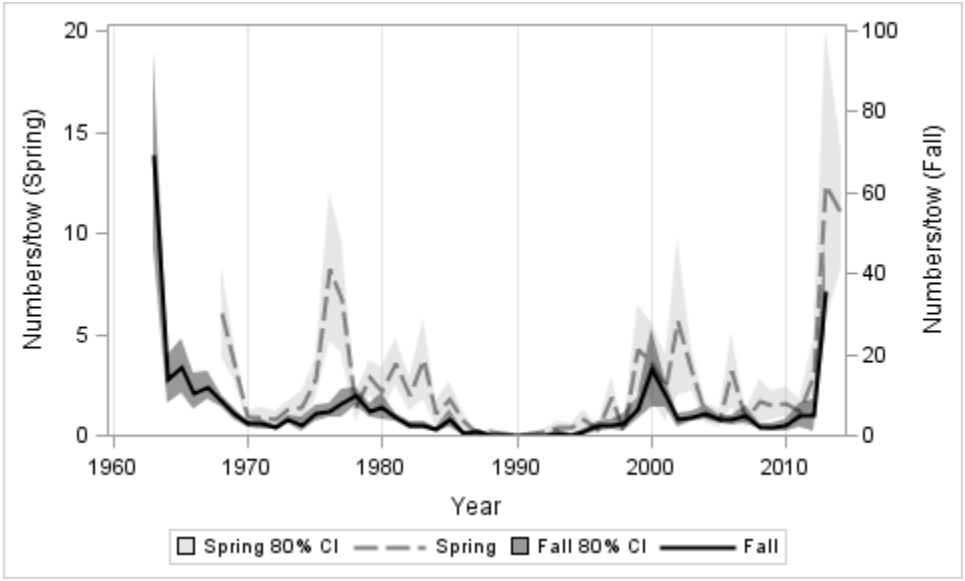


Figure 6: Indices of abundance (numbers/tow; top) and biomass (weight/tow; bottom) for the Gulf of Maine haddock between 1963 and 2014 (spring only) for the Northeast Fisheries Science Center (NEFSC) spring and fall bottom trawl surveys. ***Note that the 2014 spring value was not used in the assessment model. See pp. 14, Figure A7, Assessment Summary Report.***



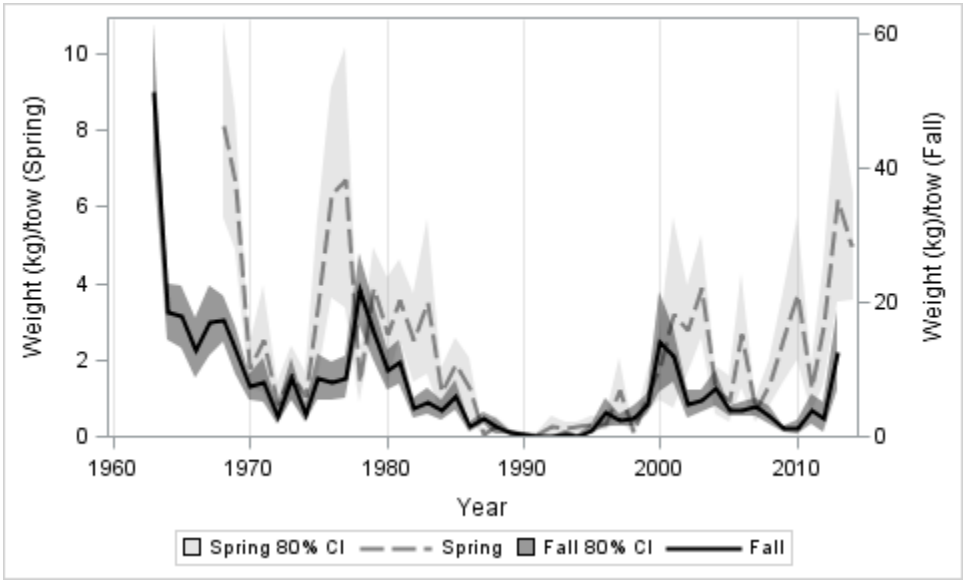


Figure 7: Short-term projections of total fishery yield and spawning stock biomass for Gulf of Maine haddock based on a harvest scenario of a) fishing at F40% between 2014 and 2017 [upper panel] and b) an assumed catch of 500 mt in 2014 and fishing at F40% between 2015 and 2017 [lower panel]. Projections from the base ASAP model (ASAP_final_temp10) are compared to three alternate runs from the SCAA model, two of which incorporate mixing between the Gulf of Maine and Georges Bank stocks. ***See pp. 12, Figure A.5., Assessment Summary Report.***